IMPACT OF URBAN DEVELOPMENT ON SUSTAINABILITY INDICATORS IN CITIES OF UTTARAKHAND

A thesis submitted to the
University Of Petroleum and Energy Studies

For the Award of
Doctor of Philosophy
in
Management

By

Avishek Ghosal

August 2023

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DECLARATION

I declare that the thesis entitled **"Impact of Urban Development on Sustainability Indicators in Cities of Uttarakhand"** has been prepared by me under the guidance of Dr. Sushil Kumar Rai, Associate Professor of School of Business, University of Petroleum and Energy Studies and Dr. Anil Kumar, Professor of School of Business, University of Petroleum and Energy Studies. No part of this thesis has formed the basis for the award of any degree or fellowship previously.

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I certify that **Mr. Avishek Ghosal** has prepared his thesis entitled **"Impact of Urban Development on Sustainability Indicators in Cities of Uttarakhand"**, for the award of PhD degree from the University of Petroleum & Energy Studies, under my guidance.

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviations	Full Form
AF	Absolute Fit
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CR	Composite reliability
EFA	Exploratory Factor Analysis
GHG	Green House Gases
GoF	Goodness of Fit
HPEC	High Power Empowered Committee
HTMT	Heterotrait-Monotrait Ratio of Correlations
IF	Incremental Fit
IHR	Indian Himalayan Region
JnNURM	Jawahar Nehru National Urban Renewal Mission
LA	Local Agenda
MM	Measurement Model
NFI	Normed Fit Index
PM	Particulate Materials
PWD	Public Works Department
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modelling
SRMR	Standardized Root Mean Square Residual
UN	United Nations
UNDP	United Nations Development Program
USD	Urban Sustainable Development
UNFCCC	United Nations Framework Convention on Climate Change

Abstract

The main purpose of this study was to obtain a better understanding of the impact on the sustainability indicators due to urban development for the state of Uttarakhand, India. The rate of urbanization is also much higher than what we observed post the industrial revolution. Particularly in emerging and poor nations, this fast urbanization has resulted in several issues, including housing, sanitation, education, the availability of safe drinking water, unemployment, etc. As we also know urban development is a must for any country's economic development, policymakers and administrators must intervene to handle the challenges and issues due to rapid urbanization. It should be noted that India has been sluggish to urbanize compared to other countries. As of the year 2010, thirty percent of India's total population called urban regions home. But still India is facing various issue and challenges.

To resolve issues and challenges of urbanization and urban development government both at central and state level have created policies and programs like Smart city Mission, AMRUT, JnNURM etc. But still issues and challenges persist.

Metropolitan regions all over the globe have been working on projects to enhance urban services and infrastructure to create better social, economic, and environmental circumstances, as well as increase the competitiveness and attractiveness of communities. But due to unsustainable policy and developments are headache to the population residing in the cities. Similar situation is taking place in the cities of Himalayan region specially in the state of Uttarakhand. Flash floods, water logging, informal residential houses (slums) are giving bad image to cities. For that reason, a study is required for the studying the impact of sustainability indicators of the urban areas.

For the first step we tried to identify the relevant sustainable development indicators for the state of Uttarakhand India through systematic literature review. After the step we identified 22 relevant indicators. Next objective was to study the impact of

urban development on sustainable development indicators. For this objective we used structural equation modelling. After first step of SEM, we identified five latent constructs and then we tried to find the loading relationship between the constructs.

This study led to five major findings.

- To increase the Happiness Index focus should be given to improving the economic condition of urban areas with a balanced act on environmental performance.
- To enhance ecosystem protection improvement will be required in urban services like drinking water supply, public transport service, use of electric vehicles etc.o improve economic conditions the focus should be on giving proper skillsets to the population and framing balanced environmental norms.
- To improve Wellbeing index population should be protected from disasters and other calamities.
- To improve Environmental performance, awareness programs within the population should be increased and for building infrastructure EIA study should always be a part of Feasibility study.

The study could be helpful in future research on complexity theory because it also seems to provide a potent research tool for evaluating the impact of sustainable development. The applications show, albeit in a preliminary manner, how the sustainability scenarios might aid in decision makers' model expansion and the creation of more diverse and resilient sustainable development policies and strategies. In this sense, they validate the theoretical frameworks that were utilized to create the scenarios as well as the scenario approach itself, and they indicate a chance to turn the sustainable development scenarios into an effective instrument for making sustainable development decisions.

Chapter 1

Introduction

1.1 Introduction

More than 56% of the world's population now lives in urban areas, and urbanization is happening quickly. According to UN estimates, the number of people living in cities worldwide is anticipated to rise from 7 billion in 2011 to 9.73 billion in 2050, a 68 percent increase (UN DESA, 2019). The process of rapid urbanization can be observed from the start of the 19th century post industrial revolution. Presently in the 21st century, we can observe a similar trend of urbanization due to the growth of tertiary economy. Additionally, the rate of urbanization is far higher than what was seen during the Industrial Revolution. Fast urbanization has led to several problems, including housing, sanitation, education, the accessibility of safe drinking water, unemployment, etc., particularly in developing and impoverished countries. We are seeing a similar tendency of urbanization after independence in India as well. Urbanization in India increased from 0.37 percent of the total population in 1951 to 27.81 percent in 2001 and 31.16 percent in 2011 (Census, 2011). Due to which the population residing in the cities of India are facing several issues and challenges. According to Asian Development Bank, there are two major factors for rapid urbanization in India. Increase in natural population growth and net migration from rural areas are two vital factors for rapid urbanization. These factors are contributing to the growth of slum population, traffic congestion, constrained urban services etc. For these issues and challenges policymakers and city administrators are facing a tough job creating a sustainable and resilient city.

Urbanization will also continue to increase soon as the population will be attracted towards cities for economic opportunities. In available literature urbanization has been defined with different perspectives. A term derived from the Latin word "Urbs," which the Romans used to refer to a city, is "urbanization". In general, the term "urbanization" refers to the increase in population in urban regions.

According to the UN, urbanization is the movement of people from rural to urban regions. Misra (1998) described urbanization as a process rather than a result through which a population begins to live in towns and cities dominated by industrial and service enterprises rather than largely dispersed agrarian communities. It entails expanding cities' populations and multiplying urban areas. The number of people living in cities is merely one aspect of urbanization. According to Arouri and Youssef (Mohamed et al., 2014), urbanization is the demographic process in which a growing proportion of the population of the country resides in urban areas. A place is only regarded as urban when most of its residents depend primarily on non-farm work. Urbanization has always been a major factor in the advancement of people and economies. Kingsley Davis, a prominent demographer, has divided the process of urbanization into three distinct phases in his classification of it. Stage I is the first stage of development, and it is characterized by traditional rural societies, a focus on agriculture as the primary economic activity, and a pattern of scattered patterns of habitation. The growth rate of population residing in urban area steadily increases from 25% to 40%, then 50%, then 60%, and so on throughout the stage-II transition. This is the stage of acceleration that is characterized as the stage in which fundamental reorganization of the economy and financing in social overhead capitals such as in mobility and communication take place. When the percentage of people living in cities reaches or surpasses 70 percent, we have reached stage III, sometimes known as the terminal stage. According to Davis, the amount of urbanization at this stage is roughly equivalent to staying the same or being constant.

Soon, urbanization is expected to rise, particularly in emerging nations. A third of the increase in the urban population over the next few decades will come from China and India combined (Li-Yin et al, 2011; UN, 2008). Urbanization is being implemented by developing nations like India and Vietnam as part of their national development plans. But to pursue this strategy, balance is required urban and rural development (Li-Yin et al , 2011). If balance is not maintained, then cities will be overburden and the population will face several issues and challenges. The population will keep relocating to urban areas in search of better living conditions and job possibilities. As a result, accomplishing the goals of global sustainable development depends greatly on the practice of sustainable urbanization.

It has been noted that India has been sluggish to urbanize compared to other countries. As of the year 2010, thirty percent of India's total population called urban regions home. This is a far lower rate than that seen in other major emerging nations, such as China (45%), Indonesia (54%), Mexico (78%), or Brazil (87%) for example (HPEC, 2011). Another factor that contributes to India's low urbanization rate is the definition of the word "urban." Any community in India that included more than 10,000 people was required by law to be categorized as a "urban" area by the Indian government. If we compare this definition with that of other countries this would imply a level of urbanization much lower than in other countries (The High Powered Expert Committee, 2011). Definition of "URBAN" of selected countries given below.

• China: Urban neighborhoods that have an mean population density of at least 1,500 people per square kilometer.

 • Indonesia: Municipalities (kotamadya), regency capitals (kabupaten), and other areas having urban features.

• Argentina: Population centers having a minimum of 2,000 people.

• Brazil: The urban and suburban zones that surround the administrative centers of "municipios" and districts.

• Mexico: Communities having a minimum population of 2500 people.

• South Africa: a categorization based on the predominant form of habitation and the usage of the land. Urban settlements commonly refer to populous places including towns, cities, townships, and suburbs. Urban enumeration areas include unofficial communities, dormitories, institutions, industrial and recreational areas, and minor properties that are inside or close to any established urban community. (Census units).

• According to the 2001 Census, all settlements, and localities in Scotland as well as at least 1500 residents in England and Wales, 1000 or more in Northern Ireland, are United Kingdom urban area.

• In the United States of America, regions that meet certain standards for minimum population density and have a population of at least 2500 people (Nations, 2007).

Urban regions were also widely classed in the Indian Census. The primary categories include urban agglomerations, outgrowth, census towns, and statutory towns. According to the statute, statutory towns are "all localities having a municipality, corporation, cantonment board, notified town area committees, etc." (Census, 2011). According to the definition of a census town, these are "all localities having a minimum population of 5000 inhabitants in the preceding census, at least seventy percent of the primary working population being male, engaged in non-agricultural activities, and a population density of at least our hundred persons per sq. km" (Census, 2011). A continuous spread made up of one or more towns is referred to as an urban agglomeration (Census, 2011; IGNOU 2013). Outgrowth is defined as "a region around a central city or town, including such well-known locations as railroad colonies and universities" in the final sentence.

Table 1: Number of Urban Agglomerations/ Towns/ Outgrowth in India

Types of Urban Units		2001 Census		2011 Census
1	Towns	5161		7935
	a) Statutory Towns	3799		4041
	b) Census Towns	1362		3894
2	Urban Agglomerations	384		475
3	Outgrowth (OGs)	953		981

Source: Census 2011; IGNOU 2013

The designation of urban areas under Municipal Law in India differs from that under Census, nevertheless. The classifications are as follows, as stated by the Municipal Laws: Municipal Corporation with a population of about 3 lakhs and above, Municipal Council with a population of between 1 and 3 lakhs, and Nagar Panchayats with a population of between five and ten thousand (IGNOU, 2013; Census 2011).

With the growth of tertiary economic sectors across the world we can observe structural transformation in global economic scenarios. This structural transformation is also being associated with rapid urbanization. The activities that fall under the category of tertiary include production as well as trading. The manufacturing process includes "providing" various services that are ultimately "consumed." Production is measured in terms of earnings and salaries, which is an indirect measurement. To "exchange" anything is to "trade," "transport," and "communicate" to "overcome" a physical distance between two points. Therefore, tertiary activities consist of the commercial output of services as opposed to the manufacturing of physical objects. They do not participate actively in the transformation of the underlying physical raw materials. The relationship between tertiary activity and urban regions is quite tight. The job opportunities in the tertiary sector have increased everywhere in the world. India is not an exception to this shift; it is undergoing it as well. Since the beginning of the 1990s, the Indian economy has been seeing a very high growth period owing to the expansion of the

tertiary sector. This expansion has been coupled with less urbanization than would be typically 'anticipated' in the context of the normal scenario. The evidence assembled by this Committee suggests that India is at the cusp of rapid urbanization (The High Powered Expert Committee, 2011).

