A STUDY ON EXPLORING THE RELATIONSHIP BETWEEN URBANIZATION, ECONOMIC GROWTH AND ENVIRONMENT DEGRADATION WITH SPECIAL REFERENCE TO ASIAN COUNTRIES

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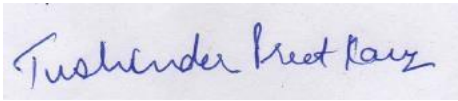**Dr Tushinder Preet Kaur (16446)**
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DECLARATION

I, hereby declared that the presented work in the thesis entitled **"A Study on Exploring the Relationship between Urbanization, Economic Growth and Environment Degradation with Special Reference to Asian Countries"** in fulfilment of degree of **Doctor of Philosophy (Ph. D.)** is outcome of research work carried out by me under the supervision of Dr. Tushinder Preet Kaur, working as Professor, Department of Economics, Mittal School of Business, Lovely Professional University, Punjab, India. In keeping with general practice of reporting scientific observations, due acknowledgements have been made whenever work described here has been based on findings of other investigator. This work has not been submitted in part or full to any other University or Institute for the award of any degree.

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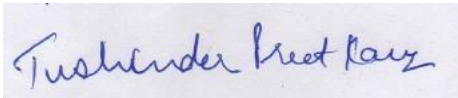
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CERTIFICATE

This is to certify that the work reported in the Ph. D. thesis entitled **"A Study on Exploring the Relationship between Urbanization, Economic Growth and Environment Degradation with Special Reference to Asian Countries"** is submitted in fulfillment of the requirement for the reward of degree of **Doctor of Philosophy (Ph.D.)** in the Department of Economics, Mittal School of Business is a research work carried out by Ramanpreet Kaur, 41500129, is bonafide record of his/her original work carried out under my supervision and that no part of thesis has been submitted for any other degree, diploma or equivalent course.

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ABSTRACT

In recent decades, Asian economies have experienced rapid urbanization. This rapid urbanization is resulting into crowded cities or high urban density. Though urbanization brings various positive externalities with itself such as skilled labor, new techniques and human capital, but high urban density is contributing to environment degradation. Not only this, urban population structure also plays an important role in impacting the growth of the economy. Where young workers, on the one hand, can contribute to the growth of the economies, high number of dependents, on the other hand, in the population structure can result into negative effect on the economic growth. It is during the process of urbanization; the population structure of the economies gets changed with heavy variations in the number of dependents and number of working people. The study has hypothesized that urbanization has significant impact on the economic growth as well as environment of selected Asian countries. The main purpose of the study is to explore the relationship between urbanization, economic growth and environment degradation in selected Asian countries.

The conceptual framework of the study links the issue of the urbanization–economy–environment relationship with various theoretical and methodological forms. Firstly, urbanization driven economic growth is analyzed based on neoclassical and Malthusian theories. Neoclassical theory holds that capital, labor and technology influence the growth of an economy, while Malthusian theory suggests that population can outgrow their resources, if left unchecked. Secondly, an urbanization-led environmental impact assessment is framed by neo-Malthusian theory whereby over-population is treated as a major source of environmental degradation. This also explores the effects of social systems on the environment, and vice versa. Lastly, the economy–environment relationship is analyzed on the basis of ecological modernization theory (EMT), which posits that economic growth benefits the environment, leading to the Environmental Kuznets Curve (EKC) hypothesis.

Initially, the study has analyzed the trends of urbanization in selected Asian countries to explore the features and characteristics of urbanization in these economies. Utilizing the concept of neoclassical growth theory, this study secondly examines the impact of

urbanization on economic growth. Estimates are obtained from the dynamic ordinary least squares (DOLS), fully modified ordinary least squares (FMOLS) and Panel VECM causality test. The results showed that urbanization cause economic growth in the selected panel of countries. The variables age dependency ratio, population density and gross capital formation also effect economic growth through urbanization in the economies. There is unidirectional causality from ADR to GDP per capita. With increasing age dependency ratio (% of working population) in selected Asian countries, capital formation in the economies is increasing with its positive impact on GDP per capita. Unidirectional causality from ADR to gross capital formation indicates that gross capital formation in these economies is increasing due to decrease in dependents in the population structure of the economy. Population density also has unidirectional causality with GDP per capita. Increasing population density in selected panel of economies is leading to decrease in natural endowment per capita. This increased population density pressurizes the land and infrastructure in that areas as well and negatively impact the growth of the economy. From these results, it is evident that in the countries with high rate of urbanization, GDP per capita is caused by Urbanization, age dependency ratio, gross capita formation and population density but GDP Per capita do not cause these variables in the long run.

Thirdly, the population-based stochastic impacts on population, affluence, and technology (STIRPAT) models are estimated using ridge regression, in the context of neo-Malthusian theory. In the analysis, the ecological footprint (EF) per capita is applied as the dependent variable, which measures the degree of environmental impact caused by human activities. The result shows that urbanization has the most significant effect, followed by GDP per capita, on EF. People opt migration in these economies for better urban services and facilities and thus put enormous pressure on the infrastructure. This indicates that urbanization highly contribute for increasing environmental pressure.

Fourthly, the study has compared all selected Asian countries based on EKC Hypothesis using Ecological modernization theory and found that EKC hypothesis is valid for China, Bangladesh, Nepal, India, Thailand and Malaysia for relationship between economic growth and ecological footprint. For the countries, Philippines, Indonesia,

Cambodia and Vietnam, there exists U shaped curve for economic growth and ecological footprint. At initial stage, the growing GDPPC in the economies has positively affected the ecological footprint because of less ecological deficit in the economies, but growing urbanization, increasing inequalities, growing poverty and unemployment in the economies can negatively impact the ecological footprint in the long run. For urbanization and ecological footprint relationship, EKC hypothesis is valid for China, Malaysia and Thailand. For the countries Bangladesh, Nepal, India, Philippines, Indonesia, Cambodia and Vietnam, the EKC hypothesis is not valid. The main reason behind this is that at higher level of urbanization, this demand of fossil fuel increases and results into high carbon emission and inappropriate waste disposal. It is not only the economic development of the economy that can control the environment degradation, but the study finds that urbanization is the key factor associated with the economic activities.

Overall, the study finds evidence of the relationship between urbanization, economic growth and environment degradation which is consistent with neo-Malthusian and structural human ecological theories. On the other hand, the impact of GDP per capita increases has a negative impact on environmental quality, which does not meet the expectations of neo–classical theories and refutes the EKC hypothesis. Considering the findings, Asian economies should work towards sustainable urban management that can be accommodated without damaging the environment. It also needs population policies that target increases in skilled working age groups in order to counteract the problems associated with an aging population. To this end, Ecological footprint should be reduced through changing consumption patterns, improving the efficiency of resource use, and cleaner technology choices. In addition, more emphasis needs to be placed on utilizing renewable resources, such as biomass, biogas, biofuels, hydro, solar, and wind power, which would be more environmentally and economically sustainable options for Asian countries.

Acknowledgement

ABBREVIATIONS

ADB	Asian Development Bank
IBRD	International Bank for Reconstruction and Development
FR	Fertility Rate
DR	Death Rate
BR	Birth Rate
NR	Natural Rate of increase in Population
EF	Ecological Footprint
SDG	Sustainable Development Goal
UNDESA	United Nations Department of Economic and Social Affairs
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WUP	World Urbanization Prospectus
WDI	World Development Indicators
GHG	Green House Gases
WHO	World Health Organization
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product Per Capita
GCF	Gross Capital Formation
ADR	Age Dependency Ratio
EKC	Environment Kuznets Curve
VECM	Vector Error Correction Model
AIC	Akaike Information Criterion
HQIC	Hannan-Quinn Information Criterion
SBIC	Schwarz–Bayesian Information Criterion
STIRPAT	Stochastic Regression on Population, Affluence and Technology

Chapter 1

Introduction

Sustainable development is the organizing principle for meeting human development goals while simultaneously sustaining the ability of natural systems to provide the natural resources and ecosystem services based upon which the economy and society depend (Evers, 2017). There are seventeen interlinked global goals that are focused on the achievement of better and sustainable future such as No Poverty, Zero Hunger, Good Health & Well-Being, Quality Education, Gender Equality, Clean Water & Sanitization, Affordable & Clean Energy, Decent work & economic development, Industry, Innovation & Infrastructure, Reduced Inequalities, Sustainable Cities & Communities, Responsible Consumption & Production, Climate Action, Life below Water, Life on Land, Peace, Justice & Strong Institutions and Partnership for the Goals. These Sustainable Development Goals (SDGs) have potential to minimize poverty and improve the well-being & health of individuals (Yoshida & Zusman, 2020). SDGs have vital importance for mitigating adverse changes in climate. Moreover, existing initiatives like "SE4All" or "Sustainable Energy for All" helps to support the efforts provided in the seventeen goals while leveraging synergies between energy and other SDGs.

SDGs help in development of the metropolitan cities which are considered as hubs for commerce, ideas, science, civilization, social, production, economic and human development through better urban planning, water sanitization, transport system, risk minimization of disasters, waste management, education and capacity building (UNDESA, 2021). SDGs are aimed at providing adequate shelter for the poor people, improve the management of human settlement, and promotes sustainable management & land implementation planning and sustainable activities. Besides that, the SDGs are crucial to promote sustainable transport and energy system in urban regions and develop human resources to build sustainable buildings. This improvement in energy efficiency in urban regions had cut the cumulative demand for global energy by more than twenty-five per cent over the years 1990-2010. However, renewable energy supplied a cumulative total of more than one thousand exajoules internationally

over the same period (UNDESA, 2021). Sustainable development approach contributes in fostering growth of the economies while conserving environment quality for future generations. Less developed and developing nations of the world are facing a serious issue of sustainable development of the economies due to population growth, limited resources and lack of government efforts. The policy makers, economists and geographers of these countries are giving utmost attention to the formulation of the policies that can help in fostering development of the economies while preserving the quality of the environment or to achieve sustainable development goals for these countries. Among seventeen interlinked sustainable development goals, SDG no. 11 is "Sustainable Cities and communities". The main target under this goal is "to enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement, planning and management in all countries" (UNDESA, 2018). It is also mentioned that the rapidly increasing urbanization is bringing various challenges with it such as rise in the number of slums, deterioration of the environment, inadequate facilities of basic services and infrastructure which makes the cities more vulnerable. In short, it might have impact on the overall development of the human being living in those cities.

While discussing about development of the economies, it is important to know the differentiation between development and growth. Development is considered as a multidimensional process which consists of variations in the social structure and national institutions as well as the growth of the economies, reduction of inequalities and eradication of poverty. In simple words, qualitative and structural change state of an economy is known as development. Growth, on the other hand, is quantitative and tangible increase in the national income of an economy. Cities are known as an engine to economic development. According to Turok and McGranahan, (2013), "No country has grown to middle income status without industrializing and urbanizing. None has grown to high income without vibrant cities. The rush to cities in developing countries seems chaotic, but it is necessary." Robinson et al. (2012) also mentioned that "The city is one of the highest pinnacles of human creation. Through agglomeration, cities have the power to innovate, generate wealth, enhance quality of life and accommodate more people within a smaller footprint at lower per capita resource use and emissions

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than any other settlement pattern." Therefore, while discussing about national and international development, role of cities cannot be neglected.

According to Yoshida and Zusman, (2020), development of the economy and urbanization go hand in hand, no country has ever obtained desired economic growth without a significant movement of population into cities. It reflects that urbanization is an important indicator for sustaining the growth of the economies. The theory of growth and development also discussed about multifaceted aspect of urbanization. The theory consider it as a vital component for multidimensional structural transformation that helps in the modernization of low-income rural societies and helps them in attaining the rank of middle and high-income countries. On the other hand, it contributes to environment change which is a global environment concern.

1.1 Urbanization

The term urbanization was coined by Ildefons Cerdà in his book named "General theory of Urbanization 1867". According to Ildefons and Vicente (2018), urbanization is "the set of principles, doctrines and rules that should be applied so that buildings and their conglomerations can help to promote their development and vitally thereby improving individual wellbeing, the sum total of which constitutes public prosperity." In general terms, Urbanization is a movement of population from rural to urban regions. It is also considered as a process of slow rise in the ratio of population in urban regions and how the society adapts changes with this rise in the urban population. According to Davis (1965), "Urbanization as process of continuous concentration of population in urban centers. It is also known as an index of transformation from traditional-rural economies to modern industrial one." It is a finite process through which a nation passes as they evolved from agrarian to industrial society (Kingsley & Golden, 1954). Dociu and Dunarintu (2012) has defined urbanization as a rise in urban population or increase in the ratio of people residing in cities due to shift from rural areas. "The rate of urbanization is the change in the level of urbanization, usually expressed as an average annual percentage over a particular period (UNESCAP, 2015)."

The phenomenon of urbanization is associated with the growth of population as well as the process of industrialization. It is with the growth of industrial sector, demand of labor in the urban regions increases and rural population flood towards cities which creates imbalance in the population of the cities. In developed countries, large cities come into existence with the emerging cities, but in developing countries, it causes dissatisfaction among the rural people due to differences in the quality of residing in rural and urban regions and they are motivated to shift to urban regions to seize new opportunities. From the experience of developing and developed countries, it is clear that industrialization is the key driving force of urbanization. It can also be said that urbanization is a product of the division of labor and achievements of technology. Industrialization allowed the organizations to be more productive and made goods and services more affordable. Moreover, industrialization leads to increased employment prospects in large and small scale industries (Owlcation, 2021).

However, in an industrialized economy, the industry attracts the unemployed and underemployed staff from the agriculture sector and enhances the revenue of the economy. On the other hand, the division of work enhances the trivial value of the "Product of Labor". The worker's income in the industrial sectors becomes higher than the average workers working in the agriculture sector. Modernization theory also states that traditional societies will develop with the adoption of modern practices. It also helps the urban regions to develop their cultural and economic centers (Goorha, 2010). Industrialization has contributed in the development of the traditional societies with improved accuracy and speed of production and increased international trade that allowed businesses to retail their products anywhere.

Modernization of agriculture is another manifestation of urbanization which consists of transformation of traditional agriculture into modern agriculture. According to Mellor's theory of agricultural development, agriculture in its traditional character cannot help non-farm sector to grow (Tolley, 1969). Fie-Ranis model of economic growth also states that development is the result of shift of central point of focus from agriculture to industry. It is possible through the shift of labor from agriculture to industry. It also indicates that there is no constraint of labor supply in underdeveloped regions. A rural to urban shift results into less rural population. On the other hand, cities

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also acquire rural lands. These are two key reasons of modernization of agriculture to meet with the needs of people. Though urbanization is benefitting the society by emphasizing on the modern techniques, but rapidly increasing urbanization is associated with some serious consequences as well. With development of urbanization, various environmental issues also occurs. These problems are also known as the product of urbanization (Owlcation, 2021). It results into negative impacts on natural environment with increase in consumption related needs of people and by consequently increasing the waste production.

1.2 Factors responsible for ushering of urbanization

There are different factors that have affected urban expansion in different periods of history. A rapid change in these factors have been observed with industrialization and modernization of society. Natural rate of increase in population and rural to urban shift of population were the key factors contributed for expansion of urbanization. Application of technology in agriculture sector also resulted into high agriculture production. It also resulted into high productivity of labor in agriculture sector and they also started supporting people in non-agriculture sectors. Agriculture revolution further enhanced the expansion of urbanization. The agricultural revolution has led to the reduction of poverty. According to an estimation by Tripathi et al. (2017), this reduction in poverty is equal to 4.25 times investment in the service sector. Due to the agricultural revolution, the nations experienced an enhancement in the food supply that added to the rapid growthof inhabitants in urban regions. Thus, the farming revolution can be cited as the only causeof the industrial revolution. Tripathi et al. (2017) argued that higher agricultural productivity provided extra food with less manpower. It allowed a shift of labor from agriculture to urban industries. Therefore, the development of agriculture is considered asa pre-requisite for the growth of cities. This development of agriculture generates a surplusof labor from land and open new avenues for them to follow different pursuits. This release of population from the agriculture resulted into concentration of people in the cities and motivated them to engage in non-agriculture activities. Dual-Sector model, which is also known as Lewis model also states that there exists extra labor in the agriculture sector. It consists of labor whose marginal productivity is zero and shifting that labor into industrials

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sector can help in making full utilization of their potential (Wang & Piesse, 2013).

Application of technology in agriculture sector also resulted into high agriculture production. It also resulted into high productivity of labor in agriculture sector and they also started supporting people in non-agriculture sectors. There was a time in 1737 when nine farms were required to support a single family in city and in 1937, one farm was feeding seven urban families. It is with the advancement of technology and utilization of machinery in agriculture, the ratio of man power required for the production process was reduced and the released section of population started shifting to urban regions to be employed in the factories during the industrial revolution. Technological revolution is also a major factor responsible for urbanization. This revolution in technology impacted production process and factory system to provide employment to a large number of people. Another factor responsible forushering of urbanization is the efficiency of transportation. Transportation system acts as a lifeline of the city life. The evolution of long-distance transportation such railways and motor cars highly impacted the growth of the cities. This transportation facilities also resulted into quick movement of goods from one city to another which consequently resulted into growth of metropolitan centers. Developments in the field of agriculture, commerce, industry and transportation also acted as demographic revolution in the economies. Innovations in the medical field resulted in providing cures of ailments and diseases. It declined mortality rate. However, birth rate did not fall rapidly but this demographic evolution resulted into needs of the cities for an increasing labor force and consumer markets.

1.3 Role of Urbanization in developing and less developed countries

Low income economies are considered as less developed and lower middle-income economies are usually referred to as developing economies. Upper Middle Income and the High Income are referred to as Developed Countries. "Less developed countries (LDCs) are low-income countries confronting severe structural impediments to sustainable development and a developed country is known as a sovereign state that has a high quality of life, developed economy and advanced technological infrastructure relative to other less industrialized nations (UNDESA, 2021)." In 1950, proportion of

urban population in highly developed regions was substantially larger as compared to less developed regions with 59% of world's total urban population in highly developed regions (UNDESA, 2021). In 2018, the urban population of less developed or developing regions is measured at three times than highly developed regions with 76% of world total urban population in less developed or developing regions (UNDESA, 2021).

Table 1.3.1: Percentage of Urban Population in highly developed and less developed or developing regions of the world

Development Group	Percentage	
	1990	**2018**
Total Population		
More Developed Regions	21.5	16.5
Less Developed or Developing Regions	78.5	83.5
Urban Population		
More Developed Regions	36.2	23.6
Less Developed or Developing Regions	63.8	76.4
Rural Population		
More Developed Regions	10.4	7.9
Less Developed or Developing Regions	89.6	92.1

Source: Compiled from World Urbanization Prospectus, 2018

Table 1.3.1 depicts that in 1990, total population of more developed regions of the world was 21.5% of the global population. In 2018, this ratio declined to 16.5% of the global population. This decline was due to increased ratio of total population in the less developed or developing regions of the world which was 78.5% in 1990 and increased to 83.5% in 2018. This rapid growth in urban population of less developed or developing regions of the world is due to rapid growth of total population of these economies. Till 1990, these countries passed through high fertility rate and declined mortality rate which resulted in fast growth of population. Though fertility rate in these economies have fallen and has also affected the growth of population since then. But

fast growth of these economies is the result of effect of factors such as natural increase in the population, rural-urban migration and the expansion of urban settlements.

In terms of economic development, the process of urbanization has inconsistent effects in different countries of the world. It is with urbanization, consequent physical changes to urban regions, these physical changes consist of development of technology and economic growth of the cities on the one hand and rapidly increasing poverty, inequality, deterioration of environment and spread of diseases on the other hand at different level developing countries of the world.

Increasing rate of urbanization in developing countries is leading to high concentration of people in the cities. This congregation of a large number of people in the cities generates problems especially for the poor people. Many poor rural migrants who shift to urban regions have to set up their housings in unregulated, congested and crowded areas where it becomes hard for them to get the basic facilities of their life. In such crowded and congested areas, there are high chances of spreading communicable and non-communicable disease, high GHG emission arouse with the use of fossil fuels and road traffic as well. All these issues also have its spillover effect on the city dwellers. With increasing trend of urbanization, this spillover effect also increases and results into lack of nutrition among individuals, respiratory diseases due to increased pollution, and communicable diseases due to poor sanitation facilities which further affects the quality of life of people residing in these areas.

Urbanization also affects the nutritional health of poor population negatively because for these rural migrants, cost of food in urban regions is too high. Moreover, due to limited financial resources, they have to compromise with the quality of food they consume. It is due to deficiency of micronutrients, around 168 million children in all over the world are suffering for weak immune system and 76% of this proportion of population is from Asia. Pollution is another consequence of urbanization that adds to environment degradation. According to WHO reports 11.6% of overall deaths at global level are due to indoor and outdoor air pollution. In low- and middle-income economies, approximate 90% people are suffering from severe respiratory diseases due to this air pollution (Saxena & Naik, 2018).

Another challenge faced by people in congested areas is due to the impact of inner-city transportation such as road traffic. Various people are losing their lives in megacities due to increased traffic on the road. The only reason is that infrastructural availability on the road is not as per the increasing traffic of vehicles on the roads. It is due to varying roles of urbanization in developed and developing countries of the world, the relationship of urbanization with growth is differentiated. In some countries, urbanization cause growth and development of the economies and in some countries growth of the economies attract urbanization. This relationship between urbanization and growth has always remained a question of debate among the researchers. Some urban growth theories have also explained the importance of this relationship.

1.4 Theories of Urbanization

There are a large number of theories that have highlighted the association of urbanization with the growth. The key theories associated with urban growth are Modernization theory, Dependency theory and Urban Bias theory.

1.4.1 Modernization theory

The theory of modernization came into existence in 20th century Max Weber, through this theory of modernization focused on the process of modernization within the societies (Wang, 2020). This theory focused on transition of traditional society into modern one through the introduction of new methods of production and with increased use of advanced technology. Especially in under-developing economies, there is high need to adopt advanced technologies for leading them towards development. The theory states that economic development through modernization can also promote social and political development of the economies. The theory emphasized on the measurement of economic development through an operationalized variable GDP per capita. According to modernization schools, urbanization is the result of industrialization (Berliner, 1977).

In highly urbanized societies, there would be high level of urbanization. It is also believed that urbanization is the result of surplus labor released from the agriculture and has been shifted to industry. Urban researchers have explained this theory in an evolutionary and functionalist perspective using some analytical based tools. In

evolutionary processes, there exists unidirectional, progressive and gradual changes in society. In this irreversible evolutionary process, rural primitive stage approaches towards urban biased society.

According to functionalist approach, technology and industrialization has vital importance in this change of society from traditional values to modern one. The theory emphasized on the rural to urban push of population for modernization of the society. This theory is also based on the assumptions that urbanization and development process move together. As per "Evolutionary ladder of development" concept given by Walter Rostow in the book entitled "The Stages of Economic Growth (1977)". The concept of evolutionary ladder of development is based on model of demographic transition given by Warren Thompson in 1929. The only difference between the concept of evolutionary ladder of development and demographic transition is the stages of development. The stages of "Evolutionary ladder of development" are traditional society, pre-take off, take-off stage, stage of maturity and high mass consumption. On the other hand, stages of demographic transition model are pre-modern, industrializing/transitional, mature industrial and post-industrial. Increasing rate of urbanization in developing countries is leading to high concentration of people in the cities. This congregation of a large number of people in the cities generates problems especially for the poor people. Following graph shows the stages of demographic transition.

Figure 1.4: Stages of Demographic Transition
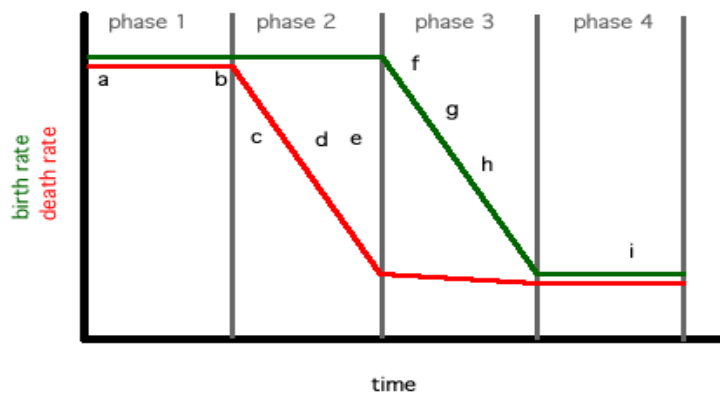
Source: Conventional approach summarized in literature

As per figure 1.4, stage 1 is highly fluctuating and the rate of birth is high due to less awareness regarding family planning and the need for workers in agriculture. In stage 2, there is high rate of birth and the death rate falls due to improved health care, sanitization, food production, food transport and sanitization (Harper, 2016). In stage 3, the birth rate starts declining due to a lower infant mortality rate and increased standard of residing. In stage 4, both, birth and death rate are low whereas the population is steady due to fertility rate less than the replacement level. "Replacement level fertility is the level of fertility at which a population exactly replaces itself from one generation to the next generation" (Duggal & Kaur, 2022).

Developing countries of the world are at the third stage of demographic transition where birth rate starts declining due to a lower infant mortality rate and increased standard of residing. During this phase the urban lifestyle dominates the traditional one. The modernization theory states that urban lifestyle consist of modern facilities which acts as urban pull i.e., push people from rural to urban regions. Examples of this urban pull can be seen in all the countries which are at the different stages of development. In mid of 18th century, with the advent of industrial revolution, there were a large number of manufacturing industries in England that attracted rural populations into the cities. Development of fuel powered tractors in 20th century is another example of rural push in United States. In recent years, a large-scale rural push has been observed in various developing countries as well.

1.4.2 Dependency Theory

Dependency theory was first given by Raúl Prebisch in 1950 which gained prominence in the 1960s and 1970. According to dependency theory, the historical processes of switching from pre-capitalist to capitalist mode of production plays an important role in the development of the economies (Saad-Filho, 2005). The theory emphasizes that the countries which are at the developing stage acts as an input source for the factories set up by the developed countries. In short, developing countries act as the supplier of raw material for them. Foreign investment in large scale agricultural production also reduces the need of man power. It results into displacement of the farmers from the rural areas and they start moving towards urban regions. High foreign

capital investment in manufacturing sector resulted into high industrialization in the urban regions of the economies. It further created multiplier effect for almost all the businesses in the urban regions. It attracted a large number of rural dwellers to urban regions. But on their arrival to urban regions, it was complex for them to find employment at good wage rate and they ended up in informal sector.

As per this theory, most of the developed nations of the world were dominating this development which is known as third world development. But with the advent of globalization, the whole scenario is changed. People in developing nations are also being provided with the jobs which has uplifted their status. The cost of labor in these economies is less. It is due to this scenario semi-skilled jobs in the developing nations have increased and results into population shift rural to urban regions (Kentor, 1981 and Dutt, 2001).

1.4.3 Urban Bias Theory

"Urban bias" is referred to as the political economy argument as per to the economic development and it is hampered by the groups who pressurizes governments for the protection of their interest. Besides that, urbanization also results into a saturated "urban labor market". Moreover, this theory was coined by "Michael Lipton" twenty-five years ago (Bezemer & Headey, 2008). The theory was demonstrated in his book, "Why poor people stay poor: Urban Bias in World Development." Urban Bias theory also explain the development process of the developing countries. According to this theory, the process of urban development is associated with economic as well as political perspective.

Lipton (1977) stated that favorable policies for the urban regions, provision of basic facilities for urban life highly contributes for the development of urban regions. The policies of the state government overtax the rural citizens. They have to pay high taxes for their agriculture products. The marketing boards under the control of the state government purchase agricultural products from the farmers at very less cost and sells the products to the customers at higher prices.

Less focus on the provision of facilities for the rural dwellers and focus in high standard of residing for urban regions results into urban rural disparities. Consequently, rural dwellers are attracted to shift to urban areas for getting advantage of such facilities. These theories of urbanization have highlighted the association between urbanization and development, but this association varies from county to country and there are various factors contribute in this relationship especially the type of urbanization. Therefore, before proceeding with the relationship between urbanization and development, it is essential to understand the scenario of urbanization at global level.

1.5 Global Scenario of Urbanization

Since Independence, there was high contribution of sluggish performance of manufacturing sector in the growth of urban regions. During the period of 1980-1990, the urban growth was decelerated due to less rural to urban movement of population (Tacoli et al., 2015). Though manufacturing industries in the developing economies were performing well during this period but they were not able to generate adequate employment because of their capital-intensive strategies.

In several developing economies of the world, there was low urban growth, decline in fertility rate in those economies could be the key factor responsible for this low growth in urban population. In developing economies of the world, rate of growth of urban population is continuously decreasing. In 1980-85, the rate of growth of population in the economies was 3.9% which declined to 3.43% in 2000 (UNDESA, 2021). According to UN reports, current 55% proportion of urban population would increase to 68% by the end of 2050. From this total increase in urban population, approximate 90% increase in urban population would be in Asia and Africa. According to UNDESA (2021), this increased proportion of urban population would be concentrated in few countries only. Though, there exist low level of urbanization in Asian countries, yet the region is accounting for 54% of global urban population. The population in urban regions was growing 2.5 times faster as compared to rural areas. In 2005, the level of world's urbanization crossed 50%. According to UNO projections, by 2025, more than 3/5th of the world's population would be urban (UNDESA, 2021).

Table 1.5.1 Total population, urban population and rural population in different regions of the world

Geographic Regions	Population (Million)		Percentage	
	1990	2018	1990	2018
Urban Population				
World	2290	4220	100	100
Asia	200	548	8.7	13.0
Africa	1040	2266	45.4	53.7
Europe	505	553	13.1	11.1
Latin America and the Caribbean	315	526	12.5	11.6
Northern America	211	299	9.2	7.1
Oceania	19	28	0.8	0.7
Rural Population				
World	3041	3413	100	100
Asia	434	740	14.3	21.7
Africa	2182	2279	71.8	66.8
Europe	217	190	7.1	5.6
Latin America and the Caribbean	131	126	4.3	3.7
Northern America	69	65	2.3	1.9
Oceania	8	13	0.3	0.4
Total Population				
World	5331	7633	100	100
Asia	635	1288	11.9	16.9
Africa	3221	4545	60.4	59.5
Europe	722	743	13.5	9.7
Latin America and the Caribbean	446	652	8.4	8.5
Northern America	280	364	5.3	4.8
Oceania	27	41	0.5	0.5

Source: Compiled from World Development Indicators

According to the table 1.5.1, the urban population of the world in 1990 and 2018 was 2290 and 4220 million respectively, where Asia was calculated to be 200 million

in 1990 and 548 million in 2018. Besides that, the rural population of the world in 1990 and 2018 was 3041 and 3413 million respectively, where Africa was calculated to be 2182 and 2279 million in 1990 and 2018. Thus, we can say that Africa and Asia are the two regions where a big change has been observed in the rural and urban population. Asia is the only region where there is increased trend in both urban as well as rural population. Though total population of the region has grown during 1990-2018, but a slow growth rate has been observed in the developing regions.

Various cities of the world have experienced decline in population. Many of these cities in Asia and Europe have observed population losses due to economic contractions and natural disasters. Nagasaki and Busan cities of Japan and Korea observed population decline between 2000 and 2018. Low fertility and emigration are the key reasons of declined population sizes in these cities. But according to UN Projections, as compared to last two decades, comparatively fewer cities would have to face population decline until 2030. Since 1950, rural population of the world is growing at a very slow rate. Total rural population of the world is 3.4 billion, it is expected that this population would decline by 3.1 billion in 2050. Asia and Africa are the only two regions with approximate 90% of rural population of the world with 893 million rural population in India and 578 million rural population in China. Moreover, Asia is the region with a large number of megacities as compared to other regions of the world.

1.5.1 World's Largest Megacities

According to UNDESA (2021), Megacity is defined as large city typically with the population of more than 10 million inhabitants. New York City and Tokyo are the first known megacities of the world. Both these cities reached crossed 10 million inhabitants in 1950s. In 2018, there are 34 megacities on this planet with China and India have maximum number of megacities. Almost all the megacities are located in Asia and Africa. These regions are also known as home to the fastest growing megacities.

Table 1.5.2: Megacities

S. No	Mega City	Country	Population
1	Tokyo	Japan	37.5 million
2	Delhi	India	28.5 million
3	Shanghai	China	25.6 million
4	Sao Paolo	Brazil	21.7 million
5	Mexico City	Mexico	21.6 million
6	Cairo	Egypt	20.1 million
7	Mumbai	India	20.0 million
8	Beijing	China	19.6 million
9	Dhaka	Bangladesh	19.5 million
10	Osaka	Japan	19.3 million
11	New York	United States	18.8 million
12	Karachi	Pakistan	15.4 million
13	Buenos Aires	Argentina	15.0 million
14	Chongqing	China	14.8 million
15	Istanbul	Turkey	14.7 million
16	Kolkata	India	14.6 million
17	Manila	Philippines	13.5 million
18	Lagos	Nigeria	13.4 million
19	Rio de Janeiro	Brazil	13.3 million
20	Tianjin	China	13.2 million
21	Kinshasa	DR Congo	13.1 million
22	Guangzhou	China	12.6 million
23	Los Angeles	United States	12.5 million
24	Moscow	Russia	12.4 million
25	Shenzhen	China	11.9 million
26	Lahore	Pakistan	11.7 million
27	Bangalore	India	11.4 million
28	Paris	France	11.1 million
29	Bogota	Colombia	10.8 million
30	Jakarta	Indonesia	10.6 million
31	Chennai	India	10.5 million
32	Lima	Peru	10.4 million
33	Bangkok	Thailand	10.2 million
34	London	UK	10 million

Source: Compiled from World Urbanization Prospectus report, 2018

Table 1.5.2 depicts the top megacities of the world. Among 34 top megacities of the world, there are 21 megacities are in Asia with 6 megacities in China, 5 megacities in India, 2 in Japan, 2 in Pakistan, 2 in Thailand, 1 in Turkey, 1 in Bangladesh, 1 in Indonesia and 1 in Philippines.

As per UN projections, Tokyo is the largest city of the world with 37.5 million inhabitants. But the population of Tokyo tends to decline and soon Delhi would take place of Tokyo in terms of population and it would be the largest mega city of the world by 2028 (UNDESA, 2021). At present there are 34 megacities in the world, it is expected that by 2030, there would be more than 43 megacities that are having

population more than 10 million inhabitants in each megacity. On the other hand, there are various urban agglomerations in Asia and Africa which are the fastest growing urban agglomerations with the population of less than 1 million. It is around 12% of the total urban dwellers of the world that reside in smaller settlements with less than 500000 inhabitants (UN DESA, 2018).

Table 1.5.3: Proportion of urban population in total population of world

Year	Total Population (Thousands)	Urban Population (Thousands)	Percentage of urban population
1990	5 330 943	2 290 228	43.0
1995	5 751 474	2 575 505	44.8
2000	6 145 007	2 868 308	46.7
2005	6 542 159	3 215 906	49.2
2010	6 958 169	3 594 868	51.7
2015	7 383 009	3 981 498	53.9
2018	7 632 819	4 219 817	55.3

Source: Author's computation using WUP data

Table 1.5.3 reflects percentage proportion of urban population in the global population is increased from 43% in 1990 to 55.3% in 2018. According to the projections of United Nation, in 2030, the proportion of urban population in the global population would be 68% (UN DESA, 2018). It has also projected that due to this rapid increase in rural to urban movement of population, the population of urban regions would be 2.5 billion by the end of 2050 and 90% of the urbanization would be only in Asia and Africa because these are the regions with the fastest rate of urbanization. In spite of low level of urbanization in Asia and Africa, Asia covers 55% of the global population (UNESCAP, 2018). The huge variations in the level of urbanization in the countries is the consequence of social, economic and demographic changes in the regions.

According to United Nation Projections, the future of global population is urban expansion with more than 50% of the world's population residing in urban regions. These estimates and projections indicate that there would be growth of 2.5 billion urban dwellers between 2018 and 2050. 90% of this rise in population would be concentrated

in Africa and Asia. It is with increase in proportion of urban population in the cities, the number and size of cities would also increase. There would be a combination of factors such as surplus of birth over deaths, increased shift of rural to urban population and migration from abroad would be responsible for this. Urbanization is also shaping the lives of people residing in rural areas near cities. Cities are the main gateways of internal as well as international migration which further promotes strategic planning as well as management of the cities. Urbanization is linked to social, economic as well as environmental aspects. Well managed urbanization in the cities results into maximization of the benefits of agglomerations and minimization of environmental degradation. It also reduces the adverse impacts of growing number of city dwellers in low income and lower middle-income countries. From this global scenario of urbanization, it is clear that there would be dynamic effects of urbanization in Asian countries in the coming year due to fast pace of urbanization in these economies. Therefore, it is required to study scenario of Asian urbanization.

1.6 Urbanization in Asia

Asian countries have passed through enormous demographic changes in the past few decades. In 1990, the urban population of this region was 1 billion, but within the period of 2.5 decades, this number has increased by 75%. The number is expected to grow in the coming years. It is expected that urban population of Asian countries would be around 2.6 billion by 2030. The proportion of urban population in Asian region has increased from 31.5% in 1990 to 56% in 2018. This is the highest percentage increase among all the regions of the world. The number of megacities is increasing in all around the world, but it has been observed that half of the world's megacities are located in Asia. Megacities and highly urbanized areas attract heavy investments but in Asia, majority of urban population lives in smaller towns and cities. Around 60% urban population of Asia lives in urban regions with less than 1 million population which are known as medium cities (UNDESA, 2021).

These medium cities in urban Asia acts as a bridge between rural areas and large urban centers by providing markets for rural products in the urban areas besides providing urban services as well. In this way, these medium sized cities link the rural

areas with the global economy. There are various small towns which serve as a stepping stone for rural migrants. In this way these medium cities and small sized towns in Asian regions acts as important economic centers. The key reason behind increased number of megacities in Asia are high birth rate and increased level of migration. Most of the people prefer to relocate to urban regions because of more opportunities as compared to rural areas. Megacities also offer better health as well as education facilities. But poor urban planning for these small and medium town increases the adverse effects as well. It can be said that Urbanization in Asia has various economic, social and demographic characteristics that have positive as well as adverse impacts on the economies.

1.6.1 Characteristics of Asian Urbanization

Diversification of Asian economies have promoted innovation and has made them global service providers at the large scale. Export led growth is the first economic characteristic of Asian urbanization (Huff, 2012). The economy has become a manufacturing base for various industries because of availability of abundant labor and attraction of global capital which has increased the proportion of exports of Asian region in all over the world. Improvement of innovative capabilities in various Asian regions has led to next generation outsourcing. Various multinational companies are looking for investments in Asian regions because of availability of talented employees and increasing trend of research and development (Yang et al., 2010).

Though economic characteristics of Asian urbanization indicates about economic growth of the regions, but all urban dwellers in Asian regions have not been benefitted equally from this economic growth. Around 40% of urban dwellers in Asia are residing in overcrowded slums (Huff, 2012). In such large and over-crowded areas, there is large and ever increasing backlog in the delivery of basic services. Not only has this, over crowded cities also increased threat to the security and safety of women and children. Overcrowded cities also increases issues of waste disposal and pollution. The main reason behind the poor health condition of people in the Asian cities is the deteriorated environmental conditions of the cities. The poor environmental conditions such as malnutrition, poverty, cramped residing conditions, polluted air and

contaminated water also pose pressure on the medical facilities in the state. There are various poor people that are not able to access those basic medical facilities. In highly populated areas, there is big issue of poor sanitation facilities that results into breeding, mutation and spread of disease in dense areas.

1.7 Urbanization and Economic Growth

Growth of economies is considered as a key factor associated with generation of resources for human development and for environment protection that is usually measured in terms of GDP or GNP. Economic growth of any economy has a close association with population of the economy because GDP per capita which is used as a proxy to economic growth is measured by dividing GDP of the economy with overall population. GDP per capita is considered as an effective way to determine living standards in comparison to GDP alone. GDP per capita has a strong correlation with development indicators i.e. life expectancy of people living in society, infant mortality rate, literacy rate and environmental quality indicators as well. The proportional relationship between national income and population indicates that with increase in population GDP of an economy also increase. But overwhelmingly large population would reduce the GDP per capita because it would reduce amount of wealth with each individual and would also affect the standard of residing of people. High GDP per capita of an economy indicates that the economy is more efficient. Asian countries are known as the fastest growing economies by both GDP nominal and PPP. Rapid growth of GDP as well as urbanization in these economies emphasizes the researchers to explore the association between urbanization and economic growth in these economies.

Urbanization is also associated with various important aspects for economic transformations such as geographic mobility, long life expectancy and population ageing. Cities are important drivers of development and poverty reduction in both urban and rural areas, as they concentrate much of the national economic activity, government, commerce and transportation, and provide crucial links with rural areas, between cities, and across international borders. Urban residing is often associated with higher levels of literacy and education, better health, greater access to social services which reflects a strong relationship between urbanization and economic development.

Higher-income countries are generally more urbanized than lower-income countries, and urbanization increases more rapidly with economic growth in lower-income countries than in higher-income countries (UNESCAP, 2015).

According to Davis (2012) less developed countries have high urban growth rate and highly developed countries have low level of urban growth rate. Less developed or developing countries are going to obtain high urban growth rate in near future as well. In higher income economies, the proportion of urban population is higher in comparison to low income countries. But rate of urbanization remains higher in developing and low income economies because of increasing rate of growth of the economies (Neiderud, 2015). It is obvious that the association between urbanization and economic growth is different in high Income and lower income countries, but what kind of relationship is there in the economies with middle income level is a big question and how urbanization is impacting environment of these economies. Rapid growth in these economies affect the consumption pattern and residing standard of people. In high income countries, people shift towards sustainable resources with increase in their income and rise in residing standard but in low-income economies, population density, age structure or age dependency ratio are the key factors which affect their standard of residing, energy consumption level and consequently affect the environment.

1.8 Urbanization and Environment degradation

Environment degradation is defined as the deterioration of environment through depletion of resources such as air quality, land and water. It is considered as one of the largest threats of the world these days. According to United Nations' International Strategy for Disaster Reduction, environment degradation is also considered as reduction in the limit of the earth to meet with the social and environmental requirements. Various environmental issues such as increased consumption of water, high energy intensity, high emission of CO_2 from vehicles and pressure on land have long term ecological effects and can demolish the whole environment in the long run. The effect of these environmental issues can be measured through ecological footprint.

Ecological footprint is defined as "the measurement of biologically productive area needed to provide for everything that people demand from nature: fruits and vegetables, meat, fish, wood, cotton and other fibers, as well as absorption of carbon dioxide from fossil fuel burning and space for buildings and roads". In simple words, "Ecological footprint is defined how activities of individuals which are measured in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated (Kitzes & Wackernagel, 2009)." Reducing size of per hectare ecological footprint in the developing economies has become a matter of concern.

Ecological footprint can help in understanding the consumption level of individuals and its impact on the environment and can optimize investment for public projects by guiding the policy makers to improve sustainability and well-being of the countries through the analysis of demand and supply side of ecological footprint. Demand side of ecological footprint measures the requirement of ecological assets for the production of the natural resources (livestock and fish products, timber, plant-based food, and fiber products) to meet with the consumption needs of population and to absorb the waste produced from it. The supply side of ecological footprint refers to productivity of the ecological assets. The area which generates supply of renewable resources and for the absorption of wastes is considered as biologically productive area. Both the terms ecological footprint and bio capacity are expressed in global hectares. Excess of ecological footprint as compared to bio capacity results into ecological deficit. It depicts that the demand of population for the natural resources is higher than its supply which can also results into emission of toxics into the air. On the other hand, excess of bio capacity as compared to ecological footprint results into ecological reserve. It is required to have smaller ecological footprint as compared to bio capacity for maintaining sustainability in the environment. It has become a conventional wisdom that population growth and urbanization are the key factors responsible for environment degradation. Based on this view, various developing countries are working to curb rural to urban migration and to cut urban expansion. But there is an inaccurate view because urbanization can affect the environment positively as well if it is managed in an efficient manner.

The positive externality of urbanization is that it brings higher productivity. However, rapid urbanization can lead to adverse externalities like property devaluation and enhancement of disease outbreak incidence. Urbanization adds to productivity with its positive externalities. In Asia, productivity of urban regions is 5.5 times higher than rural areas. These urban regions are able to produce same output using limited resources (Kitzes & Wackernagel, 2009). In this way urbanization can be helpful for reducing ecological footprint of the economies. Service sector generally contributes less to the environmental degradation as compared to manufacturing sector, but this sector needs concentration of the clients which is not possible without urbanization.

High urban density is also a benign for environment. It has potential to boost innovation and productivity and improve the overall access to services and goods. As a result, it will reduce the typical travel distances and encourage energy-efficient construction. Thus, it can be said that high urban density will be responsible for developing a sustainable environment. Public transport in the areas with high population density helps in reduction of length of the trips. People prefer walking or cycling instead of driving which reduces the carbon emission in the environment.

In urban settings, people used to get environment-friendly infrastructure that can enhance effective waste management. These facilities are also available at affordable prices in urban regions. Urbanization also promotes innovation. Green technologies are the best example of environment friendly equipment which contribute for environmental sustainability. These green innovations not only reduce environment degradation but also create investment opportunities for entrepreneurs in developing economies. Moreover, urban growth in the economies generate revenue that helps in funding infrastructure projects, reducing congestion and improving public health. The negative externalities of urbanization are property devaluation, enhancement of disease outbreak incidence, increased occurrences of crimes and despoliation of the natural environment. Property devaluation is caused due to increased mortgage rates, short sales and natural disasters (Palm & Bolson, 2021).

There is no doubt that urbanization comes with costs. With rapidly increasing urbanization in developing countries, various companies are also being set up to provide

employment to the migrated people. With these increasing industrial activities, such as power generation, transportation, construction, garbage and waste disposal, environment is being deteriorated. There is high need to maintain balance between its benign and adverse effects.

Nevertheless, rapid and unplanned urban growth threatens sustainable development when policies are not implemented to ensure that the benefits of city life are equitably proportioned. Today, despite the comparative advantage of cities, urban regions are more unequal than rural areas and hundreds of millions of the world's urban poor live in sub-standard conditions. In some cities, unplanned or inadequately managed urban expansion leads to rapid sprawl, pollution, and environmental degradation, together with unsustainable production and consumption patterns. The main environmental issues are related to the poor quality of air, clean water supply and management of waste and sanitation.

1.8.1 Environmental scenario at Global Level

According to Global Environmental Outlook (2018), increasing GHG emission at global level has increased the risk of droughts, floods and superstorms due to climbing sea levels. This climate change would pose risk to billions of people in near future. In 2015 alone, the key reason of 9 million deaths in all over the world was pollution. This man-made pollution and environmental damage results into a quarter of all premature deaths. 1.4 million People around the world dies because they don't have access to clean drinking water. According to UN DESA (2018), air pollution is ranked at 13th in the list of diseases highly contributing to deaths at the global level. This air pollution is also causing 519,000 pre-term death of babies annually. Manufacturing industries are also heavily contributing to the environmental deterioration by releasing a large amount of chemicals to the seas and results into potentially multi-generational" adverse health effects. Global food wastage also accounts for 9% of the global GHG emission because 56% of the total food produced worldwide goes waste.

Table1.8.1Ecological Footprint and Bio capacity in different regions of world

Country Name	Ecological Footprint (GHA per person)	Bio Capacity (GHA per person)	Ecological Reserve/Deficit
World	2.771571821	1.5982016	-1.173370224
Asia	2.433245459	0.75491837	-1.678327094
Africa	1.230708107	1.17958048	-0.051127631
Europe	4.739598627	3.00344881	-1.736149819
Latin America and the Caribbean	2.612113881	5.1897831	2.577669221
North America	8.040327403	4.61748018	-3.42284722
Oceania	7.113102776	12.2637651	5.150662366

Source: Compiled from Global Footprint Network Indicators

Table 1.5 depicts that average global ecological footprint is 2.77 GHA per person and the average bio-capacity is 1.59 GHA per person. It reflects that there is ecological deficit of 1.1 GHA per person. Ecological footprint is rapidly increasing in all regions of the world but the regions with low bio-capacity highly suffer due to increasing ecological footprint. As compared to all the regions of the world, Asia has the lowest bio-capacity. As more and more people are shifting from rural to urban regions, pressure on cities is increasing which is responsible for the deterioration of ecological footprint of the economies. The bio-capacity available in the developing and less developed countries is limited, but more pressure on the land of cities of these countries results into increasing size of ecological footprint. The key reasons behind low level of bio-capacity are overpopulation, industrialization, and an increasing supply over demand for natural resources. Rapidly increasing urbanization might be the reason behind this low level of bio-capacity and increasing ecological footprint. Therefore, it is essential to know the relationship between urbanization and ecological footprint in these economies.

1.8.2 Environmental scenario of Asia

Asian region is known as the hub of more than 50% most polluted cities of the world. Every year, around ½ million deaths are reported due to polluted air. In urban regions, there is more polluted air as compared to the rural areas. 67% cities of Asian region falls in the category of the cities which do not meet the air quality standard set

by European Union. From 2000 to 2018, per capita GHG gas emission in Asia has increased by 97% which is only 18% at the global level. According to (UNESCAP, 2018) as the Asian countries are growing at a rapid rate, there are high chances of more environmental degradation. It is also expected that the level of CO_2 emission would reach 10.2 metric tons per capita by 2050, if it would not controlled. This projected ration of CO_2 emission is three-fold as compared to the level of CO_2 emission in 2008 which is giving a disastrous indication for the Asian region because three out of five top CO_2 emitting economies at the world level are in Asia. In Asian regions, 0.7 GHA per person biologically productive area is available and in average each person is using 1.6 GHA (UNESCAP, 2018). Therefore, increasing size of ecological footprint has become a major environmental concern in Asian economies. In 2020, total CO_2 emission by Asia-Pacific region was 16.75 billion metric tons with 60% emission only by China. It was equal to total emission of all other regions in 2020. This rise in the CO_2 emission is the biggest concern for achievement of SDGs for Asian countries.

From theoretical point of view, there are a large number of positive as well as negative factors linked with urbanization, economic growth and the environment. The existing studies in literature have discussed the positive and negative relationship between urbanization, economic growth and environment, but there are lack of studies focusing on the aspect of ecological footprint while analyzing this relationship. The studies such as (Schnore, 1961) and (Fay & Opal, 2000) have explored positive association between development of the economies and level of urbanization in those economies. But various other researchers such as (Turok, 2013 & Chen et al., 2014) have confirmed disproportionate role of urbanization in the growth of the national income of the economies. But the studies have measured urbanization with a single indicator i.e., percentage of urban population. Other aspects of urbanization such as urban density, scale of population concentration and scale of urbanization have been ignored. Therefore, it has become a crucial practical issue to develop a methodology to explore the dynamic association between growth of the economies, urbanization and environmental deterioration for a country or for a region.

1.9 Objectives of the study

The key focus of the research is to explore the relationship between urbanization, economic growth and environment degradation in selected Asian countries. Therefore, the study, is an effort in the direction to analyze the following objectives:

1. To measure the trends of urbanization in selected Asian countries.

2. To investigate the relationship between urbanization and economic growth in selected Asian countries.

3. To explore the relationship between urbanization and environment in selected Asian countries.

4. To compare the selected Asian countries on the basis of urbanization, economic growth and environment degradation.

1.10 Hypothesis

1. H0: There exist no significant difference in trends of urbanization in selected Asian countries.
   H1: There exist significant difference in trends of urbanization in selected Asian countries.

2. H0: There is no significant relationship between urbanization and economic growth in selected Asian countries.

   H1: There is significant relationship exists between urbanization and economic growth in selected Asian countries.

3. H0: There is no significant relationship exists between urbanization and environment in selected Asian countries.

   H1: There is significant relationship exists between urbanization and environment in selected Asian countries.

4. H0: There exist no significance difference in Asian countries on the basis of urbanization, economic growth and environment degradation.

   H1: There exist significance different in Asian countries on the basis of urbanization, economic growth and environment degradation.

1.11 Chapter Scheme

This research study is divided into eight chapters.

- Chapter 1 discusses introduction of the topic. Apart from introduction, this chapter has also discussed area of study, justification for the study, objectives, significance of the study, limitations of the study and chapter scheme for the work done.
- Chapter 2 deals with the review of literature at international, national and state level and focuses on the theoretical issues related to objectives.
- Chapter 3 explains the database, concepts and the methodology used in the study.
- Chapter 4 deals with the first objective of the study that is trends of urbanization in selected Asian countries. The chapter discusses the trends of urbanization as well as its associated variables.
- Chapter 5 discusses the relationship between urbanization and economic growth in selected Asian countries. It has also discussed the relationship of age dependency ratio and population density with urbanization and economic growth.
- Chapter 6 discusses the relationship between urbanization and environment in selected Asian countries.
- Chapter 7 of the study makes a comparative analysis of selected Asian countries by testing Environment Kuznets Curve.
- Chapter 8 concludes the results of the study and recommends the policies concerning environment sustainability in selected Asian countries.

Chapter 2

Literature Review

Before conducting study on any area, it is required to have a review of previous research studies on that particular area and its related fields. It provides insight about the topic and explores new ways to make analysis of the lacunae left while conducting research by the previous researchers. This process explores new horizons for conducting research in that field. Therefore, the present chapter is a detailed assessment of the literature available on various aspect of urbanization at national and international level. There exists varied and intensive literature on the process of urbanization and manifestation of urbanization process at its different levels. The studies available in the process of urbanization, especially associated with growth and environmental perspective are sectoral and widely distributed. For developing nations, urbanization is associated with the growth as well as environmental aspect of these countries, therefore, it is essential to explore what the previous researchers have discussed about this association and which new factors can be explored from this association. This chapter is an attempt to review the existing literature on three different aspects. Section 2.1 presents the trends of urbanization. Section 2.2 discusses the association between urbanization and economic growth. Section 2.3 presents association between urbanization and environment degradation.

2.1 Trends of urbanization

Kasarda and Crenshaw (1991) defined urbanization in Asian countries after 1990 as a third world urbanization. The study found a positive inclineed trend for the growth urban population. The study also mentioned that there would be an urban explosion in Asian countries after the period of 1990. Simon (1995) also named urbanization in Asian countries as third world urbanization and mentioned that the rate of urbanization in Asian countries followed a positive increasing trend after 1990. Most of the researchers relied on urban population size for level of urbanization but there were various other concepts related

to level of urbanizaton such as population density, population size and division of labour (Murakami et al., 2005; Jones, 2017). Kundu (2009), while studying trends of urbanization in Asian countries, found that population density in Asian countries was continuously increasing and internal migration was rather high in comparison to other regions of the world. Southward movement of urbanization in Asian countries increased unaffordability to provide basic urban services, ineffective policy perspective towards urbanization and various rural development programs designed to discourage migration were responsible for this exclusionary urban growth (Kundu, 2009; Behera and Dash, 2017).

