CHAPTER 5

CONCLUSION AND POLICY RECOMMENDATIONS

While contemplating possible sustainable growth, it is important to provide a detailed understanding of both the historical and current circumstances in terms of the relationship between economic development and environmental quality.

Grossman and Krueger, as well as Shafik and Bandyopadhyay, conducted an economic analysis on the EKC, with the latter serving as the background study for the World Bank report. By way of World Bank, the term became commonly accepted. Furthermore, it was expected that the EKC would be able to forecast long-term environmental changes and thus encourage formulation of environmental policies.

Since economic growth and environmental protection are mutually exclusive, some environmental pollution is inevitable during the early stages of development. However, pollution has the potential to cause long-term environmental damage. As pollution rises, the environment becomes a more scarce resource, increasing its significance. Additionally because effective pollution reduction steps are taken in coordination with capital accumulation, economic development and environmental protection can coexist.

Because of its potential and promising consequences for making economic growth sustainable, the validity of the Environmental Kuznets Curve (EKC) has become customary in technical debates regarding environmental policy. The expected shape of the EKC and the projected income turning point are not the same for every country. Since countries vary significantly in terms of political, social, economic, and biophysical influences, one should expect different trends in their relationships between the environment and the economy.

To reiterate, the study examines existence of the EKC hypothesis and its applicability to the Indian economy. The study investigates the underlying course of EKC by decomposing the causes of environmental degradation into four effects viz. economic effect, demographic effect, environmental effect and governance effect. The results of decomposition is utilized to investigate the impact of structural change on environmental quality in India. Taking everything into account the study concludes the

existence of EKC for India and underlines the impact of demographic factors on environmental degradation.

To recapitulate Part A of the study focuses on analyzing traditional EKC hypotheses and concludes that there is a positive correlation between economic growth (measured in terms of GDP per capita) and environmental quality (in terms of CO_2 emissions) with respect to India. The initial estimation reflects a monotonically increasing function but with the help of curve fitting technique a cubic function was extracted for the relationship. This indicates that while CO_2 emissions in India have increased since 1960, it might reduce in future and under certain circumstances might increase, reflecting an N-shaped curve. Developing countries in their process of development degrade the environmental quality. As per Economic Survey 2020-21 India's GDP (at constant 2011-12 prices) was estimated at Rs. 33.14 trillion for the second quarter of FY2020-21 and GVA by service sector was approx. Rs. 17.9 trillion. 54 percent of GDP was contributed by the service sector. India's workforce distribution across economic sectors depicts 41.49% of workforce in agricultural sector, 26.18% in industrial sector and 32.33% in service sector. Still stuck in the transition phase, India is expected to degrade its environment further until a turning point is reached.

The study has attempted to predict the CO_2 emissions in India and found that, after 2030 the emissions stagnate. This forecast can be said to be consistent with the concept of race to bottom by Dasgupta et. al. 2002. On the basis of beta coefficient values and their significance levels the study rejects the null hypotheses, that there is no significant relationship between economic growth and environmental quality in India. The alternate hypothesis, with all beta coefficients in the cubic function being non-zero, is accepted. Hence Part A of the study concludes that Indian EKC can be an N-shaped curve.

It can be concluded from the results presented in Part B of the previous chapter, that the Environmental Kuznets Curve in India has been affected by structural change in the economy. It discusses the decomposition analysis. To put it simply, it is breaking up all the effects that influence the environmental quality in the economy. These effects in the literature review were categorized as: scale effect, composition effect and technological

effect. In the present study four effects were identified to be influencing environmental quality in India. These are presented in terms of factors as they are extracted using principal component analysis. The study has captured individual impact of these effects on EKC in India.

Economic effect (written as economic factor in earlier chapters) comprises of trade element, electricity produced from coal sources, share of industry in GDP and foreign direct investment. It reflects the level of economic activity in terms of production. As per the literature review the larger scale of economic activity degrades the environmental quality as production and output levels increase in the economy. Environment and natural resources are used as input in the production process. Higher levels of production in the economy leads to higher rate of natural resource extraction thus degrading environmental quality. All the variables used to create a composite index are positively correlated with the economic factor and in turn, initially positively correlated to environmental quality. It is important to de-link environmental quality from economic growth as is the case in OECD countries. De-linking is the only way out.

Demographic effect comprises of population density, urban population as percentage of total population, population on ages 15-64 as percentage of total, urban poverty as a percentage of total population.