One of the main difficulties facing humanity in the twenty-first century is the growth of urban areas or increase rate of urbanization. This had evolved into the key drivers of economic expansion and serve as hubs for an opportunity, affluence, innovation, and cross-cultural exchange (Hannele et. al., 2017). Urban areas currently hold most of the world's population—55 percent—and are growing both in size and importance. Due to urbanisation and population growth across the world, it is projected that 70% of people would live in urban regions in 2050. (Verma & A. S., 2022). Socioeconomic and environmental issues that cities are required to address include the reduction of natural resources, the destruction of biodiversity, climate change, air pollution, excessive noise, the production and discarding of trash, the use of land, the availability of drinking water, and other issues. The social and economic difficulties of ensuring that all city dwellers have a sufficient standard of living and equitable access to opportunities are linked to the environmental problems that now afflict cities. Providing a minimal standard of living is only one component of ensuring quality of life; other aspects include issues with democratic governance, equal economic and social conditions, public health, employment, and education (Mori & Christodoulou, 2012). Providing a rudimentary material existence is only one component of ensuring the quality of life. Recently, COVID-19 became an epidemic that swept the whole world, and the problems that it creates are far more severe in populated regions. According to Huovilaa, Boschb, and Airaksinenc (2020), COVID-19 was shown to have the most severe impacts in areas of densely populated urban regions that were also undeveloped. Because urban sustainability is decisive to the long-term viability of countries, regions, and states (Yigitcanlar & Kamruzzaman, 2014), the problems that were outlined before can be found not just inside cities but also outside their borders. It is vital to analyze how the growth of cities connects to global difficulties

in addition to how cities, as well as the environment, are connected (Tanguay et al., 2010; Huang et al., 2015). Specifically, it is necessary to consider how global challenges relate to the development of cities.

Urban sustainability refers to the idea of cities or urban regions that are set up to be self-sufficient in terms of their needs for electricity, water, sanitary facilities, resource distribution, food, etc. Urban regions must be able to generate their energy, ideally utilizing renewable resources, to cut down on pollution and lessen their impact on climate change. Along with waste minimization, effective land use is also necessary. The population of urban areas will significantly increase by the year 2050. The "growth drivers" of the century are thought to be these urban centres, where technology is expected to have a big impact. Urban areas have the potential to foster public and fiscal mobility, but they may also serve as hotspots for inequality and environmental deterioration. To live in cities, it is necessary to effectively manage and maintain the urban systems, making it important to address the problem of urban sustainability.

1.2 Problem Statement

Numerous worldwide environmental, social, and economic crises had a significant impact on the world since the middle of the 20th century (Mori & Christodoulou, 2012). Metropolitan regions all over the globe have been working on projects to enhance urban services and infrastructure to create better social, economic, and environmental circumstances, as well as increase the competitiveness and attractiveness of communities (Joss et. al, 2015). These initiatives gave rise to the idea of intelligent cities or in other words smart cities (Komninos, 2021; Yigitcanlar, Dur, & Dizdaroglu, 2015). Smart cities, according to Deakin (Deakin & Waer, 2011; Townsend, 2018), are the result of the smart use of electronic information, for instance in the fields of urban government, education, knowledge transfer, human health, mobility, and energy consumption. Sustainability and ecologically friendly urban planning concepts highlight the use of local resources required for housing and other commercial activities (Pietrosemoli & Monroy, 2013; Wang, 2015). The aim of sustainable metropolitan growth is environmental

consciousness then efficient use of resources in smart cities (Boyko et.al., 2012; Dizdaroglu & Yigitcanlar, 2016). Additionally, the researchers also centred on the idea of ecological cities. Since 1970, this idea has been explored and advanced as a element of the agenda for urban sustainable development highlighted under SDG 11.

India underwent a significant transition after gaining its independence, and in the past 20 years, growth has advanced more quickly. Urban drift is a result of a transition from a traditionally rural county to a contemporary urban community. With increasing urbanization come the advantages of economic growth. Industrialization, modernization, and rationalization are all directly tied to urbanization. Urban centres are hubs for possibilities, information repositories, creative ideas, and the commercialization of those ideas. For the sake of their financial survival, they draw on the talent and human resources. Beyond economic development, urbanization may also promote social fairness by weakening the caste and creed divisions that are pervasive in rural life. India's market was made more open to foreign competition in the 1990s thanks to sectored reforms in several different sectors (including industries, agriculture, investment, commerce, infrastructure, banking, and finance). This increased domestic capital markets, removed trade barriers, and produced growth rates of 5.7% from 1991 to 2000 and 7.2% from 2001 to 2010. Rapid urbanization, however, poses environmental and social problems and is thus unsustainable. High levels of resource exploitation occur in urban settings. Unplanned urban growth leads to pressure on the infrastructure, the expansion of squatters, environmental degradation, traffic issues, and excessive living costs. Indian administrative officials, policy makers, and planners are under pressure due to the country's enormous population, wide and diversified landmass, and poverty-induced rural-urban migration (Lal, 2019). As a result, there is insufficient governance. The route of sustainable and intelligent urban development will spur environmentally benign and socially inclusive economic growth to address the obstacles. India has acted by creating a framework

for sustainability. This study focuses on the impact of Urban Development on Sustainability Indicators in the Cities of Uttarakhand.

Participation of the private sector is required to close the gaps in the provision of basic utilities in metropolitan areas. According to Skoch (2015), states have a responsibility to be proactive in spelling out precisely how local bodies may pursue the objective of pursuing increasing private engagement, and regulations in this respect must be articulated explicitly. In addition, states must be clear about how they will enforce these policies.
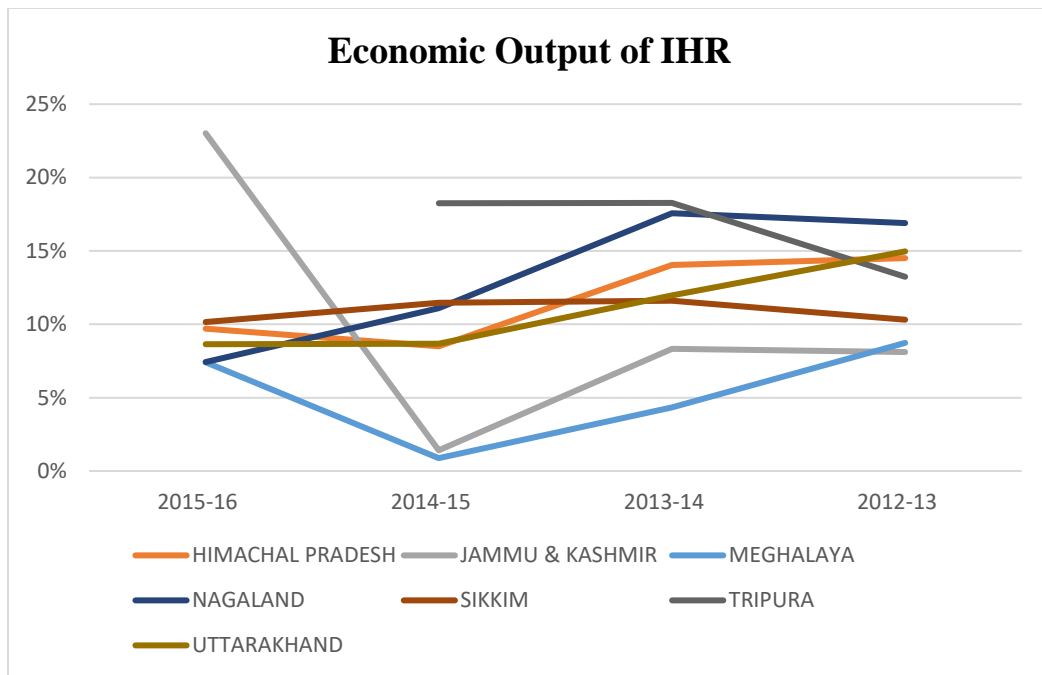
Figure 1: Economic Output of Indian Himalayan Region

(Source: Author)

Almost every town in the Himalayas has expanded in a way that was not at all planned, which has put a tremendous amount of stress on the natural ecosystem. Additionally, urban infrastructure and services are severely lacking, which has led to a deterioration of the urban environment and an increasing number of people who are at risk from the emerging dangers of climate change. The growing dangers of climate change-induced geo-hydrological hazards and the depletion of water

supplies are two of the most significant environmental problems linked with this kind of uncontrolled urban expansion. Even though urban areas are becoming more susceptible to the dangers that are brought on by climate change, the governments of the Himalayan states, including the government of Uttarakhand, have not developed a special climate change adaptation strategy for any of the cities. In the current time, global warming has been proven to generate oscillations in the pattern of precipitation, and these fluctuations have exhibited growing tendencies. These trends represent major dangers to urban ecosystems that are biologically vulnerable, tectonically active, and densely inhabited, especially those that are situated in the Lesser Himalaya. There is a growing degree of unpredictability in the patterns of precipitation in the Western Himalaya because of the severe drought conditions that the area experienced in the years 2007–08 and 2008–09. During the years 2007–2008 and 2008–2009, it was reported that several districts in the Western Himalaya were suffering from drought. During the 2015–2016 winter season, the whole alpine region of Uttarakhand and Himachal Pradesh was plagued by dry weather from August 2015 all the way through January 2016.
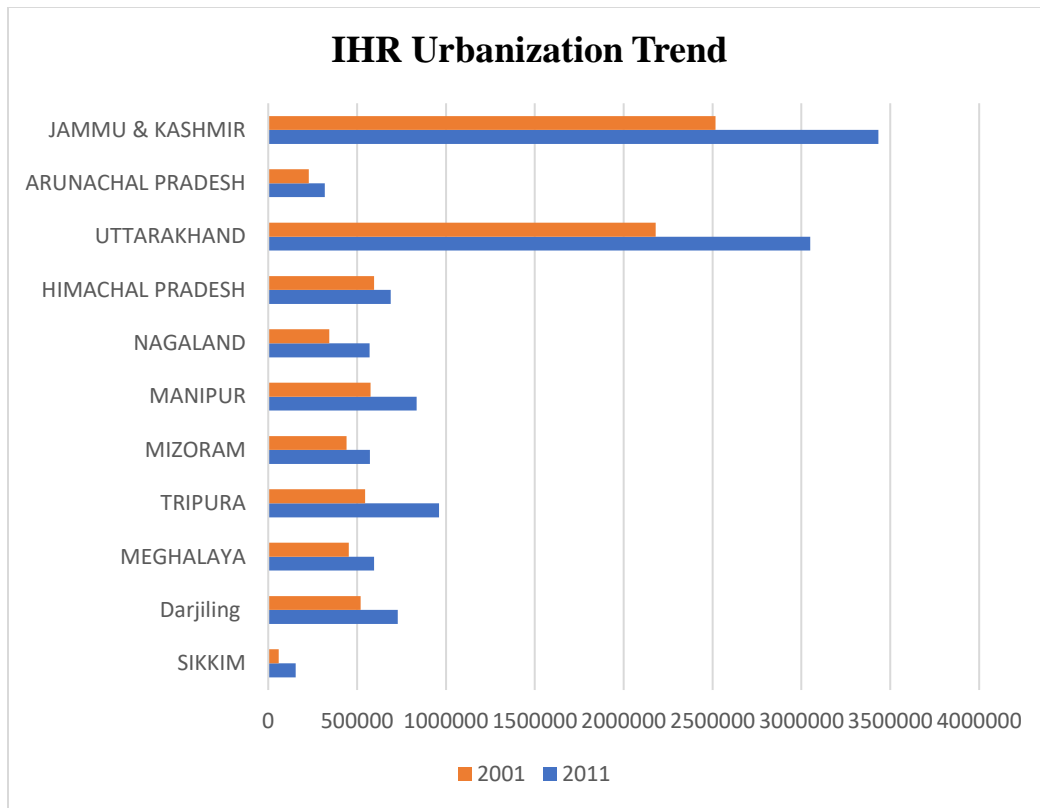
Figure 2: Indian Himalayan region Urbanization Trend