Structure of urban population was changing across the region and population was shifting from large to second order cities. There was moderate to high pace of economic growth in selected Asian countries but it was not because of urbanization but because of labor intensity of rapidly growing informal sectors (Cohen, 2006; Gong et al., 2012). Similarly, while studying the trends of growing urbanization in the developing nations of the world, Cohen (2006) found that 50% of the global population resides in urban areas. In developed nations, around one third of total population resides in urban areas. The study found that migration and conversion of rural areas into cities were the key factors associated with growing urban population. The results of the study also found that in the coming 30 years, most of the global population would be living in urban areas. Therefore, the study also highlighted the importance of an inclusive way for future sustainability so that there can be less pressure on land with increasing urban growth.

Jones (1991) studied the trends of urbanization in Southeast and East Asian countries for the period of 1960 to 1990 and also gave projections for urbanization for the year 2000. Besides analyzing the trends of urbanization in Southeast and East Asian countries, the study highlighted the causes of urbanization in these countries. The results profound that urban rural income disparities were the key reason of city inward migration. Therefore, reclassification of the cities, rural to urban movement of population and natural rate of increase in population were the main causes of increasing urbanization. The study depicted that the level of urbanization in these area was well below in comparison to other

regions. In Southeast Asia, natural rate of increase in population remained very low which remained the main cause of low level of urbanization. Similarly, Kim and Choi (1997) studied the urbanization trends and development of cities in East Asian region by making comparative analysis with other regions and by making brief discussion of major issues associated with the process of urbanization. The study focused detailed discussed regarding social, economic, environmental, and physical implications on urbanization. Economic growth was accompanied by rapid urbanization in East Asia but undesirable consequences of rapid urbanization were lack of jobs, inadequate availability of the infrastructure and environmental deterioration (Oh et al., 2021; Hashmi et al., 2021). The studies also highlighted the future potential problems because of unanticipated, unplanned and unmanaged growth of the megacities in the East Asian countries. While measuring the trends of urbanization in Asian countries, Kundu (2010) found that though governments of the countries were focusing on the improvement of infrastructural facilities in a few large cities and it resulted into high income level and quality of basic amenities in these cities but there was no strong evidence regarding association of urbanization with destabilization of agrarian economy and poverty. UNDP and other international agencies had analyzed that governments of several countries had become alert about how to control inflow of people for security purpose or to curtail pressure on limited amenities (Rakodi, 2014; Hashmi et al., 2021). Rural-urban migration continuously accelerated over the recent decades in the Asian countries, especially during the 1990s. According to the trends of urbanization in Asia, the pace of urbanization in the region would be reasonably high but it would be below the level projected by UNDP.

Bhagat and Mohanty (2009) studied the process of urbanization in India with its special focus on the regional inequality and association of urbanization with urban growth, natural increase in population, emergence of new towns, net contribution of rural to urban migration extensions of boundaries of cities and towns. The study found that the major components contributing for urbanization in Indian economy were urban increment, natural rate of growth of the population, net reclassification from rural to urban regions and net rural to urban movement of population. The study concluded that during 1990, the rate

of urbanization in India was at its lowest level though there was increased rate of movement of population from rural to urban regions due to decrease in the rate of natural increase in population which further slowed down the overall pace of urbanization in India. The most important fact, the study concluded that less urbanized areas of the economy were growing through increase in natural rate of increase in population and highly urbanized areas were due to migration of people from rural to urban regions. While analyzing the trends and patterns of urbanization in West Bengal, Anisujjaman (2015) also found that there exists association between urbanization (degree of urbanization) and human development index and high level of urban growth rate was observed in West Bengal due to migration as compared to other advanced states of India during the post-independence period and highest growth of urban population is observed around Kolkata district and a positive association had also been observed in level of urbanization and the HDI.

Various researchers have also found positive and negative outcomes of urbanization while measuring the trends of urbanization. Geyer & Kontuly (1993) found that level of urbanization was also related to positive outcomes in the society such as technology and innovation, progress of the economy and high living standard. The study emphasized on the effect of demographical variables on the urbanization level in the economies where urbanization level was measured as percentage of urban population and stated that these variables played a crucial role for regional differences in the level of urbanization in Asia. On the other hand,Leet (2006) and Ritchie and Roser (2029) studied negative outcomes of urbanization. Ritchie and Roser (2005) studied the trends in world's urbanization and found that more than 50% of total population of world was residing in urban regions and especially in the highly dense cities. According to the projections of United Nation, 2004 was the first year when first time population residing in urban regions in the world was higher than rural areas. High density of population also resulted into increase in population residing in slum areas. The results of the study concluded that industrial and economic development of the economies inevitably led to emergence of urbanization and urban agglomerations. Therefore, it was required to formulate policies for the alleviation of problems in relation to growing urbanization. Leet (2006) also found

negative impacts of urbanization on society. The study found that in the regions with high population density, increasing urbanization would result into negative effects on standard of residing. The study confirmed that migration and conversion of rural areas into towns and cities are the key components of urbanization and stated that the government should control rural to urban migration to balance the urbanization process.

The authors Bhagat (2011) and Kundu (2011) studied the reasons behind substantial rise in the urban population. Bhagat (2011) found that from the period of 2001-2011, the rate of urbanization in the economy rapidly increased from 286 million to 377 million. This increased number of urbanizations with 90.5 million was for the first time in history after independence. The study concluded that though natural rate of increase in population declined throughout the period but it remained an important factor contributing for overall growth of urban population. Urban infrastructure, civic amenities and health facilities also contributed for this growth of urbanization in the economy. According to Kundu (2011) studied that growth in urban population in past few decades was continuously growing and the methodology adopted by UNDP (logit regression model) applied to the data confirmed the proposition that migration was an effective process for improving economic wellbeing for reducing poverty among the adult population. The study analyzed the rate of urbanization in India and Asia and has compared it with other regions of Asia using Urban growth differentials and concluded that urban growth differentials in India was continuously increasing as compared to Overall Asia. It also depicted that urban growth differentials in Asia and Africa were growing almost at similar rates. The study had further calculated annual exponential growth rate for urban population in India and found that annual exponential growth rate for urban population had continuously increased in the country for the period of 1901-2001, but the population remained concentrated in cities with population 100000 or more. Dociu and Dunarintu (2012) found that labor intensive structure of Indian economy remained the key reason behind fast pace of urbanization in this economy. The study also emphsized on the impact of social and economic indicators on urbanization. The study found that fertility rates, health facilities, death rate, birth rate,

access to education, level of employment, poverty and lack of opportnities are the factors affecting urbanization level in the economies.

There were few authors that focused on measuring urbanization from different aspects and therefore, they have created indexes to measure the level of urbanization in different economies. Tettey (2005), Fernando et al. (2016), Rodrigues and Franco (2019) and Jiang and O'Neill (2018) developed indexes to measure the level of urbanization. Tettey (2005) used urbanization index that was created using principal component analysis using socio-economic indicators for Africa to measure level of urabnization and its association with social and economic developent in the economy. The study found that 1 in 3 people in urban regions are residing in slums at global level. People used to shift from rural to urban regions to find employment and to raise their standard of residing, but high population density was the key factor that decline the per capita proportion of the people residing in urban regions and results into negative impact on environment. Fernando et al. (2016) discussed about development of a composite index using modified factor analysis approach to measure level of urbanization. The main indicators used to develop this index are density of population, residential buildings and non-residential buildings, total number of vehicles and number of students in the population. For developing this index, first of all, internal consistency of the variables was measured using Cronbach alpha and then grouping pattern was identified using factor analysis approach. The single factor obtained was explaining the substantial amount of variability in the data. Weight of each indicator was defined as function of coefficient of correlation between indicator variables and first principal component. The weights of all the scaled variables were again used in final factor analysis. Rodrigues and Franco (2019) also studied systemized indicators that can help for the measurement of sustainable development in the cities and town from social, economic and environmental point of view. This study developed a composite index to measure the sustainable urban development by analyzing urban sustainability dimensions of 308 Portuguese cities/towns in a tri-partite way. It was by compiling various indicators that helps in the measurement of urban sustainability as well as by relating it to the theoretical support, the findings of the study concludes that this composite index could be applied in

any geographical context. The results of the study concluded that entrepreneurship in the economy strengthened the economic stability because new businesses had helped in decreasing the unemployment in the urban sector. Various social sustainability projects helped in improvement of social infrastructure in the cities. Environment sustainability indicated that Portugal heavily focused on environmental perspectives. Overall, the study explored how social, economic and environmental indices can help in measuring the certain aspects of the development level of the city. Jiang and O'Neill (2018) discussed about the new method of measuring urbanization that gives equal weight to all the individual indicators' population density, students, housing facilities, establishment of business and vehicles. This method of composite urbanization index also gives index value for all the countries and this method can be applied for all the countries of the world. The study concluded that this methodology can be applied to any country for measuring the level of urbanization. This new index would help in measuring the urbanization from various different aspects.

2.2 Relationship between Urbanization and Economic growth

Most of the researchers highlighted that urbanization should influence economic development in a positive manner. But there are other indicators which contributes for this association between economic development/ growth and urbanization. Smith and London (1990) analyzed urbanization and economic development at global level by comparing different regions of the world. Using the data for percentage of urban population, urban primacy, over urbanization and urban bias in different global regions for the period of 1971-1988 and by applying the regression analysis, it was found that percentage of urban population and urban primacy in the nations were the key factors affecting economic development of the nations. There was existence of convergence in the global urban pattern. Different pattern of urban primacy, overurbanization and population concentration were the key factors responsible for this convergence (Potter, 1993; Jiang and O'Neill, 2017).

Pernia (1993) studied how economic development is associated with urbanization in developing nations of Asia. The study using socio economic indicators such as adult literacy rate, life expectancy, GDP growth rate and GNP per capita analysed this association between urbanization and economic development for the period of 1950-1990. The study through the analysis of the growth rates of urbanization measured that spatial concenteration of the population in primate cities in souteast asian economies was the critical concern for the economic develoment of the economies. The growth of urban population in these cities was higher than the economic absorptive capacity of these cities. Therefore, policies related to urbanization and population distribution should be a country specific matter. The studies highlighted that demographic factors contributes in the economic developement of the developing economies, thererfore policies to slow down the populaton growth in lagging countries should be introduced (Tettey, 2005; Dociu and Dunarintu, 2005). Yegorov (2005) also studied the socio-economic influences of population density in economies with different income level besides considering demographic factors. The study concluded that population density highly influences economic growth as well as social life of people. Population density which was closely associated with urbanization in the economy positively impact economic growth in resource rich economies and on the other hand, low income and less developed economies where resource endowment per capita is not so high, population density could have negative impact on the economic growth. The study concludes that population density was an important factor while measuring economic growth of any economy. Nour (2015) also studied the association between urbanization and economic development in Sudan with special emphasized on social and economic indicators. The study considered education and human resource indicators, health and nutrition indicators, cultural indicators, demographic indicators and population distribution indicators for measuring the association between urbanization and economic development. It was by identification of the factors through factor analysis and by measuring the impact of those factors on urbanization and economic development through regression analysis, the study concluded that urbanization and socio-economic development are two high related aspects. The factor analytical approach helped

to identify region wise variations in this association. Based on demographic transition theory, the study incorporated life expectancy, fertility rate and young dependency ratio for measuring economic growth in these countries. The study using panel ARDL model analyzed long run and short run impact of demographic variables on the economic growth of the economies. The results of the study found positive association between fertility rate and life expectancy. On the other hand, increasing young dependency ratio was negatively impacting the economic growth which is a serious concern (Munir and Shahid, 2020).

Henderson (2000) studied that economic growth is significantly associated with the degree of urban concentration. Through the use of GMM approach, the paper estimated growth effects using panel data of 100 countries from 1960 to 1995.The study concluded that urban concentration in the economies has direct positive association with GDP per capita. But after reaching a peak level i.e., $2400 this association curve starts declining. The studies also stated that in middle income economies, investment on roads highly effect the urban concentration of population as compared to high-income and low-income economies (Guimaraes et al., 2000; Davis and Henderson, 2003). Kelley and Schmidt (2007) also explored the relationship between economic growth and urbanization but the study considered dependency ratio as the key variable and found a significant positive effect on GDP per capita. High ratio of working age population positively had positive impact on economic growth and supported that low dependency ratio results into high saving rate and is also considered as a key driving force for per capita income (Ginting et al., 2020; Bidisha et al., 2020).

Deng et al. (2009) studied factors that contributed to the urban expansion in China from the late 1980s to 2000. The main focus of the study was to explore the association between economic growth and urban core areas to understand the pressure on land. The study, using a panel dataset for the time period of 1980-1990 applied descriptive statistics and multivariate analysis found that urban land area in China was continuously increasing. The study further performed spatial statistical analysis using ordinary least square approach the study depicted that with 10% increase in GDP of the economy urban land expands by

3%. The study also found that changes in economic structure of China is associated with expansion of urban core. The study concluded that expansion of urban core and urban density were the key factors associated with economic growth and urban planners should consider these factors while making analysis of how urban population growth is associated with the economic growth of the countries. Chen et al. (2014) also studied pattern and correlation of urbanization and economic growth for 30 years data of China using cross section panel data and geographic information system method. From the data of the study period, it was clear that during three decades of the study period, the level of urbanization has substantially changed. The results of the study had also highlighted that there exists close link between level of urbanization and economic growth in the country. The study also described that at global level there was no association between level of urbanization and economic growth. The study concluded that government led urbanization could not help the country to obtain expected economic benefits from accelerated urbanization. The study suggested that to fully assess the process of urbanization and to measure its economic benefits, it is required to consider all its facets. Marmara (2015) analyzed urbanization and economic growth in China for the period of 1986-2013 using time series data and confirmed that there exists bilateral causality between economic growth and urbanization. There existed a significant and positive association between urbanization and economic growth for the period under review. The study suggested that there should be development of some policies on economic base, for favorable migration, and for the growth of tertiary service sector, which will induce marginal efficiency of labor.

There are large number of studies that explored long run association between urbanization and economic growth (Lo, 2010; Vasher, 2011; Turok and McGranahan, 2013). Urbanization caused economic growth for developing nation whereas the case is opposite for developed nations. The results demonstrated that causality between urbanization and economic growth was based upon economic development status of country. The studies also concluded that changes in sign of causality is due to shift from labor intensive technique to capital intensive technique. Vasher (2011) studied the impact of urbanization on economic development using Human development indicators in Sub

Saharan African countries by creating human development index. The hypothesized association between variables had been checked using OLS regression. The study considered HDI as the key indicator to measure the development level of the economy. The results indicated that there was a positive association between level of urbanization and human development. While studying association between urbanization and economic growth in Asia and Africa, Turok and McGranahan (2013), found that urbanization in both Asia and Africa is a matter of concern for governments of the countries. After making analysis of the effect of rapid population on residing standard of people of particular economies, the study found that magnitude of agglomeration economies is highly varying from the development effects of urbanization. The study also found that there exists no simple linear association between size of cities and productivity. Urbanization could have impact on the growth of the cities but this impact would vary from country to country according to the institutional settings of the economy. Rural-urban migration in these economies could push economic growth of these economies but more focus on infrastructure investments and supportive policies can help in producing better results. Arouri et al. (2014) investigated the role human capital formation in influencing urbanization and growth of economy in Africa using dynamic panel data regressions and estimated that there exists an inverted U-shaped association between urban population proportion and per capita Gross domestic production. There was also impact of urbanization on human capital variables such as school enrollment rate, health variables etc. The sectorial composition of the economy was being reshaped by urbanization in which proportion of services is 51% of GDP in the most urbanized economies, and proportion of agriculture is 76.1% of total employment in the less urbanized countries.

Sarker et al. (2016) examined the association between urbanization and economic growth in South Asian economies for the period of 1990-2014. The study using a panel of South Asian countries explored that there exists long run co-integration between urbanization and economic growth. Through the analysis using VECM model, the results indicated the existence of long run association between urban population and economic growth. The causality results showed long run causality running from urban population

growth to economic growth in South Asia. Hoselitz (2016) examined the role of urbanization in development of the economies in India for the period of 1990-2014. The study through descriptive analysis of the urban industry in India stated that urban industry in India is less developed. The key characteristic of urban industry in India was that it contains a large number of small-scale and cottage type enterprises. The laborer in the industry is not highly skilled and therefore, they were not being able to make optimum use of the available resources. Consequently, there existed less upward social mobility and no relief from the increasing unemployment in the industry. All these features reflected that the economic development of India was highly complex as compared of European countries in 19th century. Elnagi and Hassan (2017) studied the connotation between urbanization and economic growth in Indonesia. The study used gross regional domestic product per capita as a proxy to economic development. The study concluded that though there exists positive connotation between urbanization and economic growth but there was need to measure urbanization from various different aspect such as urban density, concentration of urban population in the economy and degree of urbanization. There were various other socio-economic indicators such as health, education and infrastructure that could help in providing accurate measurement for urbanization and its association with economic growth and economic development.

Brueckner and Hansl (2018) studied the economic growth rate in Philippines and found that investments in infrastructure play key role in lifting up the growth of the economy. The study found negative association between increase in population and economic reform because of insignificant impact of structural reforms in the economy. The key reason behind modest growth performance of the county is lack of policies related to structural reforms and investments in public infrastructures. Urbanization or population growth without structural reforms and investments in public infrastructures could have negative impact on the growth of the economy. Nguyen and Nguyen (2018) studied the association between urbanization and economic growth for ASEAN countries for the period of 1993-2014. Through regression estimation and panel granger causality test, the study found that urbanization has positive association with economic growth. The study

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also found that in ASEAN region, the urbanization could have negative impact on economic growth after reaching a threshold point of 69.99%. The study found presence of nonlinear association between urbanization and economic growth and stated that urbanization in this region had potential to accelerate growth of the economies but this would depend on the investments in public infrastructure. The results of the study concluded that the governments should formulate policies for urbanization while keeping social, environmental and economic aspects in concern because these factors had high potential to impact the perception of people for the quality of urbanization in cities. In ASEAN region, urbanization had not attained high level of urbanization. There was high potential of urbanization yet. But the government of the economies, rather than just focusing on speeding up the urbanization, should focus on development of urbanization that could contribute in the growth of the economies while maintaining environmental sustainability. Khan (2020) studied the nexus between urbanization, economic growth and gross capital formation in Saudi Arabia for 1974-2018. The research elucidated that urbanization and gross capital formation has positive long run association with economic growth. The study emphasized on the GCF as an important indicator for the association between urbanization and economic growth.

Various studies found that different types of urabnization impact economic growth of the countries in a different manner. The studies through the analysis of natural increase and residual increase mechanism of urbanization found that there is high correlation between residual increase in urban regions and economic growth of the countries. On the other hand, urbanization due to natural increase of population is not correlated with the economic growth of the economies. The study explored insights behind factors responsible for increase in urbanization and their effects on the growth of the economies (Armeanu et al., 2021; Gross and Ouyang, 2021; Adebayo et al., 2021).

2.3 Relationship between Urbanization and Environment

This section of the literature review highlights the reviews of the studies focused on association between urbanization and environment. Most of the empirical studies have

considered Environmental Kuznets Curve to show the linkage between environment degradation and economic activities which is basically used to represent the association between income per capita and pollutant emission. Following are the studies that have identified the association between urbanization and environment and the studies that have used EKC to measure this association

Wackernagel and Rees (1996) stated that ecological footprint help to measure the essentials to meet with the consumption level and for the absorption of the waste material. The study stated that with this growth of the economies, societies start looking for the alternatives to be environmentally sustainable. Technological innovation, urbanization and shift of economy to manufacturing to service sector helped in the reduction of this adverse effect. The studies through emphasize on theory of ecological modernization described urbanization as an indicator of modernization because social and economic factors associated with urbanization promotes modernization in the economy. The theory also stated that economic growth occurred when the societies move from low level of development to middle level of development (Gouldson and Murphy, 1997; Mol and Spaargaren, 2000). The studies stated that the process of urbanization is associated with social transformation which is known as an important element of modernization. As the societies step up from low level of development to the middle level of development, the environmental degradation became the major issue and it became essential to look for the ways to environmental sustainability. Technological innovation and more emphasize on shifting people from manufacturing sector to service sector could play key role in reducing the adverse effects on the environment. Ehrhardt-Martinez et al. (2002) also discussed about ecological modernization theory and explored that level of urbanization in the economies, urban agglomeration effects, services dominated urban economies and democratic states were the key factors responsible for this high rate of deforestation in the economies.

Dasgupta et al. (2002) examined the Environmental Kuznets Curve at global level for the countries with different income level. The study found that in Asia and Africa, the

conventional Environment Kuznets Curve was valid. These countries experience observed rising level of pollution when their per capita income starts increasing. Expansion of income and employment can be considered as the key strategies to reduce such negative impacts on environment. The study further suggested that economic analysis must be employed to test the flatter and lowered Environmental Kuznets Curve. Shi (2003) described that the economies with high manufacturing capacity or with high percentage proportion from industry produces more emissions and contributes for high environmental degradation. Shi (2003) stated that from past two decades increase in CO_2 emission is proportionally associated with change in population at the global level. The study also added that population change has strong association with carbon dioxide emission in developing economies as compared to developed economies.

Numerous studies have given importance to the use of ecological footprint as the key variable while measuring environment degradation (York et al., 2004; Lenzen, 2006; Bagliani et al., 2008; Caviglia-Harris et al., 2009; Jia et al., 2009; Hobday and McDonald, 2014). York et al. (2004) through the analysis of 139 countries with ecological footprint as a key variable analysed that EKC was valid for developed countries. The results of the study also indicated that urban growth in these economies would deteriorate the environment. In short, the study highlights that in Asian economies, economic development of the economies is increasing environment degradation as well. Lenzen (2006) made use of NSW data in their study to measure environmental impact using ecological footprint and concluded that variation in the size of EF are associated with population change and increasing use of the resources. The study proved that urbanization is the major factor affecting ecological footprint in the developing economies. Bagliani et al. (2008) examined EKC hypothesis for 141 countries of the world using ecological footprint as an explanatory variable and found that EKC was not valid in this case. The results of the study indicated that the environment Kuznets curve for economic development and ecological footprint would be statistically significant only if energy consumption level would be reduced. The study also conclude that only economic growth cannot lead to sustainable development of the economies.

Caviglia-Harris et al. (2009) studied the association between economic development and environment using a comprehensive measure of measuring environment degradation which is ecological footprint. The study found that there is limited support for the association between ecological development and ecological footprint in developing economies. The study found that energy consumption level of the economies is responsible for lack of inverted U-shape association between the economies for economic development and ecological footprint. Jia et al. (2009) studied ecological footprint of China province for the period of 1983-2006. The study also concluded that population and affluence are two major drivers impacting ecological footprint. Using partial least square method, the study has proved that the association between economic development and ecological impact is curvilinear in this province. The study identified the most anthropogenic factors impacting environment in Nigerian economy and after making analysis of the suitable factors, it concluded that population and affluence are the major drivers in the economy. Caviglia-Harris et al. (2009) analyzed 146 countries for the period of 1961 to 2000 and found that EKC was not valid for ecological footprint and economic development. The study analyzed impact of Co2 emission on the environment using STIRPAT model in China. The results of the study have proved that size of population, Grow of economy and level of urbanization in the economy increases pressure of Co2 in the economy but energy intensity has adverse impact on the Co2 emission. Mingquan et al. (2010) and Cornelia (2014) found ecological footprint as a powerful indicator to measure the pressure on the environment. This variable has potential to measure the pressure on environment. In field of ecology and environmental social science this variable has been widely used to measure the pressure on environment. The results of the study found that Asia has not become successful in creation of an effective regulatory framework for the reduction of carbon emission. It is only through the maturity of emission control policies and adoption of technologies for environmental sustainability that difference in scenarios' adaptability between Sulphur and carbon emissions in Asian economies can be observed. The policies such as charges on carbon emission or policies to store carbon dioxide gas can help in the reduction of emission of these gases in these economies. Ahmed et al. (2020) studied the linkage

between urbanization, human capital and ecological footprint for G7 countries using advanced panel data econometric techniques and found that urbanization increases ecological fotprint in the economies and human capital on the other hand, helped in reducing the ecological footprint. The study also concluded that energy consumption in the economies was responsible for increasing size of ecological footprint.

While exploring the linkage between urbanization and environment, the studies measured the impact of other variables such as population density (Cole and Neumayer, 2004; Imuraa et al., 2005; Fan et al., 2006). The studies found significant positive impact of population density on the environment. But addition of variable urbanization in the model, reduces the impact of other variables and shows high impact on environment. The study found very less evidences for influence of foreign debt on the deforestation rate. Though deforestation was posing environmental risks for these economies but the study found evidences self-corrective ecological and modernization processes that would help in mitigating the risks. The studies also found a link between population growth, urbanization, economic development and environmental issues in the economies of Asia. The study through descriptive analysis has explored that rapid pace of urbanization in 1980s has affected the economic development as well as environmental quality of the economies. The study considered pollution due to transportation, solid waste management, and water supply & sanitation as important indicators to measure the association between economic development and environmental degradation. It is because of high gap between demand and supply of urban infrastructure in these Asian economies.

Fan et al. (2006) added that the variables affect the environment in an economy differently at different level of development. The results of the study proved that population size, affluence and technology have high impact on the environment but the effect of these variables changes with change in level of development. The study also mentioned the impact of working-age dominated population on the environment and proved that this population has both negative as well as positive impacts on the environment. According to Wood and Garnett (2010) the impact of environment is based on the economic situation of

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the people residing in this economy. Economically active people exert less pressure on the population as compared to low-income people. Nathaniel et al., (2019) explored the association between ecological footprint, urbanization and energy consumption in South Africa for the period of 1965-2014. The study using OLS regression found that energy consumption and urbanization promoted quality of environment in the long run. Nathaniel et al., (2019) also supported energy-led-growth in the economies.

There are various studies in literature that have discussed about the negative impact of the urbanization on the environment (Lin et al., 2010; Medina, 2010; Mingquan et al., 2010). Lin et al. (2010) stated that with population and affluence, urbanization, industrialization, GDP per capita, and energy intensity ae the other variables affecting environmental pressure in the economies. The study found that rapid population growth and economic development of the economies are the most compelling issues for the developing economies of the world that have rapidly increased the consumption demand and consequently deteriorating environment. Medina (2010) studied that there are various countries in Africa, Asia and Latin America are facing issues for waste management. The study examined the negative effects of this inappropriate waste management on environment as well as on human health. The key issues with this waste management process are inappropriate methods to collect the waste and inappropriate final disposal of the waste. Many cities in Africa and Asia are able to collect almost half of the waste generated. This insufficient collection of waste material results into significant pollution related issues and risk to human health as well as environment. The study concludes that in these developing regions rapid population growth and economic development are increasing consumption level as well as environmental deterioration. Mingquan et al. (2010) also examined that the reason behind decrease in carbon emission at the initial stage was that at low level of urbanization, people made efficient use of the fossil fuels and this efficiency goes undermine with the rise in level of urbanization. The process of urbanization was strongly associated with the energy-intensive lifestyles and demand for housing. For this purpose, agriculture land was being converted into the residential houses which had adversely impacted the environment and had affected the level of carbon

emission in these economies. The study concluded that it was essential for the national policy makers to focus on policies which could help in reduction of carbon emission in SAARC countries.

Numerous studies have used STIRPAT model to test the impact of urbanization on environment Ping and Xinjun, 2011; Robert, 2012; Shahbaz et al., 2015; Lin et al., 2017; Long et al., 2017; Anser et al., 2020). Shahbaz et al. (2015) examined the influence of urbanization on CO2 emissions In the country Malaysia for the period 1970 to 2011. Based on STIRPAT model, the study examined how increasing level of urbanization in economy is impacting the level of carbon dioxide emission. For, this purpose, the study tested the integrated properties of the variables (percentage of Urban population, GDP per capita, energy consumption and carbon dioxide emission). After testing stationarity, the study tested co-integrating association using Bayer-Hanck combined cointegration approach. The study also applied VECM Granger causality test to measure the causal association between the variables. From the results of the study, it was clear that GDP per capita was the key contributor for environment degradation. High GDP per capita in the economy increased the energy intensity and energy consumption. There was U-shaped association found between urbanization and carbon emission but after reaching a certain level urbanization startd increasing Co2 emission. Lin et al. (2017) studied the impact of urbanization and real economic development on environment in non-high-income countries. The study considered percentage of urban population as a proxy to urbanization and GDP per capita as a proxy to real economic development. Co2 emission was used as an indicator for environment degradation. Using extended STIRPAT model, the study examined urbanization and real economic development had very less impact on the environment in non-high-income countries.

Long et al. (2017) studied influence of urbanization on environment for 72 countries of the world over the period 1980-2008 using STIRPAT model. Using both static and dynamic STIRPAT model, the results of the study concluded that urbanzation showed an ecological protection effect in high income countries only. In low and middle income

countries urbanization resulted into increased size of ecological footprint which indicated increasing environment degradation. The study found that in these economies, there would be very less negative impact on environment with increase in CO_2 emission with increase in urbanization and real economic development. On the other hand, in upper middle-income economies, high economic development would lower down the CO_2 emission but urbanization would impact the environment with increase in CO_2 emission. Anser et al. (2020) examined the influence of urbanization, GDP, and size of population on CO_2 emission in SAARC member nations for the time period of 1994 to 2013. It was through STIRPAT model framework and fixed effect regression model, the study confirmed that size of population and GDP per capita were the key drivers for enhancing the emission of carbon dioxide in SAARC nations. The study proved the validation of Environment Kuznets curve for these countries and stated that Carbon emission decrease at initial stage with increase in urbanization but after reaching a turning point of 25.33%, it started increasing with increase in urbanization (Long et al., 2017; Anser et al., 2020).

Ping and Xinjun (2011) and Robert (2012) used STIRPAT model to assess the status of sustainability in the 16 cities of China and made analyses of the relevant driving forces in the economy. The results of the study concluded that level sustainability and impact on ecological footprint in the region varies from city to city as per the development level. GDP per capita is the only factor that makes huge changes in the environmental pressure. The study also found that age structure is an important variable affecting CO_2 emission in the economies. The study through STIRPAT model proved that working age population contributes for higher emissions as compared to other population. The study also used the STIRPAT model to analyse how household dynamics are associated with fuel wood consumption. The study proves that these variables have imposed anthropogenic threat on the environment in these economies.

Gade et al. (2013) analyzed the connection between urbanization, economic growth and environment by using data from 2001 to 2010 of South Asian countries with the help of econometric models and conclude that there exists a positive connection

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between urbanization and GDP and on the other hand negatives linkages are found between GDP and environmental quality. Urbanization and environment are negatively and significantly correlated. Shahbaz et al. (2014) examined the association between economic growth, electricity consumption, urbanization and environmental degradation for United Arab Emirates for the time period of 1975–2011. The study, through ARDL technique, has proved that there exists long run association between economic growth, electricity consumption, urbanization and environmental degradation. The study has also tested causal association between the variables using VECM Granger causality approach. The results of the study concludes that there exists U-shaped association between economic growth and CO_2 emissions. Bao and Chen (2015) examined the association among urbanization, economic growth and water use change 31 provincials of China for the period of 1997-2011. The study found that urbanization is a very weak factor that impacts economic growth of the economy. Industrial structure of the provincials plays an important role in determining the impact of urbanization on economic growth as well as consumption of water. Water efficiency in most of the regions has increased with increased GDP per capita which indicates the sustainable development of the economy. Therefore, with rapid urbanization in the economy, there is need to focus on the policies related to efficient use of water which can maintain environmental sustainability. Bao and He (2015) studied the association between urbanization, economic growth, and water use change which became a key issue for the sustainable development of the economy. Though there exists rapid urbanization as well as rapid economic growth in the economy but the country is passing through a steady water stress. The study used vector error correction approach to test co-integration and causality between urbanization, economic growth, and water use in the Chinese economy for 1997-2013. The results of the study proved that there exists long run association between urbanization, economic growth, and water consumption. The study could not find short run association between the variables. The results of the study concludes that urbanization is a major driving force for economic growth in China but it would bring water crises in the long run. Therefore, it is required to emphasize on the

targeted and relatively separate policies for the coordinated development of China's urbanization, economy, and water resources.

Molla (2015) has also found negative impact of urbanization on environment in various countries at international level. The study through descriptive statistic analysis and correlation analysis explored how urbanization leads to ecological problems multiple spatial scales. The results of the study also found that there were various socio-economic, political and environmental impacts of urbanization that occurred in developing countries, but rapid urbanization was the major issue among all identified issues which had high predictive power to impact global change issues. The results of the study also concluded that deterioration of urban environment in developing countries was exacerbating various health problems. Azam and Khan (2016) evaluated the impact of urbanization along with some other variable factors on environment degradation of SAARC countries (India, Bangladesh, Sri Lanka, Pakistan) using time-series data of 1982-2013. The results of least squares estimate showed that the impact of urbanization on the environment is found blended. In case of Bangladesh and India, the relation between urbanization and environment is negative. There was positive association found between urbanization and environment in case of Sri Lanka and insignificantly positive for Pakistan. The results of the study concluded that it was highly required to focus on the formulation of policies for the mitigation of large CO_2 emissions/environmental pollution. Toth and Szigeti (2016) proved that population and affluence were among the least important factors affecting environment. The study analyzed the data from 1961 to 2014 using the indicators population, GDP, bio-capacity and EF. The results of the study concluded that consumption level in the economy was the primary factor affecting the pressure on environment. Phong et al. (2018) also studied the crucial factors associated with association between urbanization, economic growth, energy consumption and CO_2 emission in Vietnam. The study using Panel Co-integration approach found that there exist long run association between the variables. The study found that the main driving forces for CO_2 emission are population, affluence, energy intensity and CO_2 emission intensity. The study helped in

making analysis of the characteristics and driving forces for CO2 emission for each type of country so that appropriate policy recommendations could be followed.

Numerous studies in literature have used Environment Kuznets' Curve to test the relationship between urbanization and environment Taguchi, 2012; Hobday and McDonald, 2014; Maneejuk et al., 2020; Ansari et al., 2020; Maneejuk et al., 2020). Taguchi (2012) tested the applicability of Environment Kuznets Curve in Asia by using environmental indices for Sulphur dioxide and carbon emissions. The study using panel data for the period of 1950 to 2009 confirmed the validity of Environment Kuznets Curve in Asian countries. Panel regression results of this study indicates that Sulphur emission in these economies follows inverted U-Shaped curve and Carbon emission, on the other hand, increases with increase in per capita income of the individuals. The outcome of the study is supportive for literature and confirms that Environment Kuznets curve for Asian economies is applicable for local pollutants as compared to global pollutants. Though, there are various studies that have proved that carbon emission increases with increase in per capita income and the Race to Bottom scenario is not applicable in this case, but it is only because those studies have assumed the existence of high environmental standards in the economies. Hobday and McDonald (2014) stated that growing population in areas is one of the key factors affecting environment in the economies. But the study also added that change in ecological footprint depends upon change in per-capita consumption and the rate of growth of the population. It depicts that CO2 emission in the economy increases with rise in economic growth and declines after a threshold point in per capita income of the people of the economy. The study confirms the validity of EKC in the economy. The study also found positive association between urbanization and carbon dioxide emission. The study concludes that exports help in lowering down the CO2 emission in the economy. Causality analysis has also proved that there is existence of feedback effect between carbon dioxide emission and electricity consumption. Per capita income of the people of economy and urbanization also have uni-directional association with CO2 emissions.

Ansari et al. (2020) examined the association between environment and growth using ecological footprint as a key variable for a group of 37 Asian countries for the period of 1991-2017. The study using Panel Co-integration approach, OLS regression found that there is existance of EKC only in central and east asian countries. The study included four other control variables (financial development, industrial sector, renewable energy and urbanization) in the estimation model to explain the influence of economic growth on the quality of environment. The model explained that renewable energy reduces the carbon emission while all other variables have positive impact on the carbon emission. The findings of the study concludes that economic growth does not always lead to reduction in the negative impact on the environment, but it depends upon the role of other variables such as financial development, urbanization and renewable energy. Maneejuk et al. (2020) studied the association between economic development and its influence on environment through Environment Kuznets Curve for eight different communities and 44 countries across the world. The study used CO_2 emission as a proxy of environmental deterioration to assess the association between economic growth and environmental degradation. The findings of the study concluded that the Environment Kuznets curve was valid only for three communities EU, OCED and G7.

Ahmed et al. (2021) discussed the association between urbanization, economic growth and environment in G7 countries. The study found that financial globalization of the economies contributes in affecting the environment of the economies. The results of the study also found that urbanization and economic growth both are responsible for the affecting the ecological footprint of the economies. But the study found that promotion of renewable energy brings benefits for the environment. Therefore, it is high recommended to focus on the policy formulation related to generation of renewable energy sources and related infrastructure. It is to summarize the literature review in brief manner, the most important studies from literature have been presented in the following tabular format. Table 2.1 highlights the studies related to trends in urbanization, table 2.2 highlights the studies related to relationship between urbanization and economic growth and table 2.3 highlights the studies related to relationship between urbanization and environment degradation.

Table 2.1 Studies Reviewing Trends of Urbanization				
Authors (Year)	Title of the study	Country	Methodology	Findings
Kasarda and Crenshaw (1991)	Third World Urbanization: Dimensions, Theories, and Determinants	Asian countries	Secondary	Positive inclined trend for the growth urban population
Jones (1991)	Urbanization Issues in the Asian-Pacific Region	SEA Countries	Secondary	Urban rural income disparities were the key reason of city inward migration
Simon (1995)	Population growth may be good for LDCs in the long-run: A Richer Simulation Model.	Asian countries	Secondary	Positive increasing trend in urbanization after 1990
Kim and Choi (1997)	Urbanization in East Asia: Retrospect and Prospect	East Asian Region	Secondary	explored social, economic, environmental, and physical implications on urbanization
Murakami et al (2005)	Trends in urbanization and patterns of land use in the Asian mega cities	Asian Countries	Secondary	Population density, population size and division of labour are associated with level of urbanization
Kundu (2009)	Urbanisation and Migration: An Analysis of Trend, Pattern and Policies in Asia.	Asian Countries	Secondary	Population density in Asian countries was continuously increasing and internal migration was high
Cohen (2006)	Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability	Asian Countries	Secondary	Structure of urban population was changing across the region
Bhagat and Mohanty (2009)	Emerging pattern of urbanization and the contribution of migration in urban growth in India	Asian Countries	Secondary	Urban increment, natural rate of growth of the population, net reclassification from rural to urban regions and net rural to urban movement of population
Anisujjaman (2015)	Urbanisation and human development: A study of west Bengal.	West Bengal	Secondary	There exists association between urbanization (degree of urbanization) and human development index
Kundu (2010)	Urbanisation and Migration: An Analysis of Trend, Pattern and Policies in Asia.	Asian Countries	Secondary	improvement of infrastructural facilities in a few large cities and it resulted into high income level
Dociu and Dunarintu (2012)	The Socio-Economic Impact of Urbanization.	India	Secondary	Labor intensive structure of Indian economy remained the key reason behind fast pace of urbanization
Fernando et al. (2016),	Modified Factor Analysis to Construct Composite Indices: Illustration on Urbanization Index	West Bengal	Secondary	Formulated Urbanization index to measure the level of urbanization
Rodrigues and Franco (2019)	Measuring the urban sustainable development in cities through a Composite Index: The case of Portugal	Portugal	Secondary	Formulated Urbanization index to measure the level of urbanization
Jiang and O'Neill (2018)	Global urbanization projections for the Shared Socioeconomic Pathways.	Africa, Asia	Secondary	Formulated Urbanization index to measure the level of urbanization

Oh et al (2021)	Possible impact of urbanization on extreme precipitation–temperature relationship in East Asian megacities	East Asia	Secondary	Consequences of rapid urbanization were lack of jobs, inadequate availability of the infrastructure and environmental deterioration
Hashmi et al (2021)	Non-linear relationship between urbanization paths and CO2 emissions: A case of South, South-East and East Asian economies	East Asia	Secondary	Economic growth was accompanied by rapid urbanization in East Asia

Table 2.2 Studies Reviewing the relationship between urbanization and economic growth

Authors (Year)	Title of the study	Country	Methodology	Findings
Smith and London (1990)	Convergence in World Urbanization?: A Quantitative Assessment.	Global Level	Secondary	Percentage of urban population and urban primacy in the nations were the key factors affecting economic development of the nations.
Pernia (1993)	Urbanization, Population Distribution and Economic Development in Asia.	Asia	Secondary	Positive relationship between economic development and urbanization
Kelley and Schmidt (1995)	Aggregate population and economic growth correlations: The role of the components of demographic changes.	Developing countries	Secondary	Dependency ratio as the key variable and found a significant positive effect on GDP per capita
Henderson (2000)	The Effects of Urban Concentration on the Economic Growth	Developing countries	Secondary	Positive relationship between economic urbanization and economic growth
Yegorov (2005)	Socio-economic influences of population density	Global Level	Secondary	Population density highly influences economic growth as well as social life of people
Deng et al (2009)	Economic Growth and the Expansion of Urban Land in China.	China	Secondary	Changes in economic structure of China is associated with expansion of urban core.
Lo (2010)	Urbanization and Economic Growth: Testing for Causality	Africa	Secondary	Positive relationship between urbanization and Economic growth
Vasher (2011)	Urbanization and Human Development in Sub-Saharan Africa	Africa	Secondary	Positive relationship between urbanization and Economic growth
Turok and McGranahan (2013)	Urbanization and economic growth: the arguments and evidence for Africa and Asia	Asia and Africa	Secondary	Positive relationship between urbanization and Economic growth
Arouri et al. (2014)	Effects of urbanization on economic growth and human capital formation in Africa	Africa	Secondary	Positive relationship between urbanization and Human development Index
Chen et al. (2014)	The Global Pattern of Urbanization and Economic Growth: Evidence from the Last Three Decades.	China	Secondary	Positive link between level of urbanization and economic growth in the country
Marmara (2015)	An Economic Analysis of Urbanization and Economic Growth in the Republic of China	China	Secondary	Positive link between level of urbanization and economic growth in the country

Sarker et al. (2016)	Urban population and economic growth: South Asia perspective	South Asian Countries	Secondary	Long run co-integration between urbanization and economic growth.
Elnagi and Hassan (2017)	Urbanization and Economic Development in Indonesia: Demographic Perspectives Analysis	Indonesia	Secondary	Positive connotation between urbanization and economic growth in Indonesia
Brueckner and Hansl (2018)	Drivers of Growth in Phillipines	Philippines	Secondary	Negative association between increase in population and economic reform because of insignificant impact of structural reforms in the economy
Nguyen and Nguyen (2018)	The relationship between urbanization and economic growth: An empirical study on ASEAN countries	ASEAN	Secondary	Urbanization has positive association with economic growth
Khan (2020)	The Nexus between Urbanization, Gross Capital Formation and Economic Growth: A Study of Saudi Arabia	Saudi Arabia	Secondary	Urbanization and gross capital formation has positive long run association with economic growth.
Armeanu et al (2021)	Understanding the multidimensional linkages among renewable energy, pollution, economic growth and urbanization in contemporary economies: Quantitative assessments across different income countries' groups.	Countries with different income level	Secondary	Urbanization due to natural increase of population is not correlated with the economic growth of the economies

Table 2.3 Studies Reviewing Relationship between Urbanization and Environment

Authors (Year)	Title of the study	Country	Methodology	Findings
Ping and Xinjun (2011)	Spatiotemporal change of ecological footprint and sustainability analysis for Yangtze Delta Region	China	Secondary	Level of sustainability and impact on ecological footprint in the region varies from city to city as per the development level
Taguchi (2012)	The Environmental Kuznets Curve in Asia: The Case of Sulphur and Carbon Emissions	Asian Countries	Secondary	EKC Valid
Gade et al. (2013)	Exploring Nexus between Urbanization Growth and Environment: with Reference to South Asian Countries	South Asian Countries	Secondary	There exists a negative connection between urbanization and environment.
Hobday and McDonald (2014)	Environmental issues in Australia	Australia	Secondary	Growing population in areas is one of the key factors affecting environment in the economies. EKC Valid
Molla (2015)	Urbanization process in developing countries: A review on urban ecosystem degradation and public health effect	Developing countries at global level	Secondary	Urbanization leads to ecological problems multiple spatial scales

Azam and Khan (2016)	Urbanization and Environment Degradation: Evidence from four SAARC Countries—Bangladesh, India, Pakistan, and Sri Lanka.	SAARC Countries	Secondary	Impact of urbanization on the environment is found blended
Toth and Szigeti (2016)	The historical ecological footprint: from over-population to over consumption	Developing countries at global level	Secondary	Population and affluence were among the least important factors affecting environment.
Phong et al. (2018)	The Role of Globalization on Carbon Dioxide Emission in Vietnam Incorporating Industrialization, Urbanization, Gross Domestic Product per Capita and Energy Use	Vietnam	Secondary	Driving forces for CO2 emission are population, affluence, energy intensity and CO2 emission intensity
Ansari et al. (2020)	Environmental Kuznets curve revisited: An analysis using ecological and material footprint	37 Asian countries	Secondary	Financial development, urbanization and renewable energy plays important role in environment degradation
Maneejuk et al. (2020)	Does the Environmental Kuznets Curve Exist?	44 Countries across the world	Secondary	Environment Kuznets curve was valid only for three communities EU, OCED and G7.
Ahmed et al. (2021)	Linking urbanization, human capital, and the ecological footprint in G7 countries: An empirical analysis	G7 Countries	Secondary	Financial globalization of the economies contributes in affecting the environment of the economies

Research Gap

- For effective implementation of 2030 agenda of sustainable development, it is essential to understand the key trends of urbanization in the Asian economies. With rapid urbanization, successful management of urban growth is the crucial factor responsible for sustainable development especially in low-income and low-middle income economies. As per UN projections, there would be high pace of urbanization in these economies in the coming years. Therefore, it is essential to explore the association of urbanization with the growth of the economies and environment. Asian countries are experiencing demographic changes as a result of changes in the age structure of population, declining birth rate, fertility rate and death rate. Besides faster pace of urbanization in the Asian countries, the age structure of the urban population is also changing rapidly and declining age dependency ratio has a flow-on effect on the economy as well as environment.

- Research to date has not linked changes in population structure, economic growth and environment (Ansari et al., 2020). It indicates that there is scarcity of empirical research on measuring the association between urbanization and economic development by keeping population age structure in concern. The prior studies have explored the association between urbanization and economic growth using rate of urban population and GDP as the key variables (Long et al., 2017). But it is essential to measure urbanization from various different aspects such as by developing an index of variables related to urbanization.

- This study is an initiative to measure the association between urbanization, economic development and environment using urbanization index. Moreover, the study has also made comparative analysis of selected Asian countries through time series analysis of data. There exists various studies that have explored the association between urbanization, economic development and environment using panel data approach. There are very few time-series country specific studies. According to Dinda (2004), time series method for data analysis is considered as the best method to show a complete picture of the scenario, therefore, this method is preferred over other methods. According to Lindmark (2004), cross country analysis on the other hand, just provides general understanding of the association between the variables and are not helpful for

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guiding the policymakers. This research study has filled the gap by using both panel and time series approaches using enhanced econometric techniques.

- While measuring the association between urbanization and economic growth in selected Asian countries, use of age dependency ratio has helped to capture impact of overall demographic changes in an appropriate manner. There are large number of country specific and cross-country studies discussing the importance of demographic changes on growth of the economies, but no study in literature has highlighted the importance of demographic changes while measuring this association between urbanization, economic growth and environment (Ansari et al., 2020).

- There exists various research studies that have measure the impact of urbanization and economic growth on environment using a single indicator such as CO_2 emission or energy depletion (Caviglia-Harris et al., 2009). Ecological footprint is known as a useful measure to assess the environmental impact of different activities of human being. There are very few studies in Asian countries that have used ecological footprint to measure the environmental degradation for country specific analysis (Ansari et al., 2020). Most of the studies that have used ecological footprint as a proxy to environment degradation have conducted cross country analysis ((Bagliani et al., 2008), (Caviglia-Harris et al., 2009), (York et al., 2004), (Long et al., 2017), (Nathaniel et al., 2019), (Ahmed et al., 2020), (Ansari et al., 2020)).

- There are only few studies which have used ecological footprint for country specific studies. Moreover, there is scarcity of research on the literature for testing of Environment Kuznets curve for the association of urbanization and ecological footprint in Asia. There is also lack of evidences for empirical associations between ecological footprint and economic growth. Therefore, the need of the study is to explore the interaction of three key aspects i.e., urbanization, economic development and environment degradation. This study, by using advanced econometric modelling techniques, has provided extension of the analysis and has overcome the gaps in literature.

2.5 Need for the study

Rapidly increasing urbanization in Asian economies has become a matter of concern because it is not only increasing the population density but is also changing the

population structure of the economies. Consequently, urban growth management has become a crucial factor for the sustainable development of the economies. According to UN projections, this urban population growth would be at high pace in the coming years. Therefore, it is essential to explore the relationship between urbanization, economic growthand environment in Asian economies with fastest rate of urbanization to formulate policies for sustainable growth of the economies. The key focus of the researchers in this field remained to measure urbanization from a single aspect that is by using urban population growth rate as a proxy to urbanization. Other important aspects such as urban density andscale of population concentration have been ignored. There is need to create a standardizedurbanization index to measure urbanization from these aspects as well and to fill the gap in literature. On the other hand, to measure the relationship between urbanization and environment in Asia, researchers have mainly focused on GHG emission. Those studies have ignored the other aspects of environment degradation such as impact of human activities on air, water and soil. Therefore, it is required to measure association between urbanization and environment using ecological footprint which can explore the impact of all human activities on the environment. Given the evidence on growing interdependence of urbanization, economic growth and environment degradation in Asian countries, this study is an attempt to examine their relationship in Asian countries.

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Chapter 3

Database, Concepts and Research Methodology

Cities play a multifaceted role in every economy. They are known as heart of technological development and economic growth. On the other hand, cities also serve as a breeding ground for poverty, inequalities and environmental hazards. It depends upon the population structure of the cities and availability of bio capacity in those cities to meet with the needs of people. Rural to urban movement of population is known as a significant factor for the growth of the cities. But how this rural to urban movement of population affects the growth of the economies, depends upon the density of population in that economy, population concentration in different regions of the economy, degree of urbanization, availability of infrastructural facilities, health, education and other basic needs of human beings residing in that economy. There is huge difference between role of urbanization in developed and developing economies. Developed economies of the world benefits from urbanization because they have abundant resources to fulfil the basic requirements of the people and growth in urban population helps in increasing the productivities of the economies. On, the other hand, developing and less developed economies suffers because of unplanned urbanization, limited resources, population concentration in small and medium sized cities.

There is high heterogeneity in the level of urbanization and its effects in all regions at global level. Asia and Africa are the two regions with rapid rate of urbanization. Asia is also known as the region with lowest bio capacity available at the global level. Therefore, rapidly increasing population has become a matter of concern especially for the developing economies. This study would analyze how urbanization in Asian economies is related with the economic growth and environment degradation. There is vast literature available on this aspect but the key focus of the researchers was to measure the level of urbanization using a single aspect i.e., percentage of urban population in the economies. The present study would use urbanization index that has tried to measure urbanization from various different aspects and relationship between urbanization, economic growth and environment

degradation using urbanization index. Moreover, the study also aims at measuring relationship between urbanization and environment degradation in Asian countries through Ecological Footprint. For the purpose of the study, top ten Asian countries on the basis of annual rate of growth of urbanization have been selected. The 10 selected countries for this study are China, Bangladesh, Nepal, India, Thailand, Philippines, Indonesia, Cambodia, Vietnam and Malaysia.

This chapter is an attempt to outline the database and construction of variables used in the study by explaining the sources of the database available regarding all the indicators used in this study. It has also explained the methodology used for the estimation of different variables. The chapter also highlights the theoretical underpinnings of the concept and methodology to work out relationship between urbanization and economic growth. The chapter has also discussed the methodological framework to measure the relationship between urbanization and environment degradation. For this purpose, the chapter has been divided into four distinct sections. *Section-I* discusses about the sources of the data, conceptual definitions and explains the procedure of constructing urbanization index. *Section-II* discusses about econometric estimations to measure the relationship between urbanization and economic growth. Further, *Section –III* discusses about methodology used to measure the relationship between urbanization and environment degradation and finally *Section-IV* explains the application of Environment Kuznets Curve used to make comparative analysis of the selected Asian countries.

3.1 Sources and database, Conceptual definitions and Computation of Index
3.1.1 Sources and database

It is acknowledged that exploration of empirical relationship between urbanization, economic growth and environment degradation require a set of economic variables based on the objectives of the research study. The data required for this research study is fetched from World Development Indicators, International Energy Agency and Global Footprint Network. Various reports of United Nations, Asian Development Bank and World Population Prospectus have also been considered for this purpose. The confined time

period for this study is from 1990-2018. The choice of this time period is based on the availability of data from the different sources.

3.1.2 Conceptual Definitions

The study consists of various concepts and definitions from literature that lay a strong foundation for making move in the right direction. This section of conceptual definition covers some important terms used in this study data for which has been culled up from World Development Bank Indicators.

While utilizing the data of population and urbanization provided by World Bank and United Nation, there is high need to be careful because there is no standard definition for the measurement of the population threshold. Thus, Gibbs, through his measures of urbanization tried to deal with this problem and he came up with three different measures for measuring the level of urbanization in the economies. These three measures consist of degree of urbanization, scale of urbanization and scale of population concentration. According to the United Nations' approach, degree of urbanization can be calculated by dividing the urban population with total population or the proportion of urban population residing in a particular area.