Urban population refers to people living in urban areas as defined by national statistical offices. Explosive growth of the urban areas signifies demographic transition from rural to urban. This transition is a consequence of structural change in the economy from an agrarian to industrial economy. The age distribution of a country's population affects its growth trends in part. Different age groups have varying effects on the climate and infrastructure requirements. Therefore the age structure of a population is useful for analyzing resource use and formulating future policy and planning goals with regards to infrastructure and development.

Urban sprawl resulting from the demographic transition from rural to urban causes (Rubiera-Morollón, F., & Garrido-Yserte, 2020) immediate environmental impact through urban extension, soil predation or landscape effects. Their study also highlights

that there is relationship among sprawl, climate change, energy efficiency and urban sustainability. Urban sprawl increases the average distance travelled and obstructs the use of less-energy intensive transportation modes. Other gases and particulates are emitted as a result of burning fossil fuels and commuters generate emissions which lowers the ambient quality of the air.

Longer transportation distances worsen traffic congestion, causing lost efficiency, and necessitate more comprehensive infrastructure (such as more highways), which has a negative effect on the environment by raising impervious cover and needing more natural capital.

Environmental effect comprises of access to alternative fuel and nuclear energy, access to clean fuel for cooking, access to electricity and people practicing open defecation. These basic needs of people define the role of hygiene and sanitation for a dignified human life. Sanitation is one of the major components that impacts the standard of living. Poor sanitation conditions and non-availability of clean fuel and electricity are barriers to improve livelihood in developing economies. Energy is important to create growth in the economy. Access to electricity is crucial to human development as it is necessary for basic activities and cannot be replaced by any other form of energy. Use of energy is important in improving people's standard of living. But electricity generation also can damage the environment. Whether such damage occurs depends largely on how electricity is generated. For example, burning coal releases twice as much carbon dioxide - a major contributor to global warming - as does burning an equivalent amount of natural gas.

The global investment in renewable energy, driven by wind and solar, has increased over the last few decades. Many governments have introduced programmes to encourage consumers to purchase electric cars. The growth of fossil fuels continues to outpace alternative and renewable energy sources. Coal is the world's fastest-growing energy source.

Governments in many countries are aware of the fact that they need to make better use of the world's energy resources. Improved energy efficiency is often the most economic

and readily available means of improving energy security and reducing greenhouse gas emissions.

Governance factors include the concepts used by World Resources to create a World Governance Index. A report by Swedish Environmental Protection Agency on The role of Governance for improved Environmental Outcomes in 2012 provides evidences of the linkages between policy implementation and different governance aspects. The report highlights key parameters to evaluate the governance level in the economy. These parameters are effectiveness and efficiency of the processes and institutions, fairness and impartial enforcement of legal framework, accountability of the stakeholders, opportunity to participate in the decision making process and transparency.

In conclusion, weak rule of law, high corruption risk, low transparency and lack of participation restrict the implementation of environmental legislation, obstructs accountability and suppress voices and rights of vulnerable groups.

Availability of governance data since 1996 limits the study in analysing the governance position during pre-liberalization. Though the direct and indirect impact of governance factors is not so great, it helps in establishing the linkage between economic growth, environmental quality and governance.

The result in Part C of the analysis lay emphasize on change in the source of emissions during pre and post liberalization in India as a part of structural change in the economy. During pre-liberalization, environmental factors comprising of use of alternative and nuclear energy, access to clean fuels and technologies for cooking, and access to electricity were the main culprits. The structure of the economy was diverse from what it is today. During the period 1971-2005, India's electricity consumption per capita in kilowatt-hours (KWh) and real GDP per capita both increased. This suggests that electricity may have played a significant role in India's economic development. During the period 1979-1992, annual growth in electricity consumption per capita outpaced annual growth in real GDP per capita. The shift in energy consumption patterns from traditional - fuel wood, crop residue, animal waste, and animal draught power towards commercial forms - coal, refined oil, natural gas, and electricity presented a disaggregated pattern of energy consumption and emissions in India (Tiwari. A, 2011).

The per capita carbon emissions in India is very low at 0.26 tons per year. However because of the growing population, these numbers are large and will grow to only increase in future.

The scenario during post-liberalization period is extremely diverse. The heart of the entire growth-environment debate lies in understanding the influence of foreign direct investment on environmental quality of the economy. Economic reforms in India in 1991 led to sanctioning of foreign direct investment because the reforms systematically removed restrictions on trade and FDI. The evidence from Gamper-Rabindran *et. al.* 2004, supports the statement that exports and FDI grew in pollution-intensive industries. The pollution-haven hypotheses (PHH) was applicable in Indian scenario as FDI supported exports that polluted water and air quality in India. Economic reforms consequently promoted economic growth in India but it has also degraded the environmental quality. Economic growth encouraged rural-urban migration for better employment opportunities. In the last decade, degree of urbanization has risen to approx. 35% of the total population. According to Bloomberg India it is expected to rise to 50% by 2050. Structural changes eliminate obstacles to the growth drivers by liberalizing institutions and economic activities.