(Source: Census 2011; Author)

On the other hand, between the years 2010 and 2013, the whole area was subjected to an abnormally high amount of monsoonal precipitation, and enormous losses were recorded from across the region because of many instances of flash flooding, landslides, and cloudbursts. Despite this, no comprehensive climate vulnerability risk assessments have been carried out yet from the perspective of natural catastrophes, and more specifically climate change caused geo-hydrological hazards, for any of the townships in the states of Western Himalayan regions. In the Himalayan Provinces, several urban development programs that have been supported jointly by the Central and the State Governments are now in the process of being put into action. However, these urban development projects did not include a mechanism for adapting to the effects of climate change on urban ecosystems (Government of Uttarakhand, 2007). In addition, adaptation to urban climate

change and risk reduction from natural disasters were not included in Uttarakhand's State Action Plan for Climate Change (Government of Uttarakhand, 2016; Disaster ManagementandMitigationCentre,2011).
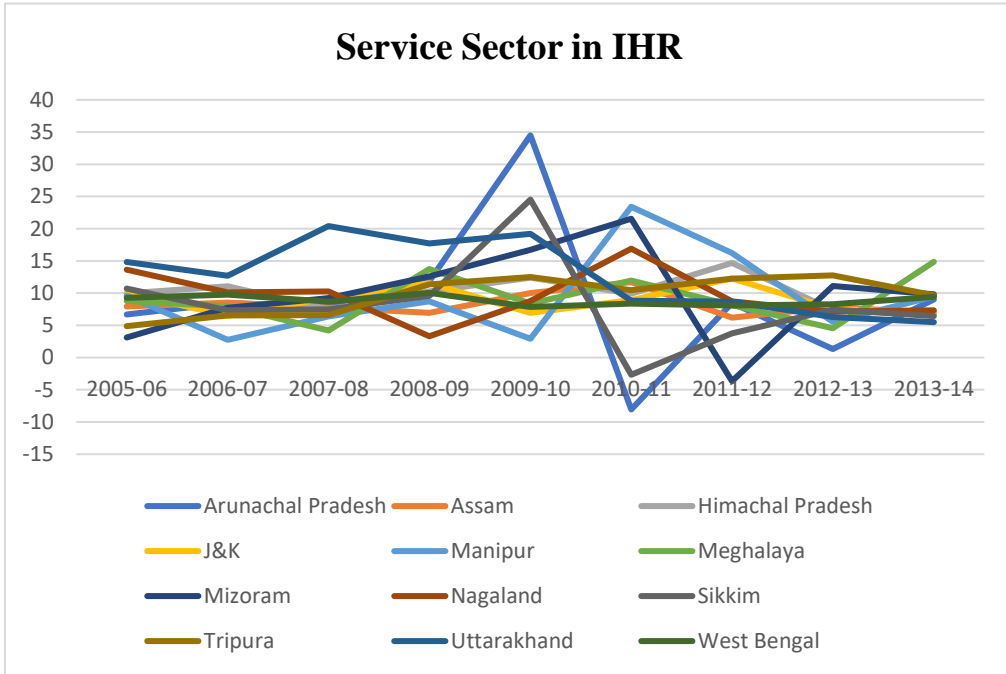
Figure 3: Service Sector in IHR

(Source: Data from NITIAAYOG)
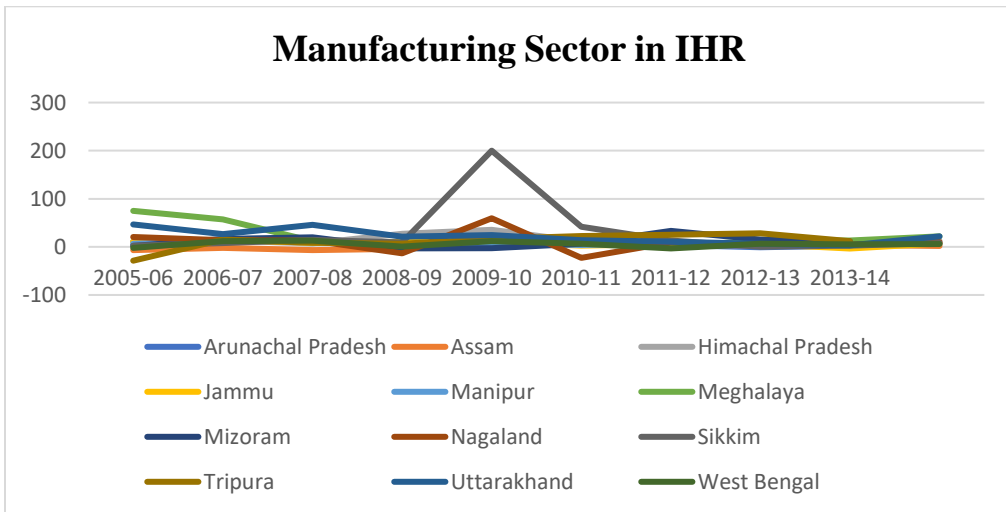
Figure 4: Manufacturing Sector in IHR

(Source: Data from NITIAAYOG)
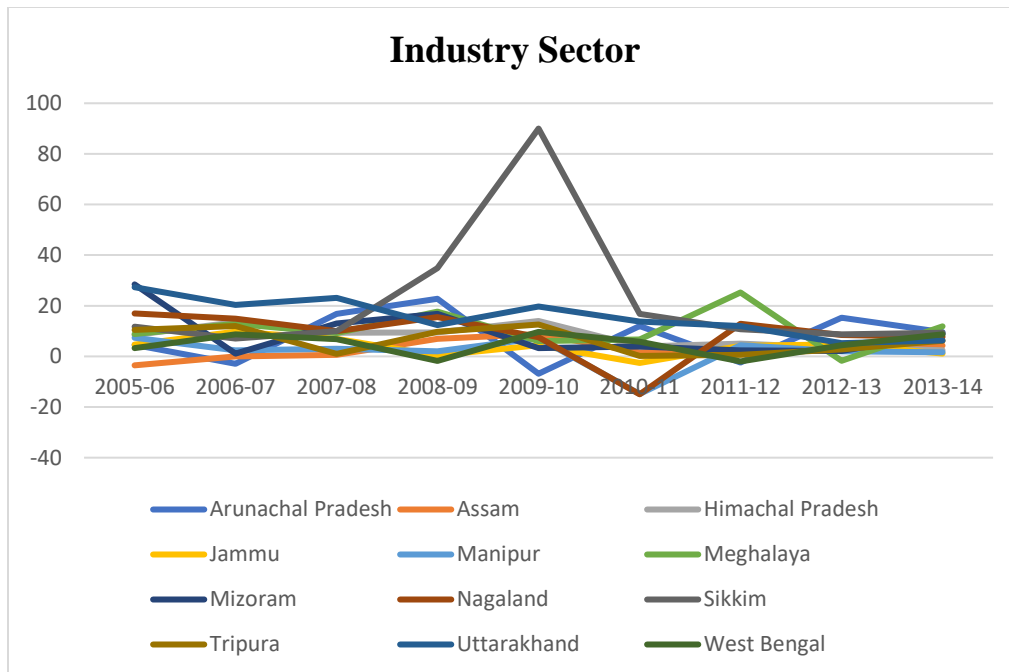
Industry Sector

Figure 5: Industry Sector in IHR

(Source: Data from NITIAAYOG)

A case was made for a comprehensive framework of urban policy and planning in the High-Powered Expert Committee's report on Indian Urban Infrastructure and Services, which suggested levitation outlay in urban infrastructure from one percent of GDP in 2011–12 to three percent by 2031–32 (HPEC, 2011). According to the HPEC, the investment in urban infrastructure over a 20-year period is expected to total 39 trillion dollars. In addition, there had been no clear model for application of policies and regulations for the cities in the Himalayan range. Only funding methodology is different for some of the cities in the Himalayan range. The model or framework for the development of sustainable cities in Himalayan range will not be same that of the model for the cities in the plains or costal belt. Therefore, a study is of utmost need to find the model of development for the cities like Darjeeling, Dharamsala etc.

Further, from the above graphs we can observe that the economic sector growth in primary and as well as in tertiary sector is not uniform in nature. Political

disturbance and catastrophic natural disaster are one of the reasons for the up and downs in potential growth of the region. According to the National Skill Development Corporation, major industries in the Indian Himalayan Region (IHR) that would have a significant need for human resources between 2017 and 2021 include agriculture and allied industries, handicraft and textile, construction material, tourism and hospitality, education, and manufacturing. Aside from tourism that is focused on religious sites, "modern" tourism around the IHR, which is exemplified by mass tourism and is mostly restricted to sight-seeing and traveling to major tourist centers, is also responsible for placing a significant amount of strain on the ecology and ecosystem services provided by the Himalaya as well as on the social structures of the local community. This kind of tourism places enormous demands on the region's water supply as well as its natural resources since it necessitates the continuous expansion of road networks, hotel accommodations, and other associated infrastructural and institutional capacity. In recent years, outdoor activities including hiking, mountain climbing, and tourism focused on nature have become more popular in the IHR. These are activities that may be enjoyed throughout the year and should be encouraged and promoted in a responsible manner.

Implementing sustainable tourism practices in the Himalayan region to harness its potential as a development sector. It suggests that for tourism to drive future development effectively, it should adhere to principles of inclusivity, considering sidelined areas and population, and sustainability, ensuring job creation, promotion of local culture, and tourism products. Tourism helps fulfil the Sustainable Development Goals (SDGs), especially SDG 8 (i.e., Decent Work and Economic Growth) and 12 (i.e., Responsible Consumption and Production).

Nevertheless, the issues faced in the IHR relate to several other SDGs, such as poverty eradication (SDG 1), climate action (SDG 13), and protection of ecosystems and biodiversity (SDG 15). Despite this, long-term investment planning

pays insufficient attention to sustainable components of tourist growth, such as determining the capacity of possible locations.

Furthermore, a World Bank survey conducted in 2015, which considered factors like "Business Environment" and "Environmental Accordance," revealed that none of the IHR states ranked among the top 10 states in India in terms of these criteria. This suggests that there is room for improvement in terms of creating a conducive environment for tourism businesses and ensuring compliance with environmental standards in the region.