- **Degree of urbanization**

Urbanization is defined as the process of increase in the urban population of an economy due to some non-agricultural activities in the economy. Growth in urban population can be measured through the proportion of urban population to total population of the economy. Degree of urbanization in an economy can also be measured through this proportion of urban to total population. There would be high degree of urbanization at higher percentage of growth of urban population. The formula to calculate degree of urbanization is

$$\text{Degree of urbanization} = \frac{\text{URBP}}{\text{TP}} * 100 \qquad (1)$$

Where URBP = urban population, TP = Total population

Zahra and Mowla (2017) stated that degree of urbanization should be measured using different measures according to size of urban centers. Size of all the urban centers should be considered and the median value of the size should be used to measure the degree of urbanization. According to this study, it is essential to consider the urban population concentration for measurement of this level or degree of urbanization. Generally, at national as well as international level, proportion of urban population is used to measure the degree of urbanization. But for the measurement of degree of urbanization at international level, it is required to work on a standard definition of urban that is not available. Minimum size limit of the cities is the main base of the measurement through this degree of urbanization. But this minimum size of the cities varies for almost all the countries if we use this criterion at international level. Thus, it is required to use a criterion which can be universally applicable. If there would be a universally applicable standard definition of urban, still this formula of degree of urbanization would be limited to some specific dimensions. It is also possible that majority of the population of an economy is residing in a particular small point of concentration. The minimum size limit of the area should not be less than 5000 inhabitants.

- **Scale of urbanization**

Scale of urbanization is based on the two major properties. Firstly, it measures the concentration of urban population in different class sizes and secondly, it measures the concentration of the total population in different class sizes. There would be high scale of urbanization if there is high concentration of the urban as well as total population in a specific area (Gibbs, 1966). The formula to calculate scale of urbanization is as follows.

$$Su = \sum_{i=1}^{n} XiYi \qquad (2)$$

Where Su stands for scale of urbanization, Xi is the proportion of urban population in a particular class limit according to size of population and all other classes, Yi is the proportion of total population in a particular class limit according to size of population and all other classes and i is a particular class size of population.

- **Scale of Population Concentration**

Gibbs (1966) gave measure for urbanization as scale of population concentration. This method is considered best by World Bank because it covers all points of population concentration. Arriaga (1970) in his study also measured urbanization using degree as well as speed of urbanization, scale of population concentration but ignored social and economic aspects associated with urbanization. The study defined that degree of urbanization, concentration and scale of urbanization provide almost equal level of urbanization, but scale of population concentration is considered best because it covers all the points of population concentration.

Scale of urbanization is based on the minimum size limit of the population class. The major limitation of this formula is that it does not describe the pattern of the population in different classes. This formula is not appropriate for the situations when population of a country is same at two specific points of times and two countries have the same level of population (Megeri and Kumar, 2018). The main benefits of using this scale of urbanization is that it focuses on the distribution of total as well as urban population. It calculated the population concentration of all countries in a dataset based on the same class size. This scale is based on some specific minimum as well as maximum values. High scale of urbanization indicates high concentration of urban population in large cities in an economy and low scale of urbanization indicates high concentration of urban population in small cities (Megeri and Kumar, 2018).

This scale of measurement of urbanization helps in the measurement of concentration of urban population from the upper end of the size of class i.e., this method considers large size of the classes. It is considered as the best method of measurement as compared to degree of urbanization and scale of urbanization. Scale of urban population focuses on all points of aggregation of population. Formula to calculate scale of population concentration is as follows.

$$SPC = \sum_{i=1}^{n} Zi \qquad (3)$$

Where SPC = Scale of population concentration

Z_i = proportion of total population in a particular size class and in above classes

This study has used the method of scale of population concentration to measure the population concentration in the different class size of the economies.

3.1.3 Computation of Urbanization Index:

Principle component analyses (PCA) is a branch of multivariate technique. This straight forward method helps in the transformation of a set of variables into a new set of principle components (Megeri and Kumar, 2018). Harold Hotteling explored this method for the maximization of sum of squared loading for the given factors. PCA is a technique used for the purpose of dimension reduction for a particular dataset. This technique helps in enhancing the interpretability of the data as well as it helps in the loss of information. It converts a large data set into a smaller one with the required useful information only. There is no specific assumption regarding structure of the variables. The only major requirement is to explore the best suitable linear combination of the variables. The first principal component explains the summary of linear combinations of the data set. The second principal component explain the variance that has not been considered by the first variable. After removing the effect of first principal component the linear combination of the most residual variables is considered as the second principal component. The solution requires N number of component unless at least one variable is being perfectly determined through other variables in the data set. If the variance of all the principal components is added it would be equal to the addition of variances of actual variables. PCA is based on the following data matrix.

$$X = |Xij| \tag{4}$$

The derived variables can be explained by the following equation.

$$Zj = aj1P1 + aj2P2 + aj3P3 + \cdots \ldots \ldots \ldots + ajnPn \ (j = 1 \text{ to } n) \tag{5}$$

Where z_j = the standardized values of the observed variables;

p_n= the new uncorrelated components

a_{jn}= the coefficients known as 'factor loading' or weights

The standardized values obtained would be considered as the principal components and the process of obtaining this value is known as principal component analysis. The first component of this analysis always explains the maximum variance that is why this component is used for the creation of the index. Square of all the coefficients is considered as the weights to the particular variables. In this study, urbanization index has been created using the squares of factor scores.

As indicated, the study has created an urbanization index because there is no standard threshold in the literature to measure the urban status of the Asian countries. Due to scarcity of detailed data of population for Asian countries, it was best to use scale of population concentration for measuring the status of urbanization in the Asian countries. It has been mentioned earlier that factor analysis technique was used to create urbanization index. The urbanization index was created with a set of socio-economic variables associated with the process of urbanization. The key variables used for the development of urbanization index are Urban Population, Population Density, Life Expectancy, Health Expenditure, Gross Domestic Product Per capita, Gross Capital Formation, Fertility Rate, Employment in agriculture, Employment in Industry and Employment in services, Death rate, birth rate, adult literacy rate, Annual rate of growth of urban population, Hospital beds, improved drinking water, improved sanitation, physicians, school enrollment primary, school enrollment secondary and school enrollment territory. Scale of population concentration and urban density have also been calculated to regress these variables with other socio-economic variables.

Table 3.1.1: Computation of Scale of population Concentration

Country	Fewer than 300 000	300 000 to 500 000	500 000 to 1 million	1 to 5 million	5 to 10 million	10 million or more	SPC ∑X	Degree of Urbanization
Bangladesh	0.32409	0.114584	0	0.105109	0.061818	1	1.605601	36.632
China	0.117293	0.113503	0.249286	0.135943	0.061329	0.322646	1	59.152
Indonesia	0.069853	0	0.199169	0.061886	0.026548	0.993533	1.350989	55.325
India	0.204625	0.056926	0.271966	0.119326	0.113813	0.859789	1.626446	34.03
Cambodia	0	0	0.140191	0	0.006854	0.032198	0.179242	23.388
Malaysia	0	0.315308	0.045112	0.107205	0.09063	0.608642	1.166897	76.036
Nepal	0	0	0.040716	0	0.013485	0.071627	0.125828	19.74
Philippines	0.267714	0	0.041468	0.211742	0.194178	0.778559	1.493662	46.907
Thailand	0.295236	0	0.153924	0.346563	0.413627	0.964066	2.173415	49.949
Vietnam	0	0.234222	0.346108	0	0.11209	0.937187	1.629607	35.919

Source: Author's computation using WDI data

Table 3.1.2: Computation of Urbanization Index for the selected Asian countries

Country	Degree of urbanization	Scale of population concentration	Factors	Urbanization index	Urbanization index (Percentage)
Bangladesh	36.632	1.6056007	0.17893	0.469577	46.9577
China	59.152	1	0.34893	0.515221	51.52209
Indonesia	55.325	1.3509893	0.22961	0.483184	48.31842
India	34.03	1.6264459	-0.9768	0.159271	15.92706
Cambodia	23.388	0.1792422	-0.5444	0.275367	27.53673
Malaysia	76.036	1.1668966	2.15448	1	100
Nepal	19.74	0.1258276	-1.56513	0.001308	0.130757
Philippines	46.907	1.4936618	0.55798	0.57135	57.13496
Thailand	49.949	2.1734152	-0.0092	0.419065	41.90652
Vietnam	35.919	1.6296069	-0.3744	0.321011	32.10113

Source: Author's computation using WDI data

Degree of urbanization and scale of population concentration, both variables were grouped together under the same factor and the factor scores obtained from that group were used for the development of the urbanization index for Asian countries. This index has been further used for exploring the relationship between urbanization, economic growth and environment in Asian countries. Generally, value of index remains between 0 and 1 but in this study, the value of urbanization index has been multiplied with 100 so that it can be converted into percentage as the value of degree of urbanization is. The process of computation of urbanization index for Asian countries was started from the calculation of scale of population concentration for these countries.

Gibbs (1966) gave scale of population concentration to compute all points of population aggregation. For calculation scale of population concentration, it was required to consider proportion of population in different class sizes. According to the statistics provided by World Bank on the data related to population in different class sizes, following class sizes have been considered for analysis in this study.

- Fewer than 300000
- 300000 to 500000
- 500000 to 1 million
- 1 million to 5 million
- 5 million to 10 million
- 10 million and more

While creating urbanization index, it was very complex to deal with the negative values produced by factor scores, thus these negative values were converted into the positive ones using the following formula

$$\text{Value of Index} = \frac{p-n}{m-n} \tag{6}$$

Where p is the original value of the series, n is the maximum negative value of the series and m is the maximum positive value of the series. The above formula removed all the negative elements of the factors scores obtained through factor analysis and the values of the factor scores were used to create urbanization index. This value

of urbanization index for the selected counties has been used to explore the relationship of urbanization with economic growth and environment degradation in the further chapters.

3.2 Research Methodology

The research study is aimed at achievement of the following objectives

 1. To measure the trends of urbanization in selected Asian countries.

2. To investigate the relationship between urbanization and economic growth in selected Asian countries.

3. To explore the relationship between urbanization and environment in selected Asian countries.

4. To compare the selected Asian countries on the basis of urbanization, economic growth and environment degradation.

Objective 1: To measure the trends of urbanization in selected Asian countries.

The objective of the study will be achieved by calculating Average growth rate of urban population, Urban density, Percentage change in GDP per capita, Percentage change in death rate, Percentage change in birth rate, Natural rate of increase in population, Percentage change in employment in agriculture, Percentage change in employment in industry and Percentage change in employment in services for all selected Asian countries.

- *Average Growth Rate*

The average growth rate measures the average rate of return or growth over a series of equally spaced time periods. Formula used to calculate average growth rate of urban population in the study is as follows.

$$\text{Average Growth Rate} = \frac{GR_1 + GR_2 + \cdots + GR_n}{N} \qquad (7)$$

<center>Where GR= Growth rate and N stands for number of years</center>

- *Percentage Growth/Change*

Percentage growth refers to change in the growth rate of data in present year in comparison to the previous year. Formula used to calculate percentage growth/ Change in the study is as follows.

$$Percentage\ Change = \frac{Ending\ Value}{Begining\ Value} - 1 \qquad (8)$$

Where ending value is the data of present year and beginning value is the value of the past year.

- *Urban density*

Urban density is also considered as a measure of urbanization that is calculated by dividing the urban population of the economy with total area. As the percentage of urban population defines degree of urban population, in the same way, urban density is used to measure the concentration of population in a particular region.

$$Urban\ Density = \frac{Urban\ population}{Land\ Area} * 100 \qquad (9)$$

- *Natural Rate of Increase in population*

Natural Rate of increase in population is known as an important indicator of urbanization. This natural rate of increase in population is known as the difference between birth rate and death rate in an economy. Birth rate is defined as the total number of births per thousand in a year. It is required to calculate the birth rate to estimate the needs of newly added population and to calculate the growth of population in an economy. It is also easy to calculate demographic transition in an economy through death rate and birth rate. Total number of deaths per thousands in a year in an economy is known as death rate. Death rate in an economy indicates health facilities, medical facilities and the level of awareness towards health and hygiene of the residents. Formula to calculate Natural rate of increase in population is as follows.

$$Natural\ Rate\ of\ Increase\ in\ population = \ Birth\ Rate - Death\ Rate \qquad (10)$$

Objective 2: To investigate the relationship between urbanization and economic growth in selected Asian countries.

This objective will be achieved by analyzing the relationship between urbanization and economic growth through Panel co-integration analysis and Panel Causality analysis.

3.2.1 Theoretical estimations

Through literature, it has been explored that several methods have been used by researchers to test the relationship between urbanization and economic growth. The relationships explored by Neo-classical growth theory to measure economic growth and level of economic development have been used by various researchers in literature (Barro & Sala-i-Martin, 1992). Kelley and Schidst (1995) identified that Neo-Classical growth theory is more efficient for measuring the relationships as compared to production function theory. Therefore, the study has used Neo-Classical growth model to explore the relationship between urbanization and economic growth. The equation for this model is as follows.

$$Y/N_{g(t,t+n)} = y(\frac{Y}{N_t}, X; Z_{(t,t+n)})$$

(11)

Where $Y/N_{g(t,t+n)}$ refers to growth rate of GDP per capita, $\frac{Y}{N_t}$ is the initial level of GDP per capita. X refers to urbanization; Z refers to factors which influence economic environment of the economies i.e., Gross capita formation. According to Levine and Renelt (1992), Gross capital formation is the most robust factor for such type of studies. Using the above given theoretical framework, this study has assumed that there is cumulative influence of urbanization, gross capital formation, trade openness and age dependency ratio.

3.2.2 Panel Unit root test

It is always essential to test the unit root of the data while dealing with the macro-economic variables. The series are considered as integrated at order zero if it is stationary at level. If series is stationary at first difference, it is considered as integrated at order 1. In case of time series data, Augmented Dickey Fuller is the most common test to check the stationarity of the series. For panel data, Levin (2002), IPS (2003), Hadri (2000) and Madala and Wu (1999) have given panel-based tests (Levin et al.

2002). In case of balanced samples Hadri (2000) and LLC (2002) are the most important tests (Hadri et al. 2003). These tests examine the stationarity of the series with same time bound. This study has used appropriate group of panel unit root tests to test the stationarity of the variables used for the analyses. The first test of this group is Levin, Lin and Chu test (LLC). The equation of this test is based on the basic assumptions of Augmented Dickey Fuller test which is as follows.

$$\Delta Yi, t = \partial i Yi, t - 1 + \sum_{L=1}^{p} \alpha i, 1\Delta Yi, t - 1 + \beta i di, t + \varepsilon i, t \qquad (12)$$

In the above equation, Yit refers to the stochastic process for n number of years and for t countries. Exogenous variables in this model and error terms are represented by d_{it} and $\varepsilon i, t$ respectively. This test determines the order of integration of each panel. This test is known as the most complicated one because it combines the data into a single regression. Null hypothesis of this equation states that there exists unit root and alternative hypothesis states that there exists stationary root. The main limitation of this test is that it assumes that all the individual processes are independent as well as unrealistic. Thus, the study has also used Im, Pesaran and Shin unit root test (IPS). This unit root test is based on a separate ADF regression equation for each panel as follows.

$$\Delta Yi, t = \alpha i + \partial i Yi, t - 1 + \sum_{L=1}^{p} \beta i, 1\Delta Yi, t - 1 + \varepsilon i, t \qquad (13)$$

3.2.3 Panel Co-integration test

After checking the stationarity of the variables, co-integration tests have been used to test the co-integrating relationship among the variables that were found stationary through the unit root test. Pedroni (1999) gave co-integration tests to examine co-integration among the stationary variables. The co-integration tests offered by Pedroni controls the size of country and heterogeneity of multiple regressors. There are seven different tests introduced by Pedroni to test the co-integration among the variables. The null hypothesis for all these panel co-integration tests is that there exists no co-integration among the variables. These tests can be categorized into two categories within dimensions and between dimensions. Within dimension tests consists of panel-υ, panel-ρ, panel-ρρ, panel-ADF and three others i.e., group- ρ, group-ρρ,

group ADF are between dimension tests. For each statistics null hypothesis states that there exists no co-integration among the variables.

For between dimension statistics; $H1 = p_i < 1$ for at least one i.

For within dimension statistics; $H1 = p = p_i < 1$ for all i.

The between dimension test allows for heterogeneity that is why it is known as less restrictive test. There is another test of co-integration known as Kao test. This test was formulated by Kao in 1999. This test is based on the Dickey Fuller and Augmented Dickey fuller tests and assumes null hypothesis as there is no co-integration among the variables. Third test of co-integration is known as Johanson Fisher co-integration test. This test was proposed by Madala and Wu (1999) and tests co-integration among the variables on the basis of trace and maximum Eigen value and gives combined values for the whole panel. The following equation describes how this test combines the individual cross section values.

$$-2 \sum_{i=1}^{N} \log(p_i) \rightarrow \delta_{2n}^2 \tag{14}$$

Where pi is the individual p values obtained from the cross section and n is the number of cross sections in the dataset.

3.2.4 Panel FMOLS and DOLS estimates

After checking co-integration among the variables, the next step is to measure long run equilibrium among the variables. Generally, OLS method is used for this purpose but in case of panel data, this method gives biased and inconsistent results. OLS estimates may also suffer from serial correlation and heteroscedasticity which leads to invalid inference. DOLS and FMOLS takes care of endogeneity by taking care of leads and lags and also use white heteroskedastic errors. Therefore, the study has used Fully Modified Ordinary Least Square Method (FMOLS) and dynamic ordinary least square method (DOLS). These methods were proposed by Kao and Chiang (2000). These methods allow high flexibility even in case of heterogeneity among the variables. The equation for fixed effect panel regression is as follows.

$$y_{it} = p_1 + qx_{it} + u_{it} \qquad (15)$$

Where i refers to n number of terms and t refers to t number of terms. Yit is a (1,1) matrix, q is vector of slope dimension, p_1 is individual fixed effect, u_{it} is disturbance term and x_{it} is a vector assumed to be of an order one. FMOLS and DOLS are improvement over OLS method for endogeneity and serial correlations. Both FMOLS and DOLS provides standard error which can be used as inference. In case of FMOLS, there exists no issues of lag and leading variables. The equation for FMOLS is as follows.

$$Y_t = \alpha_0 + \alpha'x_t + u_t \qquad (16)$$

Kao and Chiang (2001) mentioned that both these estimators have normal limiting properties but in case of small samples, DOLS outperforms FMOLS. DOLS can be estimated using the following equation.

$$D_{it} = \alpha_i + \beta x_{it} + \sum_{j=-q}^{q} c_{ij}\, \Delta x_{i,t-j} + \varepsilon_{it} \qquad (17)$$

Where i refers to 1 to n and t refers to 1 to t. c_{ij} refers to lead or lag coefficients of dependent variable at first difference.

3.2.5 Panel Vector Error Correction model

Granger representation theorem states that two series which are co-integrated at order 1, it can be characterized that these series have been generated through an error correction mechanism. Only co-integration among the variables cannot confirm the direction of causality among the variables. Thus, panel-based vector error correction model is used to test the direction of causality among the variables. This model works according to a two-step Engel Granger procedure. In the first step, long run relationship is tested using DOLS equation and an error correction term is generated for the second step. Error correction term is also denoted as one period lagged residual of long run equation. And deviation of the variables from long run can be estimated through sign of the coefficient of error correction term. This error correction model provides long

run relationship as well as short term dynamics of the variables. The equations for VECM model are as follows:

$$\Delta Y_t = C_0 + \sum \beta i\ \Delta Y_{t-i} + \sum \alpha i\ \Delta X_{t-i} + p_i ECT_{t-i} + u_t \tag{18}$$

$$\Delta Y_t = C_0 + \sum \partial i\ \Delta x_{t-i} + \sum \emptyset i\ \Delta y_{t-i} + n_i ECT_{t-i} + \varepsilon_t \tag{19}$$

In the above equations Δ denotes difference operators, αi and φi are estimation parameters, ECT_{t-i} refers to error terms and this term would describe the long-run co-integration relationship. There is not only lag that affects the dependent variable but disequilibrium level of the previous periods also affects changes in the dependent variable.

Objective 3: To explore the relationship between urbanization and environment in selected Asian countries.

This objective of the study will be achieved by analyzing the relationship between urbanization and environment degradation using OLS regression and Ridge regression method. The study has considered STIRPAT model to achieve this objective. The theoretical estimations of the model are as follows.

3.2.6 STIRPAT Model

STIRPAT is known as a coordinated program to understand the dynamic relationship between human activities and the ecosystems. Theoretical foundation of this model is based on Social, Scientific and Ecological lenses. This model identifies the causation between human activities and its influence on the eco system. The word STIRPAT, itself refers to Stochastic Regression on Population, Affluence and Technology. It is a general assumption that each and every human being impacts the environment through its daily activities. On the basis of this generalization, various researchers have examined the impact of population on environment.

This Model is based on the theoretical aspect of structural human ecology that defines the relationship between human activities and the ecosystem (Catton, 1987). Human ecosystem mainly consists of four different components: population, social

organization, environment, and technology (Duncan, 1961). This theoretical approach emphasizes on the bi-directional relationship between social and natural environment (Knight, 2008). But it is not a recent effort to measure the effect of socioeconomic factors on the environment using this model. Basically, this model is based on IPAT model developed in 1970s. This model focused on assessing the magnitude of human activities on the environment. Ehrlich and Holdren (1971) first introduced this model. This model is based on the principal idea of impact of Population (P), Affluence (A) and Technology (T) on the environment. The following mathematical equation express IPAT model.

$$I = P*A*T \qquad (20)$$

But various researchers have conducted reformations in this model till 2005. Waggoner and Ausubel (2002) introduced a new variable in this model named as consumption and the model was reframed as IPACT. Consumption in this model represent per unit consumption of GDP. Schulze (2002) claimed that behavior of human beings is also an important aspect that should be considered while measuring this impact on environment. Therefore, he added a variable named human behavior measured it as a driving force for environmental impacts. Xu et al. (2005) added another two variables in the model (social development (S) and management (M)) and claimed that these variables contributes in decreasing the influence of activities of individuals on the environment. But with the addition of these variables, it became complex to measure the environmental impact. None of the above given models helped in testing the non-monotonic relationship of human-induced factors and environmental changes. According to Alcott (2010), the success in lowering any of the right-side factors of IPAT identity does not necessarily lower down impact of human activities on the environment and reshuffled the IPAT identity into STIRPAT model. This study has used panel data for selected Asian countries to measure the impacts on environments using STIRPAT model with Ecological footprint as a proxy for environmental impact. This model balances the non-proportionate impacts of urbanization on environment using the following equation.

$$I_i = \alpha\, P_i^b A_i^c T_i^d e_i \qquad (21)$$

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The logarithmic form of the equation is as follows

$$lnI_{it} = ln\alpha + blnP_{it} + clnA_{it} + dlnT_{it} + lne_{it} \qquad (22)$$

In the given equation 4, dependent variable is Ecological footprint, i refers to number of observations in the study. The constant 'a' scales the model, and the residual or error term 'e' possesses the effects of all other variables of I that are uncorrelated with P, A and T, while b, c and d are the exponents or coefficients of these independent variables that must be estimated from the regression. The coefficients are used here to represent the net effects of the variables and are referred to as the Ecological Elasticity (EE). Affluence is generally measured as per capita gross domestic product. EE is defined as the proportionate change in environmental impacts due to a change in any driving force (York et al. 2003a). The coefficients b and c represent population (P) and affluence (A) elasticity of impacts respectively. The coefficients b and c represent population and affluence elasticity of impacts respectively. The technology elasticity of impact is denoted by d, which has much controversy (Fan et al. 2006) in the literature in respect of single operational measure for environmental quality. T is considered the most significant contributor to environmental impact (Commoner, 1972), but the impact values are determined by using the estimated value of I, P, and A, and they equate the environmental impact per unit of economic activity (York et al. 2003b). Whether T needs to be included in, or excluded from, the error term in the STIRPAT model is an important issue in assessing the driving forces of environmental quality.

Madu (2009) included T in the error term in his study because of inappropriate measures of technology (T) in the regression. In a typical application of the basic STIRPAT model, T is included in the error term, rather than estimated separately. Many studies simply drop T altogether, performing to estimate P, A, and A2 without the complexity of pinning T down to a single metric (York et al., 2003b). Regardless of the specific approach, T remains complex to translate into a single variable. Sometimes, researchers disaggregate technology (T) by adding other variables into the equation. In the logarithm format, it becomes a natural additive (Cole & Neumayer, 2004). Using the natural logarithm, the coefficients of the independent variables can be estimated as elasticities, where changes in any explanatory variable cause percentage changes in the

dependent variable. York et al. (2003b) have suggested that other explanatory variables can be added to the basic STIRPAT model if they are conceptually consistent with the specification of the model. Thus, most STIRPAT research uses an econometric framework as a starting point, and then specifies models on different scales by simply adding or dropping variables. In most of the cases, population size (P) and affluence (A), described as GDP per capita, are used as explanatory variables, while the EF, energy consumption, CO2 emissions, and GHG emissions are the most common derivatives of environmental impact (I), treated as the dependent variable.

3.2.7 Ridge Regression

While applying Ordinary least square method, the value of correlation coefficient was found to be very high which is known as the problem of multicollinearity among the independent variables of the study. The regression model shows inaccurate results if there exists the problem of multicollinearity among the independent variables (Marquardt, 1970). It is to identify the multicollinearity issue; the value of variance inflation factor is considered. This variance inflation factor measures multicollinearity through the regression of independent variable with all other independent variables (Halcoussis, 2005). The rule of thumb cut off value of Variance inflation factor (VIF) is

$$VIF(VIF = (1 - R^2)^{-1}) = 10 \tag{23}$$

It is not possible to completely eliminate the issue of multicollinearity from the model, but with the help of ridge regression, the multicollinearity can be reduced (Montgomery et al., 2001). In case of multicollinearity, the ridge regression provides the most striking benefits (Hoerl and Kennard, 1970). The usual notation for regression equation in the matrix form is as follows.

$$Y = X\beta + \varepsilon \tag{24}$$

In the above equation Y is dependent variable and X is independent variable. β is the coefficient of independent variable and ε is error term. According to Hoerl and

Kennard (1970), regression coefficient in OLS method is estimated using the following formula.

$$\beta_{ls} = (X'X)^{-1} X'Y \tag{25}$$

It is based on the above given formula; ridge regression is proceeded by adding a small constant value of K to the diagonal elements of correlation matrix before its inverse. This value of k helps in the improvement of the stability of the OLS estimator by reducing the standard error.

$$\beta_{ridge} = (X'X + kI_p)^{-1} X'Y \tag{26}$$

In equation (5), $\beta\ ridge$ is used as a biased estimator of β instead of β_{ls} as an unbiased estimator. But the relation between $\beta\ ls$ and $\beta\ ridge$ can be described as

$$\beta_{ridge} = \frac{n}{n+k} \beta_{ls} \tag{27}$$

Ridge estimator in the given equation produces shrinkage and k in the equation helps in controlling the shrinkage. The degree of shrinkage is directly associated with the degree of freedom of the parameters. These parameters are heavily constrained in case of large value of k and degree of freedom would be lower in this case.

Objective 4: To compare the selected Asian countries on the basis of urbanization, economic growth and environment degradation.

This objective of the study will be achieved by estimating the shape of Environment Kuznets Curve for the relationship between urbanization-environment degradation and economic growth-environment degradation in selected Asian countries.

As the main focus of this objective of the study is to make comparative analysis of the selected Asian countries on the basis of urbanization, economic growth and environment degradation therefore, the study would estimate relationship of ecological footprint with urbanization and economic growth for all selected countries using time

series analysis. First of all, the unit root of all the variables will be tested. It is after testing the stationarity of the variables, the Johanson co-integration technique would be applied to test the co-integration among these variables in the selected countries. After testing co-integration among the variables in the selected countries, OLS regression would be applied to test the shape of Environment Kuznets curve for each country. The Environment Kuznets Hypothesis states that in the initial phase of development, the environment degradation takes place. This relationship between growth and degradation is described through the inverted U-shaped curve between the variables. According to Saboori et al. (2012), the general format of EKC hypothesis is as follows.

$$E = f(Y, Y^2, Z) \tag{28}$$

Where E refers to environmental indicator, Y is the growth indicator and Z is an explanatory variable that may impact the association between environmental deterioration and growth of the economies.

In the present study, ecological footprint is used as a proxy to environment degradation which measured on Y axis of the EKC. On X axis, Urbanization and GDP Per capita is measures. The upswing of inverted U of EKC illustrates that at initial phase, urbanization and economic growth adds on to the size of ecological footprint and after reaching a certain point, ecological footprint of the economies starts declining. This chapter would separately analyze the relationship between Urbanization-Ecological footprint and Economic growth-Ecological Footprint with special focus on Linear, quadratic and cubic model of EKC to identify different shapes of EKC for different countries.

3.3 Summary of the Chapter

This chapter summarizes the research methodology and data sources used for conducting the present study. The present study would use urbanization index that has measured urbanization from various different aspects and relationship between urbanization, economic growth and environment degradation using urbanization index. The study would measure the relationship between urbanization and economic growth using panel co-integration and panel Granger Causality. The study would measure the relationship between urbanization and environment degradation in Asian countries

using Ridge regression technique. Finally, the study would compare all selected Asian countries on the basis of urbanization, environment and economic growth using Environment Kuznets curve.

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Chapter 4

Trends of Urbanization in selected Asian Countries

Rapid urbanization process in the developing nations of the world is known as the dominant feature of global demographic transition. In the global scenario, Africa and Asia are the two regions with a rapid rate of urbanization (Turok & McGranahan, 2013). Various urban researchers have indicated that the main factor behind this rapid rate of urbanization in these economies is rural to the urban movement of population (Satterthwaite et al., 2010). Population growth in the urban regions of the developing economies is an important hurdle in developing economies. In comparison to the past half-century, the population of the developing economies of the world has doubled. In 1950, the population residing in urban regions was just 30% of the global population which has increased to 55% in 2018. Asia is the only region in the world with the lowest level of urbanization but with the fastest rate of growth of urbanization.

4.1 Urbanization trends in Asia

According to United Nation reports, the proportion of urban population, rural population and population of cities can be used to measure the trends of urbanization in the economies. It is important to know about the movement of population to explore the dramatic changes in the needs and demands of goods and services in the economies. From the global perspective of urbanization, it has been observed that Asia is the only region in the globe with the fastest rate of urbanization (UN DESA, 2018). Then it can be assumed that it would have a different effect on the demand and consumption of goods and services in the economies. As discussed above, rural to the urban movement of population and the natural rate of increase in population are the two main factors behind urbanization.

The main reason behind this movement of population from rural to urban regions is that the cities in urban regions are known as the hub of human activities. Not only this, but these cities also contributes in magnifying the social, economic and environmental requirements of human beings. This drift of population from rural to urban regions is also bringing significant changes in the social, economic and

demographic transformations in different regions. The following figure describes the proportion of the urban population in Asia and the World.

Figure 4.1.1: The percentage proportion of the urban population in Asia and the World
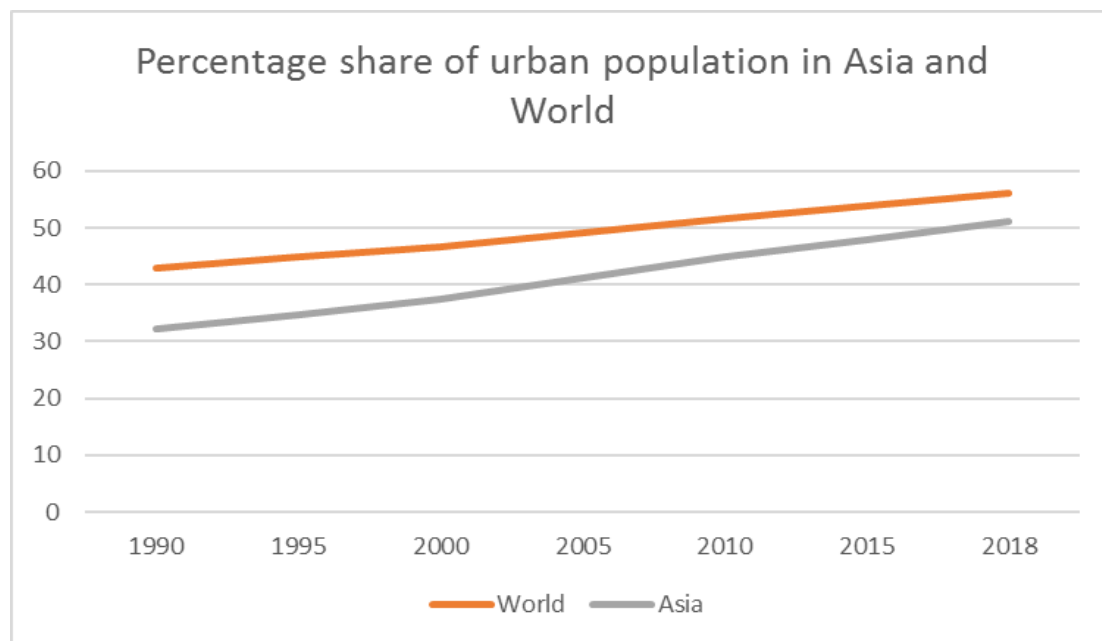
Source: Author's computation

According to Figure 4.1.1, the percentage proportion of the urban population in the world in 1990 was 43% and in 2018 this ratio was 53.6%. In Asia, this ratio of urban population to total population in 1990 and 2018 was 32.3% and 51.1% respectively. At the global level, Asia and Africa are the two regions with the lowest proportion of urban population but with rapid urbanization in comparison to other regions of the world. In 1950-55, the rate of urbanization of Africa was the highest, but after the 1990's Asia was having the highest rate of urbanization.

The natural rate of increase in population, rural to the urban movement of population and reclassification of the cities are the key factors contributing to the fastest growth of urbanization in Asia. The developed regions of the world are the regions with 90% of their population except for Europe with 82% of their population as urban. This rapid increase in the urban population in the cities of the world also indicates that increasing population in these economies might pressurize the land in these economies and can directly affect the ecological footprint of the countries. Following table describes the trends of the urban and rural population in Asia.

Table 4.1.1 Trends of the urban and rural population in Asia

Year	TP(000's)	UP(000's)	UP (%)	Decadal % change	RP(000's)	RP (%)	Decadal % change
1950	1404062	246193	17.53		1157869	82.46	
1960	1700463	360171	21.18	46.29	1340292	78.81	15.75
1970	2137828	507089	23.71	40.79	1630740	76.28	21.67
1980	2642489	716919	27.13	41.37	1925570	72.86	18.07
1990	3221342	1039594	32.27	45.00	2181748	67.72	13.30
2000	3730371	1399722	37.52	34.64	2330648	62.47	6.82
2010	4194425	1877015	44.75	34.09	2317410	55.24	-0.56
2018	4623454	2361464	51.07	25.80	2261990	48.92	-2.39

Source: Author's calculation

(Note: TP: Total Population, UP: Urban Population, RP: Rural Population

Figure 4.1.2 Trend of the urban and rural population in Asia
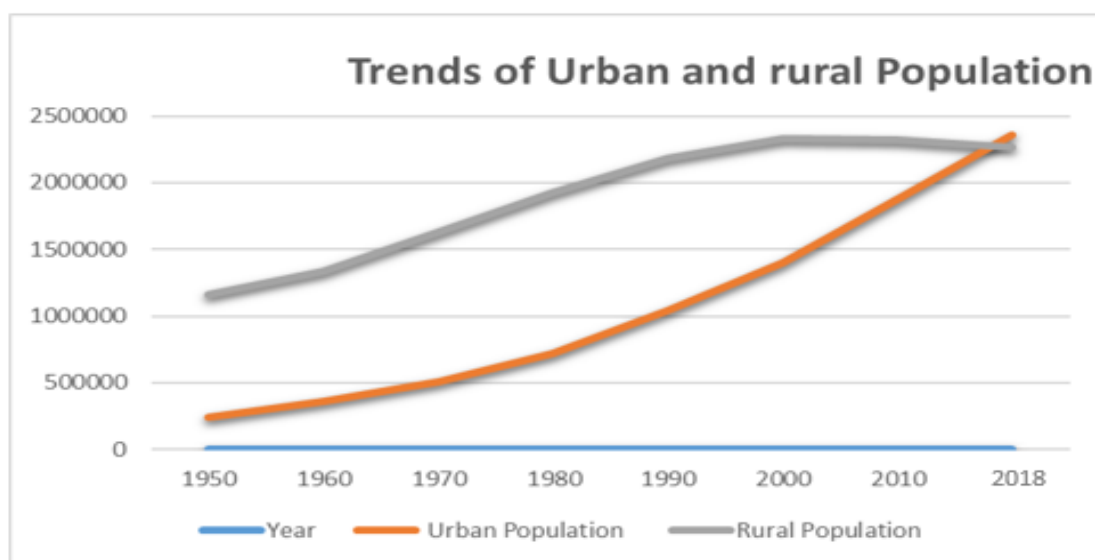
Source: Author's computation

Table 4.1.1 and Figure 4.1.2 explains that from 1950 onwards percentage of the urban population to the total population has continuously increased and the percentage of the rural population to the total population on the other hand has decreased. In 1950, the percentage of the urban population to the total population was 17.53% and the percentage of rural population to total population was 82.46%. A huge variation has been observed in this percentage of rural and urban population to total population in this era of 70 years. In 2018, this percentage of urban population to total population is observed at 51.07% and the percentage of rural population to total population is

48.92%. Decadal percentage change in the population explained that initially from 1950-1960, the decadal percentage increase in the urban population was 46.29% which falls to 40.79% and 41.37% in the next decades. In 1980-90, this decadal percentage change again took an upward trend with a 45% increase in urban population. This indicates that the urban population in Asian economies has started growing continuously after 1990. On the other hand, decadal percentage change for the rural population has shown a downward trend after the 1970s. The figure 4.1.2 present the change in the rural and urban population in Asia from 1950-2018. This decadal percentage change in growth shows that urbanization in Asia is increasing rapidly but at decreasing growth rate. The main reasons behind this fall in percentage change in the growth rate of the urban population are policies adopted by the governments for migration within the countries, rising disparities in rural and urban income level, increasing ratio of people working in agriculture sector and use of farmland for industrial purposes (Gong et al., 2012)

These structural changes in the rural and urban population in Asian countries have resulted in rapid urbanization in these economies. Economic development of the countries has also played an important role in changing the structure of population in these countries. Not only had this, socio-economic development of the Asian countries also contributed in the dynamic process of urbanization in these economies.

The most populous economies of the largest continent Asia are known as self-sufficient in various economic and social activities. According to the World Bank classification, this continent has been classified into five main regions. These regions are south Asia, East Asia, Central Asia, Western Asia and South-Eastern Asia. Before World War II, this region was completely under the control of colonial ties. But after World War II, this region came at the front as the region with the fastest growth all over the world. From 1990 to 2010, Asia has recorded impressive growth. Due to this dynamic growth, the poverty level in this region has reduced, the residing standard of the people has improved. In this period, the GDP of this region also recorded an increase of 7.5 times in comparison to an increase in the GDP of the world (Lin et al., 2018). The economic growth of Japan after the second war pushed the overall growth of the Asian continent in the 1960s. East Asian economies also contributed in an equal manner for promoting the overall growth rate of Asia. In 2000, after joining the world trade

organization China witnessed a double-digit growth and became a force for the Asian continent (Gong, et al., 2012).

Figure 4.1.3 Growth of urban population in Asian regions
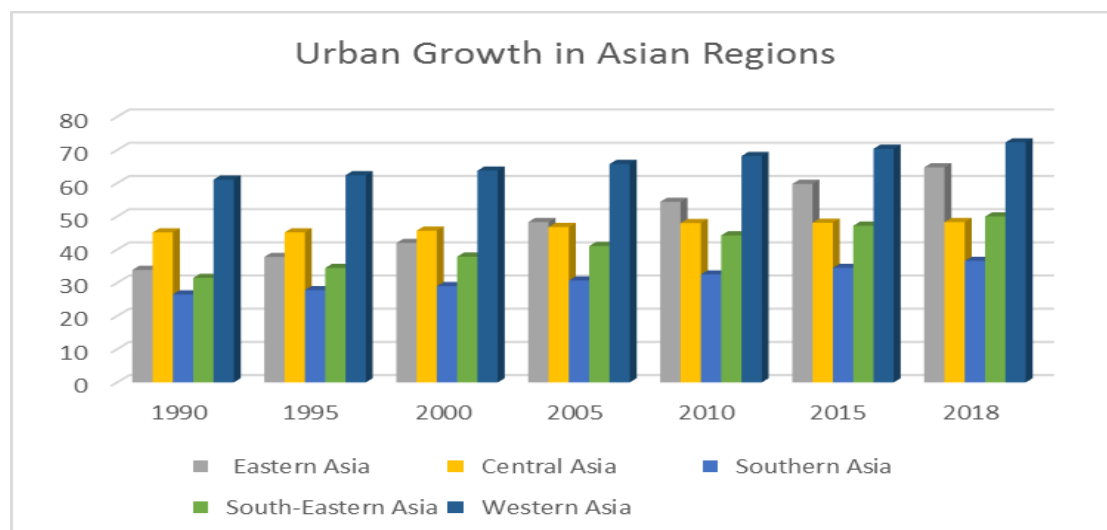
Source: Author's computation from WUP data

The World Urbanization Prospects (WUP) statistics described in the above table mentioned that Eastern and Southern Asia covers the large proportion of the urban population of the overall continent (UN DESA, 2018). Since 1990, the population in the cities of these regions is continuously growing. In 1990, the percentage proportion of the urban population in Asia was 32.3%. Globalization of the economies also contributed in this increased proportion of the population in these economies. In 2000, the percentage of the urban population in Asian economies aroused to 37.5%. As per the population forecast of the United Nation, this rate of the urban population would be 54% in 2025. The growth rate will further increase the urban population of these economies by 2050 and the percentage of the population would be 66.8%. The growth of population in East Asian countries is more than double in comparison to the largest populated countries of Europe (Fensom, 2015). The rate of urbanization in East Asian countries remained five to ten times higher than urbanization in other regions of the world. At present, the level of urbanization in East Asia is 64% and the global level of urbanization is 56.2%. This rapid urbanization in this region has resulted in various economic, social and political changes in the past few decades.

This chapter aims to analyze the trends of urbanization in selected Asian countries. For this purpose, the top 10 countries with a high annual rate of growth of

urbanization have been selected. These countries are China, Bangladesh, Nepal, India, Thailand, Philippines, Indonesia, Cambodia, Vietnam and Malaysia. All selected countries are developing countries of Asia. Country-wise analysis of all the selected Asian countries is described in the below-given sections.

4.2 Urbanization Trends of China

The urbanization process in China has acted as an epitome for the overall development of the country. Since 1950, urbanization has been contributing to rural to urban transformation of the cities of China. Initially, in 1949 when the country was founded, only 10% area of the economy was urban. But, after armed conflicts and wars with other countries, the Chinese government realized the importance of urbanization and adopted new approaches for the revival of the national economy (Chen et al., 2014). The industrialization methods adopted by the government in 1960 helped in increasing the urban population of the economy by 2.3 times. Chinese urbanization remained at a standstill from 1966-78 due to the Cultural Revolution in the economy. During this period, the rate of urbanization in the economy remained around 17%.

Table 4.2.1 Proportion of the urban population in China

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	1135185000	300165618	26.44	-	120.4482	3184.89
1995	1204855000	373035157	30.96	4.86	127.8399	3958.050
2000	1262645000	452999147	35.88	4.29	133.9719	4806.50
2005	1303720000	554367818	42.52	4.48	138.3301	5882.07
2010	1337705000	658498663	49.23	3.76	141.9361	6986.94
2015	1371220000	761027100	55.50	3.11	145.4921	8074.81
2018	1392730000	823827650	59.15	2.75	147.7744	8741.15

Source: Calculated using WDI indicators

Table 4.2.1 depicts that Chinese urbanization started growing rapidly after 1990. Stagnant industrial development in the economy during this period was also one of the main reasons behind this low rate of urbanization. Urbanization in China took a rapid turn after 1990 because the Chinese government implemented various key reforms for the development of the cities. In 1990, the percentage of the urban population to the total population was 26.44% which increases up to 30.96% in 1995

with a growth rate of 4.86% in this period. 2000-2010 is the decade with the highest growth of the urban population of China. In this decade, the rate of urbanization increases by 1.9% annually. The growth rate of 2000 and 2010 also described that there was the highest difference in the growth rate of these two years. In 2018, this proportion of the urban population to the total population of China increased to 59.15% with a rate of growth of 2.75%. The population density in the economy increased from 120.44 per km square in 1990 to 147.77 per km square in 2018. With the increase in the urban population of the economy, urban density is also increased from 3184.89 per km square to 8741.15 per km square in 2018.   There are various factors such as measures in the areas of housing, education, medical care, and taxation which are responsible for this sharp growth in the rate of urbanization from 1990-2018 (Cholin et al., 2012).

Figure 4.2.1: Urban population growth in China
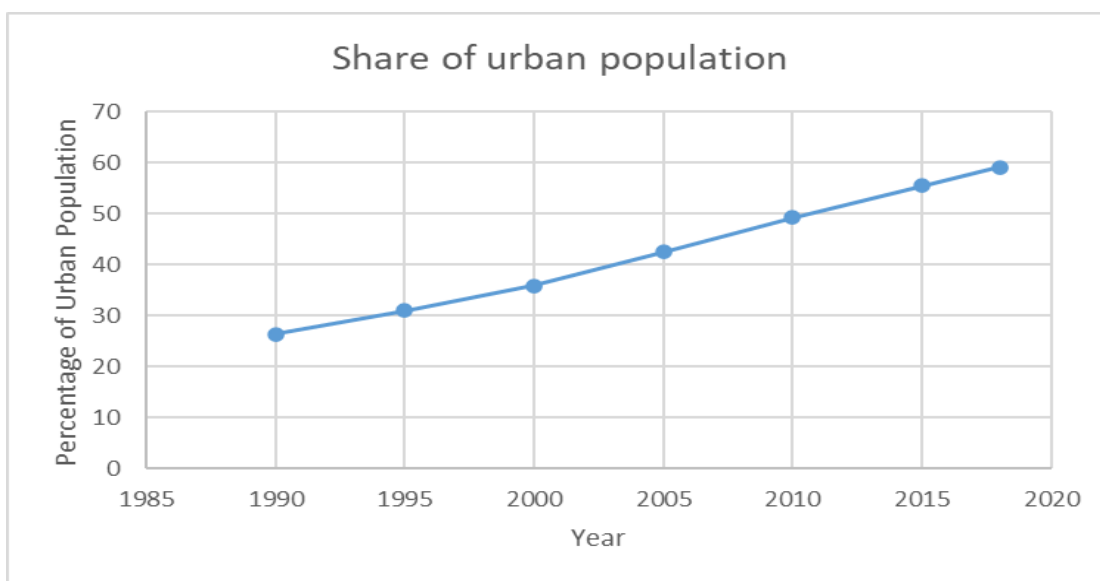
Source: Calculated using WDI indicators

Figure 4.2.1 has described the trend of growth of the urban population of China from 1990 to 2018. From this upward trend, it can be assumed that there is various push and pull factors behind this growth of the urban population. Therefore, it would be interesting to study the effect and relation of this growth with other factors associated with it in this study.

There was a time when China was among the poorest countries in the world. But the country transformed its scenario within 30 years and in 2015, it was considered

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as the second-largest economy in the world with $19.95 trillion GDP (based on PPP). In 2018, the GDP per capita of the economy was $14.140 trillion (Deng, 2016).

Table 4.2.2 GDP Per capita (Constant 2010 US$) of China

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	827732227234.60	
1995	1475765226704.89	0.78
2000	2232146289974.25	0.51
2005	3561979300667.95	0.60
2010	6087164527421.24	0.71
2015	8913316598060.84	0.46
2018	10872977784497.10	0.22

Source: Calculated using WDI indicators

Since 1980, China has been the fastest-growing economy in the world. According to World Bank statistics, from 1978 to 2005, the average annual rate of growth of GDP of the economy remained 10%. The above-given statistics depict that from 1990 to 1995, there was a 0.78% rise in the GDP per capita of the economy. From 1995 to 2000, GDP per capita of the economy increased with decreased percentage change in comparison to previous years i.e., 0.51%. In 2000-2005, this percentage change in the GDP per capita of the economy increased by 0.60%.

Figure 4.2.2 GDP Per capita (Constant 2010 US$) of China
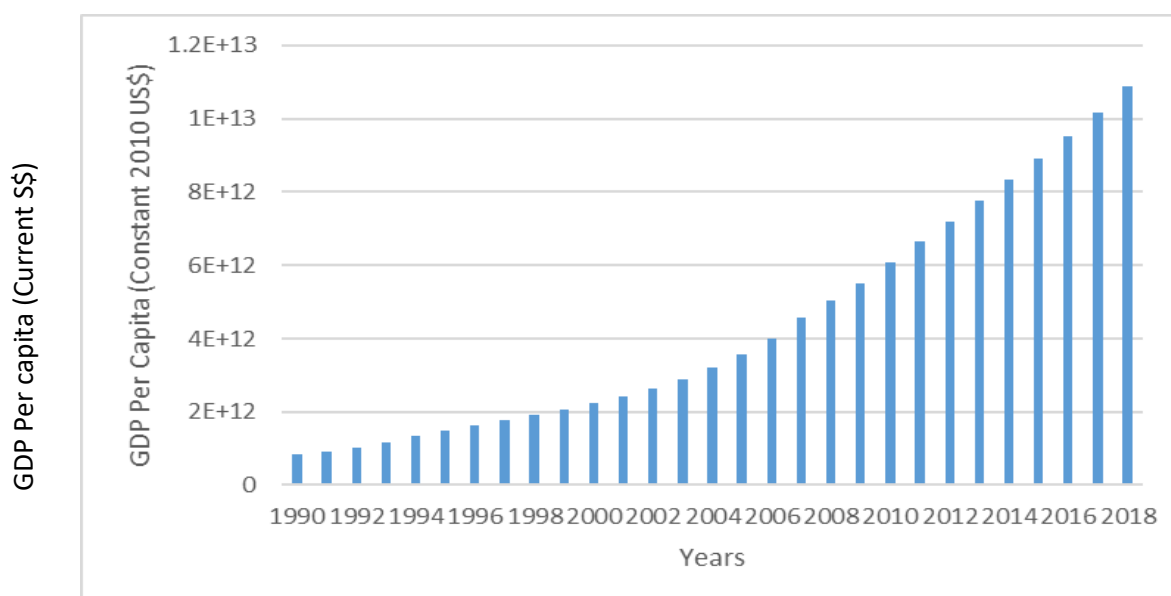
Source: Calculated using WDI indicators

From the above figure 4.2.2, an upward trend with minor fluctuations can be observed for the GDP per capita of China. Although, GDP per capita of China has rapidly increased from the period of 1990 to 2018, this percentage increase in the GDP per capita remained fluctuated during this period of 1990-2018. After a sharp rise in the GDP per capita of the economy by 0.71%, this GDP per capita of the economy again increased with a decreased trend of 0.46% in 2015 and 0.22% in 2018. The main reason behind high fluctuations in the growth rate of GDP per capita is the credit expansion in the economy, variations in the value of Yuan and fluctuations in the housing market. The sharp rise in GDP per capita of the economy has affected the residing standard of the people and the overall human development of the economy (Lin et al., 2018).

But the question is how this increased trend of GDP per capita with fluctuated percentage change has affected the process of urbanization. Therefore, efforts have been made to explore the effects of other factors on this growth of GDP per capita and vice-versa in this study.

The natural rate of increase in population is considered an important factor in the increase of the urban population. This natural rate of increase in population is calculated through the difference between crude death rate and birth rate. The following table has described the trend of the natural rate of increase in population by analyzing the trend of death rate, birth rate and fertility rate in the economy.

Table 4.2.3 Death rate (DR), Birth rate (BR) and Total Fertility rate (TFR) and Natural rate of increase in Population (NR) of China

Year	DR	Percentage change	BR	Percentage change	TFR (TFR)	Percentage change	NR= (BR-DR)
1990	6.67		21.06		2.31		14.39
1995	6.57	-0.01	17.12	-0.19	1.66	-0.28	10.55
2000	6.45	-0.02	14.03	-0.18	1.60	-0.04	7.58
2005	6.51	0.01	12.40	-0.12	1.61	0.01	5.89
2010	7.11	0.09	11.90	-0.04	1.63	0.01	4.79
2015	7.11	0.00	12.07	0.01	1.67	0.02	4.96
2018	7.10	0.00	10.90	-0.10	1.69	0.02	3.80

Source: Calculated using WDI indicators

Figure 4.2.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of China
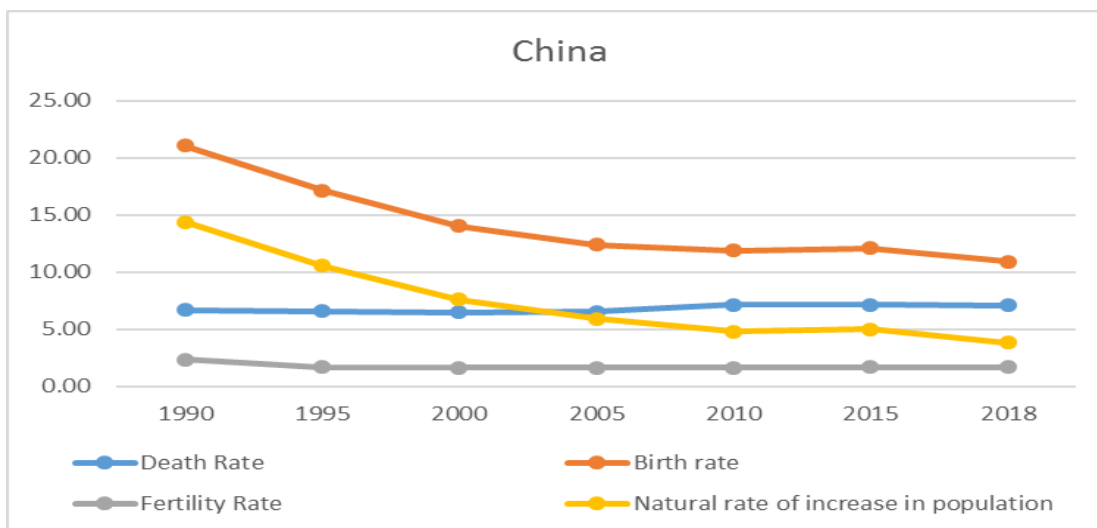
Source: Calculated using WDI indicators

Table 4.2.3 and figure 4.2.3 describe the trend of death rate, birth rate, fertility rate and the natural rate of increase in the population of the economy. The birth rate and the natural rate of increase in the population decreased with similar slopes. The economy also observed a sharp decline in the fertility rate from 1990-2000. After that rate of decrease in fertility rate was almost steady. One child policy program in the economy has effectively worked to control the birth rate in the economy. Better provision of health services and proper immunization have also controlled the death rate (Meng et al., 2018). The rapidly declining natural rate of increase in the population in the economy depicts that there are other factors such as rural to the urban movement of population and reclassification that have played role in the urbanization process in the economy.