5.1 Overview

Syrquin, M. (1988) in his work on patterns of structural change has stated that economic development is seen as an interrelated set of long-run processes of structural change accompanying economic growth. He pointed out eleven economy-wide phenomena such as industrialization, changes in the location of economic activity (urbanization), agricultural transformation, sectoral transformation, and increase in the rates of accumulation, change in the consumption basket of the economy as structural transformation.

The accumulation of physical and human capital and shifts in the composition - demand, trade, production, and employment, are described by Chenery (1986) as the economic core of the transformation.

The results of the study finds evidence in the economic theory that change in the location of economic activity, known as urbanization, has been identified as structural transformation in the economy. Lampard (1955) proposed a comprehensive method of analyzing urbanization, and argued that urbanization is actually a multidimensional reflection of physical, spatial, institutional, economic, population and social characteristics.

After the 1991 new economic policy implementation, India in the last 3 decades has seen structural transformation in the economy. Unequal productivity, diminishing returns to scale in exchange and diminishing returns to scale in production incentivize movement of population from rural to urban areas. Agglomeration economies are strong to offset the cost of clustering firms in urban areas forms clusters causing development. Opportunities to share infrastructure, work force and knowledge spillovers benefits clustering. Development of such specialized urban areas are capable of fulfilling domestic as well as international demand for goods.

Shift in the location of production activity caused large scale urbanization in India. Specialized clustering of industries was complemented by change in institutional power in the country, globalization, and marketization. Emergence of new global manufacturing system also promoted trade.

Liberalization policy has been pursued to promote economic growth and increase national income. It encourages job creation, investment and productivity. People tend to fulfill basic needs of food, housing and clothing and increase effective demand in the economy. As per Engel's law of consumption, the weightage of non-food items increase in the consumption basket and that of food items decrease. As economy experiences a structural shift the demand and consumption pattern also change. Demand for housing, education and better life style encourage urban sprawl. As per Arthur O'Sullivan preference for living spaces encourage urban areas to grow out. Underpricing of fringe infrastructure, availability of mortgage subsidies and zoning impact the environmental quality.

5.2 Current Status of Each Variable in India and Its Implication At Large.

As per World Bank statistics 2021 carbon dioxide emissions per capita have enlarged substantially from 0.42 tons to 1.9 tons with an annual rate reaching 10.08% in 2009. It is expected to increase even further as the growth rate of energy production from coal sources is 70% of total energy production. Enlarged foreign sector with cumulative foreign direct investment of US$ 89.40 billion will influence growth in consumption and investment (Economic survey 2020-21). India is progressing on path of urbanization and by 2050 nearly 55.2% of the people will be living in urban centers against 35% in 2019 (S K Kulshrestha, 2018). Indian growth Statistics supports the need of integrated space and economic planning to be prepared to harness the benefits of urbanization. Innovative approaches can lead to sustainable urbanization in India.

Fossil fuel energy consumption currently make up to 75% of India's energy mix (IEA 2020). IEA released Energy Outlook 2021 report forecasting important variables of India. With increasing urbanization affordable and sustainable energy to the people. It forecasts India to become the world's third largest energy consumer by 2030 a growth rate of 35%. To fulfill its energy demand India will have to rely on fossil fuels because domestic oil and gas production has been low. Importing fossil fuel to fulfill energy demand can also lead to higher imports.

The Worldwide Governance Index is a measure of government's performance on various parameters. Though India is able to regulate the corruption and improving its performance, it is unable to create a stable political environment in the economy. The ranking on voice and accountability is very poor in 2016 as compared to 2013. Governance is one of the strongest pillar on sustainable growth path. Overall approach of the government towards demand of environmental quality will play a crucial role in the executive of development strategies.

The study is relevant in current scenario because India is at a stage where it needs to strengthen environmental quality and reduce the emissions. Government initiatives are in place but there is a need to hit the right chord. Major emissions contributor need to rework on their strategy to minimize emissions and increase efficiency. In the long run urbanization may see an upward trend in India as majority of its population is in the

younger age group. Average age of an Indian is 25 years. 60% of the population in India is below age 35. It is very crucial to curb conspicuous consumption and redirect the resources towards productive use.