Tourism businesses in the IHR (Indian Himalayan Region) may not be thriving due to unfavorable conditions. It also implies that environmental compliance in the region might have been compromised, despite the fragility of the IHR's ecosystem. The socioeconomic transformation and protection efforts in the IHR face challenges from the rise of mass tourism, which has both cross-border connections and is affected by climate change. The region also faces problems including budget shortfalls, gaps in environmental compliance, and a lack of funding for ecotourism. If the predicted 240 million tourists by 2025 materialize, these issues might get worse. Even places like Sikkim, which are recognized for putting best practices in tourism into reality, are endangered by the detrimental effects of mass tourism and the loss of forest cover owing to development.
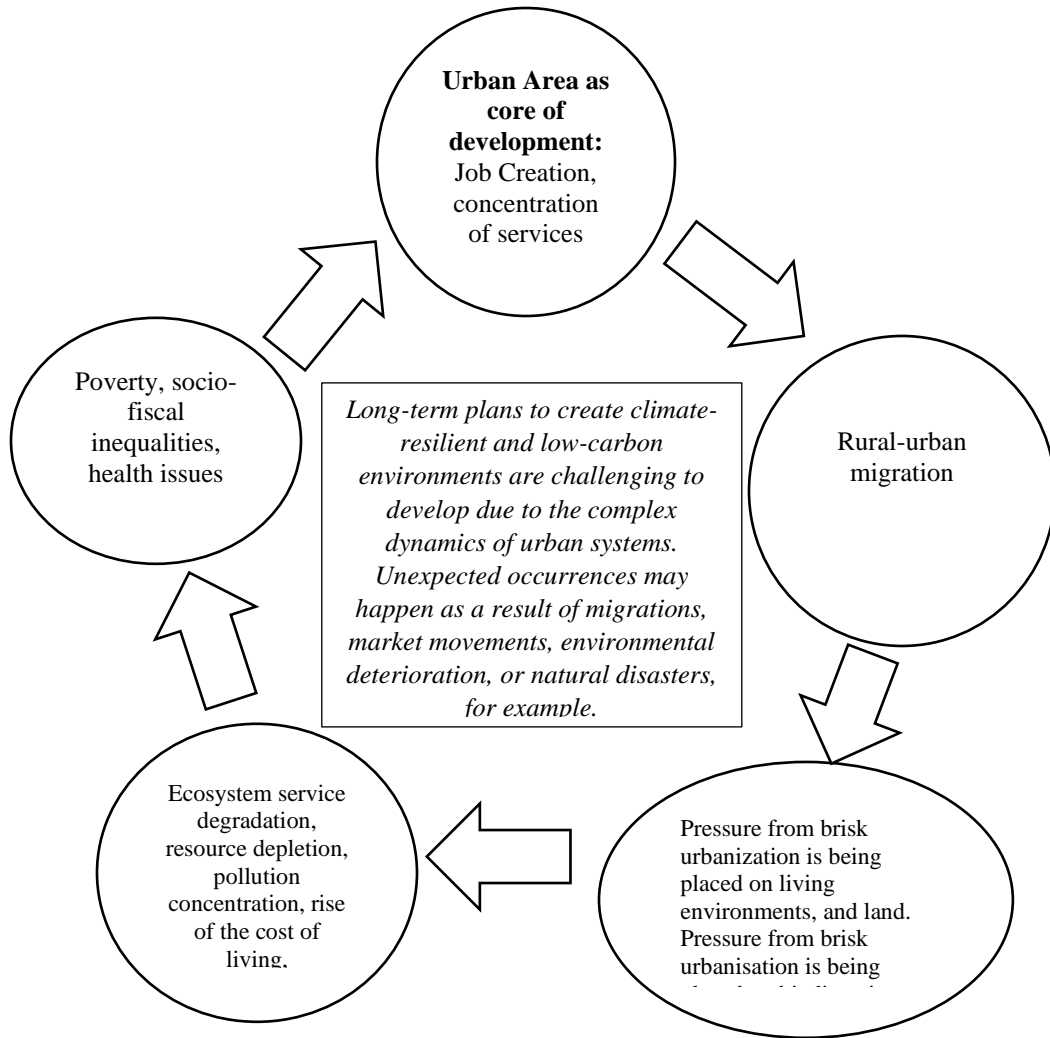
Figure 6: Use the Drivers-Pressure-State-Impact-Response (DPSIR) model to visualize unsustainable urban dynamics.

1.3 Business Problem Statement

There is need to tap its potential of resources in Indian Himalayas especially in state of Uttarakhand and to control congestion, unplanned urban sprawl, and climate change for sustainable urban growth in the region that can enhance the economic prospect and SDG11 objectives.

1.4 JUSTIFICATION OF RESEARCH

Benefits of Urban Development.

↓

Economic growth potential of Cities with annual growth rate of 9% by 2021-22

↓

Economic loss due Traffic Congestion (Bangladesh: $11.4 Billion; India: Rs. 1.5 Lakh Crores per Year); Economic Loss due to inefficient Water Supply (India 50mlcd); Economic loss due to Pollution (according to OECD in India $ 80 Billion)

↓

Opportunities & benefits associated with sustainable development in Himalayas and linkages need to be analyzed as the cities in this region have huge potential.

↓

Economic growth model for Himalayan region to attain sustainability.

Due to the growing environmental harm that cities and their residents provide, urban expansion is a topic of discussion on global levels. Sustainable urban areas are defined in a variety of ways that are characterised by standards that touch on a wide range of concerns, each of which is specific to the conditions and needs of each city (Colglazier, 2015). For instance, according to local governments, sustainable cities strive to create an environment that is environmentally benign, socially, and financially healthy, and adaptable for the current population, without compromising the possibility for future generations to experience the same (Deller, 2002). Sustainable city development is often defined as balancing around three essential sustainability features. But many urban problems demand that the right people address them and, if at all feasible, find answers. As a result, a comprehensive viewpoint and institutional dimension are needed. When seen in

this light, sustainable urban development may be viewed as the result of synergistic interaction of environmental, social, financial, and institutional elements in any individual city (Rua, 2015; Dizdaroglu, 2017). Goal 11 of the Goals for Sustainable Development for 2030, which states, "Make human settlements and cities inclusive, safe, robust, and sustainable," further demonstrates the significance of environmental sustainability on a local level. To discuss crucial issues for the upcoming urban development, several stakeholders were brought together in 2014 as part of the World Urban Campaign's Urban Thinkers Campus initiative. The principal consequence of various talks and debates was the document "The City We Need 2.0." (Visvaldis et. al, 2013; Dizdaroglu et. al., 2017). The established and accepted "New Urban Agenda" reaffirmed urbanisation as a top political issue and emphasised the need of indicators, guidelines, standards, and other instruments of a similar kind for managing the processes of implementation of urban policy. The necessity for the creation of indicators, variables or factors are outlined in Agenda 2030's (Colglazier, 2015) 75th phrase. Indicators or factors have developed into a crucial and useful tool for assessing how the sustainable development idea is being used or assessed. The subject of sustainable development indicators, it is crucial to remember, has roots dating back to the 1990s. For instance, chapter 40 of Agenda 21 (Spangenberg et al., 2002) discussed the importance of sustainable development indicators. The COVID-19 outbreak is currently highlighting the need of urban metrics in supporting wise decision-making (Braulio-Gonzalo et. al., 2015).

1.5 Measuring Sustainability

To close a gap in the study of sustainable development that exists today, the Index of Urban Sustainability was devised. Numerous initiatives have been made in recent years to contrast environmental sustainability and economic growth. Numerous models with significant overlap were produced because of those efforts, the majority of which were devoted to developing the crucial theoretical foundation for gauging sustainability (Dizdaroglu et. al., 2017). Only a few made the transition from idea to measurement, and the ones that did frequently concentrated on statistics at the national level or in the industrialized nations. As a result, it is

difficult to assess the sustainable development of urban areas in developing nations, where the problem is frequently the most pressing. The effectiveness of social, biological, and economical principles is used to gauge sustainability. While addressing all three in balance is desirable and is not appropriable achievable.

1.5.1 Principles of Urban Sustainable Development
The term's definition—to improve living conditions for the present generation without hurting future generations—is strengthened by sustainability principles. Human, societal, economic, and environmental principles are among them. Since all these ideas are connected, it is challenging to tell them apart properly.

1.5.2 Human and natural system
The sustainability of urban areas depends critically on having healthy populations, a clean environment, and good interactions between people and their surroundings. For a city to thrive, human health and well-being are essential. However, preserving people's health at the expense of native urban ecosystems would eventually reduce livability and threaten the sustainability of urban areas (Visvaldis et. al, 2013). Scale, distribution, and distribution should thus form the foundation of any sustainable development strategy. What is needed is to scale up while maintaining the fundamental principles of urbanization. Resources should be less time and money-consuming to get, making them more available. As well, proximity has an impact. The productivity of the land is increased by having the best infrastructure, which also increases opportunities for various interactions. But the community should oversee all these decisions. Urban sustainability is a problem at the communal level; it cannot be solved on an individual basis.

1.5.3 Environmental concern
Land use, development of land, integrating industrialization and urbanization into land use, environment protection and reconstruction, habitable and healthy cities, protection of the environment, resource as well as material recycling, upcycling, and social inclusivity and cultural promotion are all covered by the environmental concept of urban sustainable development (Visvaldis, 2013; Lynch, 2017). It aims to improve ecological restoration and environmental quality, the state of the air, green construction methods, green communities, the use of renewable energy

sources, and waste and recycling reduction and recycling. Through wise land use, emphasis may be placed on creating mixed-use communities with sound infrastructure, a sustainable economy, etc. Dynamic urban areas with integrated, slow-traffic networks should be built following city development regulations. Green construction practices emphasize recycling building materials while reducing waste and encouraging the newest technology, supplies, and tools.

1.5.4 Human Sustainability

Investing in people's health, education, access to services, nutrition, and skill development is a crucial part of ensuring human sustainability. Despite the restricted amount of space and resources available, there is a need for ongoing expansion. According to the theory of human sustainability, people are either directly or indirectly responsible to produce goods or the delivery of services. Promoting human sustainability, or communal and social health, is crucial for maintaining urban sustainability.

1.5.5 Social Sustainability

Our social structure serves as our guidance. This framework consists of investments and services. The goal of social sustainability is to maintain this structure. Globalization, society, culture, and community are all aspects of social sustainability. It emphasizes preserving social quality, or the caliber of interpersonal interactions. Interdependence exists between the ecological system, society, and the economy (Garau, 2018). Urban sustainability is a concept that encourages social and economic advancement while safeguarding the environment. Laws, knowledge, and common ideals may all support it.

1.5.6 Economic Sustainability

Social equality is improved via social sustainability. The goal of economic sustainability is to raise living standards. It can be done at the expense of sustainability's ecological and social components, though (Ramos, 2019; Bell & Morse, 2018). The distinction between urban and rural areas is rapidly eroding, which encourages the movement of goods, money, information, and people. Urban places and activities are supported by these resources (economical activities, societal dimensions, environmental activities).

1.6 Interconnected Cities

Cities are not independent entities, but rather are connected to one another. Urban sustainability is a complex network of interrelated subsystems with different time horizons and geographic requirements. Understanding one system does not mean understanding all others. As the network grows, urban centers or cities continue to swell, engulfing the adjacent suburbs and villages. (Phillis, 2017). This results in issues of income disparity, political inequality, class inequality, and disparities in urgent help, and health care. Urban sustainability is established by boosting economic prosperity and getting people involved in different activities. To achieve urban sustainability, each of the guiding principles must be followed. Do not forget that to live comfortably now and in the future, this is a procedure to which each one must contribute.

1.7 Sustainability in urban development

Urban expansion must be supported by a sustainable management and planning approach that encourages interconnected green spaces, a multimodal transportation system, and mixed-use development. Several public-private partnerships should be used to create liveable, sustainable communities that protect historical, cultural, and natural resources. Legislators, regulators, and developers should also promote the use of pollution-reducing site design and construction methods that combine natural and manmade systems. (Phillis, 2017). In addition to providing a variety of housing alternatives in terms of sizes, styles, and prices, sustainable urban projects and redevelopments should also include commercial, institutional, and educational uses. These mixed-use complexes' accessibility to sidewalks, trails, and private roads, which are linked to transit hubs and an integrated street network, offers a variety of transportation options and cuts pollution by lowering the amount of car journeys (Spangenberg, 2018; Spangenberg, 2007). The mixed-use districts and sections of the urban centre should encourage bicycling, walking, and other kinds of alternative transportation. These regions' boundaries and centres must be easily accessible.

The development of an ecologically conscious strategy was fundamentally based on this sustainability notion. With Agenda 21 and Local Agenda 21, it was further

expanded practically there at "World Environment Conference" in Rio de Janeiro in the year 1992 (Diaz-Sarachaga, 2019). Since then, a growing number of urban in nations all over the world have adopted the Local Agenda 21 idea. The sustainability idea calls into question a lot of the overall course that progress has previously been traveling. It is no longer acceptable to utilize resources carelessly or damage the environment, which in the past was seen as a "cost of progress." Furthermore, environmental concerns and natural resources are just a small part of sustainable urban development. Little of permanent significance will be accomplished if the urban social and economic contexts within which they are fashioned are not sustainable. The interplay of the various difficulties is crucial. How can jobs and a better environment coexist? How can we draw in new service sectors without creating social division? In metropolitan environments, these connections and their interrelationships are particularly crucial.