China has observed rapid economic development in the past few decades. The economy observed rapid growth after industrialization. Before industrialization, in the 1950s, around 83% of the population of the economy was employed in agriculture. In the early phase of industrialization, from 1960-1990, a big change in the decline in this ratio was observed. The following table has described China's proportion of employment in agriculture, industry and services from 1990-2018.

Table 4.2.4 Proportion of employment in agriculture, industry and services (% of total employment) in China

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	59.70		21.40		18.90	
1995	50.50	-0.15	23.50	0.10	26.00	0.38
2000	50.01	-0.01	22.30	-0.05	27.69	0.07
2005	42.60	-0.15	25.20	0.13	32.20	0.16
2010	34.80	-0.18	29.50	0.17	35.70	0.11
2015	27.70	-0.20	28.80	-0.02	43.50	0.22
2018	25.36	-0.08	28.20	-0.02	46.44	0.07

Source: Calculated using WDI indicators

Table 4.2.4 and figure 4.2.4 depict that in 1990, 59.70% of the population of the economy was working in the agriculture sector. This proportion of employment in the agriculture sector continuously declined and in 2018, this percentage of employment in the agriculture sector was 25.36%.

Figure 4.2.4 Proportion of employment in agriculture, industry and services (% of total employment) in China
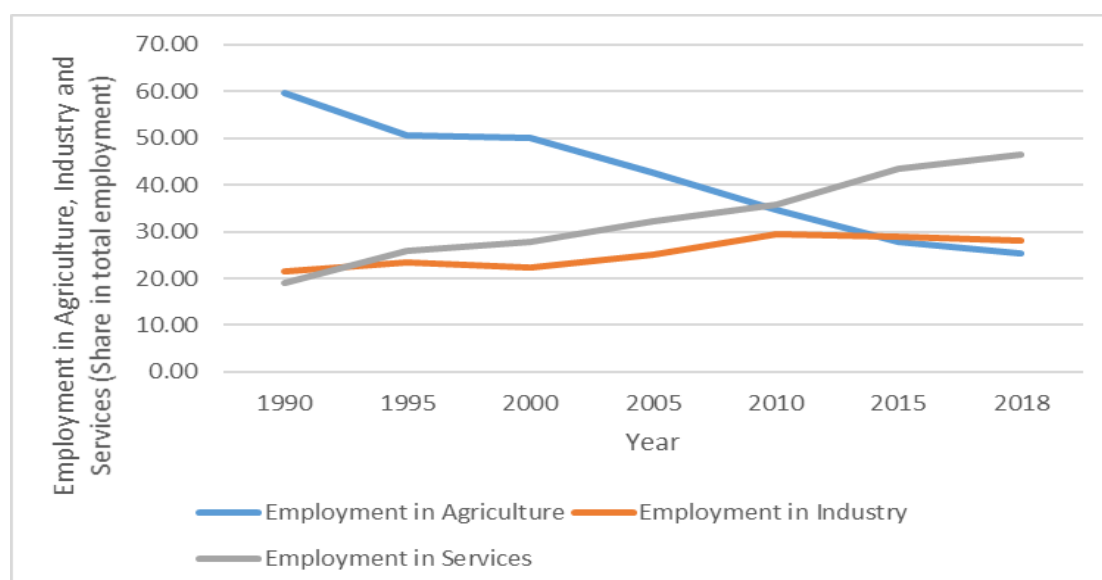
Source: Calculated using WDI indicators

During this period, the highest decline in this rate of employment in the agriculture sector was observed from 2005 to 2010. There was the highest proportion of employment in the industry during 2005-10 and in services during the period 2010-

15. Industrialization, commercialization and better provision of facilities in industry and services resulted in this increased proportion of employment in industry and services (Cholin et al., 2012).

4.3 Urbanization Trends of Bangladesh

It is since independence, the urban population in Bangladesh is growing at an average rate of 6%. It has resulted in a six-fold increase in the urban population in comparison to the rural population (UNESCAP, 2018). According to UN reports, around 25% population of Bangladesh is currently residing in urban regions. More than half of the urban population is residing in the four main cities of the country. These four cities are Dhaka, Chittagong, Khulna and Rajshahi. Dhaka is known as the capital city of Bangladesh with a population of 12 million. It is also known as the 11th largest city in the world. Dhaka is a low-income city because a large number of poor populations is residing in this city (Rana, 2011). After 1990, a rapid rural to urban shift has been observed in the city because of better income opportunities in comparison to other parts of Bangladesh. The following table has described the trend of proportion of urban population and population density in the economy from 1990-2018.

Table 4.3.1 Proportion of the urban population in Bangladesh

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	103171956	20439396	19.81		792.594	15702.08
1995	115169930	24983813	21.69	4.45	884.7655	19193.22
2000	127657854	30114488	23.59	4.11	980.701	23134.74
2005	139035505	37274029	26.81	4.75	1068.107	28634.88
2010	147575430	53608403	36.33	8.76	1133.713	41183.38
2015	156256276	59107944	37.83	2.05	1200.402	45408.27
2018	161356039	59107944	36.63	5.71	1239.579	53190.18

Source: Calculated using WDI indicators

Table 4.3.1 and figure 4.3.1 describe that in 1990, the urban population in Bangladesh was 19.81% which rises to 21.69% in 1995 with an average growth rate of 4.45%. This percentage of the urban population increased up to 36.33% in 2010 with the highest average growth rate of 8.76%. A sudden decrease in the growth rate was observed from 2010-15 with a growth rate of 2.05% which again started increasing in 2015-18 with a growth rate of 5.71%. The population density in the economy has increased from 792.59 per km square in 1990 to 1239.57 per km square in 2018. It is

also discussed above that majority of the urban population in the economy is in four major cities. It reflects that there is an uneven distribution of population in the economy which is increasing population density in some areas (Alam, 2018).

Figure 4.3.1 Proportion of the urban population in Bangladesh
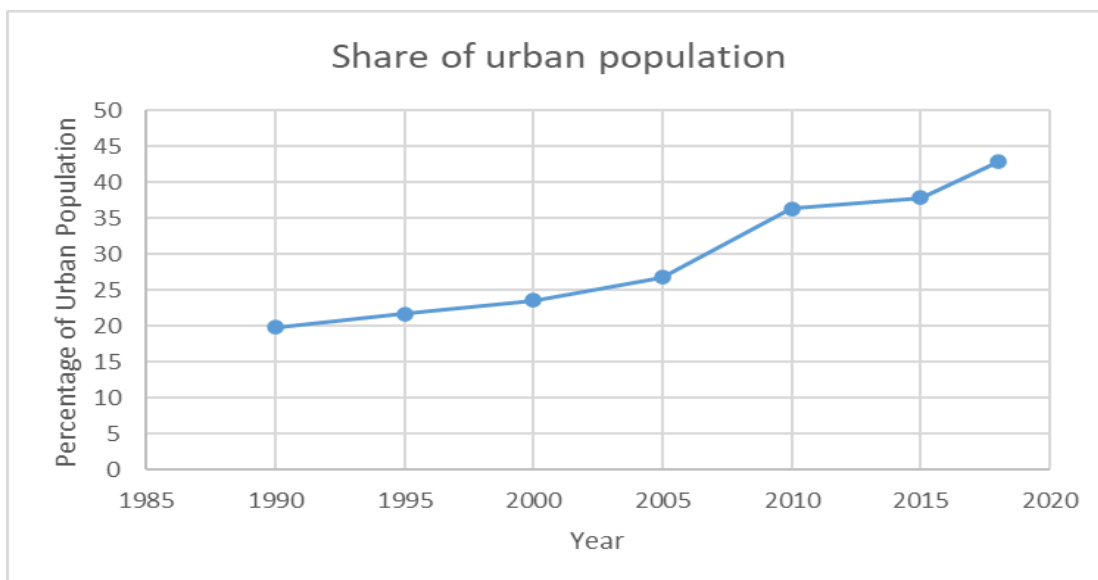
Source: Calculated using WDI indicators

Figure 4.3.1 reflects that change in the total population of the economy from 1990-2018 also affects GDP per capita in the economy. The following table has discussed the changes in GDP per capita in Bangladesh from 1990 to 2018.

Table 4.3.2 GDP per capita (Constant 2010 US$) of Bangladesh

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	42420657180	
1995	52933639391	0.25
2000	67013463193	0.27
2005	85860356478	0.28
2010	1.15279E+11	0.34
2015	1.5663E+11	0.36
2018	1.94146E+11	0.24

Source: Calculated using WDI indicators

Bangladesh is known as the seventh fastest-growing economy in the world. Table 4.3.2 elucidated that GDP per capita of the economy increaesed with slight increase in the percentage change from 1990 to 2015 with initial rise of 0.25% in 1990 and goes up to 0.36 pecent increase in 2015 but during the period 2015-2018, there was

a slight decrease in the percentage increase of GDP of the economy. Weaked demand from European countries for its exports was the key reason behind this slight impact on GDP per capita.

Figure 4.3.2 GDP per capita (Constant 2010 US$) of Bangladesh
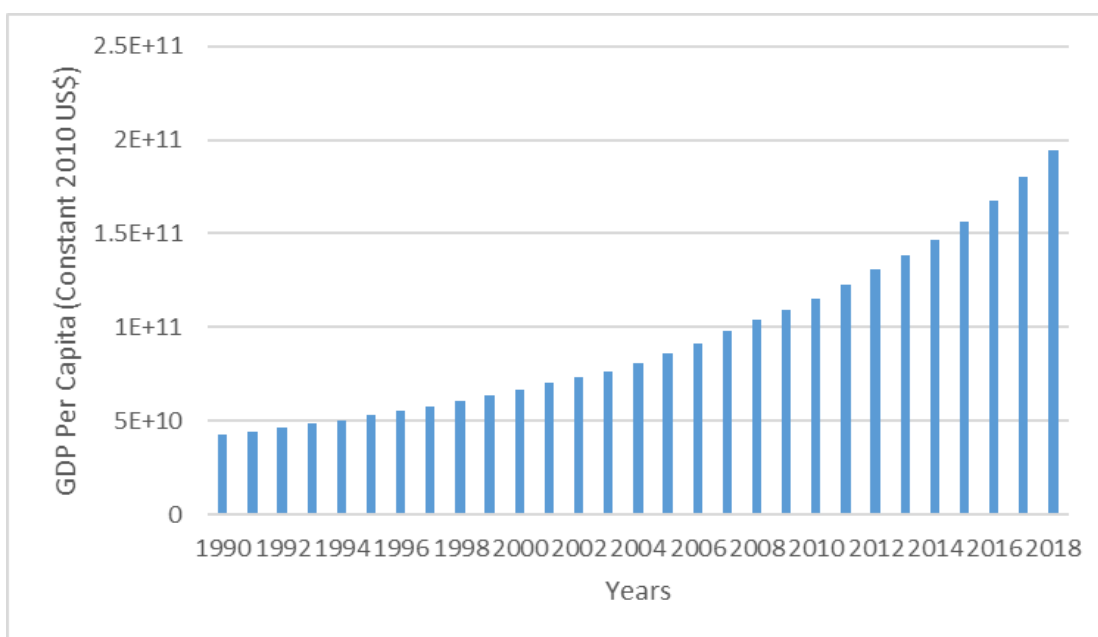
Source: Calculated using WDI indicators

Figure 4.3.2 depicts that the GDP per capita in Bangladesh has followed a rapid trend from 1990 to 2018. After 2004, export of ready-made garments and domestic agriculture is the main reason of the growth of the economy. Export-oriented industrialization in the economy has contributed in pushing the GDP of the economy (Alam, 2018). From long history, low urbanization, weak institutions, spotty and inadequate physical infrastructure, and insufficient entrepreneurship were the main characteristics of the nation and it was considered among the poor nations of the world. But in 2015, the country has fulfilled all the conditions required to be on the list of United Nations Least developed countries and it is now considered as a low middle-income country.

Besides, population density and GDP per capita, the natural rate of increase in population also contributes to change in urbanization trends in the economy. Therefore, birth rate, death rate and fertility rate in the economy are discussed in the below-given table below to explore the trend of the natural rate of increase in population.

Table 4.3.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Bangladesh

Year	Death Rate	Percentage change	Birth rate	Percentage change	Fertility Rate	Percentage change
1990	10.35		35.10		4.50	
1995	8.29	-0.20	30.90	-0.12	3.71	-0.17
2000	6.88	-0.17	27.49	-0.11	3.17	-0.15
2005	6.21	-0.10	24.05	-0.13	2.69	-0.15
2010	5.73	-0.08	21.11	-0.12	2.32	-0.14
2015	5.55	-0.03	19.16	-0.09	2.12	-0.09
2018	5.53	0.00	18.18	-0.05	2.04	-0.04

Source: Calculated using WDI indicators

Figure 4.3.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Bangladesh
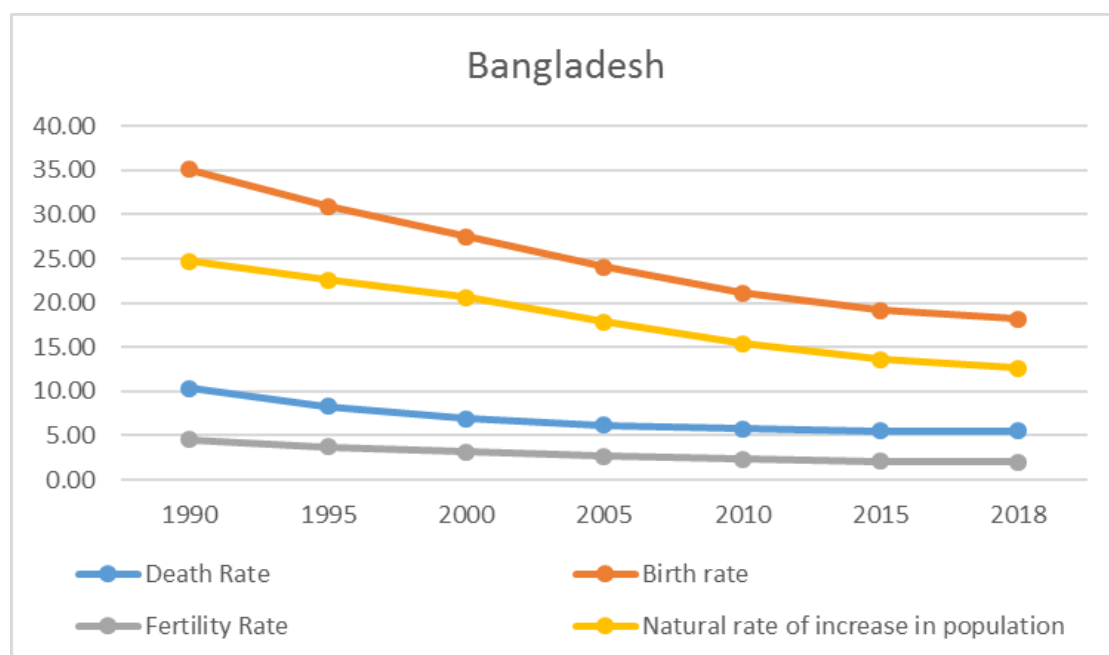
Source: Calculated using WDI indicators

From table 4.3.3 and figure 4.3.3, it can be estimated that a sharp decline in the death and birth rate since 1990 is the result of significant improvement in the health sector in comparison to other developing nations. The expanded program on immunization has significantly helped in decreasing the Death rate, Birth rate and Fertility rate and Natural rate of increase in Population (Islam & Biswas, 2014). It is

due to a rapid decrease in birth rate, the natural rate of increase in the population has also followed a downward trend.

Though the better provision of health policies can make sure for the quality life of people employed is the main factor that pushes them to shift to urban regions. Therefore, it is important to discuss the proportion of employment in agriculture, services and industry.

Table 4.3.4 Proportion of employment in agriculture, industry and services (% of total employment) in Bangladesh

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	69.51		13.58		16.91	
1995	64.63	-0.07	9.78	-0.28	25.59	0.51
2000	62.37	-0.03	11.23	0.15	26.41	0.03
2005	48.08	-0.23	14.52	0.29	37.40	0.42
2010	46.48	-0.03	18.02	0.24	35.50	-0.05
2015	42.66	-0.08	20.46	0.14	36.87	0.04
2018	38.58	-0.10	21.26	0.04	40.16	0.09

Source: Calculated using WDI indicators

Figure 4.3.4 Proportion of employment in agriculture, industry and services (% of total employment) in Bangladesh
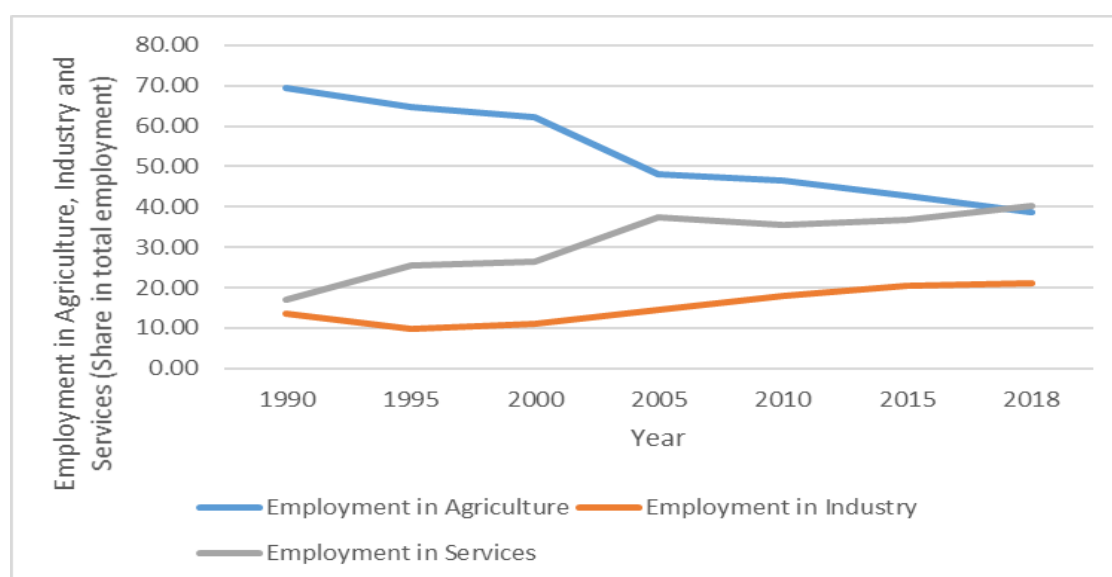
Source: Calculated using WDI indicators

Table 4.3.4 and figure 4.3.4 show that the Proportion of employment in agriculture has declined continuously from 1990 to 2018. Proportion of employment in

the industry has declined from 1990-1995 but after that, it followed a positive trend. On the other hand, the proportion of employment in services followed a slight decrease in 2005 to 2010 and in remaining years, it has grown continuously. The textile industry and telecommunication industry played an important role in shifting this proportion of employment from agriculture to industry and service (Alam, 2018).

4.4 Urbanization Trends of Nepal

Nepal is a South Asian economy with an approximate total population of 29 million. The main reason behind the gradual increase in the rural to the urban movement of population is the natural increase of population in the economy. Nepal is known as the least urbanized economy in the world. It is also considered among the top ten fastest urbanizing economies in the world. This low middle-income economy of the world is dominated by a few large and medium cities. There exists an uneven distribution of urban population in the economy. The excessive population in the economy has settled in the Kathmandu Valley (Chapagain, 2018). The following table is a detailed description of the proportion of urban population and population density in Nepal from 1990-2018.

Table 4.4.1 Proportion of the urban population in Nepal

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	18905478	1673891	8.85		132.2061	1170.55
1995	21576071	2348124	10.88	8.06	150.8816	1642.04
2000	23941110	3207391	13.40	7.32	167.0116	2237.45
2005	25744500	3900034	15.15	4.32	179.5919	2720.64
2010	27013212	4529575	16.77	3.23	188.4424	3159.80
2015	27015031	5013179	18.56	2.14	188.455	3497.16
2018	28087871	5544546	19.74	3.53	195.9391	3867.84

Source: Calculated using WDI indicators

The above table 4.4.1 show the proportion of the urban population in the total population of Nepal. The data describes that in 1990, the rate of urbanization in the economy was 8.85% which rises to 19.74% in 2018. The population density in the economy has increased from 132.20 per km square in 1990 to 195.93 per km square in 2018. Concentration of population in the few cities of the countries is the key reason behind this increasing population density of the economy.

Figure 4.4.1 Proportion of the urban population in Nepal
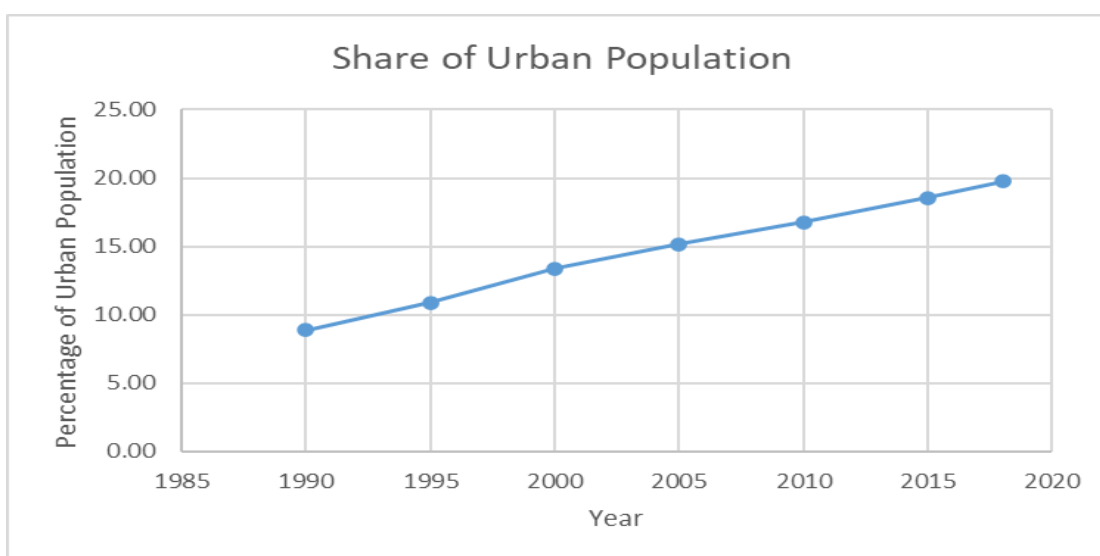
The above figure 4.4.1 show the decreased trend of the average growth rate of the economy. The decreased average growth rate of the urban population in the economy is due to the unequal distribution of the urban population in the economy and the increasing population of the economy in some specific areas (Acharya, 2018). With the increase in urban population and the total population of the economy, GDP per capita has increased from 1990 to 2018. The following table describes the trend of GDP per capita in Nepal.

Table 4.4.2 GDP per capita (Constant 2010 US$) of Nepal

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	6697408396	
1995	8623849303	0.29
2000	10899840167	0.26
2005	12877563075	0.18
2010	16002656434	0.24
2015	19774984747	0.24
2018	22969698990	0.16

Table 4.4.2 elucidates that GDP per capita of the economy of Nepal has increased in the period of 1990 to 2018 but there were fluctuations in the growth of GDP per capita. The following figure also shows the trend how GDP per capita in the economy increased.

Figure 4.4.2 GDP per capita (Constant 2010 US$) of Nepal
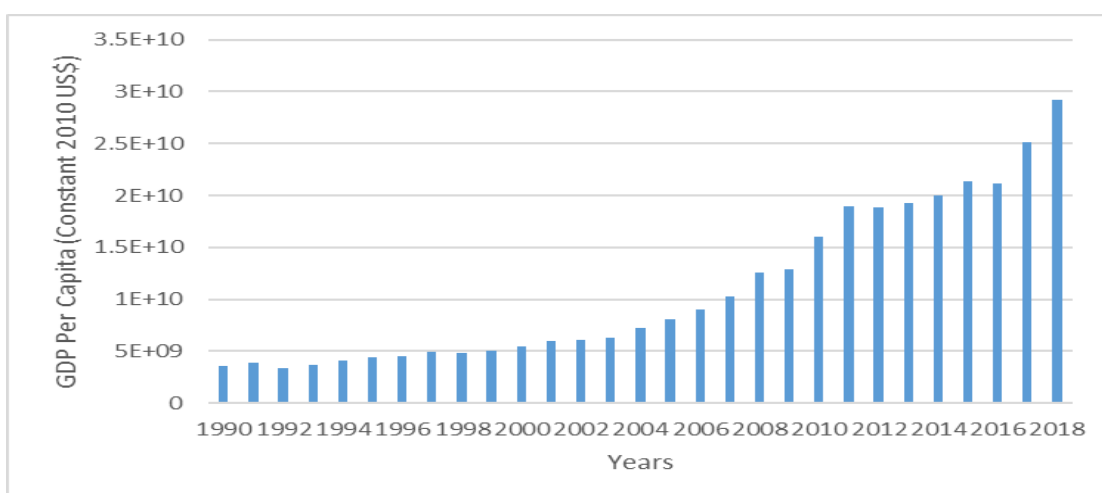
Table 4.4.2 and Figure 4.4.2 describe that the GDP per capita of Nepal has gone through minor fluctuations in the growth rate but has a positive upward trend from 1990-2018. The rate of growth in the economy was modest but there was brisk poverty reduction in the economy. It is because of this modest growth; the country remains behind its regional peers in terms of GDP per capita and could not lift from the status of low income (IBRD, 2018).

Although there is modest economic growth in the economy, yet the government is making full efforts for population control through family planning programs. The following data describes the role of these efforts of the government in controlling the birth rate and fertility rate.

Table 4.4.3 Death rate (DR), Birth rate (BR) and Fertility rate (FR) and Natural rate of increase in Population (NR) of Nepal

Year	DR	% Change	BR	% change	FR	% change	NR
1990	12.84		38.46		5.17		25.62
1995	10.39	-0.19	35.99	-0.06	4.73	-0.09	25.59
2000	8.52	-0.18	31.55	-0.12	3.96	-0.16	23.03
2005	7.36	-0.14	26.06	-0.17	3.12	-0.21	18.70
2010	6.82	-0.07	22.69	-0.13	2.54	-0.18	15.88
2015	6.50	-0.05	20.84	-0.08	2.10	-0.17	14.34
2018	6.36	-0.02	19.89	-0.05	1.92	-0.09	13.53

Table 4.4.3 and figure 4.4.3 given above describes that the birth rate in the economy is decreasing since 1990 but the death rate in the economy is decreasing at a very slow rate. The death rate in the economy is almost constant since 2005. The fertility rate in the economy has also followed a very slow negative trend.

Family Planning 2020 policies of Nepal have contributed to this declined trend of birth rate and fertility rate. Though the natural rate of increase in the economy is gradually decreasing in the selected period this economy natural rate of increase in population is higher in comparison to its regional peers (IBRD, 2018).

Figure 4.4.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Nepal
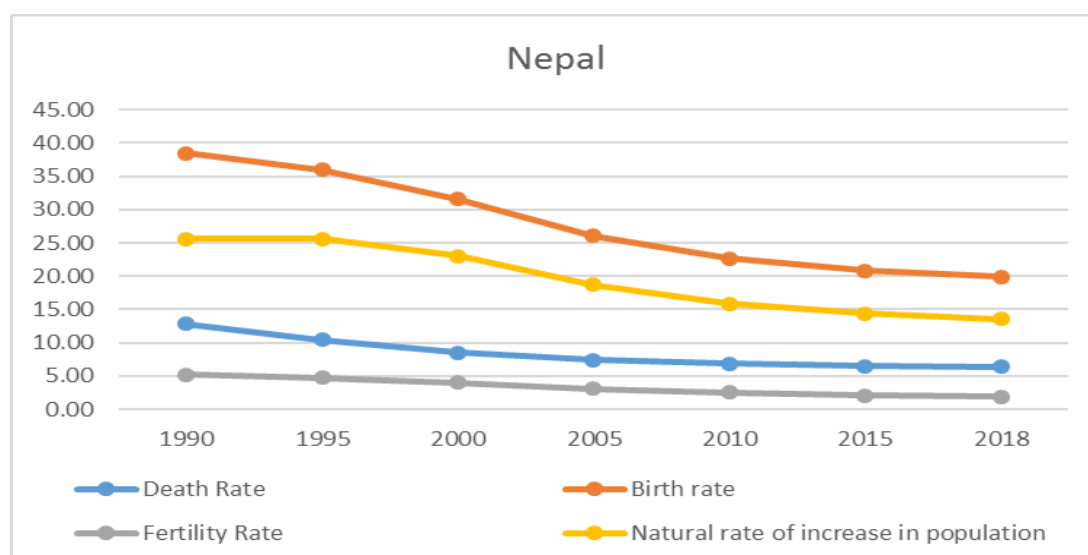
Source: Calculated using WDI indicators

Table 4.4.4 Proportion of employment in agriculture, industry and services (% of total employment) in Nepal

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	82.33		2.76		14.91	
1995	79.68	-0.19	6.13	-0.06	14.19	-0.09
2000	74.50	-0.18	11.20	-0.12	14.30	-0.16
2005	72.19	-0.14	12.47	-0.17	15.35	-0.21
2010	69.70	-0.07	13.44	-0.13	16.86	-0.18
2015	67.01	-0.05	14.23	-0.08	18.76	-0.17
2018	65.00	-0.02	15.14	-0.05	19.86	-0.09

Source: Calculated using WDI indicators

Table 4.4.4 describe that there is a gradual decrease in the proportion of employment in agriculture in this economy. Though the proportion of employment in industry and services is increasing, it is at a very low rate. It is due to inadequate development of the economy there are insufficient opportunities available in the industry and services sector. 65% of Nepalis are still relying on agriculture-based activities for their residing (Gautam, 2018).

Figure 4.4.4 Proportion of employment in agriculture, industry and services (% of total employment) in Nepal
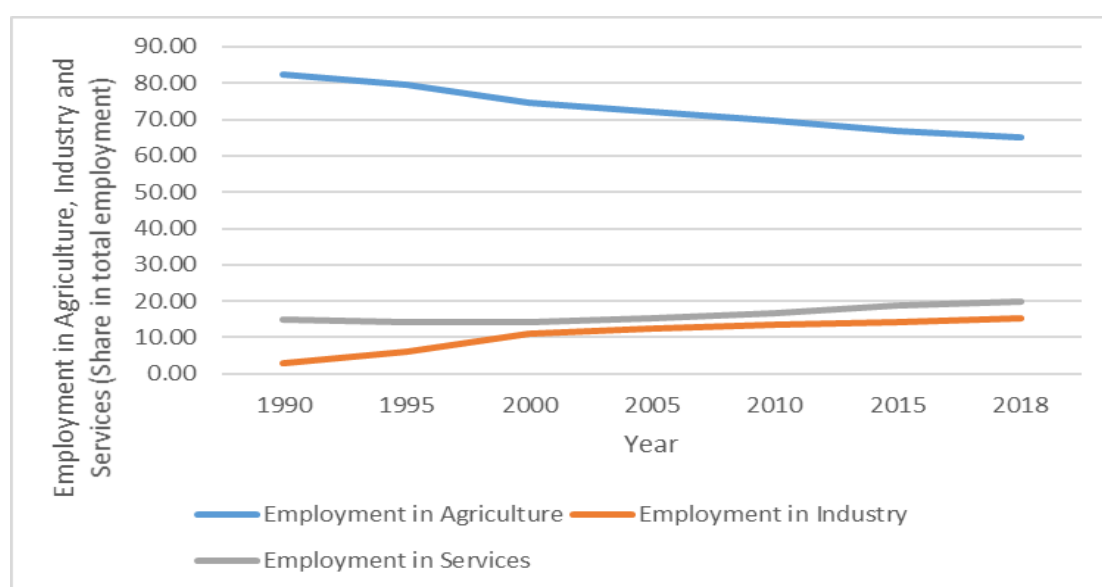
Source: Calculated using WDI indicators

Figure 4.4.4 also reflects that there is still high dependency of population of Nepal on agriculture. According to a report of International Labor Organization 68% people in Nepal still depends upon agriculture for their livelihood. Less focus of the government on services and industry in this economy is also the reason of less urbanization in this economy.

4.5 Urbanization trends of India

Urbanization in India is also pushed mainly by the natural growth of population in the economy and by rural to the urban movement of population in the economy. Expansion of towns and cities have also played an important role in pushing the urbanization process in the economy. Urbanization in India began to accelerate immediately after independence (Sarkar, 2019). As per the 2011 census, Delhi is the fastest urbanizing city in the world with a 4.1% rise in population. In the first decade

of the 21st century, a large scale rural to urban shift was observed in Mumbai. Till 1991, Maharashtra was known as the most urbanized state of India. At present, Chennai has taken its place with a 48.6% urban population. The following table has discussed the proportion of urban population and population density in India from 1990-2018

Table 4.5.1 Proportion of the urban population in India

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	873277798	223096279	25.55		293.7175	7503.60
1995	963922588	256470883	26.61	2.99	324.2048	8626.12
2000	1056575549	292322757	27.67	2.80	355.3677	9831.96
2005	1147609927	335503762	29.23	2.95	385.9861	11284.30
2010	1234281170	381763166	30.93	2.76	415.137	12840.19
2015	1310152403	429428653	32.78	2.50	440.6555	14443.36
2018	1352617328	460295677	34.03	2.40	454.9381	15481.54

Source: Calculated using WDI indicators

Figure 4.5.1 Proportion of the urban population in India
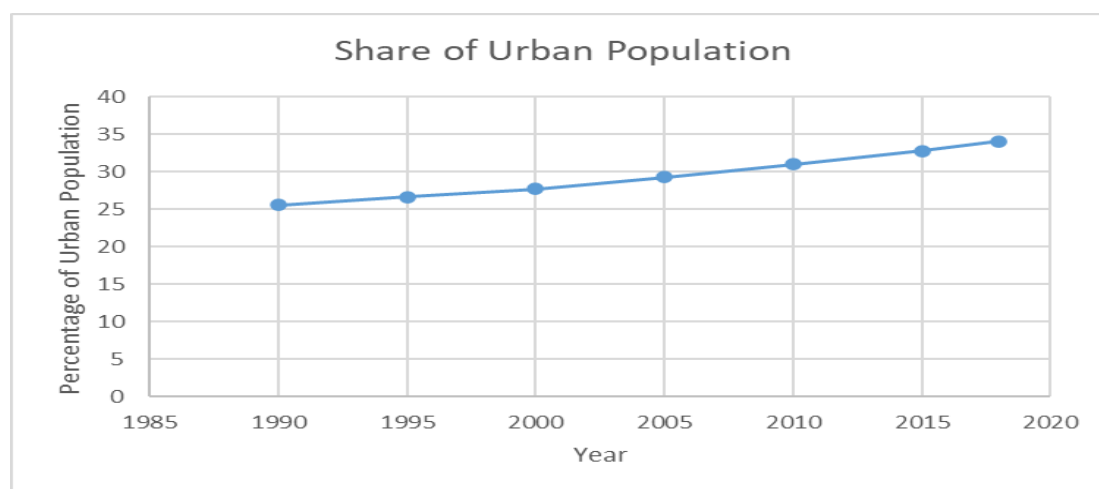
Source: Calculated using WDI indicators

Table 4.5.1 and figure 4.5.1 depict that the urban population in India increased from 25.55% in 1990 to 34.03% in 2018. The urban population in the economy has grown at an average annual rate of 2.5% from 1990 to 2018. The population density in the economy has increased from 293.71 per km square in 1990 to 454.93 per km square in 2018. The main reason behind this increasing urban proportion of the population at a constant rate of average growth is the natural rate of increase in population, industrialization, commercialization and urban planning policies in the economy (Shaban, et al., 2020).

The expansion of government services in the economy has also impacted the GDP per capita in the economy. The trend of GDP per capita from 1990 to 2018 is described below.

Table 4.5.2 GDP per capita (Constant 2010 US$) of India

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	507565004254.76	
1995	650281030594.29	0.28
2000	873357417209.47	0.34
2005	1193872737485.77	0.37
2010	1675615335600.56	0.40
2015	2294947360719.64	0.37
2018	2822169439126.96	0.23

Source: Calculated using WDI indicators

Figure 4.5.2 GDP per capita (Constant 2010 US$) of India
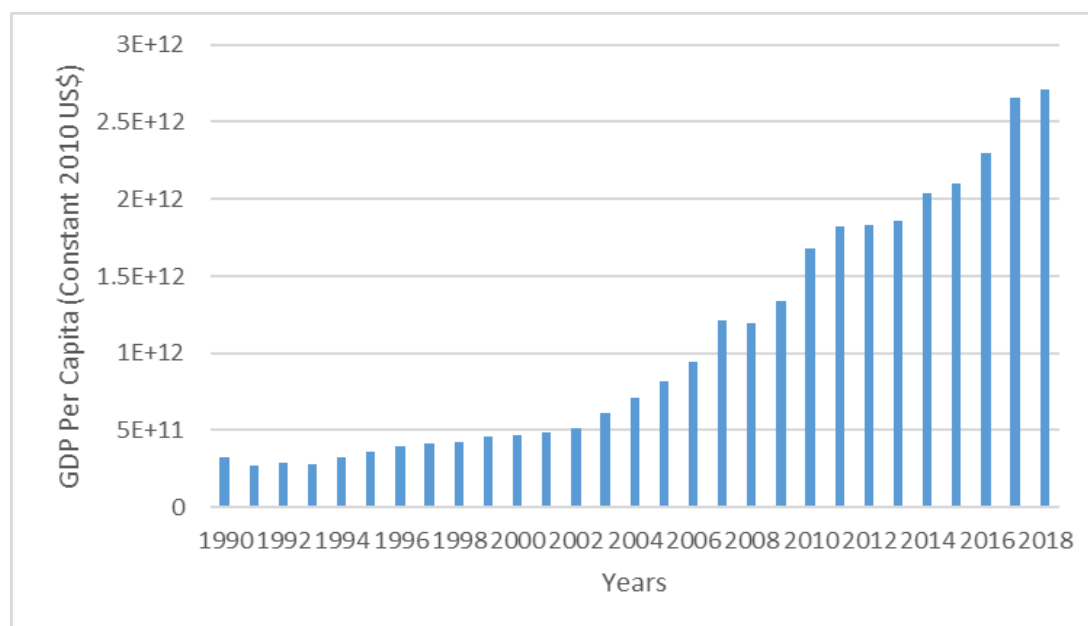
Source: Calculated using WDI indicators

Table 4.5.2 and figure 4.5.2 depict that GDP per capita in India has followed an increasing trend after 2000 with minor fluctuations. These GDP per capita dynamics indicate that it was the result of India's determination for and consistency for reforms (Sarkar, 2019).

Health-related reforms also contributed to control the death rate, fertility rate and birth rate. The trends in death rate, fertility rate and birth rate have been analyzed to explore the trend of the natural rate of increase in population in the economy.

Table 4.5.3 Death rate (DR), Birth rate (BR) and Fertility rate (FR) and Natural rate of increase in Population (NR) of India

Year	DR	Percentage change	BR	Percentage change	FR	Percentage change	NR
1990	10.86		31.52		4.05		20.65
1995	9.58	-0.12	28.75	-0.09	3.65	-0.10	19.17
2000	8.69	-0.09	26.40	-0.08	3.31	-0.09	17.71
2005	8.07	-0.07	24.09	-0.09	2.97	-0.10	16.01
2010	7.49	-0.07	21.11	-0.12	2.58	-0.13	13.62
2015	7.19	-0.04	18.63	-0.12	2.30	-0.11	11.43
2018	7.23	0.01	17.86	-0.04	2.22	-0.03	10.62

Source: Calculated using WDI indicators

Figure 4.5.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of India
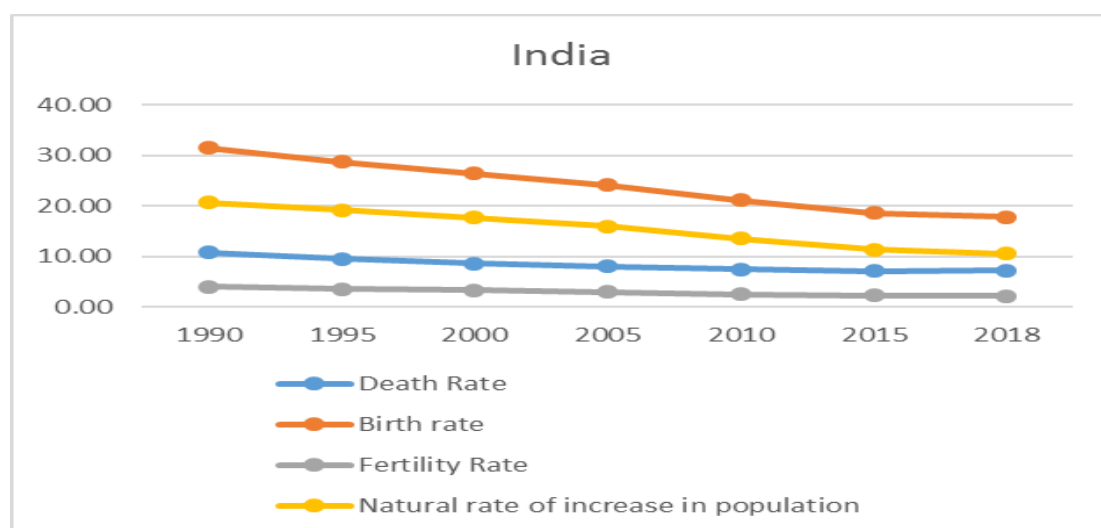
Source: Calculated using WDI indicators

Table 4.5.3 and figure 4.5.3 describe that the Birth rate in the economy has declined at a very fast rate from 31.52% in 1990 to 17.86% in 2018. Similarly, the Death rate and fertility rate in the economy have declined from 10.86% in 1990 to 7.23% in 2018 and 4.05% in 1990 to 2.22% in 2018 respectively. The main reason behind this improvement is the health protection policies implemented by the government to provide better health facilities to the people and to make them aware of family planning (Nilaish, 2017). This decreased death and birth rate has also resulted in a rapid decrease in the natural rate of increase in population from 20.65% in 1990 to 10.62% in 2018.

Besides health facilities, another factor responsible for the shift of people to urban regions is the expectation of a good wage rate in industry and services. The following table has described the proportion of employment in agriculture, industry and services in India from 1990-2018.

Table 4.5.4 Proportion of employment in agriculture, industry and services (% of total employment) in India

Year	Employment in Agriculture	Percentage change	Employment in Industry	Percentage Change	Employment in Services	Percentage Change
1990	62.56		15.72		21.72	
1995	61.70	-0.01	15.31	-0.03	22.99	0.06
2000	59.29	-0.04	16.33	0.07	24.38	0.06
2005	55.16	-0.07	19.31	0.18	25.53	0.05
2010	48.98	-0.11	23.49	0.22	27.53	0.08
2015	45.14	-0.08	23.98	0.02	30.87	0.12
2018	42.38	-0.06	25.58	0.07	32.04	0.04

Source: Calculated using WDI indicators

Figure 4.5.4 Proportion of employment in agriculture, industry and services (% of total employment) in India
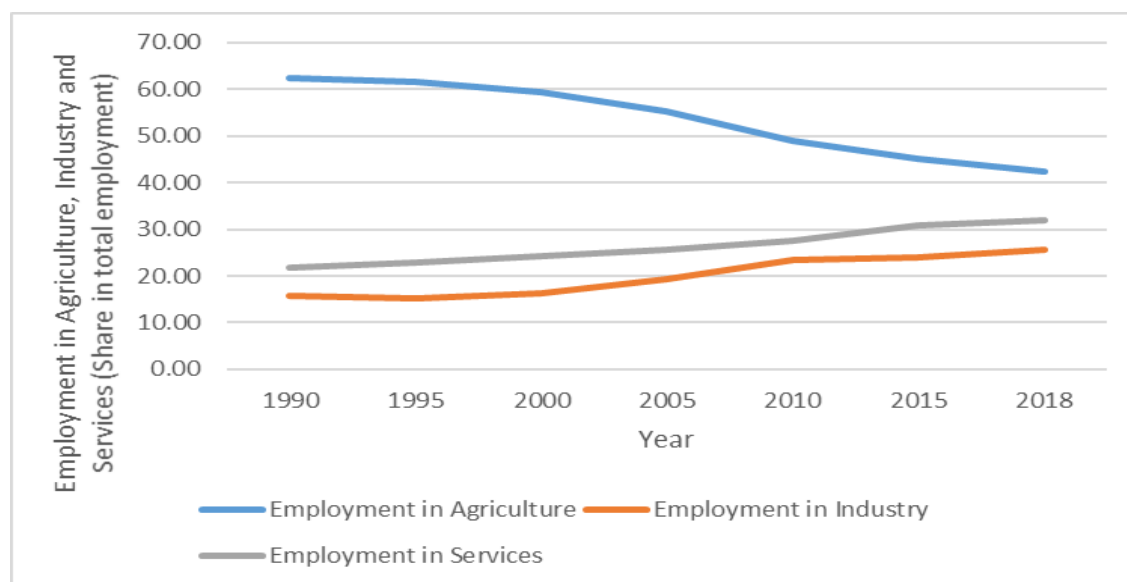
Source: Calculated using WDI indicators

Table 4.5.4 and figure 4.5.4 describe that trend of proportion of employment in agriculture is continuously declining in India. The main reason behind this decreasing trend is inadequate investment made by government for agriculture development and lack of access to institutional credit apart. Natural disaster also highly influence the

growth of agriculture sector. This is the main reason for people's increasing interest in employment in industry and services (Das & Sengupta, 2015). From the graph, it can be observed that there is a high proportion of employment in services than industries in India.

4.6 Urbanization trends of Thailand

Thailand, an upper-middle-income economy of the world, is known as a free enterprise economy with well-developed infrastructure and pro-investment policies. Urbanization in Thailand is dominated mainly by Bangkok. In terms of population, Bangkok is known as the ninth-largest city in East Asia. 80% urban population of Thailand is residing in Bangkok. No other city in Thailand has a population of more than 50000. The annual rate of growth in the economy is 1.1% which is very low for the areas with more than 5 million inhabitants (IBRD, 2015). The following table has described the proportion of urban population and population density in Thailand from 1990 to 2018.

Table 4.6.1 Proportion of the urban population in Thailand

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	56558186	16641681	29.42		110.7052	3257.39
1995	59467274	18004312	30.28	1.64	116.3994	3524.11
2000	62952642	19758316	31.39	1.95	123.2215	3867.43
2005	65416189	24472850	37.41	4.77	128.0436	4790.24
2010	67195028	29469051	43.86	4.08	131.5254	5768.18
2015	68714511	32772699	47.69	2.24	134.4996	6414.82
2018	69428524	34678853	49.95	1.94	135.8972	6787.93

Source: Calculated using WDI indicators

It is clear from table 4.6.1 that the urbanization process in the economy has started rapidly increasing after 2000. In 1990-1995 and 1995 -2000, the average growth rate of the urban population was 1.64 and 1.9 per cent respectively but after this in 2000-2005, the urban population in the economy growing up by 4.77%.

It can be observed that in 1990, the proportion of the urban population in the total population was 29.42% and in 2015 and 2018, this proportion increased to 47.69% and 49.95% respectively. The population density in the economy has increased from 110.70 per km square in 1990 to 135.89 per km square in 2018. The population density

in the economy is less in comparison to other countries with this level of the population (Wafiee & Wahab, 2015).

Figure 4.6.1 Proportion of the urban population in Thailand
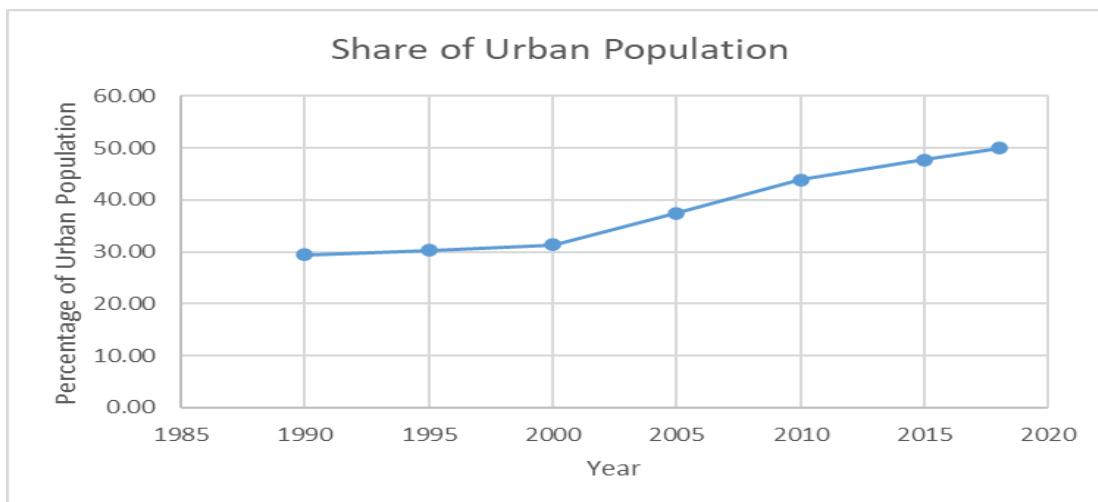
Source: Calculated using WDI indicators

From the figure 4.6.1, it is clear that till 2010, population density in the economy was increasing and the average growth rate of urban population proportion also increased and after 2010, it started decreasing 2.24% and 1.94% respectively in 2015 and 2018. Thailand is the second-largest economy of Southeast Asia and is highly dependent upon exports. But from 1990-96, various economic problems persisted in the economy which declined the current account deficit and this deficit further increased after 1996. The decreased growth of GDP per capita in the economy can also be a reason for decreased growth of urban population proportion in the economy. Therefore, in the below-given table, the percentage change in the growth of GDP per capita in Thailand has been discussed.

Table 4.6.2 GDP Per capita (Constant 2010 US$) of Thailand

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	141610897158.99	
1995	210026059881.66	0.48
2000	217712440842.02	0.04
2005	283767576325.11	0.30
2010	341104820155.46	0.20
2015	394514326505.53	0.16
2018	442260737640.11	0.12

Source: Calculated using WDI indicators

Figure 4.6.2 GDP Per capita (Constant 2010 US$) of Thailand
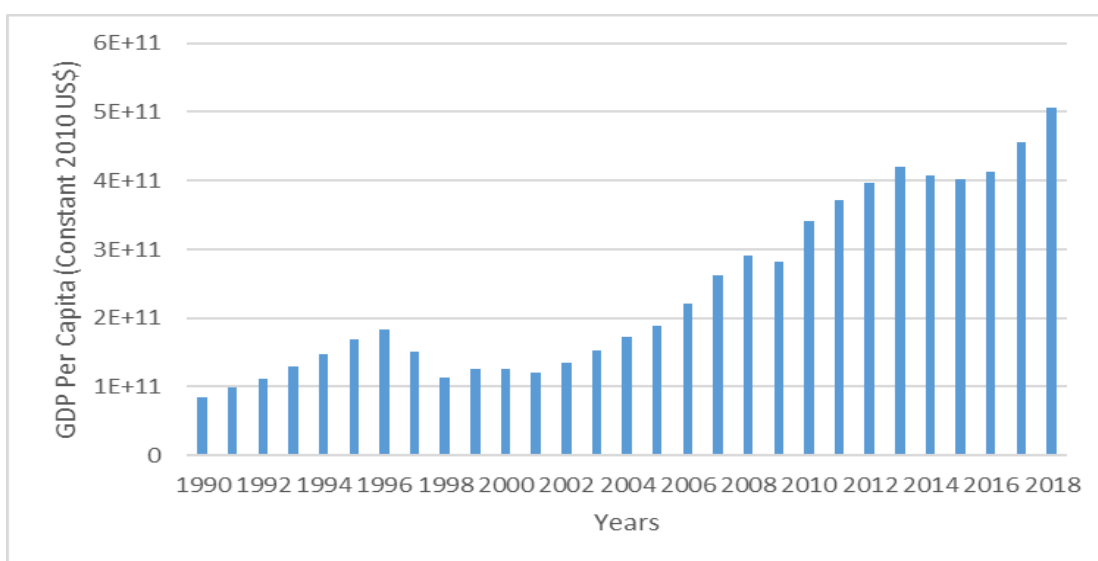
Source: Calculated using WDI indicators

From table 4.6.2 and figure 4.6.2, it is clear that GDP per capita in the economy followed a downward trend after 1996. After 2002, the economy started recovering, but again there was the effect of US financial crises in the economy in 2008 and GDP per capita in the economy fluctuated many times (Wafiee & Wahab, 2015). After 2016, GDP per capita in the economy has followed a positive trend.

The natural rate of increase in population is another important factor that increases the total proportion of the urban population in the overall population of the economy. Therefore, this section has discussed death rate, birth rate, fertility rate to calculate the natural rate of increase in population in Thailand.