Capital accumulation in the long run might encourage investment and research & development towards better technology. With urbanization, employment opportunity and income per capita increases, urban poverty reduces that puts pressure on the urban atmosphere. Some decisive policy changes are desired.

5.3 POLICY RECOMMENDATIONS

Increasing concern on climate change and emissions are matter of concern not only for developed countries but also for developing countries. Concerns have also been raised by increasing environmental problems caused by use of fossil fuels. Economic growth in a sustainable way is an enormous challenge world over. India being one of the largest emerging economies environmental degradation needs special attention.

Looking at aforementioned statistics urban development and planning should be India's utmost priority. Increasing population and rural-urban migration indicate that India needs a preemptive sustainable strategies on urban housing, transport and energy requirements. Important areas that should not be overlooked are: efficient space and economic planning in terms of housing, transport and energy, managing the water source for fulfilling future demand, waste collection and disposal (waste management).

What can the cities do to sustainably develop? The cities can focus on three major areas:
a) alleviate economic impact on the environment and initiate recovery process

b) Local government should initiate community driven solutions

c) Data on the vital variables should be made available on regular basis.

One of the important aspect of urban forecast is understanding consumption basket. Urbanization is a process of structural change due to shift in the economic activity in the economy. If larger proportion of the population is in the urban areas then consumption of non-food items will have higher weightage in the basket and greater impact on the environmental quality. To ensure productive use of resources, policy

initiative such as taxing conspicuous consumption can be helpful in diverting resources from consumption to production. Supply of goods and services to rising demand in the economy will have to ensure. Encouraging efficient production can help boost manufacturing sector in the economy. With a special focus on micro, small and medium enterprise, strategies can be developed to upgrade their technology and provide them with cost-effective eco-friendly innovation. This will be crucial in achieving self-sufficiency.

Economic growth can be harmful for environmental quality, but they are decoupled, economic growth can be sustainable. Sustainability can be achieved through minimizing waste from the efficient production processes. Using waste as input in other industries is what we need to think of.

Industrial will need to take an initiative to switch to renewable energy to meet their energy demands. Though India's is one of the largest generator of renewable energy it is not sufficient to meet its future energy demands. Energy pricing reforms can be complementary action in this direction.

Along with being one of the largest consumer in the world, India should buckle up to also become one of the largest producer of goods & services. Utilizing the "window of opportunity" it has for next three decades, where it becomes the only country with youngest population in the world, growth rates in the Indian economy easily peak.

5.4 LIMITATIONS OF THE STUDY

Environmental studies are always prone to data deficiency. Despite using 57 data points for a set of 18 variables there is always a scope of more efficient data set.

Due to variety of variables used, it was inevitable to convert data into composite index. This linear addition of the index values to create a factor leave no room for error terms in the analysis. Data conversion techniques cannot be flawless. Availability of better data points and appropriate unit of measurement, data conversion can be avoided.

As the structure of the economy changes so is the applicability of the models. No single model can be efficient and appropriate for improving environmental quality. Research can be enhanced with addition of more variables defining the structure of the economy

Since the data is only available from 1996 onwards, the number of data points in the World Governance Index is small. This is also one of the limitation of the study. The important indirect impact of political instability on environmental degradation in India is limited due to a lack of governance data.

References

Dasgupta, S., Laplante, B., Wang, H., & Wheeler, D. (2002). Confronting the environmental Kuznets curve. *Journal of economic perspectives*, *16*(1), 147-168.

Gamper-Rabindran, S., & Jha, S. (2004). Environmental impact of India's trade liberalization. *Available at SSRN 574161*.

Kulshrestha, S. K. (2018). *Urban renewal in India: Theory, initiatives and spatial planning strategies*. SAGE Publishing India.

Lampard, E. E. (1955). The history of cities in the economically advanced areas. *Economic development and cultural change*, *3*(2), 81-136.

O'sullivan, A. (2007). *Urban economics* (pp. 225-226). Boston, MA: McGraw-Hill/Irwin.

Rubiera-Morollón, F., & Garrido-Yserte, R. (2020). Recent Literature about Urban Sprawl: A Renewed Relevance of the Phenomenon from the Perspective of Environmental Sustainability. *Sustainability*, *12*(16), 6551.

Syrquin, M. (1988). Patterns of structural change. *Handbook of development economics*, *1*, 203-273.

Syrquin, M., & Chenery, H. B. (1989). *Patterns of Development, 1950 to 1983* (No. 41). Washington: World Bank.

Tiwari, A. K. (2011). Energy consumption, CO2 emissions and economic growth: Evidence from India. *Journal of International Business and Economy*, *12*(1), 85-122.