A key contributor to inefficiency and instability, persistent inequality and poverty in cities violate the fundamental socioeconomic rights of some groups of people who frequently make up a large portion of urban populations (Gudmundsson et. al., 2016). Therefore, programs for urban social development must actively encourage a reasonable and equal distribution of opportunities and resources. This entails employing tactics for the fair distribution of public resources and the collection of public funds that are based on democratic and participatory principles. The expenses and advantages of improving metropolitan areas might be split between those who can afford to pay and others who require special support. However, variations in resource availability represent only one aspect of urban inequities. Diversity in deprivation and discrimination is highlighted by intersections between disparities based on gender, age, race, religion, location, or disability (Joss, 2015; Komninos, 2016). To remove the obstacles that prevent different groups from making use of the resources and possibilities provided by urban growth, sustainable methods are required. Realizing everyone's potential is a tremendous resource for urban development and is essential to the effectiveness and sustainability of cities.

The local, as well as the economic fabric of countries, might change because of urbanization. Since they produce and consume most of the world's goods and services, urban regions are the primary forces behind development and economic expansion. Cities that are dynamic have many opportunities for long-term expansion. Cities may improve social inclusion, encourage economic growth, and uncouple growth and living standards by implementing smart urban development policies. Additionally, it will contribute to resource utilisation that is efficient, safeguard regional ecosystems, lessen poverty in both urban and rural areas, and significantly reduce pollution. Sound urban development will accelerate the achievement of sustainable growth and contribute to the eradication of extreme poverty (Kramers, 2014). However, errors in the control of urban expansion are exceedingly difficult to correct. It may be challenging to change the results of infrastructure expenditures, urban land-use rules, and building plans for many years since they are effectively set in stone. Without proper management and funding, slums may grow, and communities may struggle to provide the kinds of employment required to improve living conditions. If, urban areas may fail to offer economic possibilities to neighbouring rural regions, it may fail to uncouple economic growth from resource usage. It might make a country vulnerable to climate change and other environmental problems (Batty, 2011; Bohringer, 2007). Cities all over the world are trying to handle their expanding populations and deal with the many issues related to urban growth. Few nations will profit from sustainable urban development if current patterns continue. As a result, how cities respond to the problem now is crucial.

1.8 Urban Economic Growth

It has been established that even the tiniest, unorganized businesses may boost the local economy. The productivity of industrial, commercial, and service activities, which collectively generate the revenue and wealth of cities and their residents, is essential to sustain economic growth. Gaining productivity boosts profits for both employers and employees, which encourages additional investments and raises incomes for both individuals and households. As a result, cities' economies are

strengthened and maintained (Verma et. al., 2018; Xing et. al., 2009). To boost the productivity of both current and new businesses as well as to create new job prospects, measures must be used. Additionally, it's important to pay attention to the resource needs and environmental effects of firms.

The urban economic policy seeks to unite public, private, and community businesses to promote efficiency for the benefit of all. A new style of management is necessitated in all the urban systems because of macroeconomic changes (such as opening national markets to foreign competition and the quick emergence of new communication and transportation technologies). In parallel, national governments are giving sub-national authorities, particularly municipal administrations, the authority to run their affairs, adapt to economic restructuring, and create new productive organizations through programs of administration and budgetary decentralization (Hiremath et. al., 2013). To promote efficiency throughout the whole spectrum of urban economic activity, new ways to manage city economies can unite public, private, and community entrepreneurship. Such partnerships should put a heavy emphasis on maximizing and mobilizing the efforts of all persons involved in productive activity, regardless of the degree of technological or market demand at which they operate.

1.9 Urban Sustainability Indicators

Sustainable development has an association with concern for the carrying capacity of natural systems and the social problems that humanity is now confronting. In the 1970s, the phrase "sustainability" was initially used to refer to an economy that was "in harmony with underlying ecological support systems." Ecologists have referred to Growth Limitations. (Adinyira et. al., 2007).

Environmental sustainability, economic sustainability, and sociopolitical sustainability have historically been the three main components of the notion of sustainable development. The main distinction between green development and sustainable development is that the former places more emphasis on environmental sustainability than on issues of economics and culture (Huang et. al., 2015; Munier,

2011). Sustainable development proponents contend that it offers a context for enhancing overall sustainability in situations when cutting-edge green growth is impractical.

According to the outlined trends, controlling sustainable urban development using indicator-based sustainability assessment is acceptable and advised (Ghosh et. al., 2006). Indicators offer a clear, quantifiable tool that aids in building sustainable communities that support their residents' long-term economic output, health, and life quality (Alberti, 1996). To establish goals and assess the effectiveness of problem-solving, metrics of sustainability are utilized as a source of data when developing strategy documents and development programs. Information is provided via indicators to the public, scientists, and policy authors (Rosales, 2011; Cohen, 2017). The objective is to include or increase participation of the urban population in the administrative process. This can be done by making use of cooperation in the design, selection, and assessment of the indicators (Reed et. al., 2006). Thus, choosing indicators wisely serves an educational purpose and aids in improving knowledge of sustainable development. Numerous research on the conceptual and analytical elements of developing indicator frameworks and utilizing them in the evaluation of sustainability has recently been published, including (Gutowska et. al., 2012) and others. Sustainability is the continuity of equilibrium between the built and natural environments. It is a continuous, safe journey that never stops working to accomplish environmental, socioeconomic, and cultural objectives. An urban unit, such as a city or town, with sustainable qualities, is one that, with the help of civil society, strikes a balance between ecological, economic, and cultural progress. Additionally, the idea is crucial to most explanations of sustainability. The idea that people's lives would be more interwoven in a sustainable environment is also inherent to most conceptions of sustainability. The term demonstrates how the social, economic, ecological, and cultural sectors of existence are interconnected. Because it offers a methodical framework for assessing different possibilities, multiple criteria assessment (MCA) has been employed as a tool for supporting decisions in numerous applications

(Purvis et. al., 2019). These four overlapping rings, which stand for the social, economic, ecological, and cultural realms, allow us to see the interconnection of these four areas.

Indicators for sustainable management and designing are titbits of data that summarise and depict aspects of reinforced composites and are intended to produce patterns that would not otherwise be immediately apparent (Duic et. al., 2015). Sustainability is a very complicated notion that incorporates several actors, interests, and organizations as well as environmental, economic, social, and sociocultural factors. To make sustainability more manageable for policymakers and planners, aspects of sustainability have been created as a practical and logical tool. To guarantee that data are comprehended clearly and conveyed successfully when information must be shared on a broader scale, it is essential to formalize the models that are used to define an area. The primary data models used to represent geographical phenomena are described in considerable scientific detail. Indicators used to gauge urban sustainability are increasingly being included in research initiatives and studies. Indicators are employed in a variety of scales and locations. Models of indicators are used by many counties and areas to guide sustainable development. A variety of indicators can be established using various techniques. The development of indicators in China has primarily occurred at the academic level. Few indicators have been approved as official standards for measuring environmental sustainability at any administrative level, despite the government beginning to pay closer attention to the utilization of indicators (Hansmann et. al, 2012).

Sustainable Development can only be attained through inclusive green growth. It's the only way to balance the rapid development needed to get emerging nations to the close of affluence they desire, encounter the requirements of the almost ten crores people who are still living in extreme scarcity, and satisfy the unavoidable need for a better world setting. The three sustainability stakes are effective tools for outlining the Sustainable Development issue.

1.9.1 Social Sustainability

Social sustainability is the ability of a social system, such as that of a country, family, or organisation, to preserve a certain degree of social peace and well-being over a prolonged period. The indications of an economically unsustainable society include issues like conflict, persistent poverty, pervasive unfairness, and low education rates (Davidson, 2010; Bramley, 2009). One of the guiding assumptions of sustainable development is social fairness, with the recognition of individuals and their life quality as a key concern. Equity refers to how equally and inclusively resources are allocated, opportunities are provided, and decisions are made. It entails the provision of equivalent job opportunities and social services, such as those related to education, health, and justice. The idea applies to communities and countries both within and outside of them. The attainment of social equality confronts several challenges, including those relating to intergenerational opportunity, employment and income distribution, gender, ethnic, and age inclusion, poverty reduction, and access to financial and natural resources. In addition to widespread and ongoing problems with precarious work, poor nutrition and health, illiteracy, civic discontent connected to violence, and corruption, people who live in poverty may also feel powerless and alone (Ehrgott et. al., 2011). Land deterioration and resource overuse are caused by the rural poor's concentration on marginal land.

Social justice can be corrected by equal distribution of resources. Giving opportunity to all classes of population to have access to clean air, drinking water, housing, and public spaces. In the creation, implementation, and enforcement of environmental laws and regulations, social equity refers to the equal treatment of all individuals and communities (Vallance et. al., 2011; Satterthwaite, 1997). It is a social justice issue that places are in greater danger of being destroyed by hurricanes. People or groups may be precluded from fully participating in choices on climate adaptation depending on their socioeconomic status, geographic location, or neighbourhood. This is referred to as social equity. A community's ability to adapt to climate-related events and disasters depends on both natural factors and economic potential. In areas where marginalized people are vulnerable

to storms, flooding, or even other climate-related calamities, local groups may support grassroots initiatives and raise awareness by advocating for changes on a variety of fronts.

The democratic feature of equity refers to the idea that everyone has an equal say in the decisions that are taken by the government and, consequently, universal access to the information necessary to participate in politics and make well-informed judgments (Colantino, 2010). Some citizens' opinions and desires could be disregarded as communities grow and change. Marginalized communities are made up of minorities, the elderly, individuals with disabilities, and other impoverished residents, and they are frequently connected by money issues. Gaining the support of these organizations and a bigger segment of society will boost the number of people working toward sustainability objectives like expanding the number of green jobs available and lowering emissions of greenhouse gases and energy use.

1.9.2 Environmental sustainability

Sustainability in terms of the environment refers to its capacity to withstand throughout time a certain level of quality and rates of natural resource extraction. The largest issue facing the globe is not given enough importance to be resolved (Rzeny-Ciepliska & Szmelter-Jarosz, 2020). Since the consequences of not addressing the problem now will be delayed. Urban environmental sustainability encourages creativity, urban redevelopment, and the reduction of environmental effect while maximising economic and social benefits. It raises the quality of life. To lower pollution levels and CO2 emissions, improve air quality, and safeguard natural resources, a sustainable city idea integrates eco-friendly practises, green areas, and supporting technologies into the urban environment (Hasan et. al., 2016; Turner et. al., 2007). These initiatives boost environmental and human health while reducing the city's carbon impact. In the fight against climate change, sustainable cities must come first.

1.9.3 Environmental sustainability issues

Since each country has unique natural conditions as well as social and economic institutions, there is no one right way to put sustainable concepts into practice. Each

nation needs to develop its own unique approach to ensure that sustainable growth is pursued as a global objective. Although attaining environmental sustainability may have certain difficulties, there are clear benefits for both human and animal health globally. The biggest social barriers to achieving global sustainability are the exponential growth of the population and the unsustainable production and consumption habits of the rich. Sustainability won't be possible unless there is an enormous change in how people behave all around the world. Other social challenges include a lack of education and understanding about sustainability, a lack of interaction between the government and civil society, and a lack of financial incentives for the corporate sector to support sustainable development (Feiock et. al., 2014).

1.9.4 Economic Sustainability

The ability of an economy to sustain a particular level of economic production over a long period is known as economic sustainability. Due to problems with environmental sustainability, this is the most significant issue to have surfaced since the Great Recession in 2008 and it endangers development.