Table 4.6.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Thailand

Year	DR	Percentage change	BR	Percentage change	FR	Percentage change	NR
1990	5.71		19.22		2.11		13.52
1995	6.34	0.11	16.91	-0.12	1.87	-0.12	10.57
2000	6.88	0.08	14.52	-0.14	1.67	-0.10	7.65
2005	7.12	0.04	12.87	-0.11	1.57	-0.06	5.75
2010	7.19	0.01	11.76	-0.09	1.54	-0.02	4.57
2015	7.39	0.03	10.84	-0.08	1.54	0.00	3.45
2018	7.67	0.04	10.34	-0.05	1.53	-0.01	2.68

Source: Calculated using WDI indicators

Figure 4.6.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Thailand
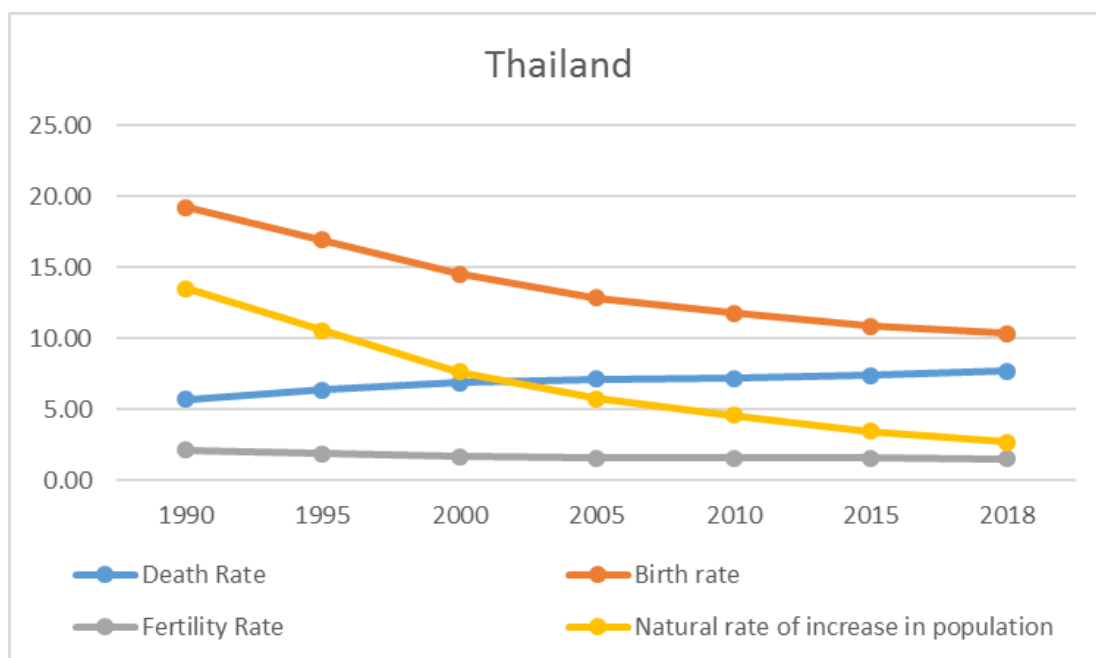
From the above table 4.6.3 and figure 4.6.3, it can be observed that the birth rate in the economy is decreasing but the rate of decline in this rate is low from 19.22% in 1990 to 10.34% in 2018. The death rate in the economy has also increased at a very low rate from 5.71% in 1990 to 7.67% in 2018. Similarly, the fertility rate in the economy has decreased from 2.11% in 1990 to 1.53% in 2018. But the gap between the birth rate and death rate in the economy has shrunk at a very fast rate from 13.52% in 1990 to 2.68% in 2018. Though the government of the economy has taken various initiatives to control the birth rate, fertility rate and death rate through better provision of health services but high residing costs, work commitments and shift of people away from their families are the main factors responsible for falling birth rate and fertility rate in the economy (Wongcha-um & Lefevre, 2018)

This rise in a shift of people from rural to urban regions is directly associated with employment. People move from villages to the cities in search of employment. Therefore, while discussing about urbanization, it is also required to discuss the level of employment in agriculture, industry and services in the economy during the period 1990 to 2018. The following table has described the proportion of employment in agriculture, industry and services.

Table 4.6.4 Proportion of employment in agriculture, industry and services (% of total employment) in Thailand

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	60.33		15.45		24.22	
1995	50.06	-0.17	20.79	0.35	29.15	0.20
2000	46.04	-0.08	18.83	-0.09	35.13	0.21
2005	39.78	-0.14	21.95	0.17	38.27	0.09
2010	41.01	0.03	19.44	-0.11	39.55	0.03
2015	31.16	-0.24	23.68	0.22	45.16	0.14
2018	31.61	0.01	22.63	-0.04	45.75	0.01

Source: Calculated using WDI indicators

Figure 4.6.4 Proportion of employment in agriculture, industry and services (% of total employment) in Thailand
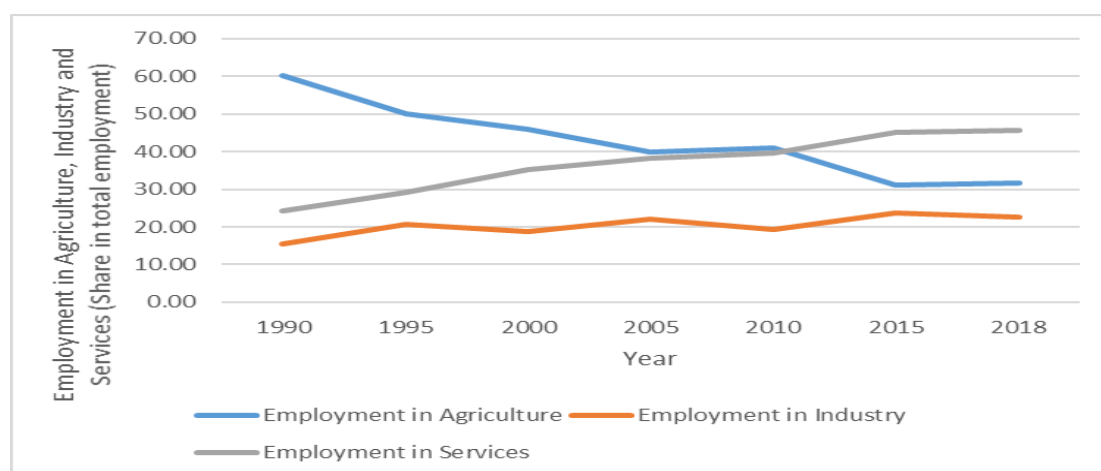
Source: Calculated using WDI indicators

Table 4.6.4 and figure 4.6.4 elucidate that employment in services has rapidly increased during 1990-2018 from 24.22% to 45.75%, in comparison to share of employment in agriculture and in industry and reflects that the shift of employment from agriculture to industry and services emphasize the rural to urban shift. In the case of Thailand, from 1990 to 2018 around half of the employment from agriculture has shifted to industry and services. The proportion of employment in the industry was 15.45% in 1990 and it increased to 22.63% in 2018. Similarly, the proportion of employment in services was 24.22% in 1990 and it increased to 45.75% in 2018. Industrialization has resulted in this increased proportion of employment in industry and services in Thailand (Fensom, 2015).

4.7 Urbanization trends of the Philippines

The Philippines, a lower-middle-income country, is known as one of the fastest-growing countries in East Asia. In the past five decades, around 50 million people settled into urban regions and it is expected that by 2050, 102 million people of the country would be residing in cities. There is overall high urban density in the economy and Metro Manila is the fastest-growing megacity of the Philippines (WBG, 2018). The following table has discussed the trend of proportion of urban population and population density in the Philippines from 1990-2018.

Table 4.7.1 Proportion of the urban population in the Philippines

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	61895160	29082060	46.99		207.5835	9753.52
1995	69784088	32491471	46.56	2.34	234.0413	10896.96
2000	77991755	35981496	46.13	2.15	261.5681	12067.44
2005	86326250	39459729	45.71	1.93	289.5202	13233.97
2010	93966780	42597021	45.33	1.59	315.145	14286.15
2015	102113212	47262079	46.28	2.19	342.4664	15850.72
2018	106651922	50027217	46.91	1.95	357.6883	16778.09

Source: Calculated using WDI indicators

Figure 4.7.1 Proportion of the urban population in the Philippines
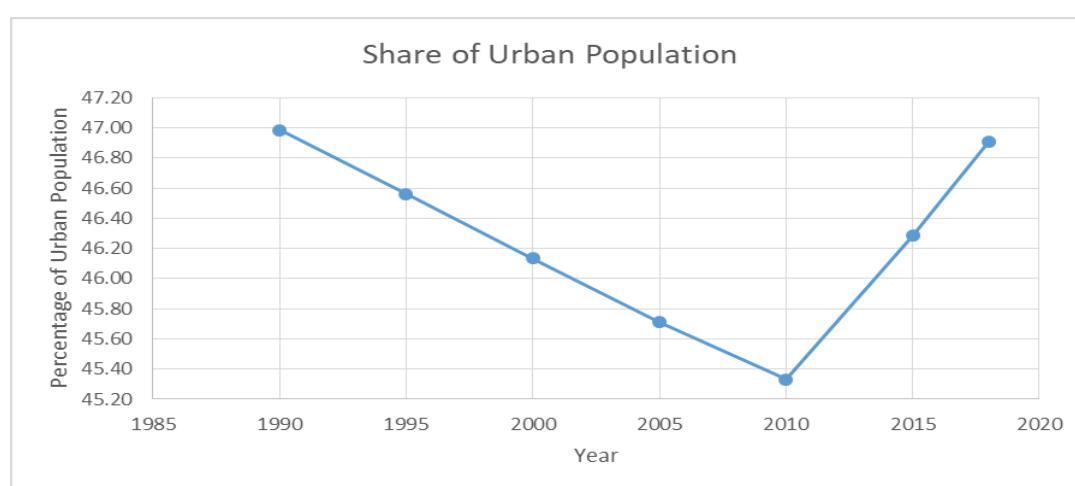
Source: Calculated using WDI indicators

Table 4.7.1 and figure 4.7.1 describe that Urbanization in the Philippines moved from 46.99% in 1990 to 46.91% in 2018. There is no big difference between the data of 1990 and 2018. There were minor fluctuations in the growth of the urban population during this period. The rate of urbanization in this economy remained high throughout

this period. The population density in the economy has increased from 207.58 per km square in 1990 to 357.68 per km square in 2018. During this period, Manilla remained an overcrowded city. The "Back to the Province" policy adopted by the government helped the economy to keep the rate of urbanization constant (Reyes et al., 2018).

Table 4.7.2 GDP Per capita (Constant 2010 US$) of Philippines

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	98138001426.68	
1995	109240672210.08	0.11
2000	130146160491.54	0.19
2005	163476307501.15	0.26
2010	208368892318.65	0.27
2015	279298784316.39	0.34
2018	340302643537.84	0.22

Source: Calculated using WDI indicators

GDP per capita in this economy has increased continuously with positive growth from 1990 to 2015. Table 4.7.2 and figure 4.7.2 describe that in 1990-95, GDP per capita raised by 11 per cent. In 2010-15, the GDP per capita in the Philippines increased by 34%. From 2015-18, a minor decline in the growth of GDP per capita of the economy has been observed. But overall GDP per capita has increased with a positive trend.

Figure 4.7.2 GDP Per capita (Constant 2010 US$) of Philippines
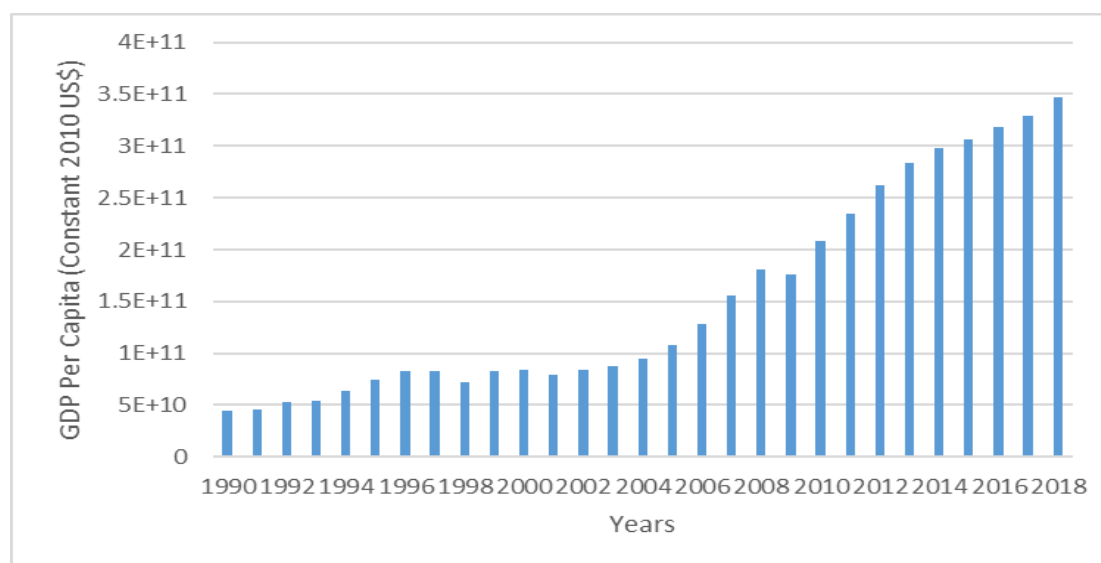
Source: Calculated using WDI indicators

Structural reforms in the economy had a positive impact on the positive GDP growth in the economy. The main factors that contributed to the developments of the economy and high GDP per capita were more emphasis on education by the government, the reduced GDP proportion of government consumption and substantial expansion of telecommunication infrastructure. But there were some adverse developments such as a decrease in financial development and a decline in trade openness which resulted in a decline in the growth rate of GDP per capita in 2015-18 (Brueckner & Hansl, 2018). The positive trend of the GDP of the Philippines economy also supported government of the economy to provide various basic health facilities to the people at free of cost such as birth control facilities which is also an important part of Philippines which helped in the reduction of birth rate. Governmental policies for education and health awareness also worked well to decrease the birth rate and fertility rate at a substantial rate which has further contributed in the declining natural rate of increase of population. It reflects that the increasing population in the economy is due to rural to urban movement of population.

Table 4.7.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Philippines

Year	DR	Percentage change	BR	Percentage change	FR	Percentage change	NR
1990	6.30		33.02		4.32		26.72
1995	5.56	-0.12	31.02	-0.06	4.01	-0.07	25.46
2000	5.43	-0.02	29.61	-0.05	3.81	-0.05	24.17
2005	5.47	0.01	27.37	-0.08	3.50	-0.08	21.90
2010	5.62	0.03	25.02	-0.09	3.18	-0.09	19.40
2015	5.80	0.03	22.27	-0.11	2.81	-0.12	16.48
2018	5.87	0.01	20.55	-0.08	2.58	-0.08	14.67

Source: Calculated using WDI indicators

Table 4.7.3 elucidate that death rate in the economy has decreased from 6.30% to 5.87% in 2018. Birth rate, on the other hand, has decreased from 33.02% in 1990 to 20.55% in 2018. Similarly, a decline in fertility rate has been observed with 4.32% in 1990 to 2.58% in 2018. Using birth rate and death rate, Natural rate of increase in population has been calculated which has been declined from 26.72% in 1990 to

14.67% in 2018. It indicates that urbanization is the key factor responsible for increase in population as well as population density of the economy.

Figure 4.7.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Philippines
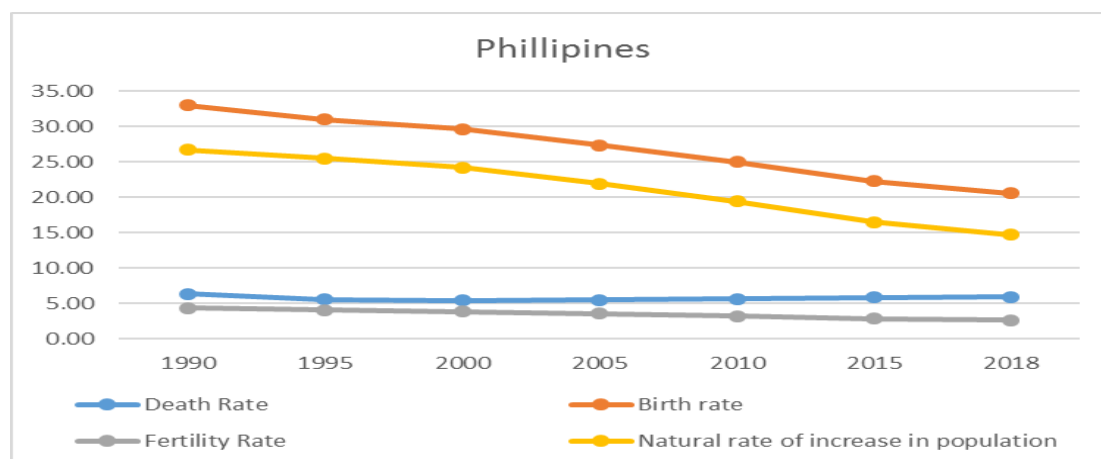
Source: Calculated using WDI indicators

Figure 4.7.3 show that the death rate and birth rate in the economy have decreased gradually from 1990 to 2018. This gradual decrease in the death and birth rate has also led to a gradual decrease in the natural rate of increase of the population from 26.72% in 1990 to 14.67% in 2018. According to WBG (2018), under Philippines Health Agenda, the government has planned to provide three health guarantees to people i.e., to ensure financial protection to poor people, improvement of health outcomes with no disparity and by providing highly responsive health service delivery networks (WHO, 2017).

Table 4.7.4 Proportion of employment in agriculture, industry and services (% of total employment) in the Philippines

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	44.90		15.70		39.39	
1995	42.83	-0.12	15.53	-0.06	41.63	-0.07
2000	36.99	-0.02	15.81	-0.05	47.20	-0.05
2005	34.91	0.01	15.70	-0.08	49.39	-0.08
2010	32.69	0.03	15.31	-0.09	52.01	-0.09
2015	27.03	0.03	17.45	-0.11	55.52	-0.12
2018	23.41	0.01	19.44	-0.08	57.16	-0.08

Source: Calculated using WDI indicators

Figure 4.7.4 Proportion of employment in agriculture, industry and services (% of total employment) in the Philippines
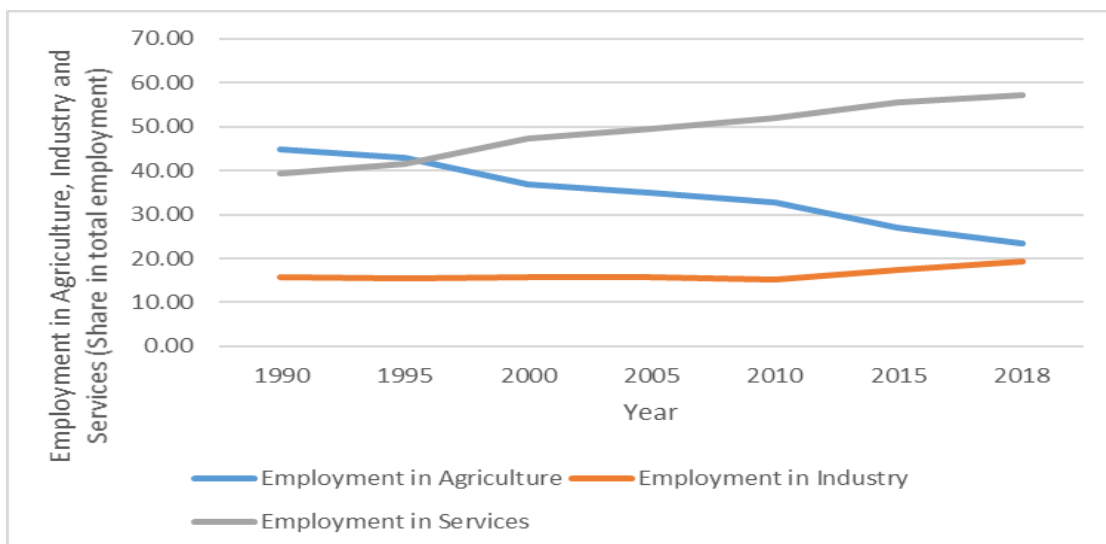
Source: Calculated using WDI indicators

From the above table 4.7.4 and figure 4.7.4, it is clear that the proportion of employment in agriculture has declined from 44.90% in 1990 to 23.41% in 2018. On the other hand, the proportion of employment in industry and services has also decreased by 15.70% in 1990 to 19.44% in 2018 and 39.39% in 1990 to 57.16% respectively. A large number of populations is attracted to shift to urban regions for exploring opportunities in industry and services (Satterthwaite et al., 2010).

4.8 Urbanization trends of Indonesia

Urbanization in Indonesia has followed a rapid positive trend after 1970. From 1950 to 1990, in 40 years, the rate of urbanization in the economy was doubled from 15% to 30%. This low-middle income country has rapidly grown between 2009- 2013 with an average GDP growth rate of 5.8%. The population density in the economy is continuously increasing. According to Central Statistics Agency (2018), the population density of Jakarta, the capital city of Indonesia, has raised to 14,400 people per square kilometer (IBRD, 2018). The main reason behind high population density of Jakarta is that most of the migrants have been settled in this city of the economy. Poverty of the regions such as Java is also one of the most important reason behind shift of the people to urban areas such as Jakarta in search of employment and better facilities. The following table describes the proportion of urban population and population density in the economy from 1990-2018.

Table 4.8.1 Proportion of the urban population in Indonesia

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	181413402	55483475	30.58		100.1415	3062.73
1995	196934260	71046004	36.08	5.61	108.7092	3921.79
2000	211513823	88840036	42.00	5.01	116.7572	4904.04
2005	226289470	103961908	45.94	3.40	124.9135	5738.77
2010	241834215	120709130	49.91	3.22	133.4943	6663.23
2015	258383256	137751865	53.31	2.82	142.6295	7604.00
2018	267663435	148084795	55.32	2.50	142.5623	8174.39

Source: Calculated using WDI indicators

From the above table 4.8.1 and figure 4.8.1, it is clear that from 1990 to 2018, the urban proportion of the population has rapidly increased from 30.58% in 1990 to 55.32% in 2018. From 1990 -2000, around for a decade, the average rate of growth in the urban population was 5%. In the next decade, this average rate of growth decreased by 3%. From 2015 to 2018, the average rate of growth in the economy remained 2%. From this data, it is clear that due to the increased population density in the economy, urbanization is growing with decreasing average rate of growth (IBRD, 2016). It is for the visual presentation of the share of urban population in Indonesia, the proportion of urban population has been drawn graphically.

Figure 4.8.1 Proportion of the urban population in Indonesia
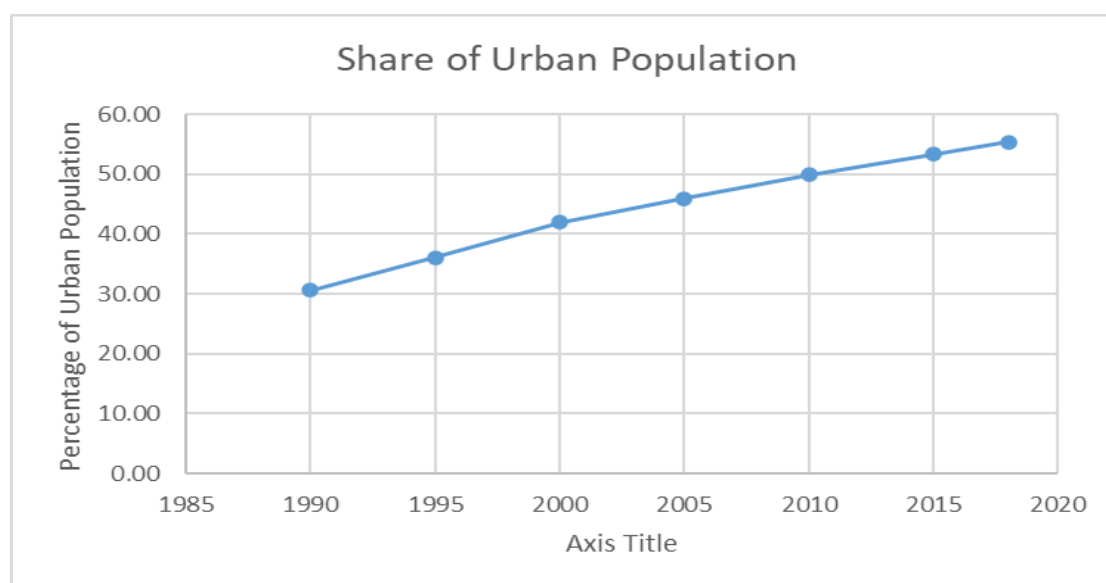
Source: Calculated using WDI indicators

From figure 4.8.1, it is clear that population density in the economy has increased from 100.14 per km square in 1990 to 142.56 per km square in 2018. According to World Bank reports, Indonesia is gaining only 4% GDP growth for every 1% of urbanization which is higher than other developing nations of Asia. It reflects that Indonesia can benefit from urbanization in future. The following table has discussed the scenario of GDP per capita in Indonesia from 1990-2018.

Table 4.8.2 GDP Per capita (Constant 2010 US$) of Indonesia

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	309821137734.34	
1995	437209211196.91	0.41
2000	453413616927.80	0.04
2005	571204954434.66	0.26
2010	755094160363.07	0.32
2015	988128596686.37	0.31
2018	1146853725883.45	0.16

Source: Calculated using WDI indicators

Table 4.8.2 depicts that GDP per capita in Indonesia, though increased but remained fluctuated during the study period. Indonesia is an emerging market economy of South East Asia. But the economy passed through various critical phases such as impact of Asian financial crises.

Figure 4.8.2 GDP Per capita (Constant 2010 US$) of Indonesia
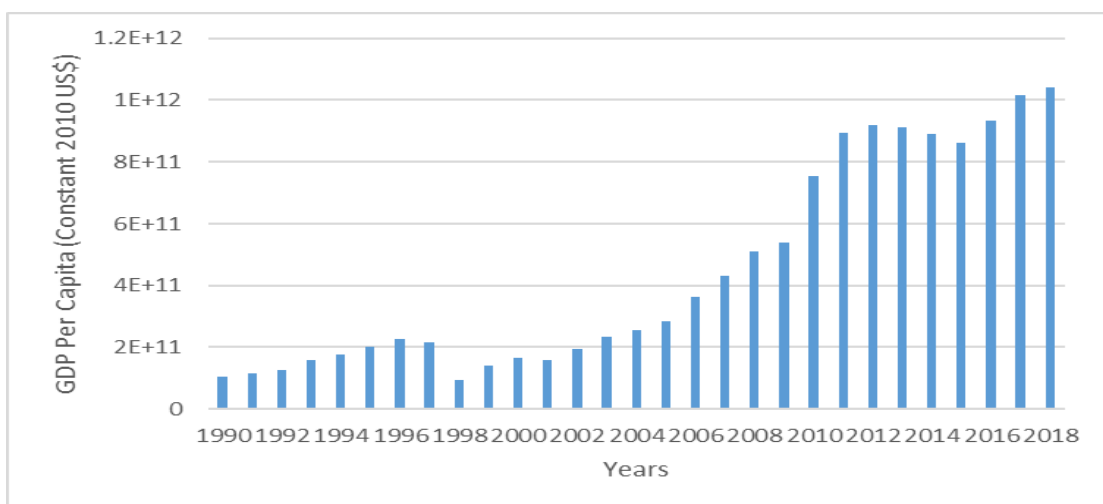
Source: Calculated using WDI indicators

Figure 4.8.2 describe that GDP per capita in the economy has followed a positive upward trend with various fluctuations. In 1997, the Asian Financial crisis

highly impacted the GDP growth rate. During this time, the government acquire non-performing bank loans to take custody of a significant portion of the private sector. The economy started recovering in 1999. From 2012 onwards, the GDP per capita in the economy jumped high because the country secured its place in G-20 economies (Pardede & Zahro, 2018).

Though growth in the GDP of an economy results in high GDP per capita heavy increases in total population can lead to negative consequences. Therefore, it is essential to know the rate of natural increase in population in the economy to know the growth of population from within the economy.

Table 4.8.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Indonesia

Year	DR	Percentage change	BR	Percentage change	FR	Percentage change	NR
1990	8.34		25.81		3.12		17.47
1995	7.67	-0.08	22.88	-0.11	2.69	-0.14	15.21
2000	7.48	-0.03	21.77	-0.05	2.51	-0.07	14.30
2005	7.20	-0.04	21.77	0.00	2.51	0.00	14.56
2010	6.65	-0.08	20.80	-0.04	2.48	-0.01	14.14
2015	6.42	-0.04	19.17	-0.08	2.39	-0.04	12.75
2018	6.47	0.01	18.07	-0.06	2.31	-0.03	11.61

Source: Calculated using WDI indicators

Figure 4.8.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Indonesia
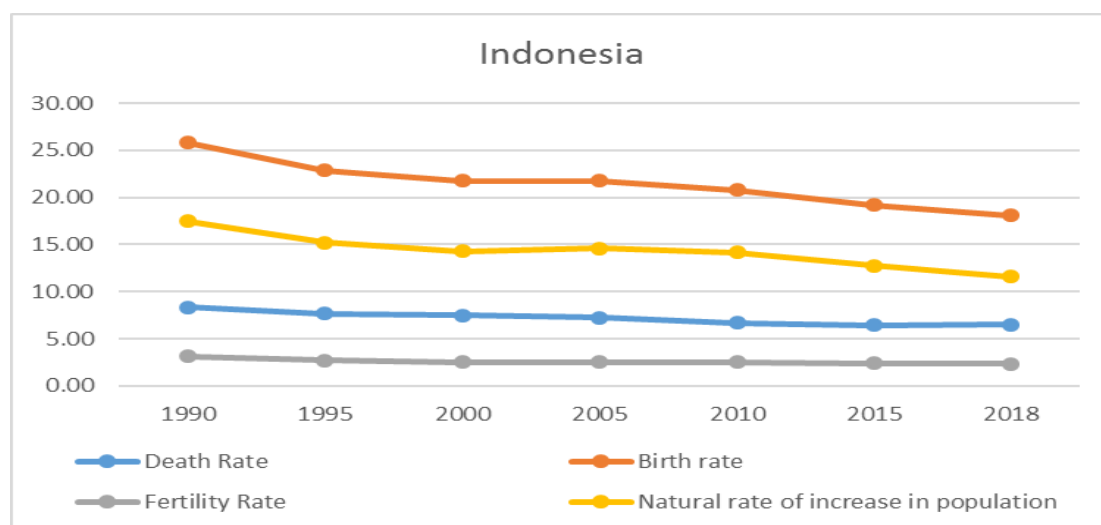
Source: Calculated using WDI indicators

The table 4.8.3 and figure 4.8.3 has described this rate of natural increase in population by throwing light on the death rate, birth rate and fertility rate in Indonesia. It is clear from the analysis that the birth rate and fertility rate in the economy are following a declined trend from 1990 to 2018. The death rate in the economy has also followed a negative trend with a decrease from 8.34% in 1990 to 4.67% in 2018. The natural rate of population in the economy has decreased from 17.47% in 1990 to 11.61% in 2018. Vigorous family planning programs and free basic education for girls contributed a lot in decreasing the birth rate and fertility rate in the economy (Jatmiko, 2019). All the family planning programs of Indonesian government are associated with the population control policies. These efforts of the government have helped in the reducing the total fertility rate in the country. Two child policy introduced by Indonesian government also helped in controlling the birth rate.

The rapid decrease in the natural rate of increase in the population indicates that the urban population in the economy has mainly grown due to the rural to the urban movement of population. Employment availability in the urban regions is the main factor behind this shift in population. The following table has discussed the proportion of employment in agriculture, industry and services.

Table 4.8.4 Proportion of employment in agriculture, industry and services (% of total employment) in Indonesia

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	54.02		14.56		31.42	
1995	44.02	-0.19	18.09	0.24	37.89	0.21
2000	43.77	-0.01	18.74	0.04	37.49	-0.01
2005	42.06	-0.04	18.59	-0.01	39.35	0.05
2010	37.19	-0.12	19.99	0.08	42.82	0.09
2015	31.82	-0.14	21.72	0.09	46.46	0.08
2018	28.64	-0.10	22.45	0.03	48.91	0.05

Source: Calculated using WDI indicators

Table 4.8.4 describe that proportion of employment in agriculture has decreased from 54.02% in 1990 to 28.64% in 2018. On the other hand, the proportion of employment in the industry has increased from 14.56% in 1990 to 22.45% in 2018 and services, it has increased from 31.42% to 48.95%. From this data analysis, it is clear

that employment in services has rapidly increased during 1990-2018 in comparison to share of employment in agriculture and in industry.

Figure 4.8.4 Proportion of employment in agriculture, industry and services (% of total employment) in Indonesia
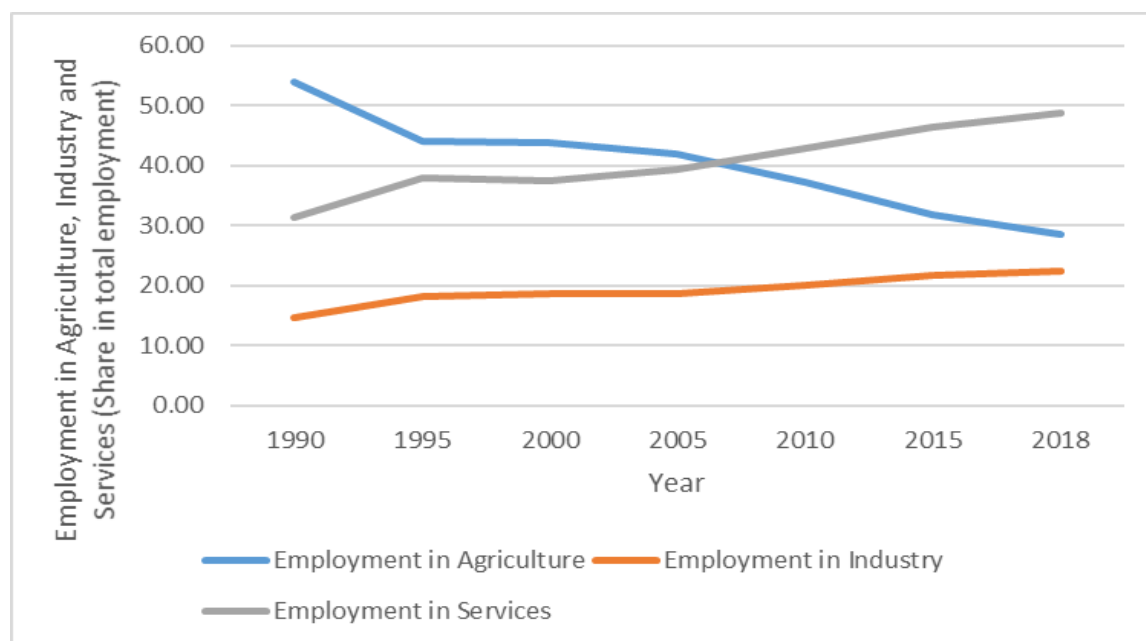
Source: Calculated using WDI indicators

Figure 4.8.4 visualize the declined trend of employment in agriculture and positive trend for employment in industry and service. The main reason behind the increased concentration of employment in services is due to the high value-added per worker in this sector in comparison to industry and agriculture (ILO, 2018).

4.9 Urbanization trends of Cambodia

Cambodia is a low middle-income country that is known for its unplanned and unregulated process of urbanization. The capital city of Cambodia Phnom Penh dominates the process of urbanization in an economy with 1.8 million inhabitants. The total population of this capital city was doubled in just eight years from 1998 to 2006 (Gangopadhyay et al., 2020). The main reason behind the growth of urbanization is use of migration as livelihood strategy by people of the economy. From 2000-2010, the urban regions of Cambodia have grown gradually with an annual rate of growth of 4.34%. The rate of urbanization in Cambodia is not growing as the rate of GDP of the economy. Following table shows share of urbanization and its growth rate during 1990 to 2010.

Table 4.9.1 Proportion of the urban population in Cambodia

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	8975597	1395346	15.55		50.84748	790.47
1995	10656138	1844684	17.31	6.44	60.36788	1045.03
2000	12155239	2259173	18.59	4.49	68.86041	1279.84
2005	13273354	2545033	19.17	2.53	75.19462	1441.78
2010	14312212	2904520	20.29	2.83	81.07983	1645.43
2015	15521436	3443896	22.19	3.71	87.93018	1950.99
2018	16249798	3800503	23.39	3.45	92.05641	2153.02

Source: Calculated using WDI indicators

Table 4.9.1 and figure 4.9.1 depict that from 1990 to 2018, the proportion of the urban population in the total population of Cambodia has shifted from 15.55% to 23.39%. There are various challenges in the economy that are responsible for a low rate of urbanization.

Figure 4.9.1 Proportion of the urban population in Cambodia
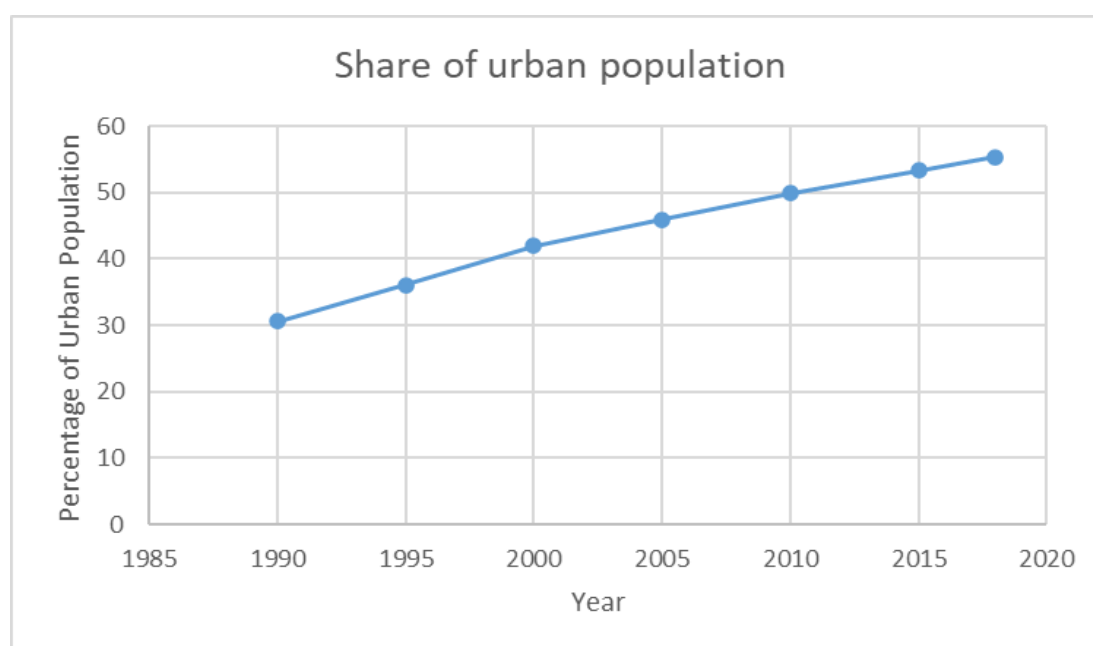
Source: Calculated using WDI indicators

Major challenges are lack of urban development policies, unequal urban development, unplanned urban growth and insufficient capacity for urban management institutional and policy development. The population density in the economy has increased from 50.84 per km square in 1990 to 92.05 per km square in 2018.

Table 4.9.2 GDP Per capita (Constant 2010 US$) of Cambodia

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	5084948751.55	
1995	3643242084.68	-0.28
2000	5241366891.85	0.44
2005	8138335730.42	0.55
2010	11242275198.98	0.38
2015	15903594933.66	0.41
2018	19542411045.65	0.23

Source: Calculated using WDI indicators

The economy of Cambodia is currently following an open market system. Therefore, it has observed a high rate of growth in the past decade. Resultantly GDP per capita in the economy has also increased. From 1990-95, there was a slight negative trend of GDP per capita due to a negative growth rate in the economy.

Figure 4.9.2 GDP Per capita (Constant 2010 US$) of Cambodia
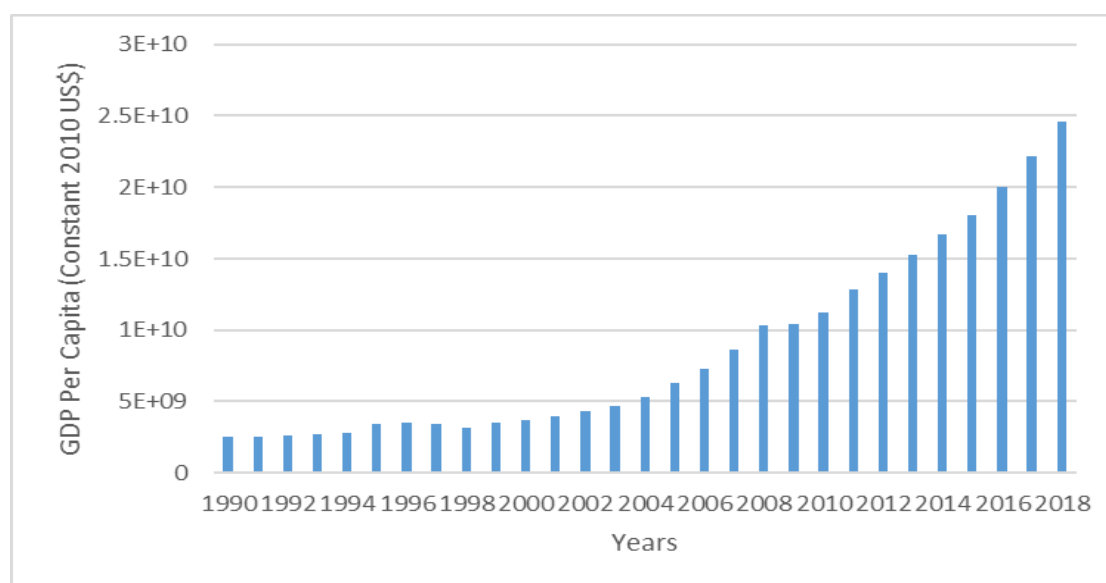
Source: Calculated using WDI indicators

In 1995, the government of the economy adopted an open market system which resulted in a high growth rate, decreased inflation and high imports in the economy. In 1997-98, the economy again slowed down due to regional economic crises and civil unrest. But the situation was recovered till 2000 and the GDP per capita of the economy followed a positive upward trend till 2018.

Table 4.9.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Cambodia

Year	DR	% change	BR	% change	FR	% change	NR
1990	12.68		42.36		5.60		29.68
1995	11.35	-0.11	34.08	-0.20	4.69	-0.16	22.73
2000	9.43	-0.17	28.06	-0.18	3.81	-0.19	18.63
2005	7.48	-0.21	26.15	-0.07	3.23	-0.15	18.67
2010	6.51	-0.13	25.50	-0.02	2.88	-0.11	18.99
2015	6.10	-0.06	23.67	-0.07	2.59	-0.10	17.58
2018	6.00	-0.02	22.46	-0.05	2.50	-0.03	16.47

Source: Calculated using WDI indicators

Table 4.9.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Cambodia
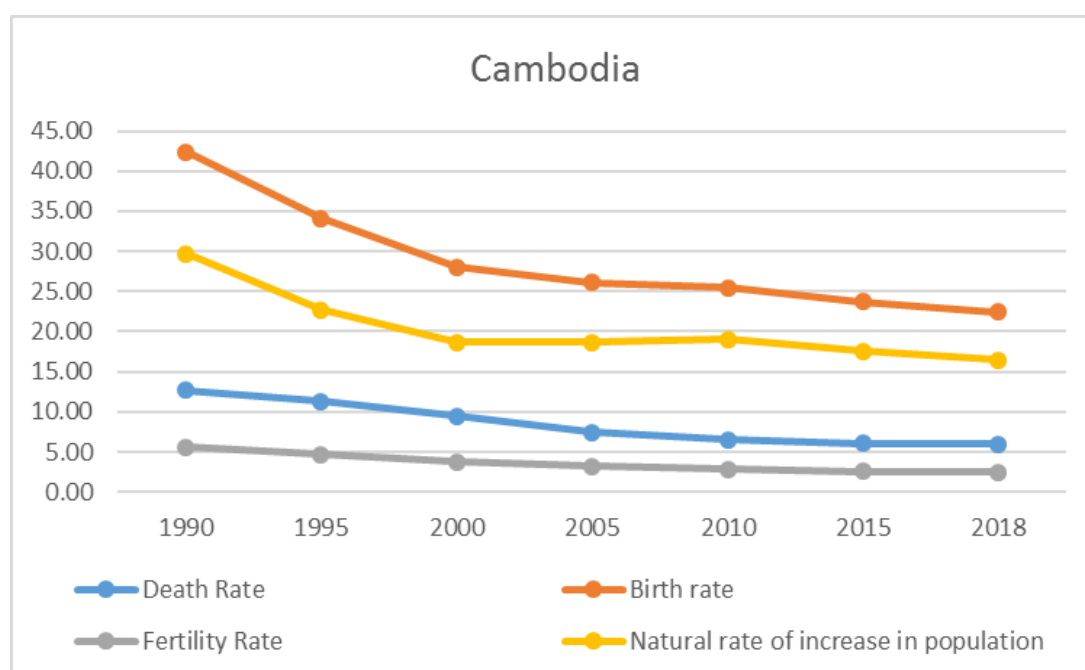
Source: Calculated using WDI indicators

The above table 4.9.3 and figure 4.9.3 describe that the death rate in the economy has decreased from 12.68% in 1990 to 6% in 2018. The birth rate in the economy has also decreased from 42.36% in 1990 to 22.46% in 2018. The fertility rate in the economy has decreased from 5.60% in 1990 to 2.50% in 2018. The main reason behind the heavy decline in birth rate and the fertility rate is the decreased contraceptive prevalence in the economy. Cambodia is the country with the lowest contraceptive prevalence in Asia. This difference between birth and death rate has resulted in a natural

rate of increase of population 29.68% in 1990 and 16.47% in 2018. The current situation of the economy can be considered as an early stage of the demographic and economic transformation with a shift of employment from agriculture to industry and services.

Table 4.9.4 Proportion of employment in agriculture, industry and services (% of total employment) in Cambodia

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	78.82		6.54		14.63	
1995	78.39	-0.01	6.32	-0.03	15.29	0.05
2000	68.93	-0.12	11.00	0.74	20.07	0.31
2005	60.06	-0.13	14.01	0.27	25.93	0.29
2010	56.55	-0.06	16.47	0.18	26.98	0.04
2015	37.54	-0.34	25.76	0.56	36.70	0.36
2018	32.30	-0.14	29.00	0.13	38.70	0.05

Source: Calculated using WDI indicators

Figure 4.9.4 Proportion of employment in agriculture, industry and services (% of total employment) in Cambodia
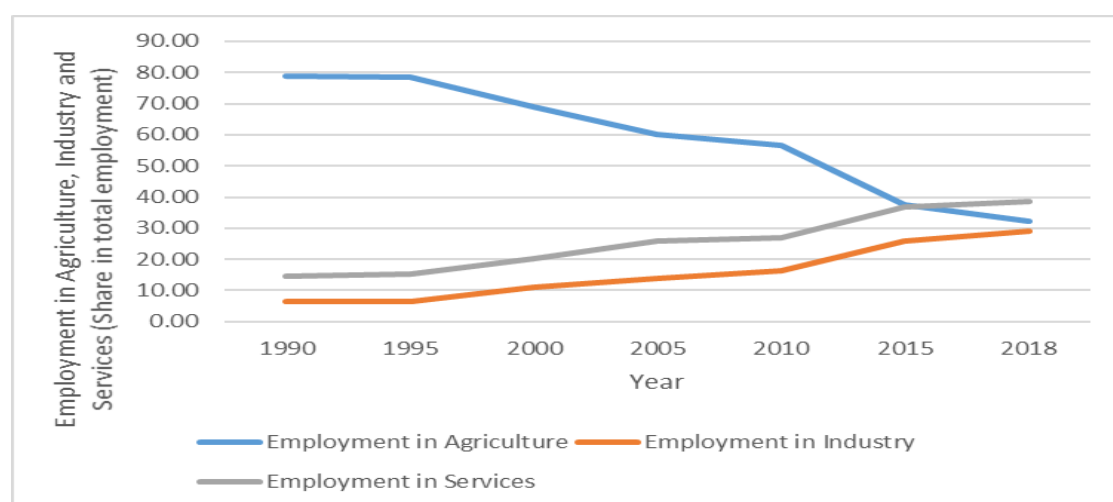
Source: Calculated using WDI indicators

From the above table 4.9.4 and figure 4.9.4, it is clear that employment in agriculture in the economy has continuously decreased from 78.82% in 1990 to 32.30% in 2018. The proportion of employment in the industry has increased from 6.54% in 1990 to 29% in 2018. Similarly, the proportion of employment in services has increased from 14.63% in 1990 to 38.70% in 2018. It indicates that people in the economy are regularly shifting from agriculture to industry and services.

4.10 Urbanization trends of Vietnam

Vietnam is a lower-middle-income country in East Asia. The shift of the economy from centrally planned to a market economy has lifted it from one of the poorest nations of the world to a lower-middle-income country. Today, it is known as the most dynamic emerging nation of East Asia. It was after political reforms in the economy in 1980, increased political stability attracted a shift of people from rural to urban regions and the process of urbanization was boosted (Cira & Wang, 2012). The following table describes the proportion of the urban population in the economy from 1990-2018.

Table 4.10.1 Proportion of the urban population in Vietnam

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	67988862	13772504	20.26		208.8816	4231.31
1995	74910461	16604653	22.17	20.56	230.1467	5101.43
2000	79910412	19477364	24.37	17.30	256.8971	6261.61
2005	83832661	22870388	27.28	17.42	270.3669	7375.88
2010	87967651	26757120	30.42	16.99	283.7026	8629.38
2015	92677076	31333193	33.81	17.10	298.8908	10105.20
2018	95540395	34317154	35.92	9.52	308.1252	11067.55

Source: Calculated using WDI indicators

Figure 4.10.1 Proportion of the urban population in Vietnam
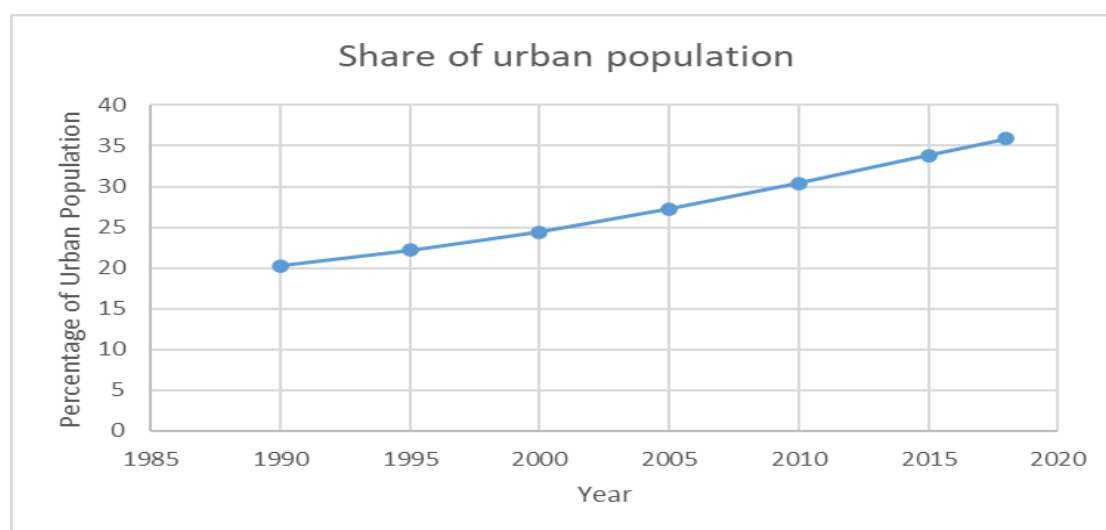
Source: Calculated using WDI indicators

Table 4.10.1 and figure 4.10.1 depict that in 1990 urban population in Vietnam was 20.26%. From 1990 to 1995, the urban population in the economy increased by

20.56%. From 1990 to 2018, a continuous increase in the urban population is observed. It is observed that from 2015 to 2018, there is a slight decrease in the growth of urbanization in the economy in comparison to previous years. Small cities and high population density have highly contributed to affecting this rate of growth (Haub & Huong, 2003). The population density in the economy has increased from 208.88 per km square in 1990 to 308.18 per km square in 2018. From 2009-2018, the urbanization in the economy grows at an average rate of 7%. The growth of population in the country itself and the increased shift of people from rural to urban regions resulted in crowded cities in the economy. The rapid increase in the total population of the economy from 1990-2018 has also affected GDP per capita in the economy.

Table 4.10.2 GDP Per capita (Constant 2010 US$) of Vietnam

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	29458481786.17	
1995	43696326983.66	48.33
2000	61146300622.51	39.93
2005	85351803030.42	39.59
2010	115931749697.24	35.83
2015	154508616051.56	33.28
2018	187686812137.29	21.47

Source: Calculated using WDI indicators

Figure 4.10.2 GDP Per capita (Constant 2010 US$) of Vietnam
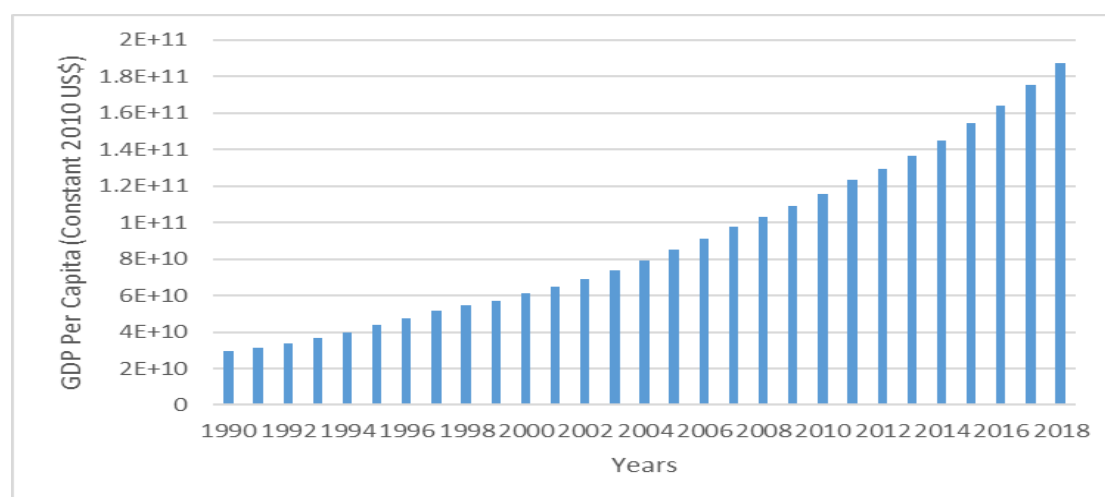
Source: Calculated using WDI indicators

Table 4.10.2 and figure 4.10.2 have described that from 1990 to 1995, the percentage increase in the GDP per capita in the economy was 48.33% and which

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decreased to 21.47% in 2015-18. GDP per capita of Vietnam has continuously increased from 1990 to 2018 but the percentage rise in the GDP per capita has decreased throughout the selected period. The positive trend with the slow growth of GDP per capita of the economy shows that certain developments in the economy have contributed to shifting this economy from poor to the low middle-income nation on the one hand. But on the other hand, the fall in the growth rate of GDP per capita of the economy is due to the increased focus of the government of the economy towards macroeconomic stability rather than the high growth rate after the 1997-98 Asian financial crises (Haub & Huong, 2003). The increase in GDP per capita from 2002 to 2018 is 2.7 times and has lifted more than 45 million people out of poverty (Vanham, 2018).

Besides GDP per capita, the shift of urban population is also associated with the provision of health services in the economy. The death rate, birth rate and fertility rate in the economy indicate the provision of health services to the individuals in the economy.