Economic sustainability aims to promote economic expansion without sacrificing the adverse environmental consequences that expansion has historically entailed. A vast array of ethical standards and business procedures make up economic sustainability. Sustainable development aims to create systems of operation that use natural resources gradually enough to allow for continuous use by future generations (Zheng et. al., 2020). Sustainable practises may be used in a variety of ways to solve the problem of humanity's overall ecological footprint. They may either concentrate on slowing down environmental deterioration or adopt an alternative strategy by learning how to decrease waste, lower carbon emissions, and use solar energy. Economic sustainability is predicated on the fundamental idea that we should refrain from short-term, wasteful behaviours and promote the long-term wellbeing of the planet. A stable economy is essential for a number of reasons, from commercial interests to high environmentalist ideals (Yi et. al., 2019; Li et. al., 2020).

It is a challenging task that requires the full participation of both the public and commercial sectors to provide the groundwork for financial stability. Retail investors, however, can put their money in companies that share their viewpoints and business practices (Mori & Yamashita, 2015). Furthermore, people should demand that their elected officials include carbon caps and sustainable development goals in their economic plans. In the end, mass action and a reform of the financial systems that underpin the world economy are the only ways to achieve environmental sustainability.

Table 2: Sustainable Development Indicators

Sustainability	Indicators	Measures
Economic Sustainability	Rates of employment as well as unemployment	The proportion of local green jobs, the rates of employment, and unemployment, and the typical number of years worked after completing a professional education
	Economic and monetary growth	The yearly growth rates of the GDP and GNP; Growth in exports as a percentage of total imports minus total exports each year; From listed foreign direct investments, capital, and yearly revenues
	Green spaces	The proportion of parks, reservoirs, rivers, and other protected areas to the total land area; proportion of trees in the city to its area or population
	Reduce greenhouse gases/ Energy efficiency	Total GHG emissions, both per person and per city, as well as the percentage of the city's energy use that comes from renewable sources

	Mobility	Percentage of each mode of transportation, such as bicycles, foot travel, and public transit; typical journey time and cost
Social Sustainability	Water quality/ Availability	The total volume of water that is available; water quality rating or index; percentage of people who have access to sufficient and clean drinking water
	Air quality	Particle matter concentrations (PM10 - mg/m3) and particulate matter concentrations (PM2.5 - mg/m3)
	Waste/ Reuse/ Recycle	The quantity of solid garbage produced; the recycling rate (% of waste stream diverted);
	Complete neighbourhood/ Compact city	Crime statistics, neighbourhood and local service accessibility, and measures of income distribution and inequality.
Environmental Sustainability	Housing	Percentage of cheap, social, or priority housing; Detailed analysis of the housing market by property type (owner-occupied vs. Rental, single vs. Couple vs. Family vs. Multifamily, etc.).
	Quality public space	Percentage of well-maintained roads; the proportion of greenery (public parks) to a city's total area or population.

	Education	Adult literacy rate; the number of institutions with environmental education programs.
	Sanitation	A percentage of the populace has access to sanitary sewage systems that are either waterborne or alternate (and efficient).
	Health	Life expectancy and mortality rates; percentage of the population that has access to medical treatment.

1.10 Implications for urban sustainability in Uttarakhand

According to the 2011 Census, there are 30.5 lakh urban residents in the state of Uttarakhand, including census towns and cantonments. The total urbanization rate in Uttarakhand, which is about 30.2%, is comparable to the nationwide average of 31.2%. The pace of population increase differs across metropolitan centres and districts. The state's average annual urban rate of growth is 4.0 percent, which is much larger than the average annual rural rate of growth, which is 1.2 percent. The state's urban population is primarily concentrated in the larger towns of Dehradun, which has a population of 5.75 lakh people, Haridwar, which has a population of 2.31 lakh people, and the towns in its southern region, which is agriculturally prosperous and industrially advanced and includes Rudrapur, Roorkee, Kashipur, and Haldwani. However, one might find it helpful to picture Dehradun, the state capital and the policy-making center that has conceptualized enhancement in the population of urban areas.

Since the state is hilly, the majority of both the urban local authorities are situated there. Because of this, urban development design is a difficult challenge in the state, and many approaches are needed to satisfy the demands of both locals and visitors, and pilgrims. Planners have extra difficulties due to the state's geography and geographical characteristics. Due to the complicated institutional structures and

abundance of organizations in the state, efficient urban development and development is also hampered.

The Uttarakhand Housing Department performs a similar function to the Urban Development Authorities, while the Town & Country Planning agency oversees urban planning. The Urban Development Group is the administrative division for local self-government in the state. Additionally, the Drinkable Water Department is the administrative division of the Uttarakhand Pey Jal Nigam and Uttarakhand Jal Sansthan, which is responsible for providing the project towns with water supply, sewage, and drainage services. In addition, organizations like the Department of Public Works (PWD), the Uttarakhand Environmental Safety and Pollution Control Board, and other line agencies operate in metropolitan areas. Local government regulations carried over from Uttar Pradesh continue to control the urban economy in Uttarakhand. The problem of ineffective inter-departmental business allocation has persisted, making it difficult to direct and administer the sector effectively. Due to a lack of operational alignment between these departments' complementary and associated industries, efficient and effective operations are now not possible.

Making the cities in countries where most of the population lives in rural regions the centers of development and growth is difficult in the age of urbanization. However, based on the forward-thinking measures implemented by the Uttarakhand administration, the state is poised to soon become a thriving, viable, livable, inclusive, and sustainable destination. As a result, the state needs a resilient urban sector that can capitalize on its growing population as a resource for long-term survival. The state has actively prepared to address the needs of evolving urban regions by putting municipal infrastructure and institutional frameworks in place to effectively provide basic civic amenities to all people, especially the urban poor. The administration of Uttarakhand has prepared ahead of time to meet the demands of changing urban regions by putting municipal infrastructure and institutional frameworks in place to effectively provide basic civic amenities to all people, including the urban poor. The Uttarakhand state will soon rank among the

nation's smartest, cleanest, and most educated states thanks to the seamless coordination of all government agencies.

1.11 Rural Development and Migration in Uttarakhand

The tough mountain topography and scattered populace of the mountainous areas remain the main obstacles to development and eradicating poverty in Uttarakhand, where more than 66% of the people live in rural areas (more than 80% inside the hill districts). The hill districts of the state, which include Haridwar, Dehradun, and Udham Singh Nagar, have had slower rural development than the plain regions. In the hilly regions, the ancestral lands are relatively few and dispersed. In hill districts, just 10% of the land is irrigated. Most of a rural community in the hills generally migrates in search of better employment prospects or depends on subsistence farming to survive. Building infrastructure in the hill areas, including roads, power, and irrigation will be efficient. The infrastructural imbalance across districts exacerbates the growing economic and living conditions between the lowlands and the hills. Additionally, the region's reliance on non-farm sectors for revenue has grown significantly.

There are many underpopulated hamlets or villages in the state's hill regions because of outmigration from rural areas, which has become a significant issue. A significant barrier to solving the outmigration issue is the hill communities' stagnant socioeconomic situation. One of the main forces driving change in the rural parts of Uttarakhand, especially in the hill districts, has been the strengthening of regional development and rural livelihoods. The rural population's primary sources of income are agriculture and manual labor. One of the primary interventions for halting migration from such areas will be to strengthen the state's rural economy.

The state government established the Rural Advancement and Migration Commission in 2017 with the mandate to develop a vision for the targeted development of the state's rural areas that would help reduce out-migration and encourage welfare and wealth of the local dwellers; give recommendations on multi-sectoral advancement at the grassroots level that would group at the district and federal levels; standardized assessment on those segments of the population

that are most in need of improvement. To fulfill this mandate, the Commission has examined the major programs and policies in the field of rural development being carried out by various state government departments and agencies for their socioeconomic advantages and has made recommendations for their improvement. This will improve the rural socio-economy, which will in turn help to reduce out-migration. The state of Uttarakhand has a total size of 53,483 sq km, of which 7 percent is plains and 93 percent is made up of hilly terrain. It has international boundaries with Nepal in the east and Tibet (China) in the north. India's national border is defined by two states: Uttar Pradesh in the south and Himachal Pradesh in the north.

Its varied landscape includes river valleys, hills, and snow-capped mountain peaks in addition to the little number of lowlands that make it up Tarai, Bhabhar, and Doon. The bulk of the locations features significant ground undulations. The climate is likewise impacted by these altitudinal gradients. Both the biodiversity and the landscape are magnificent. The Uttarakhand Himalaya, which consists of 13 districts, is separated into the Kumaon Himalaya and the Garhwal Himalaya, two different geological and socio-cultural areas. The Kumaon Himalaya is comprised of six districts, featuring Udham Singh Nagar (USN), Nainital, and two precincts: Haridwar in the Garhwal area region and USN. The Garhwal Himalayas are made up of seven districts, including Kumaon and each of the following: Uttarkashi, Haridwar, Pauri, Dehradun, Chamoli, Rudraprayag, and Tehri. There are six districts in Himalaya, and Udham Singh Nagar and Nainital are two of them. While Dehradun, also in the Garhwal region, and Nainital, in the Kumaon region, are both very somewhat plain, Haridwar, in the Garhwal area, and USN, in the Kumaon area, are both plains. The districts listed below are all located in hilly terrain. The state's population is unevenly distributed since over half of its residents reside in plain areas, which account for 10% of the state's total geographical area. There are 189 people per square kilometre. According to the 2011 India Census, there are 49 people per square kilometre on average. Although subsistence farming predominates, there is a lack of arable land and inadequate agricultural yields to

feed the state's growing population. Numerous populations have relocated to the cities in search of employment because of each of the aforementioned factors.

1.12 Research Objective

By 2050, over two-thirds of the world's population will reside in urban areas. The local resources are under stress because of rapid urbanization. City planners, policymakers, and urban municipal organizations should try to make this urbanization more sustainable. All social, economic, and environmental considerations go into sustainable urbanization. As a result, achieving sustainable urbanization is a challenging task. Policymakers and city planners may assess the performance of the city with the aid of these urban sustainability indicators. These are the goals of this research project.

➢ To find relevant urban sustainable development indicators for urban areas in Uttarakhand.

➢ Assesses how Urban Development in Uttarakhand affects urban sustainable development indicators.

➢ Establishes the foundations of sustainability and its significance in Uttarakhand's urban areas.

➢ When choosing urban sustainability indicators, consider several sustainable urbanization techniques.

➢ Determine the motivations for the creation of several lists of urban sustainability indicators.

1.13 Research Methodology

The following section analyses the present state of sustainable development in cities in Uttarakhand, India and noting the variations between them. The statistical information utilized to prepare this study were analysed and compared using statistics that were both local and national (municipal) in scope.

We utilized a collection of 22 indicators divided into the following three categories for an easy evaluation of the level of sustainable development: The signs include,

Economic Indicators of sustainability

- Urbanism

- Employment scenario

- Local Body services

- Local body expenditure

- Private firm participation

- Income level for small vendors MSME/Small Business

- Tourism

- Urban-Rural synergy

Social Indicators of sustainability

- Quality of Education

- Female participation

- Performance of health service

- Service of public transport

- Population living in slums and informal settlements.

- Safety of Electricity supply

- Quality and supply of drinking water

- Air quality

- Waste/ Reuse/ Recycle

Environmental Indicators of sustainability

- Ecosystem

- Green cover like parks & open spaces

- Air pollution

- Renewable energy like Solar etc. and biofuel

- Water pollution

- Natural disaster

1.15 Chapters scheme

The research examined sustainable urban development strategies used in several Uttarakhand cities. This study is structured as follows to achieve the stated purpose and objectives:

In chapter one **-** The initial assessment of the research issue is highlighted. The subjects of sustainable urban development and smart urban planning were

introduced to set the scene for the investigation. The chapter discussed the study's problems, goals, importance, limitations, and methodologies.

In chapter two **-** Academic literature was reviewed about sustainable development and sustainable urban development. This is a brief description of how cities try to achieve sustainable urban development as well as a historical backdrop for it.

Chapter three **-** The application of both quantitative and qualitative research methods. The 22 indicators and pertinent research that connects to the sample studies and sustainable urban development plans were examined and evaluated in this case. The formulation of hypotheses and research methodologies were covered in this chapter.

In chapter four- In this chapter, the data collected were evaluated using various statistical methods, and the findings were drawn.

In chapter five **-** Conclusions from the study are formed, and suggestions are offered to direct further investigation into sustainable urban development in Uttarakhand.

Chapter 2

Literature Review

2.1 Introduction

As the world rapidly urbanizes, there is a lot of emphasis on attaining procedures and outcomes for cities sustainable development. To achieve this goal, it is required to visualize sustainable cities, evaluate the existing policies, and observe the development of sustainable cities. Despite a growing body of research on sustainability evaluation, there is still much to learn about how it is used in urban settings. To better grasp the idea of city sustainability, this study thoroughly surveys the literature on sustainable urban development.

Cities throughout the world have had to deal with economic, social, and environmental issues as well as quick urban expansion like population increase and socio-spatial changes over the previous 40 years (Jaffar, 2011). These variables have significantly impacted urban regions in emerging nations (Habitat, 2009; Jaffar, 2011). Currently, emerging nations account for over 75% of the rise in world population (UN, 2019). Approximately 40% of people currently reside in urban areas; this number is projected to rise to 52% by 2020 and 67.5% by 2050 (UN, 2019). The environment, social conditions, and the economy are all being impacted by these developments. The main effects of these developments are economic uncertainty and the fight for investment attractiveness. The consumption of energy and climate change are two additional issues that affect urban areas. As a result, cities everywhere must deal with the effects of i) globalization and ii) decentralization and iii) extensive population growth.

Urbanization, urban expansion, and socio-spatial dynamics in urban regions have all been significantly impacted by shifts in administrative & financial institutional mechanisms, societal stance, and the nature and scope of the environment and dispute concerns.

Local governments must simultaneously support urban economic competitiveness and address the social issues brought on by globalization, including urban poverty, illiteracy, and fast population increase (Demiral, 2014). However, the lack of funding and specific constraints placed on municipal governments sometimes stymies their efforts. To assist cities in overcoming these difficulties, urban sustainability and sustainable urban development concepts have advanced. The term "sustainability" was first proposed in 1972 at the Stockholm Conference of the UN on the "Human Environment" and expanded upon at Habitat I in Vancouver. Additionally, Agenda 21 was endorsed in 1992 as part of the UN Environment and expansion Conference to encourage Sustainable Human Settlement Development. Finally, Local Agenda 21 (LA21) was implemented in metropolitan areas during Habitat II in 1996 (Demiral, 2014).

Establishing an equilibrium between economic, environmental, and societal demands is a key objective of sustainable development. Cities must develop social and economic systems that do not affect the environment and maintain a balance between their human population and natural resources in order to achieve sustainable urbanization. This balance may be attained by using a system that combines public engagement with scientific information offered using systematic analysis. Under this system, sustainable urban expansion is viewed as "a new-fangled large-scale vision to steer the development agenda for the 20th century" under this system. Planning nowadays is different from planning in the past to meet the problems of the twenty-first century and achieve sustainable urban development. Cities are intricate and dynamic environments. Many cities in developing nations have outdated layouts bordered by huge slums or informal settlements. Urban planning is a technique that tries to transform vision into a

priority to attract investment, improve urban areas, promote infrastructure investment and ease of doing business. Planning might also be viewed as participatory government. As a result, budgeting is not purely technical and largely depends on moral judgments (Healey, 2004).

The new urban planning methods must deal with the extraordinary challenges that 21st-century cities face to achieve sustainable urbanization. To deal with changes, unpredictable situations, and the complex problems that new cities face, these strategies should be strategic. Unfortunately, outdated methods of urban planning, including such grand schemes and comprehensive plans, which fail to address the new problems cities face, are sometimes directly causing scarcity and spatial marginalization to worsen in several regions of the world.

2.2 Sustainable Development

During the UN conference on the "Human Environment," which was first held in Stockholm, Sweden, in June 1972, international environmental law first began to take shape. The concepts underlying several global environmental challenges, such as human constitutional rights, resource supervision, pollution control, and the connection between the environment and development, were outlined in the Proclamation on the Human Environment. The UN Environment Program was further established because of the summit. The Brundtland Commission, also referred to as the World Environment and Development Commission, was the organization that popularized the sustainable development concept. The concept of sustainable development gave rise to new terms like "social accountability" and "economic, societal, and environmental performance." The link between environment and socio-economic growth was widely realized when the Relationship for the Preservation of Nature created the "Biodiversity Management Strategy" and coined the term "sustainable development." The Brundtland Report, published in 1987, helped this theory gain widespread acceptance. Unfortunately, the definition does not work, leading to many conflicts and cognitive dissonance. This occurs because procedures that may be sustained indefinitely are frequently

meant by the term "sustainability." This is untrue for socioeconomic development and success, just as the planet's population growth cannot continue at its current rate. Therefore, progress is not sustainable in this sense. However, sustainability is being employed as an adjective in this context. When it is established that "sustainable" has a distinct definition in this situation, that which satisfies present wants without jeopardizing the potential to satiate future demands, the problem is resolved.

Sustainable development policies primarily address economic, environmental, and societal sustainability. Economic growth, social advancement, and environmental preservation are referred to as the mutually co-related pillarrs of sustainable development in a number of UN documents, most notably in the 2005 World Summit Outcome (Reyna, 2018). The phrase "sustainable development" entered the environmental discussion in the late 1970s. It is a manifestation of the interconnectedness between the three systems—the economic framework, the social structure, and the ecological system—that has been recognized as essential to growth. The phrase "the environment" could be a better way to define the last component. Because every aspect of the consumer economy depends on interpersonal connection, the economy only exists inside society. In turn, society is wholly dependent on the ecological system. The environment is being changed by human activity at an increasing rate, but civilization and its monetary institutions will always be dependent on the environment. Since all three factors interact equally, a development that fulfills the "triple bottom line" is environmentally sustainable. Using this model, it is possible to illustrate the interactions between the three factors.

Burr (Azzopardi & Nash, 2017) asserts that the "ideal" capacity balance for all three systems is sustainability, which will:

➢ The more the three processes and aims coincide, the more sustainability is.
➢ Optimize goal attainment in all three components through a flexible trade-off strategy.

The Report of Brundtland (Schutte, 2009) states that environmental protection and economic development must work together for sustainable development. Without the other, neither can exist. IHR major source of economy is tourism. Be it visiting the hill stations like Mussorie, Manali or Darjeeling; or visiting the holy places like Badrinath or Kinnaur Kailash. Sustainable tourism is commercially feasible for the foreseeable future when created and maintained in this way and on this scale. It does not harm the natural and social ecosystem that supports and nurtures it. It must be economically viable since if it is not successful, whether it is ecologically sustainable might be contested. Unprofitable and unviable tourism will disappear. A greater mega-policy framework that offers a larger social, economic, environmental, cultural, legal, and political context for sustainable development is what the tourist industry must accept and operate within. To implement the principles outlined in the destination vision, particular tactics must be taken when developing tourism (Voicu, 2002). The actions necessary to reach the destination vision can be operationalized by defining various tourist goals. According to Jamieson and Noble (Keijzers, 2004), growing data indicates that an integrated approach to planning and management in the tourist industry is increasingly necessary to achieve sustainable tourism. The need to combine traditional urban administration's demands with the need to prepare for tourism has just come to be well understood. The requirements of road transportation, planning for land use, brand management, economic growth, and safety are only a few examples of traditional urban management. The following are some of the foundational ideas of sustainable tourism development:

➢ Local businesses and tourism should work together to build a connection, and tourism should provide great job opportunities for residents. Broad-based community support should be used to launch tourism, and the neighborhood should maintain control over its expansion.

➢ A standard of conduct for tourists should be created at the federal, provincial, and municipal levels based on accepted standards.

- Establishing regulations for tourism-related activities, impact analyses, cumulative effect monitoring, and allowable change thresholds is crucial.
- Building education and training programs are crucial for managing and developing historical and natural resources.

According to Sharpley (World Tourism, 2016), sustainable tourism development aims to maximize the advantages of travel for travelers (their experience), the industry (earnings), and locals (their socioeconomic development) while minimizing the effects of travel on the atmosphere. The following are the scope and targets of tourist expansion:

- Resources used in the tourist industry must be preserved and used sustainably. Tourists should be managed and planned accordingly, considering environmental constraints and the proper long-term utilization of natural resources.
- Planning, development, and operations related to tourism should be incorporated into local and national development strategies. Different forms of tourist development should be considered, as well as how they relate to current land and resource usage, sociocultural influences, and other considerations.
- A variety of local economic growth could benefit from tourism, but it shouldn't be permitted to totally replace other local revenue streams in light of environmental benefits and costs.
- With the assistance of the government and businesses, local areas have to be expected and required to participate in tourism scheduling, expansion, and management.
- All organizations and individuals should respect the local political systems, economics, way of life, culture, and environment.
- The need to create more ecological forms of tourism should be made clear to all parties involved in the industry. This involves educating the public

about sustainability and responsibly promoting tourism to visitors and the host communities.

➢ Research should be conducted at every level of tourism growth and operation to track effects, address issues, and enable locals and others to adapt to changes and seize opportunities.

➢ To minimize possible friction and maximize the advantages for everyone involved in the growth and administration of tourism, all agencies, organizations, enterprises, and individuals should collaborate and work together.

One of the foundational elements of development is cultural variety, a method of obtaining a more fruitful cognitive, emotional, ethical, and spiritual living in addition to economic advancement. This idea is further elaborated by the UN Declaration on Ethnic Diversity of UNESCO (Australian Govt., 2017), which claims that "...cultural diversity is as essential for human existence as biodiversity is for nature." According to this perspective, the fourth area of sustainable development policy is cultural diversity. Sustainability essentially implies enhancing the present to benefit the future. It is financially and technologically feasible and morally and socially acceptable. This implies that it should be in recognition of the fundamental human rights, such as the values, relationships, and basic freedom of every person, as they together contribute to the ethical, spiritual, moral, and social sustainability of growth (Pak et. al, 2020).

2.3 Sustainability and Local Agenda-21

At the UN symposium on the Development and Environment at the World Conference on 14th June 1992, in Rio de Janeiro, 182 states ratified Agenda 21, a comprehensive action plan. It offers a strategy for guaranteeing the planet's sustainable future. It outlines the environmental and developmental problems that pose a danger to the atmosphere and the economy, and a plan was developed to move toward more sustainable practices. Agenda 21 was initially referred to as Local Agenda 21 (LA 21) as the global sustainability roadmap adopted at the 1992

UN Environment and Development Conference. In Agenda 21, it is said that local governments are next to the people and require every local government to work with their residents to create and carry out a local sustainability plan [89]. LA 21 is said to as a transition process that aims to create a sustainable future Salan (2002: 2). Knowledge, political will, resources, and finance are necessary, but organizations and communities can also benefit from a wide variety of professional talents and experience that are uncommon in local government. The LA 21 initiative, according to Environment Australia's Sustainability Unit, offers a structure for putting sustainable progress into practice at the local level. The objectives are to combine environmental, economic, and social goals more effectively by utilizing already available local authority resources and procedures (Such as business plans, vegetation planning processes, and transportation strategies) (Australian Govt., 2017).