Table 4.10.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Vietnam

Year	DR	Percentage change	BR	Percentage change	FR	Percentage change	NR
1990	6.36		28.56		3.55		22.20
1995	5.89	-0.07	22.84	-0.20	2.71	-0.24	16.95
2000	5.65	-0.04	17.43	-0.24	2.01	-0.26	11.78
2005	5.65	0.00	16.81	-0.04	1.89	-0.06	11.15
2010	5.81	0.03	17.28	0.03	1.94	0.02	11.47
2015	6.13	0.05	17.26	0.00	2.01	0.04	11.13
2018	6.32	0.03	16.75	-0.03	2.05	0.02	10.43

Source: Calculated using WDI indicators

Table 4.10.3 elucidates that death rate in the economy has declined from 6.36 in 1990 to 5.81 in 2010 but again it increased to 6.32 in 2018. The key reasons behind increased death rate in the economy was poor lifestyle and increased health challenges due to increasing population density in few cities. Birth rate, on the other hand, has declined from 28.56 to 16.75. Similarly, fertility rate of economy has declined from 3.55% in 1990 to 2.05% in 2018. Natural rate of increase in population has been

calculated using birth and death rate which has also declined from 22.20% in 1990 to 10.43% in 2018.

Figure 4.10.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Vietnam
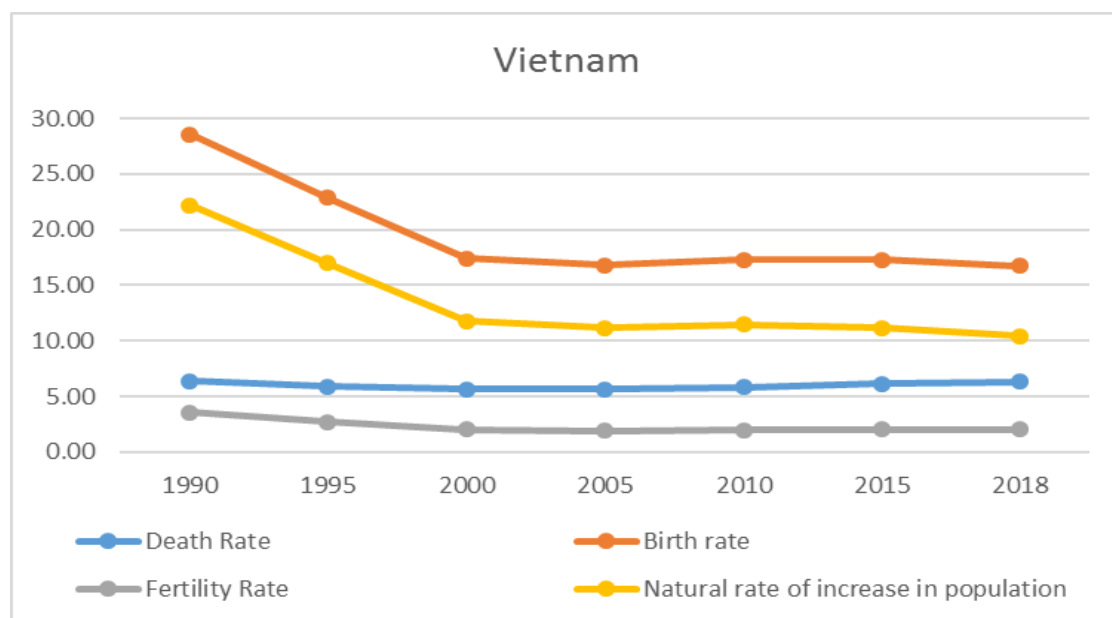
Source: Calculated using WDI indicators

From the above-given figure 4.10.3, it is clear that there was a sharp decline in the birth rate in the economy from 1990 to 2000. After 2000, this rate remains almost constant. The death rate in the economy almost remained constant throughout the period with minor fluctuations. There is a high difference in the birth rate and death rate in the economy which has resulted in a natural rate of increase in population 22.20 % in 1990 and 10.43% in 2018. It reflects that the natural rate of increase in the population of the economy is decreasing and rural to urban shift is increasing. The fertility rate in the economy also remained constant throughout the period. Two child policy in Vietnam has resulted in controlling the birth rate and fertility rate in the economy (Haub & Huong, 2003).

Though, it is discussed above that increased population in the economy has resulted in crowded cities, but still, 37% of the population of Vietnam is rural and working in the agriculture sector. In comparison to industry and services sectors, there is high proportion of the employment in agriculture sector. The proportion of employment in agriculture, industry and services is described below.

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Table 4.10.4 Proportion of employment in agriculture, industry and services (% of total employment) in Vietnam

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	70.71		10.13		19.17	
1995	66.42	-0.06	12.22	0.21	21.36	0.11
2000	63.99	-0.04	13.90	0.14	22.11	0.03
2005	51.67	-0.19	20.19	0.45	28.15	0.27
2010	48.31	-0.06	21.28	0.05	30.41	0.08
2015	41.87	-0.13	24.76	0.16	33.37	0.10
2018	37.36	-0.11	27.64	0.12	35.00	0.05

Source: Calculated using WDI indicators

Figure 4.10.4 Proportion of employment in agriculture, industry and services (% of total employment) in Vietnam
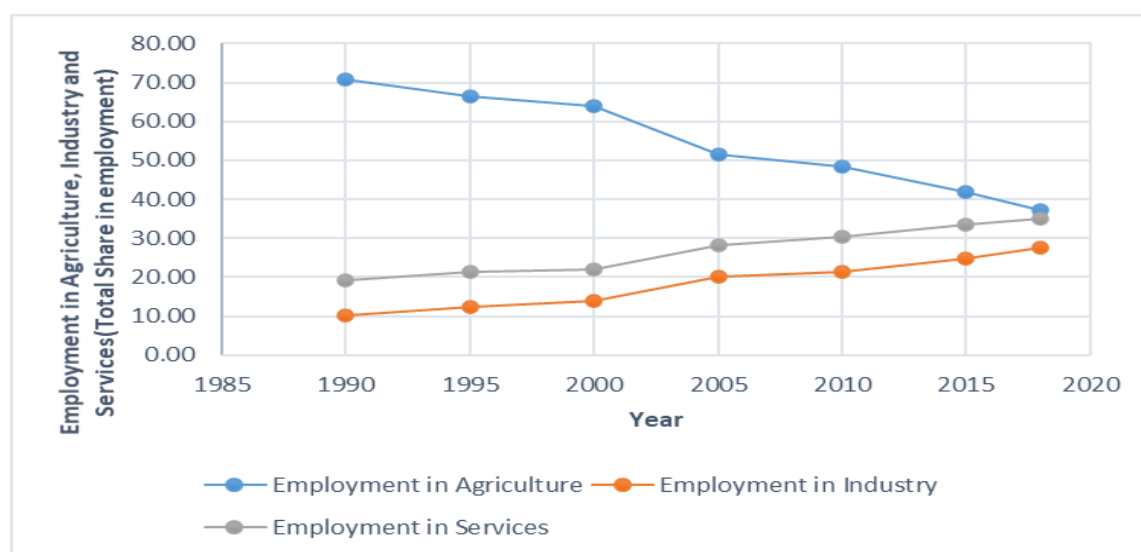
Source: Calculated using WDI indicators

From the given table 4.10.4 and figure 4.10.4, it is clear that the proportion of employment in agriculture has rapidly decreased in Vietnam from 70.71 in 1990 to 37.36 in 2018. In 1990, the proportion of employment in the industry was 10.13% and the proportion of employment in agriculture was 19.17%. A gradual decrease in both these proportions has resulted in 27.64% and 35% respectively in 2018. It is after the political reforms of 1980, industry and service sectors in the economy started growing and resulted in a decreased proportion of agriculture.

4.11 Urbanization trends of Malaysia

Malaysia, an upper-middle-income economy, was founded in 1963. Since independence in 1957, the country has been rapidly growing and has remained successful in achieving the target of an upper-middle-income economy (Bradford & Branson, 1987). With the developing nature of the economy, the urban population of the economy is also growing fast rate. From 1970 onwards, the economic growth of the country rises at a rapid rate with its decreased proportion from the agriculture sector and increased proportion from the industry and services sector.

The transformation of the Malaysian economy from agriculture to a more diversified and modern economy is one of the main reasons behind this fast rate of growth of urbanization in this economy. Before the Second World War, this increase in the population of Malaysia was due to the immigration of people from China and India. But after the Second war, a high rate of natural increase in population was the main reason behind the rise in total population (Arshat & Peng, 1988). The proportion of the urban population in the total population in the Malaysian economy is discussed below.

Table 4.11.1: Proportion of the urban population in Malaysia

Year	TP(000's)	UP(000's)	Percentage of UP	AGR	PD (Per Km Square)	UD
1990	18029824	8977771	49.79		54.87696	2732.54
1995	20487607	11409139	55.69	27.08	62.35765	3472.57
2000	23194257	14375105	61.98	26.00	70.59582	4375.32
2005	25690611	17108405	66.59	19.01	78.19392	5207.25
2010	28208035	20002882	70.91	16.92	85.85614	6088.23
2015	30270962	22464989	74.21	12.31	92.13502	6837.62
2018	31528585	23973075	76.04	6.71	95.96282	7296.63

Source: Calculated using WDI indicators

Table 4.11.1 describes the proportion of the urban population in the total population of the Malaysian economy and the rate of growth of this urban population during the period 1990-2018. According to these statistics, the percentage of the urban population to total population is increased from 49.79% in 1990 to 76.04% in 2018. In 1990-95, the growth rate of urbanization was 27.08% which is recorded at 6.71% in 2015-18. The population density in the economy has increased from 54.87 per km square in 1990 to 95.96 per km square in 2018.

Figure 4.11.1: Proportion of the urban population in Malaysia
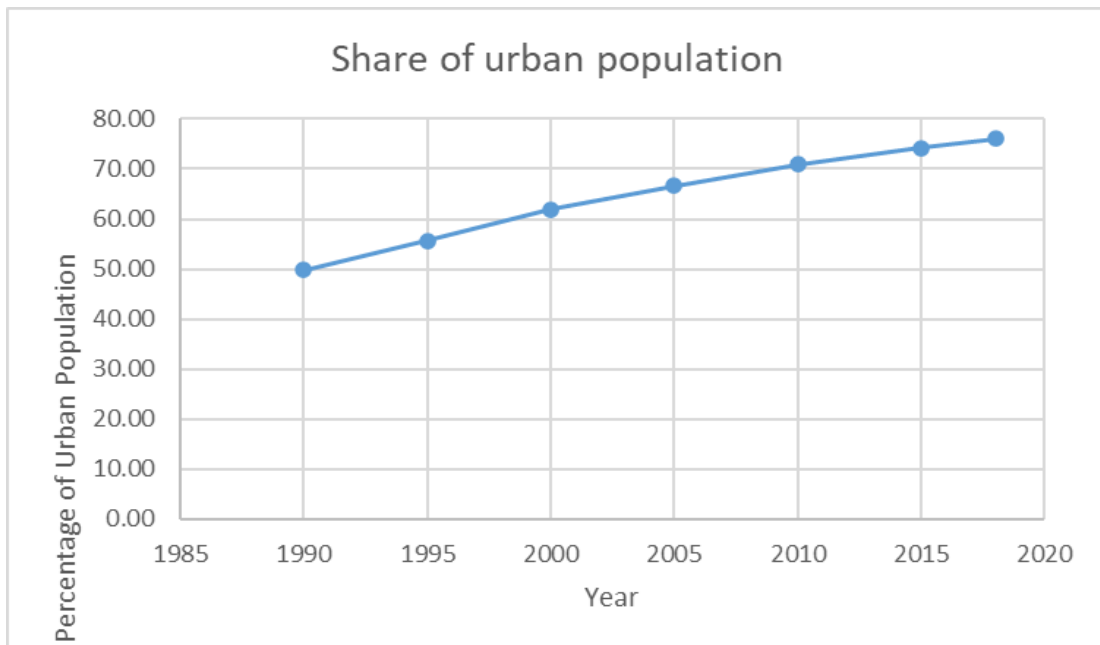
Source: Calculated using WDI indicators

Figure 4.11.1 also elucidates the trend in share of urban population in Malaysia and shows a positive trend. The trend line shows that there was sharp increase in the urabn population of the economy in the period 1990-2018 which has also resulted into increased population density. Currently, more than 3/4th of the Malaysian economy is known as urban and population density is becoming the most challenging factor in the economy because urban population of the economy is concentearted in few specific regions of the country. This is the only reason behinf sharp incraese in the population density of the economy as well.

Decreasing the average growth rate in the economy reflects that though the proportion of the urban population in the economy has increased it has increased at a decreased rate. The main reason behind this is the unequal distribution of population in the economy. Urbanization in Thailand is dominated by urban regions in Bangkok. Around 80% of the urban population of Thailand resides in Bangkok (IBRD, 2015). Growth of the economy, availability of employment opportunities and availability of health facilities always remained important factors in affecting the population structure of the economy and discussion of these factors makes the scenario of urbanization in the economy more clear. The following table has discussed the growth of GDP per capita in the Malaysian economy for the selected period.

Table 4.11.2 GDP Per capita (Constant 2010 US$) of Malaysia

Year	GDP Per capita (Constant 2010 US$)	Percentage change
1990	81800713540.39	
1995	128613226384.05	57.23
2000	162523121435.76	26.37
2005	204863376680.63	26.05
2010	255016609232.87	24.48
2015	330321318798.89	29.53
2018	382129075415.17	15.68

Source: Calculated using WDI indicators

Figure 4.11.2 GDP Per capita (Constant 2010 US$) of Malaysia
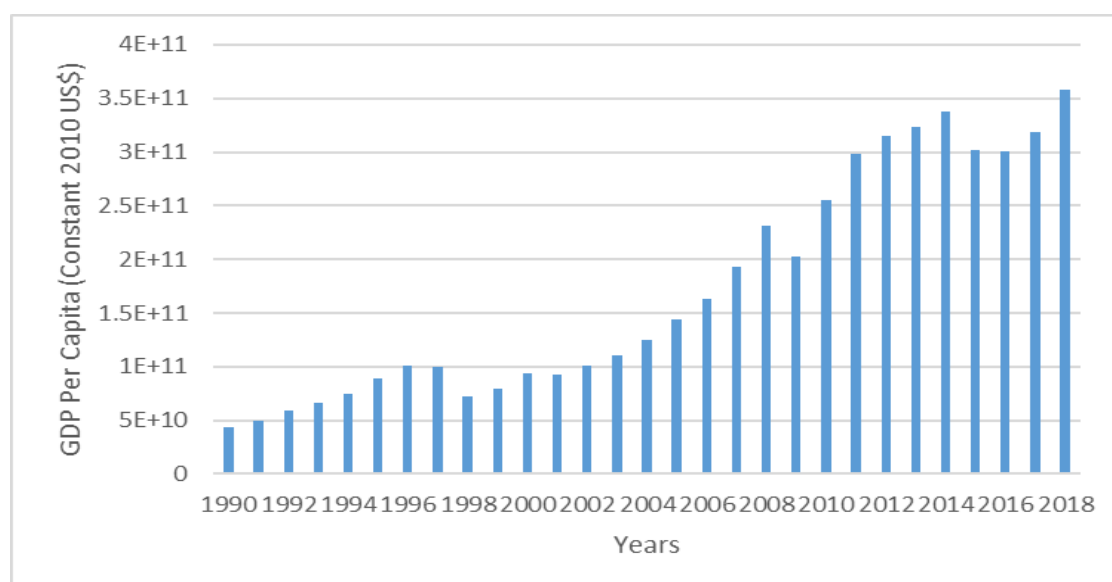
Source: Calculated using WDI indicators

The Malaysian economy has undergone an economic boom and rapid development during the late 20th century (Koen et al., 2017). The above table 4.11.2 reflects that from 1990 to 1995, the percentage change in the growth of GDP per capita in the economy was 57.23%. The economy has observed minor fluctuations in GDP per capita due to financial crises in 1998 and 2009. The GDP growth rate in the economy has increased but with the decreased average rate of growth. The key drivers of this slow growth rate were weaker demand for exports due to the effect of US-China trade tensions and lower public investments because of the low rate of saving and capital accumulation in the economy (IBRD, 2020).

The natural rate of increase in population is a significant factor that leads to an increase in the population in an economy. This natural rate of increase in population is also directly associated with the death rate, birth rate and fertility rate in the economy. Therefore, the following table has discussed the death rate, birth rate and fertility rate in Malaysia to explore the rate of natural increase in population.

Table 4.11.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Malaysia

Year	Death Rate	% Change	Birth rate	% Change	Fertility Rate	% change	The natural rate of Increase in population
1990	4.85		28.10		3.55		23.24
1995	4.63	-4.57	26.18	-6.82	3.31	-6.78	21.55
2000	4.53	-2.25	21.98	-16.04	2.78	-15.97	17.45
2005	4.52	-0.18	18.16	-17.36	2.29	-17.64	13.641
2010	4.65	2.85	17.26	-4.99	2.15	-6.28	12.61
2015	4.88	4.90	17.02	-1.36	2.06	-4.33	12.15
2018	5.09	4.37	16.75	-1.60	2.00	-2.68	11.66

Source: Calculated using WDI indicators

Table 4.11.3 Death rate, Birth rate and Fertility rate and Natural rate of increase in Population of Malaysia
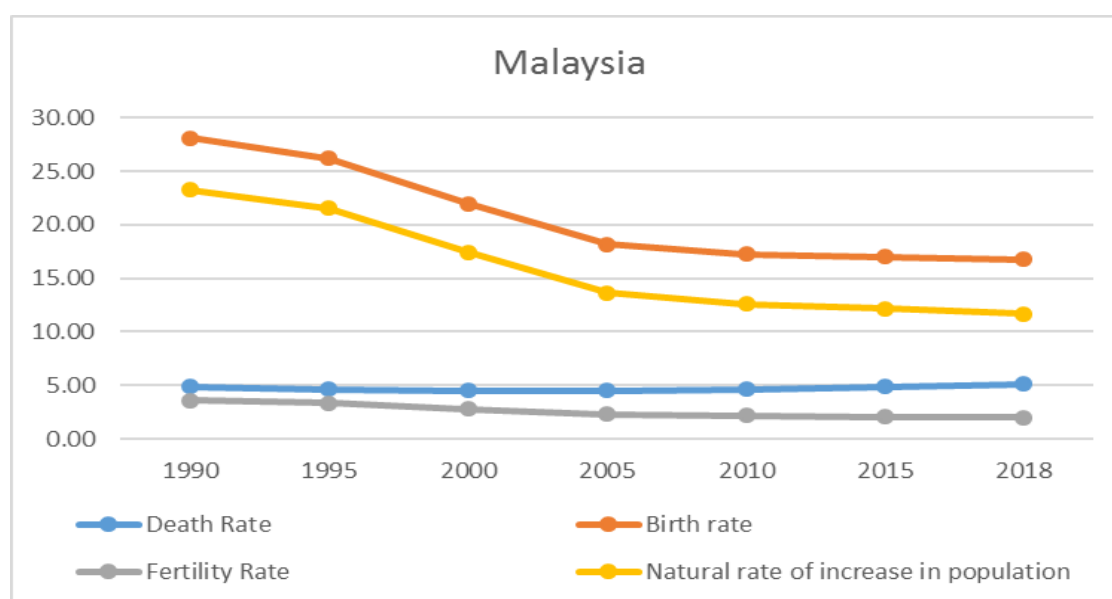
Source: Calculated using WDI indicators

Table 4.11.3 and Figure 4.11.3 have described that the death rate, birth rate and fertility rate and Natural rate of increase in Population in Malaysia have continuously

decreased after 1990. In 1990, the death rate in the economy was 4.85%. With minor fluctuations in this rate, it jumped to 4.88 in 2015 and 5.09 in 2018. The birth rate in the economy heavily decreased from 28.10% in 1990 to 16.75% in 2018. The fertility rate in the economy also decreased from 3.55% in 1990 to 2% in 2018. It was due to the better provision of facilities and increased awareness among the people. The free provision of antenatal services to all women in Malaysia has decreased the mortality rate and has increased life expectancy at birth (Moheeldeen, 2017). Free medical provision is also the main reason behind the constant death rate in the economy. The main reasons behind the decreased birth rate in the economy are participation of women in the workforce, family planning, female schooling and the average age of women at first marriage (IBRD, 2015). Constant death rate and decreasing birth rate in the economy has resulted in a decrease in the natural rate of increase in the population which has decreased in the economy from 23.24% in 1990 to 11.66% in 2018.

Besides health facilities, availability of employment is the first requirement of the residents of an economy. Most of them prefer to shift wherever they are getting employment. The following table has described the scenario of employment in the Malaysian economy in agriculture, industry and employment from 1990-2018.

Table 4.11.4 Proportion of employment in agriculture, industry and services (% of total employment) in Malaysia

Year	Employment in Agriculture	% change	Employment in Industry	% Change	Employment in Services	% Change
1990	22.37		31.39		46.24	
1995	19.36	-13.46	32.23	2.70	48.40	4.68
2000	15.13	-21.86	33.11	2.72	51.76	6.93
2005	14.63	-3.30	30.26	-8.61	55.11	6.47
2010	11.51	-21.31	29.09	-3.88	59.40	7.79
2015	11.37	-1.24	27.49	-5.50	61.14	2.93
2018	10.36	-8.87	27.00	-1.78	62.64	2.45

Source: Calculated using WDI indicators

Data in the table 4.11.4 elucidated that in Malaysia, the total proportion of employment in agriculture has continuously decreased from 22.37% in 1990 to 10.36% in 2018. From 1995-2000, there was a high decrease in the proportion of employment in agriculture by -21.86%. Industrialization played an important role in this decreased

proportion of agriculture. From 1990 to 2000, the proportion of employment in the industry is continuously increased and after this period it is slightly decreased. On the other hand, the proportion of employment in services is continuously increased from 46.24 in 1990 to 62.64 in 2018. Following figure also visualizes the trends in employment in agriculture, industry and services.

Figure 4.11.4 Proportion of employment in agriculture, industry and services (% of total employment) in Malaysia
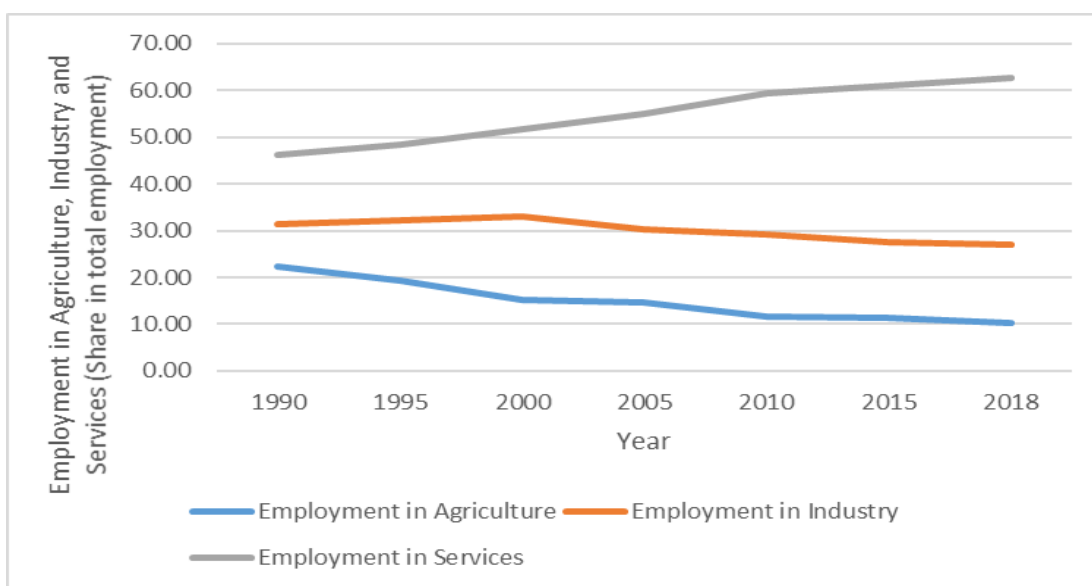
Source: Calculated using WDI indicators

Figure 4.11.4 visualizes that there is high increase in the employment in services during the period 1990-2018. This decrease in the proportion of employment in industry and increase in the proportion of employment in services was due to high educational attainment by females and their increased participation in the services sector (OECD, 2018).

4.12. Summary of the Chapter

In the selected panel of economies, urbanization has rapidly grown during the period 1990-2018. China is the country with the highest degree of urbanization with 59.15% urban population in 2018. The factors such as measures in the areas of housing, education, medical care, and taxation are responsible for this high growth in the rate of urbanization. With this rapid rate of urbanization, the population density of the economies has also increased which has resulted in crowded cities. China, Thailand and Malaysia are the countries with high rate of growth of urbanization. In Thailand, the

population density is lower in comparison to China and Malaysia. Industrialization, commercialization and better provision of facilities in industry and services are contributing to increased urban share of population in these economies. Better health facilities, increased women work participation, family planning and female schooling have heavily contributed in declining the death and birth rate in the economies. Natural rate of increase in population has continuously declined in these economies because of gradual decline in birth rate and fertility rate throughout the period of the study. Nepal, Cambodia, India, Indonesia, Bangladesh and Vietnam are the economies with low share of urbanization as well as low growth of urbanization during the study period in comparison to other selected economies for this study. The urban population in these economies is settled in few large cities which have resulted in the unequal distribution of population. The natural rate of increase in population has continuously declined in these economies because of gradual decline in birth rate and fertility rate throughout the study which indicates that rural to the urban movement of population and reclassification of the cities are contributing to urbanization. Declining proportion of employment in agriculture and increasing proportion of employment in industry and services is another factor that has pushed rural to urban shift in the economies. These trends highlight that employment in industry and services, health facilities and increasing GDP per capita are the factors associated with urbanization in selected economies. But unequal distribution of population in the economies and increasing population density are the main constraints in the development of these economies.

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Chapter 5

Urbanization and Economic Growth Proximity in selected Asian Countries

Throughout history of mankind, urbanization remained a key factor for development process of the economies. Development and urbanization are considered as two independent processes but the causal relationship between these two processes is not clear. Literature highlighted that the urban economies are considered as the backbone and motor for the wealth of the nation (Alam, 2018). With the transition of economies from agriculture to manufacturing and service sector, it has become essential for the economies to encourage human capital accumulation and to nourish innovation for the economic development (Gangopadhyay et al., 2020). Generally, growth of urban population has a very close relationship with economic development. Though there is vast literature available on exploration of association between urbanization and economic growth in different academic fields, but the debate over the relationship between urbanization and economic growth is still continuing. There are two distinct views about this phenomenon.

Various researchers (Barro, 1992), (Mankiw et al., 1992), (Solow, 1956), (Mason, 1988) and (Smith, 1776) believes urban population growth restrict growth of the economy. On the other hand, some other researchers (Boserup, 1965), (Kremer, 1993), (Simon, 1995), (Kuznets, 1960), (Kuznets, 1967) and (Grossman & Helpman, 1991) believe that urban population growth pushes growth of the economy. No single variable can measure and explore this relationship, but there are some basic indicators which can help in identification of this basic phenomenon in selected Asian countries.

5.1 Economic Scenario of Asia

High economic growth rate of Asia as compared to average growth rate of world has always maintained a healthy economic outlook for the region. The following table is compared the percentage change in growth rate of selected Asian countries (Bangladesh, China, Indonesia, India, Cambodia, Malaysia, Nepal, Philippines, Thailand, Vietnam) and World.

Table 5.1.1 Gross domestic Product Growth (% change)

Country	1990	1995	2000	2005	2010	2015	2016
Bangladesh	5.62	5.12	5.29	6.54	5.57	6.55	7.86
China	3.92	10.95	8.49	11.39	10.64	7.04	6.75
Indonesia	7.24	8.22	4.92	5.69	6.22	4.88	5.17
India	5.53	7.57	3.84	7.92	8.50	8.00	6.12
Cambodia	8.23	9.90	10.71	13.25	5.96	7.04	7.47
Malaysia	9.01	9.83	8.86	5.33	7.42	5.09	4.77
Nepal	4.64	3.47	6.20	3.48	4.82	3.32	6.70
Philippines	3.04	4.68	4.41	4.94	7.33	6.35	6.34
Thailand	11.17	8.12	4.46	4.19	7.51	3.13	4.15
Vietnam	5.10	9.54	6.79	7.55	6.42	6.68	7.08
Asia	4.47	3.96	6.36	6.6	6.76	2.73	3.74
World	3.45	3.33	4.81	4.91	5.41	3.46	3.39

Sources: World Development Bank

Table 5.1.1 depicts that world's growth rate observed a fall from 5.41 in 2010 to 3.46 and 3.39 in 2015 and 2018. Trade and monetary frictions between the largest economies of the world resulted into this global downfall in the growth rate. Asian growth rate also observed a huge fall in growth rate from 6.76 % in 2010 to 2.73% in 2015. In selected panel of economies, growth of rate of China has grown at double rate i.e., from 3.89% in 1990 to 6.57 in 2018. This economy is also known as the highest contributor to the GDP of Asia. The rate of growth in Bangladesh is increased from 5.62% in 1990 to 7.86% in 2018. In case of Indonesia a sudden decline in the growth rate is observed from 8.22% in 1995 to 4.92% in 2000. Decline in commodity prices was the main reason of this decline in growth rate in this economy. In India, a continuous increase in the growth rate is observed throughout the period. After 2015, the growth rate in the economy also surpassed the growth rate of China.

The growth rate of Cambodia also declined from 13.25% in 2005 to 5.96% in 2010 due to decline in commodity prices. Malaysian economy has observed a huge downfall in economic growth rate from 9.01% in 1990 to 4.77% in 2018. The fluctuating rate of interest and weak level of consumption in the economy resulted into this decline in growth rate. For Nepal, the overall growth rate from 1990 to 2010 is increased from 4.64% to 6.70% but the economy has observed minor fluctuation in 6.20% in 1990 to 3.48% in 2018 due to decline in commodity prices. The economies Thailand and Vietnam have observed decline in the growth rate due to consequences of

the financial crises. From this change in growth rate, it is clear that the growth rate in Asian region has remained higher as compared to world's growth rate but all Asian economies have observed fluctuations in the growth rate due to the impact of different economic factors. GDP per capita is also known as an important indicator of economic performance and is also known as useful unit to make cross country comparisons of average standard of residing and economic condition of an economy (Cholin et al., 2012). The following table has described percentage change in GDP per capita in selected Asian economies.

Table 5.1.2: Gross domestic product per capita growth (% change)

Country Name	1990	1995	2000	2005	2010	2015	2018
Bangladesh	3.09	2.90	3.26	4.97	4.39	5.37	6.74
China	2.41	9.75	7.64	10.74	10.10	6.50	6.26
Indonesia	5.35	6.56	3.48	4.29	4.81	3.56	3.98
India	3.37	5.53	2.02	6.23	7.04	6.80	5.02
Cambodia	5.67	6.41	8.26	11.48	4.34	5.33	5.88
Malaysia	5.98	7.09	6.36	3.28	5.62	3.69	3.36
Nepal	2.09	0.90	4.29	2.17	4.31	2.91	4.95
Philippines	0.45	2.27	2.18	2.98	5.56	4.68	4.87
Thailand	9.62	7.04	3.37	3.52	6.99	2.72	3.82
Vietnam	2.88	7.70	5.62	6.56	5.36	5.57	6.02
World	1.01	1.50	3.02	2.64	3.06	1.69	1.85

Sources: World Development Bank

Table 5.1.2 depicts that rate of growth of GDP per capita in world's economy increased from 1.01% in 1990 to 1.85% in 2018. In comparison to world's economy, GDP per capita in Asian region has grown at faster rate. Rate of GDP per capita in Bangladesh increased from 3.09% in 1990 to 6.74% in 2018. After 2004, export of ready-made garments and domestic agriculture is the main reason of the growth of the economy. Export oriented industrialization in the economy has contributed in pushing GDP of the economy (Alam, 2018). In China, percentage of GDP per capita increased from 2.41% in 1990 to 6.26% in 2018. But it was the highest in 2005-10 and declined after that. Acceleration in the growth of the credit significantly contributed for fluctuations and the growth of GDP per capita in the economy (Lin et al., 2018). GDP per capita in Indonesia declined from 5.35% in 1990 to 3.98% in 2018. Indonesia is an emerging market economy of South East Asia. But the economy passed through various critical phases. In 1997, Asian Financial crises highly impacted the GDP growth rate.

During this time, the government acquire non performing bank loans to take custody of a significant portion of private sector. The economy started recovering in 1999. From 2012 onwards, the GDP per capita in the economy jumped high because the country secured its place in G-20 economies (Pardede & Zahro, 2018). GDP per capita growth rate remains fluctuated in other countries such as India, Malaysia, Cambodia, Nepal, Thailand and Vietnam due to increased focus of the government of the economy towards macroeconomic stability rather than high growth rate after 1997-98 Asian financial crises (Haub & Huong, 2003)

Capital accumulation deterioration indicator for economic growth. Gross capital formation consists of sum of aggregate of gross additions to fixed assets and change in stock during the time period. According to Cira and Wang (2012), "*Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchase; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and work in progress.*" The following table has described gross capital formation as a percentage of GDP in Asian countries.

Table 5.1.3: Gross Capital Formation (% proportion in GDP)

Country Name	1990	1995	2000	2005	2010	2015	2018
Bangladesh	16.46	19.12	23.81	25.83	26.25	28.89	31.23
China	34.16	38.84	33.57	40.35	46.56	43.23	43.79
Indonesia	32.71	30.43	22.25	25.08	32.88	34.06	34.56
India	28.62	27.79	26.68	38.08	40.22	32.12	31.70
Cambodia	13.55	14.55	17.42	18.47	17.37	22.45	23.45
Malaysia	32.36	43.64	26.87	22.40	23.39	25.42	23.91
Nepal	18.13	25.20	24.31	26.45	38.27	39.06	53.90
Philippines	24.15	22.45	15.68	18.57	20.44	21.34	27.15
Thailand	41.35	42.86	22.28	30.42	25.36	22.36	25.19
Vietnam	12.57	27.14	29.61	33.76	35.69	27.68	26.53
World	25.92	24.81	24.45	24.91	24.21	24.30	24.44

Sources: World Development Bank

Table 5.1.3 depicts that percentage proportion of gross capital formation in total GDP of the world's economy is 24.44% in 2018. This proportion has decreased from 25.92% in 1990 to 24.44% in 2018. Talking about percentage proportion of gross capital formation in selected Asian economies, except Malaysia and Cambodia all

economies have high proportion of gross capital formation in GDP as compared to world. In China, this proportion has always remained the highest throughout the period. Capital formation in these economies is directly associated with the GDP per capita. High GDP per capita in the economies results into high savings and high investment. From dataset, it is clear that investment rate in all the selected Asian economies has continuously grown which has resulted into increased proportion of gross capital formation in the GDP of the economies.

Rate of growth of urban population is an important factor which describes the relationship between urbanization and economic growth. Besides urban population growth, there are various other demographic variables that affect the economy. Literature highlights that size of population, urban population growth, population density, fertility rate, life expectancy, natural rate of increase of population i.e., difference between death rate, birth rate and education are the main indicators predicting urbanization in the economy (Lin et al., 2018). Any single variable cannot capture the overall effect. Previous studies have tested the relationship between urbanization and economic growth using urban population rate as an indicator of urbanization. This study has used urbanization index to investigate the relationship of urbanization with economic growth.

While investigating this relationship, age dependency ratio, gross capital formation and population density have also been considered. Literature has also explored that age dependency ratio can capture the overall effect of change in structure of population in the economy (Moheeldeen, 2017). Lower age dependency ratio indicates that there is high ratio of workers per capita in the economy i.e., there is more supply of labor in the economy. Lower dependency ratio also leads to more savings because of a smaller number of dependents and it would lead to more productive investments. This capital formation would positively impact the economic growth. Population density is also considered as a main player of economic growth. Literature supports that not only urbanization but density of population plays a vital role in generating increased returns to scale.

This study has used Neo-Classical model of growth to investigate the relationship between urbanization and economic growth. According to the theoretical framework of this model, the study has assumed that the factors such as capital

formation, population density, age dependency ratio and urbanization have cumulative influence on GDP of the economy. Based on this assumption, all these variables have been incorporated into the model to measure the relationship between urbanization and economic growth.

$$Yt = \alpha + \alpha_1 URB + \alpha_2 ADR + \alpha_3 GCF + \alpha_4 PD + \varepsilon t \qquad (1)$$

Where Y_t is GDPPC and α1, α2, α3 and α4 are coefficients of urbanization, age dependency ratio, gross capital formation and population density with ε_t as error term. These coefficients measure long term elasticity of their variables with dependent variable.

An Urbanization index is created to measure the level of urbanization in the selected economies. This index is based on factors obtained from factor analysis of indicators related to urbanization. Age dependency ratio is the ratio of dependents and working population in the economy. GDP per capita has been used as a proxy for economic growth. Gross capital formation has been measured as a percentage of GDP. It is the sum of outlay on additions in the fixed assets of the economies. Population density is measured as the number of people in per square kilometer area. Data for all these variables is annual and is obtained from World Development Bank Database. The main focus of the objective is to analyses the relationship between urbanization and economic growth. Thus, first of all, it is required to ensure the stationarity of the available data. Natural log of all the variables helps in obtaining stationary data at less order of integration if data is non stationary at level. The key variables used for the analysis are urbanization index, gross domestic product per capita, gross capital formation, population density and age dependency ratio. Following table describes about the summary of all the variables considered for analysis.

Table 5.1.4: Summary of variables

S.no	Variable	Description
1	LNURB	Log of urbanization index
2	LNGDPPC	Log of gross domestic product per capita
3	LNGCF	Log of gross capital formation
4	LNPD	Log of population density
5	LNADR	Log of age dependency ratio
Source: Author's notes		

Before proceeding for econometric analysis, it is always required to test the normality of the variables used in the model. Therefore, the study has tested normality of all the variables to test the good fit of the model. Histograms and statistics of normality test are given below:

Figure 1: LNGCF

Series: LNGCF
Sample 1990 2018
Observations 290

Mean	1.22e+11
Median	1.21e+11
Maximum	6.67e+11
Minimum	-3.60e+11
Std. Dev.	1.87e+11
Skewness	0.074544
Kurtosis	2.922677
Jarque-Bera	0.340824
Probability	0.843317

Figure 2: LNADR

Sample 1990 2018
Observations 289

Mean	59.48080
Median	59.48000
Maximum	97.33000
Minimum	21.63000
Std. Dev.	13.79804
Skewness	2.63e-06
Kurtosis	2.792914
Jarque-Bera	0.516403
Probability	0.772440

Figure 3: LNPD

Series: LNPD
Sample 1990 2018
Observations 289

Mean	0.827820
Median	0.830000
Maximum	2.220000
Minimum	-0.560000
Std. Dev.	0.505957
Skewness	0.001241
Kurtosis	2.794573
Jarque-Bera	0.508235
Probability	0.775601

Figure 4: LNGDPPC

Series: LNGDPPC
Sample 1990 2018
Observations 288

Mean	6.53e+11
Median	6.53e+11
Maximum	5.66e+12
Minimum	-4.10e+12
Std. Dev.	1.82e+12
Skewness	0.003606
Kurtosis	2.782173
Jarque-Bera	0.570008
Probability	0.752011

Figure 5: LNURB

Series: LNURB
Sample 1990 2018
Observations 289

Mean	35.17377
Median	35.17000
Maximum	76.31000
Minimum	-5.970000
Std. Dev.	14.99589
Skewness	1.20e-05
Kurtosis	2.792944
Jarque-Bera	0.516252
Probability	0.772498

Source: Figures produced using E-Views

Figure 1 shows the normal distribution of series LNGCF. It shows that the probability value for Jarque-Bera test is greater than the critical value i.e., 5%. Therefore, it can be said that the series LNGCF is normally distributed. Figure 2 shows the normal distribution for LNADR. Probability value for this series is 0.772 which is too high than 0.05 which accept the null hypothesis of normal distribution. Figure 3, 4

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and 5 have presented the normal distribution for series LNPD, LNGDPPC and LNURB. Probability value for these series is insignificant which accepts the null hypothesis of normal distribution of data. As normal distribution for all the series is confirmed and all the series fulfilled required OLS assumptions. There is no autocorrelation, multicollinearity and heteroscedasticity in the data as discussed in chapter 3. Therefore, these series can be used for further econometric analysis.

5.2 Empirical results

In this study, a multistage procedure has been used to test the interdependency among the variables. The first step of estimation process is the panel unit root test. The panel unit root tests Levin, Lin & Chu, Im, Pesaran & Sin, ADF-Fisher and Phillips-Perron Fisher have been used to test the stationarity of the variables. In second step, panel co-integration tests Padroni co-integration test, Kao's test of co-integration and Johanson Fisher test of co-integration have been employed to test the co-integrating relationship among the given variables. Panel FMOLS and DOLS tests have been employed to test the long run co-integration among the variables. Finally, panel VECM causality test has been employed to test the causal relationship among variables.

5.2.1 Panel Unit Root test

It is always essential to test the unit root of the data while dealing with the macro-economic variables. The series are considered as integrated at order zero if it is stationary at level. If series is stationary at first difference, it is considered as integrated at order 1. This study has used appropriate group of panel unit root tests to test the stationarity of the variables used for the analyses.

For testing the unit root of the panel dataset, three different models with their different deterministic components have been considered. First model individual intercept exhibits that there is no linear trend in the data and all the series at their first difference have their mean as zero. This model is also known as the model with constant. Second model is known as individual intercept and trend and co-integration vectors in this model consists of linear trend. Third model is known as none i.e., without intercept and without trend. This model is used while observing linear trends in the level dataset.

Table 5.2.1 Panel Unit Root (Level)

		LURB	LGDPPC	LGCF	LTO	LADR
LLC	Individual Intercept	-3.16831 (0.000) **	0.60667 (0.7280)	1.22162 (0.8891)	-1.8063 (0.03) ***	-2.36080 (0.00) **
	Individual Intercept and Trend	-7.48662 (0.000) **	0.95665 (0.8306)	2.33925 (0.9903)	-0.42557 (0.3352)	1.08418 (0.864)
	None	1.56948 (0.9417)	0.924960 (1.0000)	10.6631 (1.0000)	-3.50924 (0.002) **	-1.94317 (0.1260)
IPS	Individual Intercept	-0.61341 (0.7302)	4.72337 (1.0000)	4.83112 (1.0000)	-0.71931 (0.2360)	0.45083 (0.6739)
	Individual Intercept and Trend	2.29003 (0.9818)	0.70651 (0.7651)	0.60491 (0.7274)	1.13538 (0.8719)	0.75697 (0.7755)
ADF	Individual Intercept	12.9052 (0.8814)	2.98085 (0.9254)	4.97441 (0.9997)	22.4131 (0.3285)	22.7236 (0.3021)
	Individual Intercept and Trend	1.77334 (0.9619)	12.7038 (0.8897)	19.6015 (0.4813)	14.0302 (0.8290)	14.2374 (0.8183)
	None	5.51172 (0.9994)	0.01134 (1.0000)	0.80611 (1.0000)	31.5711 (0.0042)	22.3265 (0.3231)
PP	Individual Intercept	7.44418 (0.9950)	4.88509 (0.9902)	3.30206 (1.0000)	34.4130 (0.1235)	15.8801 (0.7240)
	Individual Intercept and Trend	6.96036 (0.9968)	15.1082 (0.7701)	32.1898 (0.1413)	19.4625 (0.4920)	9.68548 (0.9735)
	None	0.85061 (1.0000)	0.3021 (1.0000)	0.41461 (1.0000)	41.1062 (0.0036)	19.1857 (0.5098)
Hadri	Individual Intercept	-1.95009 (0.9744)	-0.38368 (0.6494)	-0.27836 (0.6096)	2.38156 (0.0086)	3.05748 (0.1011)
	Individual Intercept and Trend	5.84319 (0.000) **	1.26844 (0.1023)	1.65237 (0.1492)	1.65237 (0.2492)	3.26362 (0.3900)

Note: ***, ** denote rejection of null hypothesis at the 1% and 5% level of significance, respectively

Source: Author's Calculation

Table 5.2.2 Panel Unit Root (Level 1)

		LURB	LGDPPC	LGCF	LTO	LADR
LLC	Individual Intercept	-6.00357 (0.000) **	-6.28428 (0.000) **	-13.9180 (0.00) **	-10.9672 (0.0000) **	-5.85460 (0.000) **
	Individual Intercept and Trend	-5.51474 (0.0000) **	-5.85923 (0.0000) **	-10.7441 (0.0000) **	-13.6774 (0.0000) **	-5.47846 (0.000) **
	None	-9.78959 (0.0000) **	-4.65434 (0.0000) **	-20.5716 (0.000) **	-20.4526 (0.0000) **	-9.37189 (0.000) **
IPS	Individual Intercept	-6.45975 (0.0000)**	-6.37319 (0.0000) **	-16.7946 (0.0000) **	1.97179 (0.0002) **	-6.47810 (0.000) **
	Individual Intercept and Trend	-4.83751 (0.0000) **	-4.94003 (0.0000) **	-10.4350 (0.0000) **	-16.7785 (0.0000) **	0.39964 (0.000) **
ADF	Individual Intercept	78.4562 (0.0000) **	78.9018 (0.0000) **	215.146 (0.0000) **	183.715 (0.0000) **	79.4776 (0.000) **
	Individual Intercept and Trend	56.9886 (0.0000) **	60.5633 (0.0000) **	188.793 (0.0000) **	219.703 (0.0000) **	71.3946 (0.000) **
	None	116.126 (0.0000) **	61.6294 (0.0000) **	296.864 (0.0000) **	296.864 (0.0000) **	123.266 (0.000) **
PP	Individual Intercept	134.483 (0.0000**)	132.661 (0.0000) **	220.672 (0.0000) **	2223.708 (0.0000) **	138.641 (0.000) **
	Individual Intercept and Trend	134.016 (0.0000) **	104.177 (0.0000) **	199.842 (0.0000) **	225.741 (0.0000) **	369.721 (0.000) **
	None	181.140 (0.0000) **	102.890 (0.0000) **	168.8442 (0.0000) **	1802.00 (0.0000) **	189.961 (0.000) **
Hadri	Individual Intercept	0.41568 (0.0003) **	2.57060 (0.0051) **	1.97179 (0.0002) **	1.74992 (0.0041) **	3.26362 (0.000) **
	Individual Intercept and Trend	3.08229 (0.0010) **	13.8597 (0.0000) **	11.9246 (0.0000) **	10.1563 (0.0000) **	0.39964 (0.000) **

Note: ***, ** denote rejection of null hypothesis at the 1% and 5% level of significance, respectively

Source: Author's Computation

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The results of panel unit root tests LLC, IPS, ADF-Fisher, Phillips Perron and Hadri test at level have been reported in table 5.2.1. These tests have rejected the null hypothesis of stationarity at level for all endogenous variables. The results of panel unit root test conclude that the variables LNURB, LNGDPPC, LNGCF, LNPD and LNADR are non-stationary at level. Thus, it is required to check unit root of these variables at first difference.

The results of panel unit root tests LLC, IPS, ADF-Fisher, Phillips Perron and Hadri test at first difference have been reported in table 5.2.2. This test has accepted the null hypothesis of stationarity at first difference for all endogenous variables. The results of panel unit root test conclude that the variables LNURB, LNGDPPC, LNGCF, LNPD and LNADR are stationary at their first difference. Since all the variables are now integrated at the same order, so we can apply co-integration test to test long run relationship between them.

5.2.2 Panel Co-integration test

After testing stationarity of the variables, panel co-integration tests and have been deployed to test the relationship among the variables. Before proceeding with the co-integration tests, it is essential to select the lag length. Therefore, lag length has been selected using VAR system. While selecting lag length, it has been assumed that all the variables in the study are endogenous and values of log likelihood, Akaike information criteria and Schwartz Bayesian criteria have been considered.

S. No	Order	Log Likelihood	Akaike Information Criteria (AIC)	Schwartz Bayesian criteria (SBC)
1	1-0	137.258	-5.2341	-5.8964
2	1-1	240.301	-28.332	-18.721*
3	1-2	382.281	-29.545	-17.222
4	1-3	423.321	-34.252	-18.201
5	1-4	513.422	-38.651*	-17.551
6	1-5	501.241	24.562	-16.221
Table 5.2.3 Lag length section criteria				
Note: * denotes optimal lag length according to information criteria				
Source: Author's Computation				

The above table exhibits the selection criteria for lag length based on the values of log likelihood, AIC and SBS obtained from VAR model. Literature on VAR modelling supports that lag length can be selected on the basis of minimum value of SBC and AIC. In case of any conflict between the values of lag length selection on the basis of AIC and SBC, then SBC should be preferred for lag length selection. In the above table, minimum value of SBC is -18.721. Thus, optimal lag length can be selected on the basis of this value and this value indicates that the optimum lag length is one. The existence of unit root among the variables necessitates to select appropriate tests of co-integration to test the co-integration among the variables. In econometric literature, there are five different models which describes the co-integration among the variables. These models are based on the following deterministic trend specification.

1. No intercept and trend in co-integrating equation or VAR
2. Intercept (no trend) in co-integrating equation- No intercept in VAR
3. Intercept (no trend) in co-integrating equation and VAR
4. Intercept and trend in co-integrating equation- no trend in VAR
5. Intercept and trend in co-integration- linear trend in VAR

For Padroni Co-integration test and for Kao's test of co-integration, there are three different deterministic trend components i.e., individual intercept, individual intercept and individual trend and no intercept or trend. In these cases, second model of deterministic trend is used for analyses purpose. But in Johanson Fisher Panel co-integration test, it is required to choose one model from the given five model. It has been explained in Chapter 3 that first and fifth model are not realistic one. Therefore, it is required to choose one from the remaining three models. According to Pantula principle, for selection of deterministic components, it is required to test joint hypothesis of both rank order and deterministic components. Therefore, all three models have been tested and the results from the least restrictive model to the most restrictive model have been described in the below given tables. At each stage of these model trace values have been compared with its critical value for the acceptance and rejection of null hypothesis. Results of Model 2, 3 and 4 have been presented in the tables given below through the values of trace test and their critical values.

Table 5.2.4 Pedroni Co-integration test				
	Statistics	Probability	Weighted	
			Statistics	Probability
Alternative Hypothesis: Common AR coefficient (Within Dimensions)				
Panel v-statistics	-3.193456	0.9352	-2.196584	0.9736
Panel rho statistics	-6.314529	0.0001***	-5.426525	0.0000**
Panel PP statistics	-36.48359	0.0002***	-36.45211	0.0000**
Panel ADF statistics	-12.3645	0.0000**	-11.35692	0.0000**
Alternative Hypothesis: Individual AR coefficient (Between Dimensions)				
Group rho statistics	-4.32654	0.0000**		
Group PP statistics	-36.1025	0.0000**		
Group ADF statistics	-11.2563	0.0000**		
Note: Intercept and deterministic trend are included. The optimal lag length is selected by Akaike Information Criterion. *** and ** indicates that the test statistic is significant at 1% level and 5% level of significance.				
Source: Author's Computation				

Table 5.2.4 exhibits the results of Pedroni Co-integration test. The results of this test indicate that the values for panel rho, panel PP, panel ADF under within dimension AR coefficients are significant and rejects the null hypothesis. For between dimension statistics, values for group rho, group pp and group ADF are greater than the critical values and indicates that there exists co-integration among the variables. Negative values of the statistics and probability of less than 0.05 indicates that the variables have significant long run co-integration.

Table 5.2.5 Kao's test of Co-integration		
	t-statistics	Probability
ADF	-5.65732	0.0000**
Note: *** and ** indicates that the test statistic is significant at 1% level and 5% level of significance.		
Source: Author's computation		

Table 5.2.5 exhibits that there exists co-integration among the variables at 5% level of significance. Negative value of t-statistics and significant probability value is

the evidence of rejection of null hypothesis and indicates the existence of causality among the variables.

Table 5.2.6 Johanson Fisher Co-integration test (Model 2)					
S. No.	No. of CE(s)	Trace Test	Probability	Max Eigen Test	Probability
1	None	252.5	0.0000^{**}	140.8	0.0000^{**}
2	At most 1	142.2	0.0000^{**}	81.78	0.0000^{**}
3	At most 2	78.33	0.0000^{**}	45.84	0.0008^{**}
4	At most 3	54.88	0.0000^{**}	37.19	0.0111^{**}
5	At most 4	40.18	0.0047^{***}	40.18	0.0047^{***}
Note: *** and ** indicates that the test statistic is significant at 1% level and 5% level of significance.					
Source: Author's Calculation					

Table 5.2.6 shows the number of co-integrating equation in the model based on model 2. The values of trace test and max Eigen in this test describes that for that there exist five co-integrating equations. The significant values of r=0,1,2,3,4 and 5 at 1% and 5% level decides the number of co-integrating vectors.

Table 5.2.7 Johanson Fisher Co-integration test (Model 3)					
S. No	Hypothesized No. of CE(s)	Trace Test	Probability	Max Eigen Test	Probability
1	None	182.6	0.0000^{**}	147.6	0.0000^{**}
2	At most 1	69.31	0.0000^{**}	43.31	0.0019^{***}
3	At most 2	39.84	0.0052^{***}	31.17	0.0465^{***}
4	At most 3	22.13	0.3366	13.85	0.8382
Note: *** and ** indicates that the test statistic is significant at 1% level and 5% level of significance.					
Source: Author's Calculation					

Table 5.2.7 exhibits the number of co-integrating equation in the model based on model 3. The values of trace test and Max Eigen in this test describes that for that there exist three co-integrating equations. The significant value of r=0,1,2 is the evidence of three co-integrating vectors.

Table 5.2.8 Johanson Fisher Co-integration test (Model 4)					
S. No	Hypothesized No. of CE(s)	Trace Test	Probability	Max Eigen Test	Probability
1	None	219.4	0.0000**	111.7	0.0000**
2	At most 1	124.0	0.0000**	68.67	0.0000***
3	At most 2	68.35	0.0000**	49.07	0.0003***
4	At most 3	35.35	0.0183***	27.38	0.0248***
5	At most 4	23.73	0.2544	23.73	0.2544
Note: *** and ** indicates that the test statistic is significant at 1% level and 5% level of significance.					
Source: Author's Calculation					

The results of Johanson Fisher Co-integration test in the table 5.2.8 have identified the number of co-integrating equation in the model based on model 4. The values of trace test and max Eigen in this test describes that for that there exist four co-integrating equations. The significant value of r=0,1,2 and 3 is the evidence of four co-integrating vectors. The next step is to select the appropriate model. Therefore, trace statistics of all the models have been presented together. First of all, it is required to start with the least restrictive co-integrating vector to check whether model 2 rejects null hypothesis for this vector or not. If model 2 is rejecting null hypothesis, then one should move towards model 3 to check the rejection of null hypothesis. In case of rejection of null hypothesis for this vector as well, it would be required to check same for model 4. Following table has shown trace test values for all three models for the purpose of selection of an appropriate model.

Table 5.2.9: Pantula Principal results (Trace statistics)				
S. No.	R	M2	M 3	M 4
1	0	252.5	182.6	219.4
2	1	142.2	69.31	124.0
3	2	78.33	39.84	68.35
4	3	54.88	22.13**	35.35
Note: ** first time acceptance of null hypothesis while moving from left to right				
Source: Author's Computation				

From the table 5.2.9, it is evident that model 3 is the most suitable model that can be used to study long run relationship between variables and according to this

model, there exists four co-integrating equations. After checking stationarity level and long run co-integration among them, the study has further estimated long run impact of the explanatory variables on dependent variable through FMOLS and DOLS method. The results of both these methods are almost similar in terms of level of significant and extent and effects of coefficients.

Table 5.2.10 Panel FMOLS and DOLS estimation			
Independent Variables		FMOLS	DOLS
1	LNGCF	0.55923 (44.256)***	0.51154 (38.54)***
2	LNURB	0.497775 (42.33) ***	0.51264 (39.145)***
3	LNPD	-0.225384 (-4.561) ***	-0.32145 (-3.2541)***
4	LNADR	0.32123 (3.254) ***	0.29125 (2.3245)***
	R^2	0.72	0.81
	Adjusted R^2	0.70	0.79
	Durbin-Watson statistics	0.6654	0.6251
Notes: The numbers in parentheses denote t-statistic. *** significant at 1% level.			
Source: Author's Calculation			

Table 5.2.10 exhibits the results of FMOLS and DOLS for the estimation of long run relationship between the variables. According to FMOLS, gross capital formation has a significant and positive impact on economic growth. 1% increase in gross capital formation of the economies would enhance GDP per capita by 55%. The results of DOLS also indicates that 1% increase in gross capital formation would increase GDP per capita by 51%. Increasing gross capital formation in the economy would result into more saving and more investments. Urbanization also has significant positive impact on GDP per capita of the economies. FMOLS results indicate that 1% change in Urbanization level would change GDP per capita by 49% and According to DOLS results this 1% change in urbanization would enhance GDP per capita by 51%. Increasing urbanization in the economy would attract skilled and talented labor which would further promote the productivity. Change in population density has significant

negative impact on GDPPC. The results of FMOLS and DOLS states that 1% change in population density influence population density by 22% and 32% respectively. Increasing concentration of population in the few cities result into shortage of house, lack of provision of basic facilities to the individuals and gives birth to issues such as poverty and unemployment. Age dependency ratio has inverse significant importance for GDP per capita. The statistics of FMOLS and DOLS states that 1% change in age dependency ratio pushes GDP per capita by 32% and 29% respectively. High age dependency ratio here indicates that there are more working people in the economy and increasing number of working people results into more productivity.

Table 5.2.11 Panel VECM Granger causality results						
DV	Variables causing DV					
	(F statistics)					
	ΔGDPPC	ΔURB	ΔGCF	ΔPD	ΔADR	Long run ECT
ΔGDPPC	-	1.234 (0.042)	2.123 (0.001)***	-0.023 (0.002)***	1.112 (0.001)***	-3.2154 (0.002)***
ΔURB	2.314 (0.1000)	-	3.124 (0.032)	0.002 (0.031)	1.021 (0.022)	5.2145 (0.112)
ΔGCF	5.314 (0.021)	0.124 (0.001)***	-	3.142 (0.021)	0.001 (0.002)	2.1254 (0.012)
ΔPD	1.235 (0.032)	0.002 (0.002)***	3.145 (0.013)	-	0.021 (0.032)	1.2515 (0.042)
ΔADR	-4.125 (0.011)	1.235 (0.012)	-2.345 (0.022)	0.001 (0.012)	-	-2.1452 (0.032)
Notes: P Value is described in parenthesis below F statistics. Short-run causality is determined by the statistical significance of F-statistics associated with the right-hand side variables. Long-run causality is revealed by the statistical significance of the respective error correction terms using a t-test.						
Source: Author's Computation						

It is after checking co-integrating relationship between urbanization and economic growth, a panel VECM Granger causality approach is followed to explore the causal relationship between urbanization and economic growth. The study by exploring the causal relationship between Gross Domestic product Per capita, Urbanization, Age dependency Ratio, Gross Capita Formation and Population Density

has highlighted how Urbanization is causing economic growth in the selected panel of economies. Table 5.2.11 exhibits the results of the panel VECM causality. Estimated coefficient of ECT in the table describes that the variables GDP per capita is statistically significant at 5% level of significance. It implies that GDPPC contributes in the adjustment of long run equilibrium. The results explain that there is unidirectional causality from ADR to GDP per capita. With increasing age dependency ratio (% of working population) in selected Asian countries, capital formation in the economies is increasing with its positive impact on GDP per capita (Munir & Shahid, 2020). Unidirectional causality from ADR to gross capital formation indicates that gross capital formation in these economies is increasing due to decrease in dependents in the population structure of the economy. Population density also has unidirectional causality with GDP per capita. Increasing population density in selected panel of economies is leading to decrease in natural endowment per capita. This increased population density pressurizes the land and infrastructure in that areas as well and negatively impact the growth of the economy (Yegorov, 2009).

Gross capital formation also causes GDP per capita in short run with increased purchasing power of people, high savings and high investments. But in long run, provision of skilled labor can increase the productivity and GDP per capita as well. Urbanization has unidirectional causality with population density and Gross capital formation. Urbanization affects the physical environment in the economy with more and more people shifting to urban regions resulting into crowded cities (Brueckner & Hansl, 2018). It also results into decreased level of employment and less purchasing power of people. GDP per capita is not causing any variable in short run. Regarding the results of error correction term, it has been observed that GDP per capita is the only variable that correct long run equilibrium. The other variables can be termed as weak exogenous variables. It means that any changes in ADR, GCF, Population density and Urbanization which create disturbance for the long run equilibrium can be corrected by counter balancing change in GDP per capita in these economies. From these results, it is evident that in the countries with high rate of urbanization, GDP per capita is caused by Urbanization, age dependency ratio, gross capita formation and population density but GDP Per capita do not cause these variables in the long run.

5.3 Summary of the Chapter

In the selected panel of the economies, urbanization and economic growth are moving in tandem throughout the time. There exists presence of causality from urbanization to economic growth in the long run. But there is no co-integration among urbanization and economic growth in short run. There is continuous debate over the relationship of urbanization with economic growth. Therefore, the study has investigated this relationship using other demographic variables which affect economic growth. Through Neo-classical growth model, the study has shown endogenous interaction of GDP per capita, urbanization, age dependency ratio, gross capital formation and population density in the economies. The study has used panel FMOLS, DOLS and VECM granger causality approach to test the interaction of these variables. The results showed that urbanization cause economic growth in the selected panel of countries. The variables age dependency ratio, population density and gross capital formation also effect economic growth through urbanization in the economies. There is unidirectional causality from ADR to GDP per capita. With increasing age dependency ratio (% of working population) in selected Asian countries, capital formation in the economies is increasing with its positive impact on GDP per capita. Unidirectional causality from ADR to gross capital formation indicates that gross capital formation in these economies is increasing due to decrease in dependents in the population structure of the economy. Population density also has unidirectional causality with GDP per capita. Increasing population density in selected panel of economies is leading to decrease in natural endowment per capita. This increased population density pressurizes the land and infrastructure in that areas as well and negatively impact the growth of the economy. From these results, it is evident that in the countries with high rate of urbanization, GDP per capita is caused by Urbanization, age dependency ratio, gross capita formation and population density but GDP Per capita do not cause these variables in the long run.

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Chapter 6

Urbanization and Environment Degradation Proximity in selected Asian Countries

Economic development and preservation of earth's environment are the two biggest challenges faced by the humanity. For developed as well developing countries, environment degradation due to climate change is considered among the contemporary issues. Industrialization of the economies increased the demand of energy in the World's economies. This increased demand resulted into complex and complex trade-off between economic development and its impact on environment because the increased demand of energy meets with the production expectations, on the one hand and produces a large amount of non-renewable fossil fuels on the other hand which emits greenhouse gases (GHG). In 2020, it has been recorded that the Asia-Pacific region has emitted 16.75 billion metric tons of CO_2. This ratio exceeded the total amount of CO_2 emission in all other regions at the global level. China is the only country that has emitted 60 percent of total CO_2 of Asia-Pacific region.

High rate of urbanization in the Asian economies has increased the rate of consumption of energy as well as emission of greenhouse gases. The main factor behind the disturbed level of greenhouse gases in the atmosphere is the influence of urbanization on consumption of energy. Increasing use of fossil fuel in the form of energy is continuously increasing the level of GHG gases in the environment that has resulted into global warming and change in climate. According to the reports of IPCC (2007) emission of GHG gases has strong relationship with increase in temperature in the economy. In Asia, rate of emission of GHG gases is 1.6% per year and rate of emission of carbon dioxide from use of fossil fuels is 1.9% per year. Various research studies have highlighted that carbon dioxide is the main driver of climate change because emission of carbon dioxide is associated with various important economic activities (Al-Mulali et al., 2015, Wang et al., 2011). Demand of energy, on the one hand, stimulate growth of the economy, on the other hand, it is also responsible for emission of greenhouse gases in the economy. Since 1990,

trend of GHG emission and energy consumption have turned sharp upward in newly industrialized economies. With this increase in GHG level, environment of those countries is deteriorating at very fast rate. Thus, it has become essential to understand the relationship of GHG emission with economic growth of the economies. There is vast literature on relationship between economic growth and environment degradation or environmental pollution but majority of the research studies have considered Co2 as the main driver to measure the environment degradation level (Wang et al., 2011), (Shi, 2003) and (Robert, 2012). This chapter aims to provide a fine-grained understanding of association between urbanization and environment degradation using ecological footprint as a proxy to measure the impact on environment. This chapter has mainly considered three aspects to explore this relationship i.e., urbanization, energy consumption and environment degradation for selected Asian countries where ecological footprint is the proxy to environment degradation.

6.1 Ecological Footprint

Ecological footprint concept is widely used by the researchers in ecological studies and environmental social science. Ecological footprint accounting helps in the measurement of demand on and supply of nature. On demand side, it is an addition of all productive areas and ecological assets required by population to produce the natural resources they consume and to dispose of the waste produced from this consumption. According to Wackernagel and Rees (1996), "Ecological Footprint consists of the components such as cropland, grazing land, fishing grounds, built-up land, forest area, and carbon demand on land". Supply aspect of ecological footprint covers the unharvested areas, which can be used for the absorption of waste produced during production and consumption process. As per 2018 statistics of Global Footprint Network, average global ecological footprint is 2.75 GHA per person and the average biocapacity is 1.63 GHA per person. It reflects that there is ecological deficit of 1.1 GHA per person. In Asian regions, 0.9 GHA per person biologically productive area is available and in average each person is using 1.6 GHA (Wackernagel & Rees 1996). Ecological footprint and biocapacity per capacity per capita for the selected panel of economies is given below.

Table 6.1.1: Ecological Deficit in selected Asian economies

Country	Ecological Footprint (GHA Per capita)	Biocapacity (GHA Per capita)	Ecological Deficit (GHA Per capita)	Ranking
Malaysia	3.71	2.41	-1.3	3
China	3.38	0.94	-2.44	1
Thailand	2.66	1.24	-1.42	2
Vietnam	1.65	1	-0.65	5
Indonesia	1.58	1.26	-0.32	9
Cambodia	1.21	1.09	-0.11	10
India	1.16	0.45	-0.71	4
Philippines	1.1	0.54	-0.56	6
Nepal	0.98	0.59	-0.38	7
Bangladesh	0.72	0.38	-0.35	8

Source: Compiled using data from Global Footprint Network

Table 6.1.1 depicts that the countries China, Thailand and Malaysia are the top ranked countries with per capita ecological footprint. It is due to less available biocapacity with these economies, these countries have high ecological deficit. Increasing size of ecological footprint has become a major environmental concern in Asian economies. Therefore, it is essential to explore the reasons and solutions behind this increasing size of ecological footprint. Most of the researchers in literature have used GHG emission as a proxy to environment degradation. There are a few studies (Al-Mulali et al, 2015, Wang et al., 2011, Galli et al., 2012, Mostafa, 2010, Caviglia-Harris et al., 2009 and Bagliani et al., 2008) which have used ecological footprint as an indicator to measure impact on environment. Especially in Asia very few researchers have focused on this aspect. Therefore, this study has also used ecological footprint as a proxy to environment degradation instead of CO_2 emission.

6.1.1 Concept and Application of Ecological footprint

The concept of Ecological footprint was first used by Mathis Wackernagel for the measurement of number of natural resources required for the satisfaction of consumption related needs and waste assimilation needs of human beings of a particular, city, nation and

world with in a period of one year (Wackernagel & Rees, 1996, Wackernagel et al., 2002, Wood & Garnett, 2010).

Productive area required for individuals is measured on the basis of their consumption related requirements and is expressed as hectares per capita. This productive area required for human beings consists of cropland, grazing land, fishing grounds and carbon uptake land. The actual hectares of land are converted into global hectares using factors associated with yield and land (Galli et al., 2007, Wackernagel & Rees, 1996). Yield factor is known as the proportion of productivity coefficient of different types of land and average of world's land. There is a specific yield factor for every country and for every year. The rate of conversion from hectare to global for a given year is known as the equivalence factor. Ecological footprint basically compares the demand of natural capital with the biological capacity of earth (Wackernagel et al., 1996). Biological capacity, on the other hand, measures the capacity of production. Biological capacity is also known as counterpart for the ecological footprint. Both ecological footprint and biological capacity can be measured through the following equations.

$$EF = N(EF_i) = N \sum_{i=1}^{n} r_i \left({C_i}/{Y_i} \right) = N \sum_{i=1}^{n} r_i \ \frac{P_i + N_i - X_i}{Y_i} \tag{1}$$

$$BC = N * (1 - 12\%) \sum_{j=1}^{n} a_j \ r_j \ y_j \tag{2}$$

Where N is total population of the economy, i stands for different items of consumption, C_i refers to per capita consumption of items, Y_i is average productivity with respect to bio productive areas, r_i is the equivalence factor, $P_i + N_i - X_I$ denotes net consumption, where, P_i is the production of item i, N_i is the import of item i and X_i is the export of item i. a j is the per capita biological productive area of j type land, j y is the yield factor of j type land and j r is the equivalence factor of j type land.

For calculation of ecological footprint, a matrix is compiled in which a particular area of land is allocated to a specific consumption category. Addition of all lands and its

division by total population calculates ecological footprint per capita and produces results in hectares per capita. EF>BC indicates ecological deficit it shows that of the economy is being depleted. The condition of EF<BC indicates ecological surplus which helps in the estimation of remaining ecological capacity. Comparison of ecological footprint and biological capacity helps in the measurement of human load on the biosphere by describing the human demand and supply through natural resources on graphical scale.

Rapidly growing population and economic development are the two major issues in today's world. Both compelling issues are contributing for increase in demand of global resources and degradation of environment (Mingquan et al., 2010). According to the report of WHO (2017), increasing population and specially concentration of population in few cities have resulted into the over consumption and threat for the health of human beings. Ying et al. (2009) also mentioned two-fold impact on environment because of increasing population and increasing consumption of the resources. Dietz and Rosa (1994) identified population, economic development and technology are the key factors contributing for the environmental degradation in the economies. The study has also stated that population and affluence are two critical factors for making huge impact for the environment (Dietz et al., 2007).

According to the reports of Global Footprint Network (2018), ecological footprint in Asia is rapidly increasing putting high pressure on the environment and natural resources in the economy and biocapacity in the economy is continuously decreasing. Researchers have used various methodologies to measure the environmental impact but most of them has used CO_2 emission and GHG gases to measure environment degradation in the Asian economies. Therefore, this study has used Ecological footprint as the measure of environment impact in Asian countries.

6.2. Theoretical Framework

IPAT has been widely used by the researchers to measure the impact of activities of human beings on the environment. Ehrlich and Holdren (1971) founded this formula

that is based on the impacts of different human activities on the environment. Later on, this formula was widely used by the economists to explore the determinants affecting the environment. According to IPAT, there are three main driving forces which impact the environment. These three driving forces are population, affluence and technology. Population here refers to sample population considered for the study, affluence is per capita consumption or production and technology is per unit of consumption of a product. The main feature of this method of calculating impact is that it not only measures the impact of driving forces on the independent variable but also explore the relationship between the driving forces (York et al., 2003a).

Following this formula for measuring impact on environment, Waggoner and Ausubel (2002) gave a new identity named as ImPACT. In this formula, T of IPAT model has been disaggregated into C and T. C is consumption of per unit of GDP and T is impact of per unit of GDP. Schulze (2002) gave another identity named IPBAT where b is the behaviour of the impact. Later on Roca (2002) added that there is no need to measure the behaviour of the impact because it has already been described in the term IPAT. IPAT and ImPACT models were full of limitations. These models show non- monotonic and non-proportional effects. To overcome the limitations of these models, Dietz and Roza (1994) came up with another model named STIRPAT model. STIRPAT refers to stochastic impact of regression on population affluence and technology. The model is empirically used to test the hypothesis because it is not an accounting equation. General formula for STIRPAT model is

$$I_i = \alpha\, P_i^b A_i^c\, T_i^d e_i \tag{3}$$

After taking log on both sides, the equation would be written as.

$$lnI_{it} = ln\,\alpha + bln(P_{it}) + cln(A_{it}) + dln\,(T_{it}) + lne_{it} \tag{4}$$

In the above equation, a is constant and b, c and d are exponents of population, affluence and technology. These exponents explain about the elasticity of impact of different driving forces on the environment.

York et al. (2003a) explored the factors which can be used in terms of technology in the STIRPAT model. The study added that these additional factors must be consistent with the specifications of the model. Shi (2003) used proportion of industry and services in GDP as a proxy for technology in this model. Poumanyvong & Kaneko (2010) also used proportion of GDP industry and services for analysis of carbon emission and economic growth. Martinez-Zarzoso (2007) used energy consumption and proportion of industry in GDP as a proxy of T. York et al. (2009) has used urbanization as a proxy of technology in the study. The studies (York et al. (2003a), Cole and Neumayer (2004), York et al. (2009), Liddle (2013) have used urbanization as a variable in STIRPAT model.

This empirical study has used urbanization index as a proxy of population, GDP per capita, proportion of GDP services and GDP industry as a proxy of affluence and energy consumption as proxies of technology. Therefore, the empirical model measuring the impact on environment can be written as follows.

$$Ln\ EF = ln\ a + b\ ln\ (P_{it}) + c\ ln\ (GDPPC_{it}) + d\ ln(IND_{it}) + e\ ln(S_{it)} + f\ ln(URB_{it}) + g\ ln(ENC_{it}) + lne_{it} \tag{5}$$

In the above equation EF is ecological footprint, P is the size of total population, A refers to affluence and in this equation GDP per capita is the proxy of affluence, IND is the proportion of industry in GDP per capita, S is the proportion of services in GDP per capita, U is urbanization index and ENC is the energy consumption. The main variables used to achieve this objective are total population, ecological footprint, proportion of GDP in industry and services, GDP per capita and urbanization index. Data for these variables has been fetched from World development indicators, International energy agency and Global Footprint Network.

Table 6.2.1: Summary of variables

Variables	Description	Unit of measurement
Ecological footprint	Required Land area to meet with the consumption needs of the people	Hectare
Population	Size of Population	Number
GDPPC	Per capita gross domestic product	GDP per capita at current USD
GDPIND	Percentage of GDP in industry	Percentage
GDPSER	Percentage of GDP in services	Percentage
Urbanization	Percentage of population residing in urban regions	Percentage
Energy consumption	Energy consumed in the production of each unit of product	Ratio of GDP

Source: Authors' Computation

The study makes use of data for the period 1990 to 2017 for 10 selected Asian economies (China, Bangladesh, Nepal, Maldives, Cambodia, Thailand, Malaysia, India, Indonesia, Vietnam). Data for GDP per capita, percentage of GDP in industry, percentage of GDP in services, population and percentage of people residing in urban regions is taken from world development bank indicators. Data for energy utilization is obtained from International energy agency. Data for ecological footprint is obtained from Global Footprint Network. Ecological footprint is a predicted variable in this study. It is measured in hectares to measure the impact on environment. Logarithm of all the data is taken to reduce the excessive positive skewness.

6.3 Model Specifications

STIRPAT model is basically associated with three factors i.e., population, affluence and technology. But in addition to these variables, any other conceptually compatible variable can also be added to the model. This study has incorporated six different models

and ecological footprint is dependent variable for all the models which is used as a proxy to environment degradation. The main driving forces considered in this study to measure their impact on the environment are total population, GDP per capita, urbanization, percentage of GDP from industry, percentage of GDP from service and energy consumption. The STIRPAT model for all these specifications is measured through ordinary least square (OLS) method.

$$\text{Model1:} \ln(I) = a + b\ln(P) + c\ln(A) + e \tag{6}$$

$$\text{Model2:} \ln(I) = a + b\ln(P) + c\ln(A) + d\ln(A2) + e \tag{7}$$

$$\text{Model3:} \ln(I) = a + b\ln(P) + c\ln(A) + d\ln(T) + e \tag{8}$$

$$\text{Model4:} \ln(I) = a + b\ln(P) + c\ln(A) + d\ln(T1) + d\ln(T2) + e \tag{9}$$

$$\text{Model5:} \ln(I) = a + b\ln(P) + c\ln(A) + d\ln(A2) + e\ln(T1) + f\ln(T2) + e \tag{10}$$

$$\text{Model6:} \ln(I) = a + b\ln(P) + c\ln(A) + d\ln(A2) + e\ln(T1) + f\ln(T2) + g\ln(C) + e \tag{11}$$

Model 1 (Equation 6) of STIRPAT model consists of two factors i.e., population and affluence and e refers to the error term. Model 2 (Equation 7) consists of an additional term i.e., square of affluence. This explanatory variable helps in exploring "non-monotonic" association between dependent and independent variable. Model 3 (Equation 8) consists of all basic driving forces of STIRPAT model. These driving forces are population, affluence and technology where GDP per capita is affluence and Urbanization is termed as technology. In model 4 (Equation 9), T is degree of urbanization, T1 is percentage of GDP from industry and T2 is percentage of GDP from services. Model 5 (Equation 10) has used squared terms of affluence and T1 and T2 to assess the non-monotonic relationship between the variables. Finally model 6 (Equation 11) is a saturated model which consists of all independent variables including Energy Utilization.

6.4 Empirical Results

For every panel data analysis, the first step is to test the unit root properties of data. This diagnostic test helps in the determination of nature and properties of data by testing

the stationarity and non- stationarity of data. Unit root for all the variables used in this study are as follows.

Table 6.4.1 Panel Unit Root Test

	Ln EF	Ln ENC	Ln GDP_PC	Ln GDP_IND	Ln GDP_SER	Ln URB
Level 0						
Levin, Lin & Chu	5.74173 (1.000)	-4.58060 (0.000)**	7.57801 (1.000)	0.65947 (0.745)	0.28221 (0.611)	-4.5446 (0.000)**
Im, Pesaran & Shin W – stat	8.22413 (1.000)	-2.32009 (0.012)**	9.67406 (1.000)	1.28090 (0.899)	0.71298 (0.762)	0.39272 (0.652)
ADF- Fisher Chi-Square	2.35418 (1.000)	44.7010 (0.001)**	0.54434 (1.000)	11.7341 (0.924)	17.4556 (0.623)	43.0573 (0.002)**
PP-Fisher Chi Square	2.51413 (1.000)	36.9113 (0.012)**	0.42618 (1.000)	12.5127 (0.897)	12.2384 (0.907)	45.9595 (0.008)**
Level 1						
Levin, Lin & Chu	-1.88568 (0.029)**	-2.51138 (0.006)**	-3.51744 (0.000)**	-5.80049 (0.000)**	-5.00527 (0.000)**	-6.49692 (0.000)**
Im, Pesaran & Shin W – stat	-4.72247 (0.000)**	-3.68032 (0.000)**	-2.43693 (0.001)**	-5.84841 (0.000)**	-6.65219 (0.000)**	-6.12515 (0.000)**
ADF- Fisher Chi-Square	67.9811 (0.000)**	47.1882 (0.000)**	38.2935 (0.002)**	74.1701 (0.000)**	82.5287 (0.000)**	74.3626 (0.000)**
PP-Fisher Chi Square	104.799 (0.000)**	108.853 (0.000)**	62.3211 (0.000)**	140.965 (0.000)**	150.040 (0.000)**	125.605 (0.000)**

Sources: Author's calculation

*Note: ** Indicates the rejection of null hypothesis of non-stationarity at 5%*

The unit root test determines that there exists no unit root between the variables at first order. "Im", "Pesaran and Shin W-stat", "ADF and PP (Fisher Chi-square tests)" showed that data is non stationary at level and it is required to integrate the data at first order to make it stationary. Table 6.3.1 also exhibits that at level 1 all the variables are stationary and this data can be further used for performing regression analysis.

Table 6.4.2 Regression Results

Variable	Symbol	C	Standard error	t-test	Sig	Collinearity Tolerance	R²	VIF
Model 1								
Population	LnP	2.159	2.99	7.22	0.0000*	0.012	0.67	33.62
GDPPC	LnA	-0.307	0.068	-4.52	0.0000*	0.012	0.70	33.62
Model 2								
Population	LnP	2.276	0.464	4.91	0.0000*	0.007	0.74	121.62
GDPPC	LnA	-0.344	0.129	-2.67	0.0100	0.002	0.73	80.91
Sq (GDPPC)	SqLnA	-0.007	0.022	-0.32	0.7410	0.126	0.56	7.69
Model 3								
Population	LnP	2.564	0.329	7.79	0.0000*	0.021	0.65	110.44
GDPPC	LnA	-0.53	0.11	-4.82	0.0000*	0.010	0.63	40.64
URB	LnT	2.191	0.882	2.48	0.0160	0.032	0.80	24.46
Model 4								
Population	LnP	2.974	0.365	7.65	0.0000*	0.013	0.85	60.54
GDPPC	LnA	-0.485	0.114	-4.25	0.0000*	0.008	0.84	110.44
URB	LnT	1.271	1.091	1.16	0.2490	0.015	0.71	35.04
GDPIND	LnT1	0.256	0.182	1.41	0.1650	0.012	0.75	10.45
Continued………								

Model 5								
Population	LnP	1.816	0.462	3.93	0.0000*	0.003	0.77	108.61
GDPPC	LnA	-0.338	0.116	-2.91	0.0000*	0.006	0.81	130.51
Sq(GDPPC)	SqLnA	-0.007	0.022	-0.32	0.0050*	0.012	0.88	24.04
URB	LnT	0.099	0.032	3.09	0.0030*	0.024	0.74	80.34
GDPIND	LnT1	4.314	1.505	3.15	0.0030*	0.103	0.71	70.44
GDPSer	LnT2	0.255	0.167	1.53	0.1350	0.002	0.65	8.34
Model 6								
Population	LnP	2.51	0.497	4.33	0.0000*	0.005	0.74	131.04
GDPPC	LnA	-0.354	0.114	-3.11	0.0030*	0.004	0.81	128.04
Sq(GDPPC)	SqLnA	0.05	0.041	1.37	0.1780	0.007	0.87	40.34
URB	LnT	4.314	1.501	2.87	0.0060*	0.023	0.74	87.34
GDPIND	LnT1	0.188	0.169	1.11	0.2730	0.011	0.71	40.34
GDPSer	LnT2	0.356	0.135	1.01	0.1260	0.204	0.65	41.221
ENI	Len	0.486	0.295	1.65	0.1060	0.073	0.88	11.441

Source: Authors' Computation

From the table OLS regression table 6.3.2, it is clear that the value of VIF ranges from 8.34 to 131.04. This indicates the existence of collinearity in the data. Value of VIF more than 10 indicates the presence of multicollinearity. Therefore, Ridge regression model is used to make analysis of the impact of population, affluence and technology on the ecological footprint. This model helps in eliminating multicollinearity in the independent variables but the accuracy of the model depends upon the correct selection of ridge parameter. The range of ridge parameter should be from 0 to 1. The following table shows the results of Ridge Regression.

Table 6.4.3 Results of Ridge Regression

Indicators	Symbol	M1	M2	M3	M4	M5	M6
Population	lnP	2.451 (0.213)	2.231 (0.441)	2.121 (0.213)	2.673 (0.301)	1.499 (0.321)	2.036 (0.321)
GDPPC	lnA	0.224 (0.043)	0.293 (0.110)	0.424 (0.073)	0.411 (0.087)	0.301 (0.097)	0.324 (0.101)
$(GDPPC)^2$	lnA^2	-----	-0.003 (0.0012)	-----	-----	0.078 (0.011)	0.051 (0.034)
URB	lnT	-----	-----	1.978 (0.554)	1.223 (1.122)	4.977 (1.401)	4.233 (1.331)
% GDPIND	lnT1	-----	-----	-----	0.215 (0.023)	0.210 (0.033)	0.175 (0.113)
%GDPSER	lnT2	-----	-----	-----	0.223 (0.118)	0.201 (0.112)	0.168 (0.165)
ENC	lnENC	-----	-----	-----	-----	-----	0.411 (0.113)
Constant	A	-13.321 (3.321)	14.112 (5.504)	-25.041 (6.078)	-24.341 (5.312)	-27.721 (6.112)	-30.04 (4.121)
R^2		0.839	0.815	0.862	0.873	0.856	0.887

Note: Numbers in parenthesis are standard errors

Source: Author's computation

Table 6.4.3 describes the results of Ridge regression for all specific models. Results of all the models mentioned in this table have been explained through the following regression equations.

In Model 1, population and GDP per capita are used as independent variable to measure the influence of activities of individuals on the environment in selected Asian countries. As per the results, being other factors constant, 1% change in population results into 2.45% increase in pressure on environment. It is due to increase in population, land requirement, demand for consumption and fossil fuel is also increasing. This rise in demand and less supply of natural resources is putting pressure on the environment of the economies. 1 percent change in GDP per capita is resulted into increase in pressure on environment by 0.224%. Increasing GDP per capita increases the potential of the people to purchase more sources of energy and increased used of non-renewable sources of energy emits more pollution in the environment and negatively impact the ecological footprint. Therefore, the statistics describe that 1% change in population and GDP per capita has net environmental impact on the selected economies by 2.674%. The model shows high goodness of fit with value of R square at 0.839. It indicates that in model 1, population and GDP per capita explain 83.9% pressure on environment in selected Asian countries.

Model 2 (Equation 2) tested the non-monotonic relationship between GDP per capita and pressure on environment. R square value of 0.815 indicates the goodness of fit of model. The goodness of fit of this model is slightly lower than the first model. As per this value, it can be concluded that population, affluence and squared term of affluence explains 81.5% of environmental pressure in selected panel of economies. From the coefficients of population and GDP, it is clear that 1% change in population increases environmental pressure by 2.23% and 1% change in GDP per capita increases pressure on environment by 0.29%. The insignificant p value of the squared term describes lack of goodness of fit of the model. Therefore, the results of model 2 cannot be considered.

Model 3 has considered three driving forces to measure the impact on environment. The three driving forces considered in this model are population, affluence and technology. Urbanization is used as an indicator for technology. R square value of 0.862 indicates high goodness of fit as compared to model 1 and model 2. It indicates that population, GDP per capita and urbanization explains 86.2% change in the environmental pressure. The p value less than 0.05 for all the variables of this model

indicates that the model is perfectly fit. 1% change in population results into 2.12% change in the environmental pressure. 1% change in GDP per capita is increasing EF by -0.42%. 1% change in urbanization is increasing ecological footprint by 1.97%. It shows that urbanization is also adversely affecting the ecological footprint due to increasing burden on the land and environment.

Model 4 has used additional variables percentage proportion of GDP industry and percentage proportion of GDP services to measure their impact on the environment. R square value of 0.873 indicates the high goodness of fit of model. Population is increasing environmental pressure by 2.67% and GDP per capita is increasing environmental pressure by 0.411%. Percentage proportion of industry and services in GDP also puts pressure on environment by 0.21 and 0.222 percent respectively. Significant p values of all variables indicates that the model is perfectly fit.

Model 5 has again used square of affluence to check the non-monotonic relationship between population affluence and technology and ecological footprint. Therefore, the model has considered squared term of GDP per capita in model 4 to create a new model. According to this model, 1% change in population increases the environmental pressure by 1.49 percent and 1% change in GDP per capita increases the environment pressure by 0.30 percent. Urbanization is also adversely impacting the population by 4.97 percent increase in environmental pressure. Percentage proportion of GDP industry and services are respectively affecting ecological footprint by. 0.21 and 0.20 percent. R square value of 0.856 in this model describes that the model is good fit but p values of all the variables are not significant. It indicates that the model is not well fitted.

Model 6 has used energy consumption as an additional variable to measure its proportionate impact on the environmental pressure. According to this model, 1% change in population increases the environmental pressure by 2.036 percent and 1% change in GDP per capita increases the environment pressure by 0.51 percent. Urbanization is also adversely impacting the population by 4.2 percent increase in environmental pressure. Percentage proportion of GDP industry and services are respectively affecting ecological footprint by 0.17 and 0.16 percentage respectively.

1% change in energy consumption has influenced ecological footprint by 0.411 percent. R square value of 0.887 of the models describes that the model is good fit but p values of all the variables are not significant. P value of percentage proportion of GDP services is not less than 0.05 which makes the model not well fitted.

From OLS and RR results, it is clear that results are differentiating for all the models but urbanization, population and GDP per capita are the main driving forces of ecological footprints in selected panel of Asian economies. The statistics also shows that population has high proportionate impact on the environment as compared to other variables. Increase in population in these economies results into heavy pressure on land and increased human activities. It also results into increased consumption of energy and high emission of waste. In these developing countries, the sources of waste disposal are not efficient enough which results into negative impact on the environment. High consumption of energy, land and water resources are also contributing for increase in the ecological footprint (Salahuddin, et al., 2015). Rapid urbanization in these economies is also highly impacting the ecological footprint with increased consumption and waste disposal with increasing urban population. In each model, regression coefficient value supports Malthusian point of view that population has adverse impact on the environment. GDP per capita also has negative impact on the environment in selected Asian countries. Though GDP per capita in the economies is increasing but in developing nations, increase in GDP per capita results into increased use of non-renewable resources, increased level of pollution and increased loss of environmental habitats. Such findings are well documented by Lin et al. (2017). Toth and Szigeti (2016) also support the findings of the study by emphasizing on the increased emission due to increased level of consumption which is the result of increased urbanization.

6.5 Summary of the Chapter

To put a glance around the world, urbanization is worldwide phenomenon and has become an important factor for the growth of any economy. But rapidly increasing urbanization also requires immense energy which becomes a threat to the environment in Asian economies. This study provides a useful insight into 10 selected Asian economies using ecological footprint as an indicator to measure environment

degradation and GDP per capita, energy consumption, urbanization, percentage proportion of industry in GDP and percentage proportion of services in GDP as explanatory variables for the data period of 1990-2017 for 10 selected Asian countries. There is rapid rate of growth of urbanization in these economies. People opt migration in these economies for better urban services and facilities and thus put enormous pressure on the infrastructure. This indicates that urbanization highly contribute for increasing environmental pressure. The main issue is that urbanization in these economies is concentrated in few big cities and population has high proportionate impact on the environment as compared to other variables. Rapid urbanization in these economies is also highly impacting the ecological footprint with increased consumption and waste disposal with increasing urban population. In each model, regression coefficient value supports Malthusian point of view that population has adverse impact on the environment. GDP per capita also has negative impact on the environment in selected Asian countries. Though GDP per capita in the economies is increasing but in developing nations, increase in GDP per capita results into increased use of non-renewable resources, increased level of pollution and increased loss of environmental habitats which increases the size of ecological footprint.

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Chapter 7

Comparative analysis of selected Asian countries based on Urbanization, Economic growth and Environment Degradation

In economic history, the association between environmental deterioration and growth of the economies gradually caught attention of the researchers with soil degradation in 1930 and air pollution during 1950-60 (Jiang et al., 2020). In late 20th century, it was accepted that environment sustainability through use of natural resources is the biggest challenge for the process of economic growth. Therefore, for global economy, environment deterioration factor to shape the economic development. Various research studies in literature have demonstrated the positive as well as negative association of economic growth with the environment (Dong & Karmacharya, 2018), (Lin et al., 2017) and (Shahbaz et al., 2016). This impact depends upon the consumption of natural resources and release of pollutant from the use of those resources. Not only this, human activities highly impact earths' climate and ecosystem. Therefore, increasing population and urbanization can be considered as the key factors affecting the environment. In the previous chapter, it has been explored that there exists U-shaped association between urbanization and environment in selected Asian countries for this study. It depicts that at initial level, there is positive association between urbanization and environment quality but at later stages, this association becomes negative with increase in rate of urbanization. This chapter aims at comparing selected Asian countries based on the association between urbanization, economic growth and environment degradation using Environment Kuznets Curve.

7.1 Environment Kuznets Curve

The concept of Kuznets curve (KC) was given by Simon Kuznets in 1955. The key focus of Kuznets' curve was to confront the association between environment quality and economic development. According to Kuznets, in developing countries, development is associated with transition of people from agriculture to industrialization or from rural to urban shift. At the initial stage, this development harms environmental quality but after reaching a certain point, it is converted into development process and

positively impact the environment quality. Therefore, Kuznets claimed that there exists non-linear association between economic development and environment quality (Kuznet, 1955). This association found by Kuznets between economic development and environment quality was later termed as Kuznets U-hypothesis (Kapuria-Foreman & Perlman, 1995). Later on, while analyzing the association between per capita income and air pollution, a non-linear association was found which was similar to Kuznets curve. According to this association, development in early stages degrades the environment but after reaching a turning point, the development positively affects the environmental quality (Grossman & Krueger, 1995). This association between economic development and environment degradation is termed as environmental Kuznets curve as shown in figure 1.

Figure 7.1.1: Environment Kuznets Curve
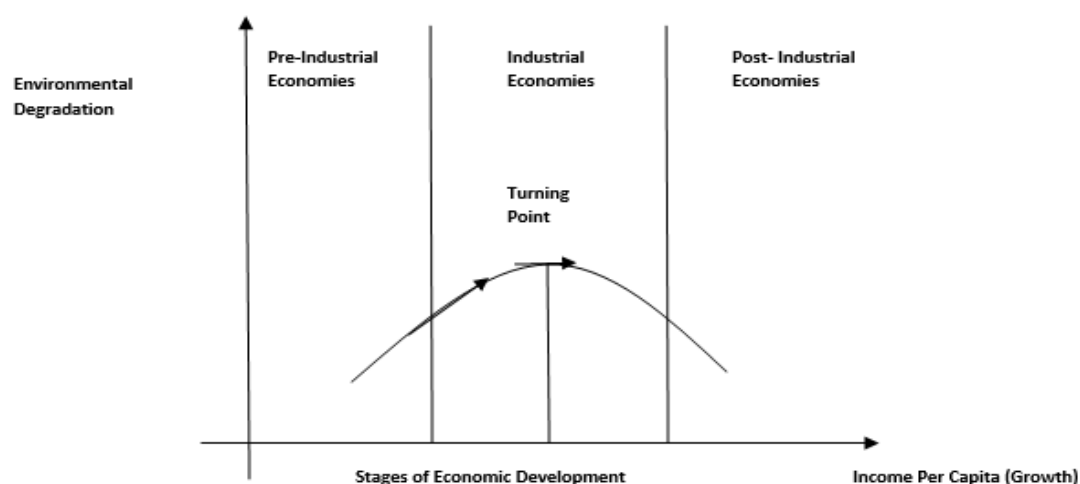
Source: Panayotou (1993)

This environment Kuznets curve in figure 7.1.1 predicts the inverted U-shaped ratio between per capita income and environment quality. But there exists a different reason behind inverted U-shaped curve for different countries. In developed countries, the reason behind inverted U-shaped association is trade with other countries as well as the adoption of environmental regulations as compared to the developing countries. According to the Heckscher-Ohlin trade theory, the countries become specialized in only those goods in which they are relatively abundant in and export excess of the goods to other countries. Developed countries require more labor and capital, on the other

hand, developing countries require more labor. Production of different type of goods may have different impact on the environment and it can be the main reason of inverted U-shaped EKC (Stern, 2004). List and Gallet (1999) have also examined N shaped association between economic development and its impact on environment. As per N shaped environment Kuznets curve, the environment degradation increases with the rise in economic development in the initial phase. It starts declining in the next phase and after some time it again reflects positive relation with increased level of economic development. Dasgupta et al. (2002) gave his alternative view for Environment Kuznets curve and described the association between pollution and income in four different ways as shown in figure 2.

Figure 7.1.2: Revised Environment Kuznets Curve
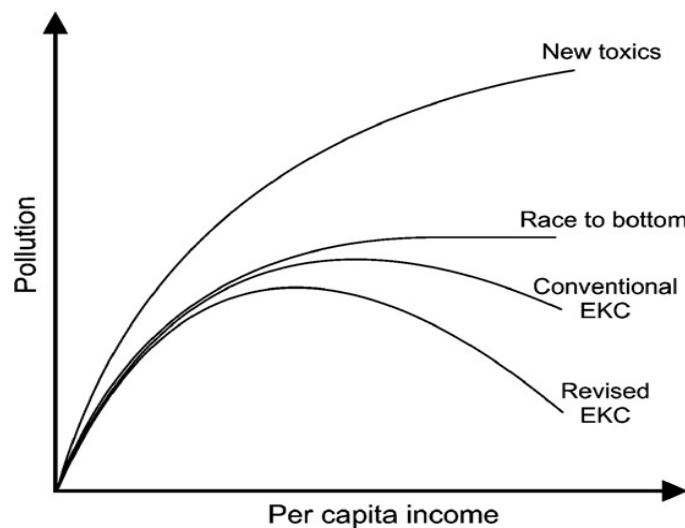
Source: Dasgupta et al. (2002)

There are different views of economists for this inverted U-shaped association between income and environment quality. According to two pessimistic views, this EKC can be referred as the Race to the Bottom as shown in figure 7.1.2. For this idea of the race to the bottom, some critics claim that when emission level increases due to globalization, it stays at the absolute maximum level in a so-called "race to the bottom" of the environmental standard (Andrée et al., 2019). Some other pessimistic critics claimed that there may be rise in the absolute emission with increasing level of economic development in the economy or it may result into new emissions as well which can also refer to as "New Toxic" (Ahmed et al., 2019). On the other hand,

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another optimistic view states that innovations in the developed countries can have positive spillover effect on the developing countries as well. This results into efficient handling of inputs and reduction in the environmentally hazardous activities. Therefore, the peak level of environment degradation in developing countries is lowering down as compared to the developed countries (Dasgupta et al., 2002). Stern (2004) mentioned this association between income and environment quality as a mixture of New Toxics and Revised EKC.

Figure 7.1.3: N Shaped Environment Kuznets Curve
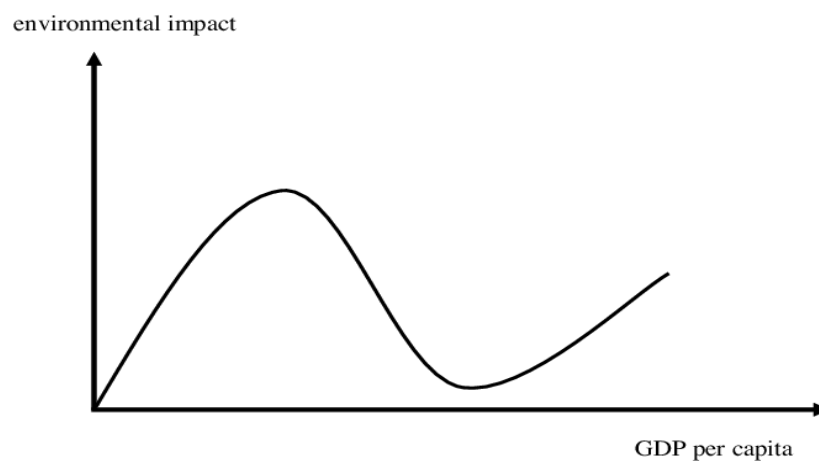
Source: Kerekes et al. (2018)

There is another type of Environment Kuznets Curve named as N-Shaped Environment Kuznets curve. But the existence of N-shaped EKC has been challenged by various economists in literature for long run (Kerekes et al., 2018). This N-shaped EKC has three different phases. The first phase represents the upturn of curve and indicates that environment degradation increases with increase in GDP per capita. This phase of N-shaped EKC characterizes the poor countries which cannot afford cleaner technologies. Second phase of EKC characterizes the middle-income economies where investment in clear technology associates the economic growth with environment quality. Third phase is when investment in cleaner technologies starts providing benefits. Overall, this N-shape curve reveals that after reaching a certain stage of development, the association between economic growth and environment become positive.

Various empirical research studies have used panel data and cross-sectional approach to prove environment Kuznets curve hypothesis (Ahmed et al., 2019). But there are very few studies which have conducted time series analysis (Lieb, 2003). Moreover, the few studies which have conducted time series analysis shows totally different results from the studies with panel data and cross-sectional data analysis. Dinda (2004) stated that time series analysis is helpful for the development of clear picture of association between environment degradation and economic development. Lieb (2003) also focused on the critical analysis of using panel data and time series analysis of measuring Environment Kuznets' curve. In literature, a variety of environmental indicators have been used to analyze environment Kuznets curve hypothesis. But no one has defined the variables which are most appropriate for this estimation purpose. Some studies have used emission of GHG gases, while others have used environmental pressure indicators for this purpose (Bekhet & Othman, 2017). Various studies have also developed their own environment index to measure environment Kuznets curve.

This study is focused on a comprehensive form of analysis of environment Kuznets curve through the use of Ecological Footprint (EF). Ecological footprint is a method used to measure the demand of human beings for natural capital. The method is given by Global Footprint Network. It is also defined as the quantity of nature taken to support people and an economy. This demand of human beings for nature is tracked through ecological accounting system. This indicator is widely used in the fields of environmental social sciences and is also known as a reliable indicator which helps in the measurement of anthropogenic pressure on the environment. Most of the research studies have used income data as independent variable for examining Environment Kuznets curve. Though various other variables have also been considered in this model but it is assumed that income level has the most significant effect on the quality of environment. But as the main aim of this study is to analyses the association between economic growth and environment in the selected panel of economies, therefore, the study has used gross domestic product per capita as the independent variable and ecological footprint as the dependent variable.

The study aims at examining Environment Kuznets curve for selected economies (China, Bangladesh, Nepal, India, Thailand, Philippines, Indonesia,

Cambodia, Vietnam and Malaysia) for the period of 1990 to 2018. These countries vary in terms of size of population, economic development, and consumption of renewable and nonrenewable resources and emission of GHG gases. Therefore, the study focused on examining the association between urbanization, ecological footprint (EF) and Gross Domestic Product Per Capita (GDPPC) by testing Environment Kuznets Curve Hypothesis (EKC). The data sources for Ecological Footprint and GDPPC are Global Footprint Network and World Development Bank respectively.

7.2 Theoretical Framework

According to environment Kuznets curve theory, GDP per capita is positively linked with environment degradation, but after reaching a certain level of GDP per capita, their would-be inverse association. In other words, EKC postulates a non-linear association between GDP per capita and environment degradation. It is to test this hypothesis in selected Asian countries, the study has followed the EKC model adopted by previous empirical studies (Lieb (2003), Dinda (2004), Saboori et al. (2012) & Sinha, et al. (2018). According to Saboori et al. (2012), the general format of EKC hypothesis is as follows.

$$E = f(Y, Y^2, Z) \tag{1}$$

Where E refers to environmental indicator, Y is the growth indicator and Z is an explanatory variable that may impact the association between environment and economic growth. This chapter focuses on exploring turning point of EKC for selected countries that is why it is has not considered any other variable that may have impact on the environment. Based on EKC hypothesis, the study has also calculated turning point of curve between urbanization and environment.

Most of the articles in literature on Environment Kuznets curve has used Logarithm of GDP per capita in quadratic form (Bekhet & Othman, 2017). Moreover, this form has been considered as the best measure in literature. This quadratic form represents association between GDP per capita of residents of country and its effect on the environment quality of that country and expresses the inverted U-shaped association between them. But the researchers (List & Gallet, 1999) have mentioned that cubic form of model can represent N shaped association between the variables. This study has used logarithm form of GDP per capita, Ecological footprints and Urbanization.

The linear, quadratic and cubic form of the models used in the study to test country specific Environment Kuznets Curve. These three forms of the models can be generally presented as follows.

$$I_t = \beta_0 + \beta_1 Y_t + \varepsilon_t \tag{2}$$

$$I_t = \beta_0 + \beta_1 Y_t + \beta_2 Y_t^2 + \varepsilon_t \tag{3}$$

$$I_t = \beta_0 + \beta_1 Y_t + \beta_2 Y_t^2 + \beta_3 Y_t^3 + \varepsilon_t \tag{4}$$

The specific form of the model representing the linear association between urbanization and environment in the selected Asian economies is as follows.

$$EF_t = \beta_0 + \beta_1 URB_t + \varepsilon_t \tag{5}$$

$$EF_t = \beta_0 + \beta_1 URB_t + \beta_2 URB_t^2 + \varepsilon_t \tag{6}$$

$$EF_t = \beta_0 + \beta_1 URB_t + \beta_2 URB_t^2 + \beta_3 URB_t^3 + \varepsilon_t \tag{7}$$

EF_t in the equation is ecological footprint that has been used as a proxy of environment degradation in the economies. URB is urbanization index that has been used as a proxy of urbanization. The model representing the linear association between environment and economic growth in the selected Asian economies is as follows.

$$EF_t = \beta_0 + \beta_1 GDP_t + \varepsilon_t \tag{8}$$

$$EF_t = \beta_0 + \beta_1 GDP_t + \beta_2 GDP_t^2 + \varepsilon_t \tag{9}$$

$$EF_t = \beta_0 + \beta_1 GDP + \beta_2 GDP_t^2 + \beta_3 GDP_t^3 + \varepsilon_t \tag{10}$$

EF_t in the equation is ecological footprint that has been used as a proxy of environment degradation in the economies. GDP_t in the equation is GDP per capita that has been used as a proxy of economic growth in the selected economies. β_0 & ε_t in the above models are intercept and error term respectively. $\beta_1, \beta_2 \ and \ \beta_3$ are slope coefficients. The type of linear association (concave, convex or linear) between to variables is represented through the sign of β. β1 shows the impact of independent variable on dependent variable. In case of β1 > 0, independent variable would have positive influence on dependent variable.

$\beta_1 = \beta_2 = \beta_3 = 0$ reveals a flat pattern or no association

$\beta_1 > 0$ and $\beta_2 = \beta_3 = 0$ reveals a monotonic or linear increasing association

$\beta_1 > 0$, $\beta_2 < 0$ and $\beta_3 = 0$ reveals an inverted U-shaped association

$\beta_1 < 0$, $\beta_2 > 0$ and $\beta_3 = 0$ reveals a U-shaped association

$\beta_1 > 0$, $\beta_2 < 0$ and $\beta_3 > 0$ reveals a cubic polynomial or N-shaped association

$\beta_1 < 0$, $\beta_2 > 0$ and $\beta_3 < 0$ reveals an inverse the N-shaped association

As per Environment Kuznets Curve, these shapes are based on the association between economic growth and environment, but there are several possible driving forces that may lead to Kuznets curve representing the association of environment with variable other than economic growth (Kaika & Zervas, 2013). Therefore, the study has examined the association between urbanization & environment and economic growth and environment through this Environment Kuznets Curve. Following figures show the pattern of above-mentioned different curves.

Figure 7.2.1: Possible shapes of the association between Economic growth & Environment and Urbanization and Environment

(i) $\beta_1 = \beta_2 = \beta_3 = 0$

(ii) $\beta_1 > 0, \beta_2 = \beta_3 = 0$

(iii) $\beta_1 < 0, \beta_2 = \beta_3 = 0$

(iv) $\beta_1 > 0, \beta_2 < 0, \beta_3 = 0$

(v) $\beta_1 < 0, \beta_2 > 0, \beta_3 = 0$

(vi) $\beta_1 > 0, \beta_2 < 0, \beta_3 > 0$

(vii) $\beta_1 < 0, \beta_2 > 0, \beta_3 < 0$
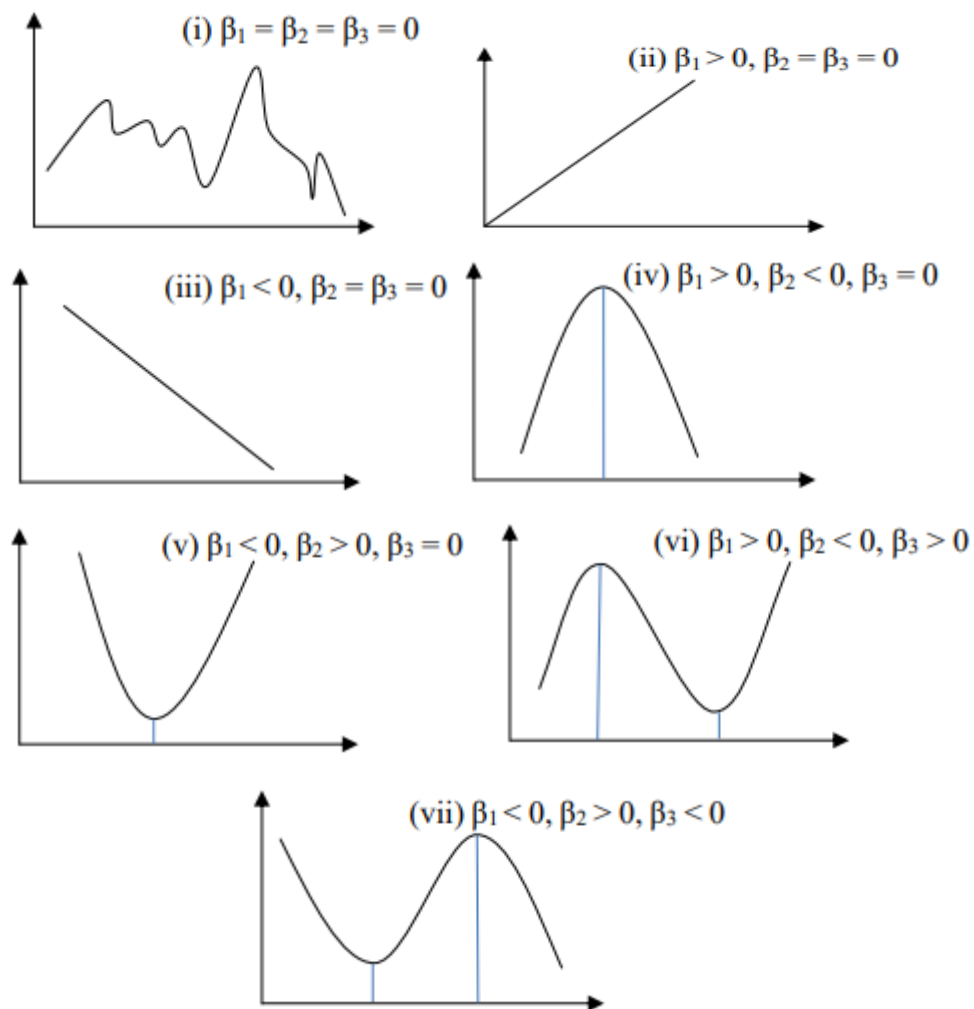
Source: (Kaika & Zervas, 2013)

Though, it is mentioned that the condition of N-shaped Environment Kuznets curve is $\beta 1 > 0$, $\beta 2 < 0$, $\beta 3 > 0$ and for an inverse the N-shaped association $\beta 1 < 0$, $\beta 2 > 0$ and $\beta 3 < 0$, but this condition does not reflect the validity of the model. It is required

to differentiate the model to the first order to test the validity of the model. The first order differential equation to test the model is given below.

$$\frac{dI}{dY} = \beta_1 + 2\beta_2 Y + 3\beta_3 Y^2 = 0 \tag{11}$$

It is also required for the above given equation to have LMx and LMx at the distinct value of Y3. The required condition for LMx and LMn is given below.

$$\beta_2^2 - 3\beta_1\beta_3 > 0 \tag{12}$$

The next step is to find the value of LMx and LMx to arrive at the second order condition. For this purpose, second order derivate of the equation 11 would be taken using the following formula.

$$\frac{d^2 I}{dY^2} = 2\beta_2 + 6\beta_3 Y = \pm\sqrt{4\beta_2^2 - 12a\beta_1}a\beta_3 \tag{13}$$

The equation 13 proves validity. From this, it is clear that two required conditions for N-shaped curve are $\beta 1 > 0$, $\beta 2 < 0$, $\beta 3 > 0$ and $\beta_2^2 - 3\beta_1\beta_3 > 0$. On the other hand, for inverted N-shaped curve, two required conditions are $\beta 1 < 0$, $\beta 2 > 0$ and $\beta 3 < 0$ and $\beta_2^2 - 3\beta_1\beta_3 > 0$. It would not be possible to estimate the environment Kuznets curve in case first condition is fulfilled but second is not. Moreover, the turning points calculated in this case, would also not be valid. However, there are various studies that have commented upon the shape of environment Kuznets curve on the basis of the results of first condition.

To investigate the country specific associations between urbanization, economic growth and urbanization, the study has used annual time series data for the selected Asian economies. Data for GDP per capita has been fetched from World Bank Database, Urbanization index has been used as a proxy of urbanization and data for Ecological footprint has been obtained from Global Footprint Network. The estimation strategy for the further analysis of the models is as follows. First of all, stationarity of all the time series variables has been checked using ADF unit root test.

$$\Delta Y_t = \beta_1 + \Delta Y_{t-1} + a_i + e_t \tag{14}$$

$$\Delta Y_t = \beta_1 + \beta_2 t + \Delta Y_{t-1} + a_i + e_t \tag{15}$$

$$\Delta Y_t = \Delta Y_{t-1} + a_i + e_t \tag{16}$$

It is required to check the stationarity of data for all three models. Equation 14 represents to first model based on intercept only. Equation 15 represents to second model based only based on intercept and trends and equation 16 represents model 3

based on no intercept and no trend. Only if the variables are stationary at their level, first difference or second difference, then co-integration test can be applied. For regression analysis, it is important to consider lagged variables in the data, therefore selection of lags is an important process of this econometric analysis. For investigating co-integration between the variables, it is essential to identify the number of lags. This lag value is identified using "Akaike Information Criterion (AIC)", "the Schwarz–Bayesian Information Criterion (SBIC)", "the Hannan–Quinn Information Criterion (HQIC)", and "the Sequential Likelihood Ratio (LR) methods". After calculation of a specified number of lags, regression is run. After this Johanson co-integration test is used to test the order of integration of the variables. The last step is to identify the required speed to adjust long-run values using Error Correction Term (ECT) which is based on the following cubic formation.

$$I_t = \beta_0 + \beta_1 Y + \beta_2 Y^2 + \beta_3 Y^3 + \beta_4 EC_{t-1} + \acute{\varepsilon}_t \qquad (17)$$

$$\Delta I_t = \beta_0 + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \beta_3 \Delta Y_{t-3} + \beta_4 EC_{t-1} + \acute{\varepsilon}_t \qquad (18)$$

7.3 Empirical Results

It is to make comparative analysis of the selected countries on the basis of urbanization, economic growth and environment degradation, first of all, Unit root for the key variables considered for the study i.e., urbanization, GDPPC and ecological footprint is tested using Augmented Dickey Fuller Unit root test.

7.3.1 ADF Test for Unit Root

This study has used appropriate group of panel unit root tests to test the stationarity of the variables used for the analyses. The first test of this group is Levin, Lin and Chu test (LLC). The equation of this test is based on the basic assumptions of Augmented Dickey Fuller test. This test is known as the most complicated one because it combines the data into a single regression. Null hypothesis of this equation states that there exists unit root and alternative hypothesis states that there exists stationary root.

Table 7.3.1 ADF Test for Ecological Footprint, GDPPC and Urbanization

Country	Variables	Model 1		Model 2		Model 3	
		T-Statistics	P-value	T-Statistics	P-Value	T-Statistics	P-Value
China	EF	-4.83751	(0.000) **	-4.94003	(0.000) **	-10.4350	(0.000) **
	GDPPC	188.793	(0.000) **	219.703	(0.000) **	71.3946	(0.000) **
	URB	-6.00357	(0.000) **	-6.28428	(0.000) **	-13.9180	(0.000) **
Bangladesh	EF	-5.51474	(0.002) **	-5.85923	(0.000) **	-10.7441	(0.000) **
	GDPPC	-13.9180	(0.000) **	-10.9672	(0.000) **	-5.85460	(0.000) **
	URB	78.4562	(0.000) **	78.9018	(0.001) **	215.146	(0.000) **
Nepal	EF	181.140	(0.000) **	102.890	(0.000) **	168.8442	(0.000) **
	GDPPC	3.08229	(0.001) **	13.8597	(0.000) **	11.9246	(0.000) **
	URB	0.41568	(0.003) **	2.57060	(0.001) **	1.97179	(0.002) **
India	EF	11.9246	(0.000) **	10.1563	(0.000) **	0.39964	(0.000) **
	GDPPC	-4.83751	(0.001) **	-4.94003	(0.000) **	-10.4350	(0.000) **
	URB	188.793	(0.000) **	219.703	(0.001) **	71.3946	(0.001) **
Thailand	EF	-6.00357	(0.000) **	-6.28428	(0.000) **	-13.9180	(0.002) **
	GDPPC	-5.51474	(0.000) **	-5.85923	(0.0000) **	-10.7441	(0.0000) **
	URB	-13.9180	(0.0000) **	-10.9672	(0.0000) **	-5.85460	(0.000) **

Continued…………

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Philippines	EF	78.4562	(0.0000)**	78.9018	(0.0000)**	215.146	(0.0000)**
	GDPPC	181.140	(0.0000)**	102.890	(0.0000)**	168.8442	(0.0000)**
	URB	3.08229	(0.0010)**	13.8597	(0.0000)**	11.9246	(0.0000)**
Indonesia	EF	0.41568	(0.0003)**	2.57060	(0.0051)**	1.97179	(0.0002)**
	GDPPC	11.9246	(0.0000)**	10.1563	(0.0040)**	0.39964	(0.000)**
	URB	-4.83751	(0.0030)**	-4.94003	(0.0000)**	-10.4350	(0.0021)**
Cambodia	EF	188.793	(0.0001)**	219.703	(0.0001)**	71.3946	(0.000)**
	GDPPC	-6.00357	(0.001)**	-6.28428	(0.0001)**	-13.9180	(0.000)**
	URB	-5.51474	(0.0000)**	-5.85923	(0.0000)**	-10.7441	(0.0000)**
Vietnam	EF	-13.9180	(0.0001)**	-10.9672	(0.0001)**	-5.85460	(0.000)**
	GDPPC	78.4562	(0.0000)**	78.9018	(0.0000)**	215.146	(0.0000)**
	URB	181.140	(0.0000)**	102.890	(0.0000)**	168.8442	(0.0000)**
Malaysia	EF	3.08229	(0.0010)**	13.8597	(0.0000)**	11.9246	(0.0000)**
	GDPPC	0.41568	(0.0003)**	2.57060	(0.0041)**	1.97179	(0.0002)**
	URB	11.9246	(0.0000)**	10.1563	(0.0000)**	0.39964	(0.000)**
*Note: ** denote rejection of null hypothesis at the 5% level of significance*							
Source: Author's Computation							

It is to test the shape of Environment Kuznets curve for Urbanization-ecological footprint and GDPPC-Ecological Footprint, first of all stationarity of all three variables is tested using Augmented Dickey Fuller Test. Results in table 7.3.1 have described the stationarity of the variables at first order of integration. In all three models, no variable was stationary at level. T statistic value for all countries was smaller than critical value in every model at 5% level of significance. Therefore, first difference for each variable was calculated. After testing the stationarity of the variables, it is required to test the co-integration among the variables. The optimum lags selected for the selected countries are from 1 to 4 which have been selected based on four different information criteria i.e., Likelihood ratio, AIC, HQI and SBIC.

Table 7.3.2: Lag Selection

Country	Lag	Lag Length	Likelihood Ratio	Degree of freedom	P-Value	AIC	HQIC	SBIC
China	4	-1523.28	68.24	72.22	0.00	72.22	71.28	73.66
Bangladesh	3	-1024.68	110.21	42.11	0.00	42.11	52.41	43.99
Nepal	3	-1121.25	115.23	53.11	0.00	53.11	53.44	54.33
India	3	-1508.31	60.21	63.66	0.00	63.66	60.93	64.11
Thailand	4	-18.71.10	42.24	81.99	0.00	81.99	80.84	82.33
Philippines	2	-1704.21	101.24	74.05	0.00	74.05	75.66	75.66
Indonesia	1	1202.81	10.68	7.99	0.00	7.99	7.06	8.01
Cambodia	3	-1023.54	12.21	14.11	0.00	14.11	6.17	15.23
Vietnam	2	-121.04	32.24	6.92	0.00	6.92	6.14	7.13
Malaysia	2	-501.41	9.73	15.77	0.00	15.77	15.93	15.79
Note: Maximum lags are selected according to the AIC, HQIC and SBIC criteria.								
Source: Author's Computation								

Table 7.3.2 exhibits the selection criteria for lag length based on the values of log likelihood, AIC and SBS obtained from VAR model. Literature on VAR modelling supports that lag length can be selected on the basis of minimum value of SBC and AIC. In case of any conflict between the values of lag length selection on the basis of AIC and SBC, then SBC should be preferred for lag length selection. In the above table, lag length selected based on minimum value of SBC for all the selected countries is shown. The existence of unit root among the variables necessitates to select appropriate

tests of co-integration to test the co-integration among the indicators. Therefore, Johanson co-integration test is applied to test country specific co-integration among urbanization, economic growth and environment degradation.

Table 7.3.3: Johanson Co-integration Test

Country	Maximum Rank	Lag length	Eigen Value	Trace Statistics	5% critical value
China	2	-1608.28	0.573	12.71	14.79
Bangladesh	2	-1223.68	0.221	18.71	19.31
Nepal	2	-1024.25	0.478	11.09	13.11
India	2	-1523.31	0.348	8.56	14.31
Thailand	2	-1789.10	0.526	19.78	30.68
Philippines	2	-1753.21	0.978	26.41	27.72
Indonesia	2	1189.81	0.225	0.84	2.86
Cambodia	2	-1108.54	0.216	18.76	21.72
Vietnam	2	-194.04	0.331	2.79	3.31
Malaysia	2	-704.41	0.225	2.72	2.79
Note: Results shown are based on 5% significance level					
Source: Author's Computation					

Table 7.3.3 depicts that there exists co-integration among urbanization, economic growth and environment degradation in all selected countries for this study. The maximum value of R=2 indicates that there exist 3 co-integration equations for all selected countries. But the main focus of the chapter is to compare the selected countries on basis of urbanization, economic growth and environment degradation using environment Kuznets curve, therefore the shape of EKC is tested using ordinary least square method

The results of OLS estimations in table 7.3.4 shows that the value of R^2 for this model is extremely low which represents that the model is not a good fit. The wide variations between the value of R^2 indicates that the variable GDPPC is not able to explain the variation in EF per capita. Therefore, it is essential to estimate long run OLS to explore the variation in Ecological footprint due to variations in GDPPC in selected Asian countries.

Table 7.3.4: Ordinary least square Estimation (EF-GDP Model)

Country	Model	β_0	$\beta 1$	$\beta 2$	$\beta 3$	R^2	EKC Interpretation	
							Outcome	Association
China	Linear	0.01	1.71	……	……	13.26	$\beta 1>0$	Increasing
	Quadratic	0.01	6.23	-1.12	……	16.11	$\beta 1>0, \beta 2<0$	Inverted U
	Cubic	0.01	1.35	-3.12	0.02	26.31	$\beta 1>0, \beta 2<0, \beta 3>0$	N- shaped
Bangladesh	Linear	0.11	2.89	………	………	5.99	$\beta 1>0$	Increasing
	Quadratic	0.16	-5.56	1.36	………	9.11	$\beta 1<0, \beta 2>0$	U-shaped
	Cubic	0.18	1.84	0.02	-1.36	13.32	$\beta 1<0, \beta 2<0, \beta 3>0$	No
Nepal	Linear	-0.04	1.29	……..	……..	5.91	$\beta 1>0$	Increasing
	Quadratic	-0.02	-3.28	5.32	…….	9.17	$\beta 1<0, \beta 2>0$	U-Shaped
	Cubic	-0.05	0.79	-1.29	7.23	18.16	$\beta 1>0, \beta 2<0, \beta 3>0$	N-shaped
India	Linear	0.00	1.27	…….	…….	0.00	$\beta 1>0$	Increasing
	Quadratic	0.00	-1.234	2.36	…….	5.00	$\beta 1<0, \beta 2>0$	U-Shaped
	Cubic	0.00	-0.321	6.32	-3.78	6.13	$\beta 1<0, \beta 2>0, \beta 3<0$	Inverted N
Thailand	Linear	0.04	-0.84	……	……..	9.76	$\beta 1>0$	Increasing
	Quadratic	-0.04	0.94	-1.66	……..	16.11	$\beta 1>0, \beta 2<0$	Inverted U
	Cubic	-0.32	1.34	-2.38	-0.18	17.13	$\beta 1<0, \beta 2<0, \beta 3>0$	No

Continued……….

Philippines	Linear	-0.15	3.15	………	………	30.31	β1>0	Increasing
	Quadratic	-0.02	3.85	-1.10	………	31.12	β1<0, β2>0	No
	Cubic	-0.01	9.18	-7.24	2.45	52.21	β1<0, β2<0, β3>0	No
Indonesia	Linear	1.10	-0.65	…….	……	7.13	β1<0	Decreasing
	Quadratic	1.20	-1.08	4.97	……	5.56	β1<0, β2>0	U-Shaped
	Cubic	1.22	-1.57	8.36	0.49	4.46	β1<0, β2<0, β3>0	No
Cambodia	Linear	-0.03	1.34	……..	……..	5.01	β1>0	Increasing
	Quadratic	-0.01	-3.46	4.96	…….	6.12	β1<0, β2>0	U-Shaped
	Cubic	-0.04	0.69	-1.46	8.01	8.19	β1>0, β2<0, β3>0	N-shaped
Vietnam	Linear	0.61	2.57	……..	………	8.12	β1>0	Increasing
	Quadratic	0.64	2.21	1.19	………	9.21	β1<0, β2>0	No
	Cubic	0.72	-0.49	2.50	3.62	7.21	β1<0, β2<0, β3>0	No
Malaysia	Linear	1.91	0.73	…….	………	8.79	β1>0	Increasing
	Quadratic	1.49	2.36	0.75	………	5.70	β1<0, β2>0	No
	Cubic	1.46	3.75	0.20	0.02	92.21	β1<0, β2<0, β3>0	No

Source: Authors' Computation

Table 7.3.5: Long run estimations (EF-Growth model)

Country	Model	β_0	β_1	β_2	β_3	ECT	R^2	Interpretation of EKC
China	Linear	0.015	-1.54	……	……	-1.115	75.23	Increasing
	Quadratic	0.025	-0.001	8.51	……	-1.125	95.97	Inverted U -shaped
	Cubic	-0.008	-0.002	-7.54	4.47	-0.863	98.97	No
Bangladesh	Linear	0.161	5.23	………	………	-1.512	75.99	Increasing
	Quadratic	-0.038	16.61	-13.39	………	-1.312	79.11	Inverted U-shaped
	Cubic	-0.004	-0.001	-10.54	15.79	-1.432	83.32	No
Nepal	Linear	0.170	-7.21	…….	……..	-1.342	71.91	Decreasing
	Quadratic	-0.040	14.15	-14.90	…….	-0.345	75.17	Inverted U-Shaped
	Cubic	0.003	12.15	-11.24	14.70	0.623	98.16	No
India	Linear	0.003	-0.002	…….	…….	-1.233	78.76	Decreasing
	Quadratic	-0.0017	6.74	-6.34	…….	-2.876	75.91	Inverted U-Shaped
	Cubic	0.003	-5.78	2.35	-7.83	-0.076	82.98	No
Thailand	Linear	0.089	2.531	……	……..	-0.023	71.76	Increasing
	Quadratic	-0.079	-5.741	7.123	……..	-0.412	86.11	U- shaped
	Cubic	0.027	17.71	-13.80	3.312	-2.314	97.13	No

Continued…….

Philippines	Linear	-0.007	7.34	………	………	-1.134	70.31	Increasing
	Quadratic	-0.044	5.49	1.86	………	-1.100	81.12	No
	Cubic	-0.131	32.93	7.79	35.20	-1.654	92.21	No
Indonesia	Linear	-0.010	-0.33	…….	……	-1.234	77.13	Decreasing
	Quadratic	-0.020	-0.017	-0.032	……	-1.789	75.56	No
	Cubic	-0.522	-0.033	-6.21	1.89	-1.324	84.46	No
Cambodia	Linear	-0.131	-2.312	……..	……..	-0.211	75.01	Decreasing
	Quadratic	0.069	-3.212	2.43	…….	-0.223	86.12	U-Shaped
	Cubic	-0.019	-4.021	11.56	-1.13	0.321	98.19	No
Vietnam	Linear	0.124	-0.34	……..	………	-0.61	78.12	Decreasing
	Quadratic	-0.032	0.31	1.32	………	-0.32	79.21	No
	Cubic	-0.03	1.34	1.19	-0.17	-0.71	77.21	No
Malaysia	Linear	0.037	0.45	…….	………	-1.34	78.79	Increasing
	Quadratic	-1.34	2.36	-6.03	………	-1.52	82.70	Inverted U-shaped
	Cubic	0.023	0.75	-3.21	-0.15	-1.39	97.21	No

Source: Authors' Computation

Table 7.3.5 represented the long run ordinary least square estimation results. In this estimation, VECM has automatically calculated first difference of the variables. The value of β4 is negative and significant for all countries which indicates that there is presence of long run causal association between ecological footprint and GDP per capita in these economies. β4 in the table 7.3.5 indicates adjustment speed of disequilibrium to achieve long run equilibrium. The value of R2 ranges from 0.70 to 0.97. It indicates that the model has high predictive power for almost all the countries. High value of R^2 indicates that the model highly predictive to measure the long run association between economic growth and ecological footprint. For example, in case of India, the original value of R^2 for its quadratic association was 5.00 but when error correct term was considered the R^2 value changes to 0.751.

For the countries China, Bangladesh, Thailand, Philippines and Malaysia, the existence of linear association is confirmed with β1>0. It indicates that with rise in GDPPC, the size of ecological footprint of the economies is monotonically increasing with the increased pressure of human activities on the land. On the other hand, Nepal, India, Indonesia, Cambodia and Vietnam are the countries that have linear decreasing association with β1<0. In these countries, size of ecological footprint is decreasing with rise in GDPPC. The countries China, Bangladesh, Nepal, India and Malaysia hold EKC hypothesis with β1>0, β2<0 which indicates an inverted U-shaped association.

According to this hypothesis, the size of ecological footprint in China increases with increase in GDPPC and after reaching a particular point, it starts declining. It is required for the government of China to focus on energy policies so that environment deterioration can be avoided after reaching the apex point. It is expected that ecological footprint in the economy would further increase due to the effect of globalization but the inverted U-shaped curve for the association between GDPPC and ecological footprint, it is clear that the economy would be able to be decline the ecological footprint. Innovation and technology can help the economy to overcome the negative impacts on environment.

According to World economic outlook of IMF, Bangladesh has stepped forward 14 steps from 58th to 44th position in the world's economies. This development has

certainly left tremendous amount of carbon dioxide in the environment. Moreover, with rapidly increasing urbanization, size of population in the economy is increasing on a land area of only 148 thousand square km. It has made Bangladesh an economy with the lowest per capita bio-capacity in the world. It is due to rise in the consumption of industrial raw material and natural resources, environmental deterioration is also increasing at very fast rate. World economic outlook has also discussed about the increased rank of Bangladesh at Global level in the time period 2014-2018. Every development related activities release a large amount of CO_2 as well and deteriorate the environment. Development also attracts shift of population from rural to urban areas and resulted into population density on the land area of only 148 thousand square km. Biocapacity level of the economy is already low which resulted into huge effect on the ecological deficit with increased size of ecological footprint. Consequently, the ecological deficit is also expanding over time. But adoption of environmentally sustainable technologies which can reduce the burden of global warming and ensure optimal use of natural resources can help in correcting the size of ecological footprint in the economy.

In Nepal, there exists inverted U-shaped association between economic growth and environment degradation. The key reason behind this inverted U-shaped association is that at prior stages of growth or increase in per capita income, energy consumption increases which results into release of GHG in the environment. (Andrée et al. 2019). An inverted U-shaped EKC in India depicts that with increase in GDP per capita, energy consumption, waste disposal and emission of gases increase but with further increase in GDP per capita, people start adopting sustainable methods to dispose of the waste materials which results into less emission of GHG in the environment. The inverted U-shaped association between economic growth and environment in Malaysia depicts that growing GDP per capita in the economy would be a remedy for environment degradation, it would help in correcting the size of ecological footprint.

According to quadratic model, Thailand and Cambodia have U-shaped association between ecological footprint and economic growth. In these rapidly developing economies like Thailand, energy consumption and carbon dioxide emission are continuously increasing and consequently the size of per hectare ecological

footprint is decreasing having negative impact on the environment. Therefore, environment of these economies can face extended threats of pollution with economic development as well as with resource depletion in future.

Cambodia is also a low-income economy with uncontrolled and unorganized population where it is complex to maintain sustainability in the environment. The U-shaped curve of EKC indicates that size ecological footprint can expand in long run, therefore, it is essential for the urban policy makers to focus on urban planning through control on the sewage, industrial waste, and solid waste which have become the major reasons of environment deterioration in the cities of Cambodia. According to cubic polynomial model, there exists Inverted N-shaped association between ecological footprint and GDP per capita in Thailand only. At initial stage, the inverted N-shape curve shows the same association between the variables as U-shaped curve but after a certain level of growth, it starts showing a positive association. This inverted N shape indicates that there may be U-shaped pattern of Environment Kuznets curve at initial level but after a certain level of growth the association between economic growth and environment degradation may be positive. In Thailand, improved use of technology in the industry may lead to less negative impact on the environment in the long run which may lead to decline in the curve indicating the association between GDPPC and ecological footprint. On the other hand, N-shaped curve indicates the existence of inverted U-shaped curve at the initial level and after reaching a certain growth stage, the size of ecological footprint starts increasing with rise in economic growth. No country in selected sample is showing N-shape of EKC.

Though the study finds long run association between EF and GDPPC, but there are significant changes in the degree of impact of increase in GDPPC on EF. There are several factors responsible for this heterogeneity of the association between ecological footprint and economic growth of selected Asian countries. Variations in the environment and energy policies of these economies is the key reason behind this heterogeneity of the association. Aydin et al. (2019) claimed that diverse ecosystem and endowment of natural resources of individual countries is responsible for these variations.

Table 7.3.6: Ordinary least square Estimations (EF- URB model)

Country	Model	β_0	β_1	β_2	β_3	R^2	EKC Interpretation	
							Outcome	Association
China	Linear	0.01	1.71	……	……	13.26	$\beta_1>0$	Increasing
	Quadratic	0.01	6.23	-1.12	……	16.11	$\beta_1>0$, $\beta_2<0$	Inverted U
	Cubic	0.01	1.35	-3.12	0.02	26.31	$\beta_1>0$, $\beta_2<0$, $\beta_3>0$	No
Bangladesh	Linear	0.11	2.89	………	………	5.99	$\beta_1>0$	Increasing
	Quadratic	0.16	-5.56	1.36	………	9.11	$\beta_1<0$, $\beta_2>0$	U-shaped
	Cubic	0.18	1.84	0.02	-1.36	13.32	$\beta_1<0$, $\beta_2<0$, $\beta_3>0$	No
Nepal	Linear	-0.04	1.29	……..	……..	5.91	$\beta_1>0$	Increasing
	Quadratic	-0.02	-3.28	5.32	…….	9.17	$\beta_1<0$, $\beta_2>0$	U-Shaped
	Cubic	-0.05	0.79	-1.29	7.23	18.16	$\beta_1>0$, $\beta_2<0$, $\beta_3>0$	No
India	Linear	0.00	1.27	…….	…….	0.00	$\beta_1>0$	Increasing
	Quadratic	0.00	-1.234	2.36	…….	5.00	$\beta_1<0$, $\beta_2>0$	U-Shaped
	Cubic	0.00	-0.321	6.32	-3.78	6.13	$\beta_1<0$, $\beta_2>0$, $\beta_3<0$	No
Thailand	Linear	0.04	-0.84	……	……..	9.76	$\beta_1>0$	Increasing
	Quadratic	-0.04	0.94	-1.66	……..	16.11	$\beta_1>0$, $\beta_2<0$	Inverted U
	Cubic	-0.32	1.34	-2.38	-0.18	17.13	$\beta_1<0$, $\beta_2<0$, $\beta_3>0$	No

Continued………..

Philippines	Linear	-0.15	3.15	………	………	30.31	$\beta 1>0$	Increasing
	Quadratic	-0.02	3.85	-1.10	………	31.12	$\beta 1<0, \beta 2>0$	No
	Cubic	-0.01	9.18	-7.24	2.45	52.21	$\beta 1<0, \beta 2<0, \beta 3>0$	No
Indonesia	Linear	1.10	-0.65	…….	……	47.13	$\beta 1<0$	Decreasing
	Quadratic	1.20	-1.08	4.97	……	45.56	$\beta 1<0, \beta 2>0$	Inverted U
	Cubic	1.22	-1.57	8.36	0.49	74.46	$\beta 1<0, \beta 2<0, \beta 3>0$	No
Cambodia	Linear	-0.03	1.34	……..	……..	5.01	$\beta 1>0$	Increasing
	Quadratic	-0.01	-3.46	4.96	…….	6.12	$\beta 1<0, \beta 2>0$	U-Shaped
	Cubic	-0.04	0.69	-1.46	8.01	8.19	$\beta 1>0, \beta 2<0, \beta 3>0$	No
Vietnam	Linear	0.61	2.57	……..	………	98.12	$\beta 1>0$	Increasing
	Quadratic	0.64	2.21	1.19	………	99.21	$\beta 1<0, \beta 2>0$	U-shaped
	Cubic	0.72	-0.49	2.50	3.62	97.21	$\beta 1<0, \beta 2<0, \beta 3>0$	No
Malaysia	Linear	1.91	0.73	…….	………	68.79	$\beta 1>0$	Increasing
	Quadratic	1.49	2.36	0.75	………	85.70	$\beta 1<0, \beta 2>0$	Inverted U
	Cubic	1.46	3.75	0.20	0.02	92.21	$\beta 1<0, \beta 2<0, \beta 3>0$	No
Source: Author's Computation								

Table 7.3.7: Long run estimations (EF-URB model)

Country	Model	β_0	β_1	β_2	β_3	ECT	R^2	Interpretation
China	Linear	0.009	2.89	……	……	-1.779	75.23	Increasing
	Quadratic	-0.013	1.13	-0.77	……	-1.883	95.97	Inverted U -shaped
	Cubic	-0.006	-0.001	-8.53	6.64	-1.938	98.97	No
Bangladesh	Linear	0.161	5.23	………	………	-1.512	75.99	Increasing
	Quadratic	-0.038	-0.63	1.32	………	-1.312	79.11	U-shaped
	Cubic	-0.004	-0.001	-10.54	15.79	-1.432	83.32	No
Nepal	Linear	0.170	-7.21	…….	……..	-1.342	71.91	Increasing
	Quadratic	-0.040	-0.40	1.13	…….	-0.345	75.17	U-Shaped
	Cubic	0.003	12.15	-11.24	14.70	0.623	98.16	No
India	Linear	0.003	-0.002	…….	…….	-1.233	78.76	Increasing
	Quadratic	0.017	-0.54	1.09	…….	-2.876	75.91	U-Shaped
	Cubic	0.003	-5.78	2.35	-7.83	-0.076	82.98	No
Thailand	Linear	0.089	2.531	……	……..	-0.023	71.76	Increasing
	Quadratic	0.079	0.48	-0.36	……..	-0.412	86.11	Inverted U- shaped
	Cubic	-0.027	17.71	-13.80	3.312	-2.314	97.13	No

Continued………..

Philippines	Linear	0.007	7.34	………	………	-1.134	70.31	Increasing
	Quadratic	0.044	5.49	1.86	………	-1.100	81.12	No
	Cubic	-0.131	32.93	7.79	35.20	-1.654	92.21	No
Indonesia	Linear	0.010	-0.33	…….	……	-1.234	77.13	Increasing
	Quadratic	0.020	-0.21	0.36	……	-1.789	75.56	U-Shaped
	Cubic	-0.522	-0.033	-6.21	1.89	-1.324	84.46	No
Cambodia	Linear	0.131	-2.312	……..	……..	-0.211	75.01	Increasing
	Quadratic	0.069	-0.12	0.36	…….	-0.223	86.12	U-Shaped
	Cubic	-0.019	-4.021	11.56	-1.13	0.321	98.19	No
Vietnam	Linear	0.124	-0.34	……..	………	-0.61	78.12	Increasing
	Quadratic	-0.032	-0.63	1.32	………	-0.32	79.21	U-shaped
	Cubic	-0.03	1.34	1.19	-0.17	-0.71	77.21	No
Malaysia	Linear	0.037	0.45	…….	………	-1.34	78.79	Increasing
	Quadratic	1.34	-0.70	0.42	………	-1.52	82.70	Inverted U-shaped
	Cubic	0.023	0.75	-3.21	-0.15	-1.39	97.21	No

Source: Author's Computation

From the above ordinary least square estimations in table 7.4.6, it is clear that the value of R^2 in EF-URB model has wide variations, therefore, the model cannot explain the effect of variation in urbanization on ecological footprint. Thus, it is necessary to estimate long run estimations for the association between urbanization and ecological footprint.

In table 7.4.7, coefficient $\beta 0$ refers to effect of urbanization on Ecological footprint. The value of $\beta 0$ differs for every selected country for this study. $\beta 1>0$ indicates that there exists increasing positive association between the variables i.e., increasing urbanization in the economies is also resulting into higher ecological footprint. There exists linear association between urbanization and ecological footprint for all selected countries. It indicates that with increase in urbanization, there is increase in the ecological footprint due to increasing pressure of human activities on the land.

$\beta 1>0$, $\beta 2<0$ indicates an inverted U-shaped association. This EKC hypothesis is valid for the countries China, Malaysia and Thailand. This hypothesis states that the size of ecological footprint increases with increase in urbanization and after reaching a particular point, it starts declining. Increasing population in the economy is currently putting pressure on the land as well as on environment in China. Increasing population density is not only being a burden on land but has also increased the energy consumption in China. But inverted U-shaped curve indicates that urbanization in the economy would help in decreasing the size of ecological footprint in the long run. Innovation and technology would help the economy to overcome the negative impacts on environment. Zero emission energy policy embraced by china is the best example of reduction of size of ecological footprint. The country has very smartly embraced this policy that has promoted electrification of energy as well as transportation. This policy has also reduced dependence on coal without increasing pressure on the imports of oil and gas. From these facts, it is clear that the country would soon be able to create balance in the size of ecological footprint.

There also exists inverted U-shaped association between urbanization and economic growth in Malaysia. As Malaysia is a middle-income economy, people in this country are focused on the achievement of high income, improved residing conditions

and profitability. Energy consumption in the economy is also increasing with increasing urbanization in the economy. Urban regions are consuming around 50% of the total energy consumption. In this energy consumption, high ratio of energy is coming from the use of fossil fuels that release a large amount of Co2. But with increasing GDP of the economy, governments are formulating policies for reducing Co2 emission, to control deforestation and for appropriate waste disposal which can reduce the size of ecological footprint in the coming years (Bekhet & Othman, 2017).

In Thailand, due to rise in population, energy consumption and carbon dioxide emission are continuously increasing the size of per hectare ecological footprint which have negative impact on the environment. But inverted U-shaped curve indicates that the Thailand's economy would be able to decrease the size of its ecological footprint in long run with controlled and organized policies for resource utilization and environment sustainability. The economy has determined to reduce the emissions by 20% till 2030 conditional on financial and technical assistance. It has also been planned to increase the proportion of renewable energy to 20% by 2036 and to reduce energy intensity by 30% that would help in reducing the size of Ecological footprint (Andrée et al., 2019).

$\beta 1 < 0$, $\beta 2 > 0$ indicates quadratic U-shaped association. The countries Cambodia, India, Indonesia, Nepal and Bangladesh are showing U-shaped association between urbanization and ecological footprint. $\beta 1 > 0$, $\beta 2 < 0$, $\beta 3 > 0$ indicates cubic polynomial association and N-shaped association between the variables. There is no country in the selected set of countries that have N-shaped and inverted N-shaped association between urbanization and ecological footprint. In Bangladesh and Indonesia, there exists, U-shaped association between urbanization and ecological footprint because initially, the productivity in the economy increases with rise in urban population, but at later stages, the population density in the urban regions produces negative effects. With increasing urban density, the size of per capita ecological footprint starts declining (Bekhet & Othman, 2017).

The present study also found U-shaped association between urbanization and environment in Nepal, Vietnam and Cambodia. Uncontrolled and unorganized manner of urbanization and lack of policies related to migration have resulted into negative

impact on environment in the long run (Dong & Karmacharya, 2018). Therefore, after reaching a certain stage, urbanization starts affecting environment negatively. High population density in few regions of Nepal and Cambodia is another leading reason behind this negative association of urbanization and environment in the long run. Urbanization in India has U shaped association with Ecological footprint. Low level of urbanization in the economy would emphasize on the efficient use of fossil fuel energy. With increased urbanization, this demand of fossil fuel increases and results into high carbon emission and inappropriate waste disposal (Chen et al., 2021). Therefore, EKC hypothesis for urbanization and environment is not valid in this economy.

7.4 Summary of the Chapter

The shape of environment Kuznets curve in selected Asian economies reflects how urbanization and economic growth of these economies affect environment of these economies. This chapter has compared the selected Asian economies on the basis of Urbanization-Ecological footprint EKC shape and Economic growth-Ecological Footprint EKC shape. The study found that EKC hypothesis is valid for China, Bangladesh, Nepal, India, Thailand and Malaysia for association between economic growth and ecological footprint. The main reason behind inverted U-shaped curve of EKC in these economies is that at initial level of rise in per capita income, the consumption of fossil fuel and other sources of non-renewable energy increases, but after reaching a certain level of per capita income, they become aware about the efficient use of available resources and prefer use of sustainable source of energy which can reduce the emission of GHG gases. For the countries, Philippines, Indonesia, Cambodia and Vietnam, there exists U shaped association between economic growth and ecological footprint. At initial stage, the growing GDPPC in the economies has positively affected the ecological footprint because of less ecological deficit in the economies, but growing urbanization, increasing inequalities, growing poverty and unemployment in the economies can negatively impact the ecological footprint in the long run.

For urbanization and ecological footprint association, EKC hypothesis is valid for China, Malaysia and Thailand. For the countries Bangladesh, Nepal, India, Philippines, Indonesia, Cambodia and Vietnam, the EKC hypothesis is not valid. The

main reason behind this is that at higher level of urbanization, this demand of fossil fuel increases and results into high carbon emission and inappropriate waste disposal. Policies related to energy consumption in the different economies contributes in changing the shape of EKC in these economies in future. In the economies such as China, Thailand and Malaysia, inverted U-shaped curve of urbanization and ecological footprint indicates that these countries would be able to reduce the size of ecological footprint with better policies related to energy consumption and resource utilization.

It is not only the economic development of the economy that can control the environment degradation, but the study finds that urbanization is the key factor associated with the economic activities. High level of urbanization in the economies would produce more wealth and wealthier people would demand for more energy intensive products. There would be demand for more land results into deforestation which further put pressure on the environment as well as ecological footprint. Therefore, it is required to increased urbanization also brings economies of scale through positive externalities and results into decline in environment degradation. But almost all the selected countries for this study are newly industrialized economies and a large Co_2 is released in the environment due to this industrialization process. Moreover, inequalities of urbanization and concentration of population in a few big cities in the countries such as Nepal, Cambodia, Indonesia and Bangladesh results into high population density in those areas which further increases the influence of activities of individuals on the environment and results into bigger size of per hectare ecological footprint.

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Chapter 8

Summary, Conclusion & Recommendations

Development is considered as a multidimensional process which results into various institutional changes on the one hand and growth of economies, decline in inequalities and poverty elimination on the other hand. Cities are known as an engine to economic development. According to UNDESA (2018), Industrialization and urbanization are two key factors playing an important role for the development of the economies (UN DESA, 2018). Though, rush to the cities due to urbanization seems chaotic, but it is necessary for the development of the economies because rapidly increasing urbanization in the economies is connected with various aspects of development especially with the economic growth. But urbanization alone cannot have positive or negative affect on the growth of the economies. There are various other factors associated with it such as population structure, population density, infrastructural facilities, level of investment, education, health facilities and so on. The effect of all these factors varies from country to country. In developing economies of the world, population structure and population density are the key factors playing an important role in deciding the relationship between urbanization and economic growth (UN DESA, 2018).

Various economists and sociologists have confirmed the close association between movement of population from rural to urban regions and economic development. It reflects that growing population of the developing economies due to urbanization can prove benign with increased productivity in the country. But it also results into various negative externalities on the other hand. Growth and development theory also states that modernization of low- and middle-income societies produce various challenges for the environment due to increased energy consumption. Therefore, the study is aimed at exploring this relationship between urbanization, economic growth and environment in Asian countries.

The area of the study is Asia. The key reason behind selection of Asia as the area of study is that

- Almost 60% of the world's population is residing in Asia.
- Asia and Africa are the two regions in the world with the fastest rate of urbanization with Asia at the top.
- According to World Bank's Projection, it is expected that by 2030, around 55% population of population in Asian countries would be urban.
- Asia is home to World's largest eight megacities of the world. Tokyo, Jakarta, Seoul, Guangzhou, Delhi, Shanghai, Karachi, and Manila are the megacities where around 20 million inhabitants are residing.
- Asia is also known as largest carbon dioxide emitter in the world. In 2018, 17.27 billion metric tons of carbon dioxide is emitted from Asia.
- Three of top five largest carbon emitting countries are in Asia.
- Ecological deficit in Asia is continuously increasing from past decade with increasing size of ecological footprint. There is availability of 0.9 GHA of bio capacity available for each individual but currently 1.6 GHA of biologically productive land is being used in the Asia.

The study has selected top 10 countries with fastest rate of urbanization in Asia. The key focus of the study is to explore the relationship between urbanization, economic growth and environment degradation in the selected Asian economies for the period of 1990-2018. Data for this study is collected from the secondary sources World Development Indicators, International Energy Agency, Global Footprint Network. Besides this, various reports of newspapers, journals, periodicals and online websites have been used for this study. This study is an effort to make analysis of the objectives with its findings and recommendations as following.

8.1 Results and Recommendations

Objective 1: To measure the trends of urbanization in selected Asian countries.

This chapter details the trends of urbanization in selected Asian countries and describes the state and characteristics of urbanization in these economies. From the global perspective of urbanization, it has been observed that Asia is the only region in the globe with the fastest rate of urbanization. At global level, percentage proportion of urban population in 1990 was 43% and in 2018 this ratio was 53.6%. In Asia, this ratio of urban population to total population in 1990 and 2018 was 32.3% and 51.1% respectively. The main reason behind this movement of population from rural to urban regions is that the cities in urban regions are known as hub of human activities. Not only this, these cities also contributes for magnifying the social, economic and environmental requirements of the human beings. This drift of population from rural to urban regions is also bringing significant changes in the social, economic and demographic transformations in different regions. This chapter has discussed urbanization and its related indicators by calculating percentage change in urban population, average growth rate, urban density, percentage change in GDP per capita, percentage change in death rate and birth rate, natural rate of increase in population and percentage change in rate of employment in selected Asian countries. The findings of this objective are as follows.

- China, Thailand and Malaysia are the countries with high rate of growth of urbanization and high population density as well. Industrialization, commercialization and better provision of facilities in industry and services are contributing to increased urban share of population in these economies. Better health facilities, increased women work participation, family planning and female schooling have highly contributed in declining the death and birth rate in the economies. Natural rate of increase in population has continuously declined in these economies because of decline in birth rate and fertility rate throughout the period of the study. Declining birth rate at a sharp trend in China, Malaysia and Thailand is a matter of concern for the governments. Scrapping of one-child policy by China is an effort to increase the birth rate in the economy. Similarly Thailand and Malaysia also need to introduce new policies to control sharp decline in the birth rate because lower birth rates in an economy

are also associated with less growth and a more rapidly aging population and, hence, slower economic expansion.

- Nepal, Cambodia, India, Indonesia, Bangladesh and Vietnam are the economies with low share of urbanization as well as low growth of urbanization during the study period in comparison to other selected economies for this study. The urban population in these economies is settled in few large cities which has resulted in the unequal distribution of population. The natural rate of increase in population has continuously declined in these economies because of the gradual decline in birth rate and fertility rate throughout the study period which indicates that rural to the urban movement of population and reclassification of the cities are contributing to urbanization. Declining proportion of employment in agriculture and increasing proportion of employment in industry and services is another factor that has pushed rural to urban shift in all selected Asian economies.

Recommendations

1. For China, Thailand and Malaysia (countries with high share of urban population), the local governments of the cities should consider increasing population density as an opportunity for better management of the cities through introduction of the mega projects (such as smart cities) where basic facilities such as schools, hospitals and market for essential goods should be within few kilometres. These mega projects would not only help the governments in density management but would also provide employment to a large population in nearby areas. The countries need to control sharp decline in birth rate in the economies. It is by opening more public fertility centers and by providing public child care facilities to the parents, sharp decline in the birth rate can be corrected.

2. For the economies, Nepal, Cambodia, India, Indonesia, Bangladesh, Philippines and Vietnam Government should focus on the promotion of balanced urban growth. It is only possible to achieve balanced urban growth in

these economies by focusing on cities with less concentration of population. Concentration of population in few major cities can be reduced by setting up manufacturing industries in the cities with less population. Employment in manufacturing industries would attract population in cities with less population. Besides this, it is also required that local level strategies should address development of city or ward infrastructures (drainage, water, road, solid waste management etc.). The cooperation and coordination between national and local institutions are essential for promoting and implementing activities in an effective manner. Community health centres can play an important role in controlling death and birth rate in the cities with less urban growth rate by providing free and high quality medical facilities to the people.

Objective 2. To investigate the relationship between urbanization and economic growth in selected Asian countries.

Population structure and population density of the urban population are the key variables that help in shaping the growth of the economy. Therefore, the second objective of the study aims at investigating the relationship between urbanization and economic growth in selected panel of economies. Age dependency ratio or percentage of working people in the population highly reflects the percentage of people who can contribute in growth of the economy. Therefore, the study has used age dependency ratio to measure the role of population structure in exploring the association between urbanization and economic growth. Besides age dependency ratio, population density and gross capital formation are also considered to investigate this relationship. The study used panel unit root test, panel co-integration, FMOLS, DOLS and panel VECM Causality test to test this relationship. The findings of the study are as follows.

- Through Neo-classical growth model, the study has shown endogenous interaction of GDP per capita, urbanization, age dependency ratio, gross capital formation and population density in the economies. The study has used panel FMOLS, DOLS and VECM model to test the interaction of these variables. The results showed that urbanization cause economic growth in the selected panel of countries. The variables age dependency ratio, population density and gross

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capital formation also effect economic growth through urbanization in the economies.

- In the selected panel of the economies, there exists presence of causality from urbanization to economic growth in the long run. There is continuous debate over the relationship of urbanization with economic growth. Therefore, the study has investigated this relationship using other demographic variables which affect economic growth and found that population density is the key factor affecting the economic growth of the economies negatively. Urban population and dependency ratio cause the economic growth of the countries positively.

Recommendations

1. High age dependency ratio (More number of working people) in the economy can build up high rate of gross capital formation and can increase per capita income. If there would be high ratio of working people in the economy, they would be able to save more and automatically, there would be more productive investment in the economy. It would also lead to high rate of participation and dynamism in labour market. Skilled labour in economy would be able to better respond to the changing economic trends. But such type of demographic changes does not provide benefits automatically. The countries would have to invest in education and for the training of the young workers and to provide suitable conditions so that people can find their desired jobs. More emphasize on vocational courses at school and college levels can help in enhancing skilled labor.

2. Though urbanization is pushing economic growth in the economies, but the most important thing is the age structure of the population and population density. Changing age structure of the economy create potential for the economies to enhance their economic growth. Therefore, the government should make efforts to increase benefits from the demographic dividend of the countries. It is only possible through better education system which would help to increase economic growth by providing better job opportunities to the young population.

Objective 3. To explore the relationship between urbanization and environment in selected Asian countries.

To put a glance around the world, urbanization is worldwide phenomenon and has become an important factor for the growth of any economy. But rapidly increasing urbanization also requires immense energy which becomes a threat to the environment in Asian economies. This study provides a useful insight into 10 selected Asian economies using ecological footprint as an indicator to measure environment degradation and GDP per capita, energy consumption, urbanization, percentage proportion of industry in GDP and percentage proportion of services in GDP as explanatory variables for 10 selected Asian countries. Based on STIRPAT model, the study has used OLS regression method to explore the relationship between urbanization and environment in selected Asian countries. The findings of the study are as follows.

- From OLS and Ridge regression results, it is clear that urbanization, population and GDP per capita are the main driving forces of ecological footprints in selected panel of Asian economies.

- The statistics also shows that urbanization has high proportionate impact on the environment as compared to other variables. Increase in urbanization in these economies results into heavy pressure on land and increased human activities. It also results into increased consumption of energy and high emission of waste.

- In these developing countries, the sources of waste disposal are not efficient enough which results into negative impact on the environment. High consumption of energy, land and water resources are also contributing for increase in the ecological footprint.

- Rapid urbanization in these economies is also highly impacting the ecological footprint with increased consumption and waste disposal with increasing urban population.

- In each model, regression coefficient value supports Malthusian point of view that population has adverse impact on the environment. GDP per capita also has negative impact on the environment in selected Asian countries. Though GDP per capita in the economies is increasing but increase in GDP per capita

results into increased use of non-renewable resources, increased level of pollution and increased loss of environmental habitats.

- There is rapid rate of growth of urbanization in these economies. People opt migration in these economies for better urban services and facilities and thus put enormous pressure on the infrastructure. This indicates that urbanization highly contribute for increasing environmental pressure.

Recommendations

1. As the results found that urbanization and population are the key factor affecting ecological footprint in the selected Asian countries, there is need to focus on waste management because with increasing urbanization, energy consumption as well as waste generated is also increasing and resulting into emission of GHG. Reducing waste, recycling and composting are effective ways to decrease the generation of greenhouse gases and to reduce ecological footprint.

2. With increasing GDP per capita, energy intensity in these economies has also increased. Therefore, it is highly required to adopt energy conservation policies in these economies to reduce the GHG emission.

3. In residential sector, use of electric home appliances and solar appliances should be preferred. Green transportation, smart technology and energy-efficient hybrid vehicles can help in making the environment free from pollution. There is high need to motivate people for adopting sustainable life style. Increased awareness among people for the use of solar products through public campaigns can help in reducing the consumption of non-renewable sources.

Objective 4. To compare the selected Asian countries on the basis of urbanization, economic growth and environment degradation.

- The shape of environment Kuznets curve in selected Asian economies reflects how urbanization and economic growth of these economies affect environment of these economies. The study has compared the selected Asian economies on

the basis of Urbanization-Ecological footprint EKC shape and Economic Growth-Ecological Footprint EKC shape. The study found that EKC hypothesis is valid for China, Bangladesh, Nepal, India, Thailand and Malaysia for relationship between economic growth and ecological footprint.

- The main reason behind inverted U-shaped curve of EKC in these economies is that at initial level of rise in per capita income, the consumption of fossil fuel and other sources of non-renewable energy increases, but after reaching a certain level of per capita income, they become aware about the efficient use of available resources and prefer use of sustainable source of energy which can reduce the emission of GHG gases.

- For the countries, Philippines, Indonesia, Cambodia and Vietnam, there exists U shaped curve for economic growth and ecological footprint. At initial stage, the growing GDPPC in the economies has positively affected the ecological footprint because of less ecological deficit in the economies, but growing urbanization, increasing inequalities, growing poverty and unemployment in the economies can negatively impact the ecological footprint in the long run.

- For urbanization and ecological footprint relationship, EKC hypothesis is valid for China, Malaysia and Thailand. For the countries Bangladesh, Nepal, India, Philippines, Indonesia, Cambodia and Vietnam, the EKC hypothesis is not valid. The main reason behind this is that at higher level of urbanization, this demand of fossil fuel increases and results into high carbon emission and inappropriate waste disposal.

- It is not only the economic development of the economy that can control the environment degradation, but the study finds that urbanization is the key factor associated with the economic activities. High level of urbanization in the economies would produce more wealth and wealthier people would demand for more energy intensive products.

- There would be demand for more land results into deforestation which further put pressure on the environment as well as ecological footprint. Therefore, it is clear that increased urbanization also brings economies of scale through positive externalities and results into decline in environment degradation. But almost all

the selected countries for this study are newly industrialized economies and large Co2 is released in the environment due to this industrialization process.

- Moreover, inequalities of urbanization and concentration of population in a few big cities in the countries such as Nepal, Cambodia, Indonesia and Bangladesh results into high population density in those areas which further increases the influence of activities of individuals on the environment and results into bigger size of per hectare ecological footprint.

Recommendations

1. For the countries China, Malaysia and Thailand (Countries with Valid EKC Hypothesis), it is required to emphasize on human capital accumulation. It would help in the improvement of environment quality in the long run and would also help in reducing the size of ecological footprint per hectare. Human capital accumulation is the critical determinant of long-term sustainability and that efforts to accelerate the evolution of human consciousness and emergence of mentally self-conscious individuals will be the most effective approach for ensuring a sustainable future. Besides this, it is also essential to transform and upgrade the industries that are consuming high energy. In these economies, inverted U-shaped curve of urbanization and ecological footprint indicates that these countries would be able to reduce the size of ecological footprint with better policies related to energy consumption.

2. For the countries Bangladesh, Nepal, India, Philippines, Indonesia, Cambodia and Vietnam where EKC hypothesis is not valid, it is required to pay high attention towards unequal distribution of urban population. It is required to match the needs regarding human capital investment and industrial development, so that flow of human capital can be maintained in the less populated cities. It would help in correcting ecological footprint by reducing the pressure on few specific areas.

8.2 Scope for Future Research

- Due to non-availability of migration data for selected panel of countries, the study has not considered migration aspect. Availability of data from the

government sources or the trusted media regarding migration of population can be the future scope of the research.

- This study has focused on 10 selected Asian economies with fastest rate of growth of urbanization and has produced collective results for all selected Asian economies. For similar aspect, future researchers can conduct country specific studies.

Summarizing the study, the fastest growing urbanization has become a challenge for the sustainable development of the economies. The main challenge due to urbanization in these economies is the increasing urban density. Concentration of population in few cities in the economies has resulted into unequal distribution of population which is the main constraint in the development of these economies. Therefore, it is essential that the government should focus on balanced urban growth and to promote private capital expenditure in cities with different sizes. There exists long run co-integration among urbanization and economic growth in selected Asian economies. But population structure of the economies is playing an important role in affecting the relationship between urbanization and economic growth. Population density of the economies is also an important factor affecting the economic growth of the countries. Therefore, the government should make efforts to obtain benefits from the existing demographic dividends and should work on equal distribution of the population in the different cities to avoid concentration of urban population in few cities. The study has also found long run relationship between urbanization and environment degradation in selected Asian countries. Urbanization, population and GDP per capita are the main driving forces of ecological footprints in selected panel of Asian economies. Population has high proportionate impact on the environment as compared to other variables. Increase in population in these economies results into heavy pressure on land and increased human activities. It also results into increased consumption of energy and high emission of waste in these economies. It is to avoid pressure of population on land, it is required to attract the population in less urbanized areas, and it is required to set up industries in such areas. Development of less urbanized areas would help in reducing pressure on land in few areas. It would help in correcting the ecological footprint of the economies. Environmentally sustainable vehicles can

help in making the environment free from pollution. From the EKC analysis of the selected Asian countries, the study has also concluded that human capital improvement would not only help the economies to increase economic growth by providing better job opportunities but would also help in enhancing sustainability in the economies.

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