At the 1992 United Nations Environment and Development Conference Summit meeting, Agenda 21 was established, according to Cotter and Hannan. The agenda has three main objectives for sustainable development: community engagement, integration of decision-making processes, and pertinent national-level policies and initiatives. The four components of Agenda 21 are further split into 40 Chapters. Following is a synopsis of each section:

- ➢ **Section I –** "Economic as well as Social Dimensions", Chapters 2-8. This section looks at the negative effects of indefensible resource usage and development.
- ➢ **Section II –** Chapters 9–22 of "Preservation and Resource Management" for development. The "sectoral problems" sections of Agenda 21 are covered in this section.
- ➢ **Section III –** "Increasing the Capacity of Major Groups" chapters 24-32. To ensure that all relevant groups actively engage in all Agenda 21 program areas, this Section places a strong emphasis on local empowerment and coalition-building among varied social partners.

> ➢ **Section IV –**Chapters 33-40, "Means of Implementation".

Just as significant as the ultimate strategy or plan is the LA 21 method of development. Open debate and discussion on the issues significant to the community must occur throughout the process. Everyone must collaborate effectively across the governmental sector, the commercial sector, and community organizations in order to achieve a single goal or objective. Local government is crucial to the flexible and continuing development process because it:

➢ Facilitating discussion of sustainability-related problems in the community.
➢ Giving direction to the LA 21 development process.
➢ Streamlining government operations.
➢ Building strong local relationships.
➢ Putting sustainability-related measures into practice in the community.

For LA 21, there is no set model. The program must tackle the environmental, economic, and social concerns that the local administration and community, who were involved in its formulation, confront. The program's speed, scale, and scope should be chosen in cooperation with the community. It would be useful to begin the LA 21 procedure.

➢ Investigate multiple strategies and results
➢ Develop a list of the current council strategies and initiatives. Seek political and managerial commitment.
➢ Simple assessments of the area's existing condition should be conducted, and the LA 21 procedure should be adjusted to meet the demands of the local council.
➢ Insist that LA 21 improves on current council resources and policies.
➢ Create a tentative budget and staffing duties, and then inform the council of the next stages.

A successful LA 21 process should lead to the following objectives:

- ➢ Relationships and trust between the local government and the populace
- ➢ Constant participation of the populace in decision-making
- ➢ Making decisions that are integrated and consider all anticipated economic, social, and environmental aspects.
- ➢ A long-term, practical plan of action that is regularly reviewed and effectively implemented. alterations that enhance sustainability and improve the neighborhood's environmental situation (Beck & Crawley, 2002).

A manual titled "Our Village, Our Prospect: A Guide for Local Agenda 21" was created by Cotter and Hannan (Australian Govt., 2016). Additionally, it was mentioned that local governments everywhere, including Australia, are increasingly taking the lead on sustainable development. To secure the long-term health and wellbeing of rural communities and the environment that supports them, they are developing and putting into practice methodical techniques. To assist municipalities and the individuals they represent in developing and implementing a LA 21 strategy, a guidebook was written. Goals include People and organizations interested in learning how to secure the support of influential parties to create a LA 21.

A LA 21 process's action areas are:

- ➢ Lay the groundwork by deciding on the structures, strategies, and tools that the council will use to construct a LA 21 with the assistance of the staff, senior executives, and the community..
- ➢ Creating relationships through getting to know the neighborhood and developing strategies for increasing interest in and participation in LA 21.
- ➢ Vision, goals, aims, and indicators are developed by determining what the community and government want to achieve, preferably broken down into objectives with targets and indicators.
- ➢ Making a list of the actions the committee will take to accomplish each objective will assist in developing a local planning stage strategy. This

includes the budget, the individuals responsible for each operation, and the schedule.

➢ Implementing, reporting, tracking, and assessing while evaluating if the actions taken contribute to the attainment of the targets, whether progress is being made toward the objectives, and whether any LA 21 components need to be changed.

The Action Areas encompass the fundamental LA 21 tasks, such as:

➢ Community participation in the development of a long-term sustainability action plan through representational community involvement.
➢ Employing an integrated strategy to establish the vision, objectives, goals, and objectives for action.
➢ Cooperating with all parties involved to achieve those objectives.
➢ Processes for monitoring development and giving participants a way to hold one another accountable for implementing the action plan, including regional indicators.

The upgrading of the frameworks and mechanisms used for planning, policymaking, and implementation is a crucial component of a LA 21 since they can be more impactful and long-lasting than individual actions, which will change often. Depending on the specifics of each council's situation, a different course of action should be pursued. From council to council, a community will focus on different concerns (Whitehead, 2003).

According to Cotter and Hannan (Australian Govt, 2016) putting a LA 21 into practice has the following advantages for a local authority:

Change is a constant for local government. Councils may manage change with the aid of LA 21. LA 21 unifies, bringing together new structural realities and future planning requirements. It makes it possible for a town council and its citizens to

develop a mechanism for regulating appropriate change for their area and moving them closer to the ideal future.

LA 21's extensive approach, which focuses on integrating social, economic, and climate change policies as well as public engagement, is expected to have positive effects on planning and organizational structures. reconciling what seem to be competing pressures for economic growth and environmental conservation while keeping sustainability in mind.

Enhancement of capacity to fulfill community needs- Council is much more likely to do so when adopting an integrated strategy and thoroughly considering the responses to questions like:

➢ What values does this society hold?
➢ What ought to be preserved for the future generation?
➢ What are the goals going to be achieved?

The neighborhood becomes more cohesive. Integrating people with decisions about their future makes it possible to solve issues with a lack of community cohesiveness, such as growing urbanization, diminished services in rural regions, and high rates of neighborhood violence. Although community participation in the Local Agenda 21 process can contribute to long-term change for improved community cohesion, it does not always result in individuals changing.

Regional ties are reinforced - Achieving sustainability calls for collaboration between the numerous organizations in charge of connected concerns, including air quality, local business, and so forth.

Cost savings can be achieved through efficient policy integration and prudent long-term planning. Communities that are strong and thriving are encouraged. By attempting to solve economic, environmental, and social problems, LA 21 promotes innovative solutions, such as by presenting chances for luring new industries that are future focused to boost sustainable employment.

Maintaining significance: LA 21 offers the chance to grab the neighborhood's attention and continue to be relevant to them. More than just delivering services to the community, local governments may contribute to community development. (Malkina Pykh, 2002).

From the debate above, it is possible to ask if there is not a chance that tourism might lessen the ecological concentration of what mainstream ecotourism entails, giving the impression that it is more ecologically friendly. To respond, the researcher thinks further study will be necessary. According to Beck and Crawley at the "Able to maintain our community" International Local Agenda 21 Summit in Australia, LA 21 was created at the Global Forum as a guidebook to help nations all over the world achieve sustainable development. One of the nine "major categories" that LA 21 recognizes as essential to sustainable development is local governance. Local governments must support the promotion of environmental, economic, and societal sustainability by embedding sustainable development principles into their planning procedures because local activities are the main cause of environmental concerns.

Systems and procedures that combine social, economic, and environmental development are part of the LA 21 program. Forming a long-term corporate plan for action that combines already-existing policies and programs with an agreed-upon future direction is the cornerstone for local, sustainable growth that is based on strong links between the governments and residents. It also inspires people to explore their ideas for a sustainable future and demonstrates that the process is just as important to the outcome as the finished product. Determining the effectiveness of community involvement in achieving LA 21 goals requires understanding what the community is aiming to accomplish. The LA 21 methods are built on empowerment, equal rights, and local capacity for change. More specifically, LA 21 includes:

> ➢ Regulation and maintenance of the local authority's sustainability performance.

➢ Monitoring, reporting, and assessing the development of sustainability.

2.4 Sustainable Urban Development

At the Stockholm UN Conference on the Human Atmosphere in 1972, the term "sustainability" was first used (Saha & Paterson, 2008). This definition was also used in 1992 at the Rio de Janeiro U.N Summit on "Environment and Development", which approved Agenda 21 to encourage sustainable human settlement development. It was also used in 1996 at Habitat II, which was concerned with putting LA21 into practice in urban areas. The idea of sustainable development is a reaction to the problems that metropolitan regions are confronting, including globalization, decentralization, and fast population expansion. As a result of these changes, socioeconomic inequality, slums or shanty towns, and climate change are problems that are known to exist. These changes impact the economy, social circumstances, and environment. Urban economic, sociological, environmental, and governance problems are intended to be addressed by sustainable development (Shen et. al, 2011). Though there are more than 100 to 400 "sustainable development," a precise definition or concept is still lacking (Tonami & Mori, 2007). Although the issues it should address are frequently revealed by a study of its definitions, these aspects are so vast that it is challenging to understand the notion itself (Spangenberg et. al., 2002). Urban sustainability, also known as sustainable cities, and sustainable urban development, sometimes known as sustainable urbanization, are the two elements of sustainable development in an urban environment. Urban sustainability and "sustainable cities" relate to the efficient use of resources, protection of the environment, limited use of non-renewable resources, community economic growth, personal well-being, and satisfaction of basic human needs (World Bank, 2000).

A sustainable community is devoid of environmental problems that can endanger its growth. According to Whitehead, the "sustainable city" manages and specifically addresses the social, economic, and ecological crises of capitalism (Saha & Paterson, 2008). The terms sustainable urban development and

urbanization, on the other hand, refer to a dynamic process meant to promote conditions that address sustainability issues in business, culture, and government. Sustainable urban development strikes a balance between social, economic, and environmental concerns. At the UN Summit on Environment and Development in 1992, Local Agenda 21 was released to establish such balance locally. Local Agenda 21 "outlines the menu of action, provides goals and a vision to promote sustainable development at the community scale" (Diamantini & Zanon, 2000). The four components of sustainability, according to Local Agenda 21, are social, economic, environmental, and organizational or governance problems (Rotmans, 2000).

According to the World Bank's description of the process for achieving sustainable development in cities (Giddings et. al., 2002) cities must be livable, competitive, well governed, and bankable. To put it another way, cities must progress socially and economically while preserving the environment. Utilizing a clever approach that integrates the elements mentioned earlier to realize an urban vision can help attain this equilibrium. For cities to flourish sustainably, urban planning is essential. To create more livable and productive cities, towns, and villages, sustainable urban development seeks to achieve an equitable amount between the financial, environmental, social, and democratic accountability aspects (U.N. Habitat, 2009) by employing techniques that call for the involvement of decision-makers and stakeholders as well as new tools to help them respond appropriately (Soini & Birkeland, 2014).

City planning techniques are used to evaluate how municipal policies affect society, the economy, and the environment. They make it possible to analyze social, economic, and environmental processes systematically, describing the interdependence between city planning and environmentally sustainable growth at the conceptual and practical levels. To attain continuous urban growth, city design should be founded on sustainability. Planning for sustainable urban development should consider the global trends and changes influencing cities, particularly in

emerging nations. Systems for strategic urban planning created in previous decades included frameworks and indicators that assessed municipal initiatives' viability. This essay looks into how far the concept of sustainable development has been incorporated into CDS. It is necessary to choose the sustainable urban development paradigm to use.

To define sustainable urban development, several research projects have been conducted in both industrialised and developing nations (Spangenberg, 2002). However, this concept still seems to be hazy. Some academics claim that there are more than 200 different interpretations of "sustainable urban development" (Tonami & Mori, 2007). Saha & Paterson's study has attempted to assess the commitment of the idea of sustainable urban development in coordinating ahead notwithstanding all these definitions. As a result, this definition seems adequate for comparing two CDSs to achieve sustainable urban development, according to the World Bank and Cities Alliance. According to the authors, the four pillars of sustainable development are environmental protection, economic development, social equity, and administration and governance. Several studies assessed how local governments and cities used sustainable activities in their sustainable development initiatives. Because the investigations of the researchers investigated the connections between sustainable development and planning, they may be considered in assessing smart city planning and sustainable development.

Additionally, Portney (Spangenberg et. al, 2002) listed 23 actions for environmental conservation while maintaining that activities for economic growth might also contribute to environmental stability; nevertheless, they omitted activities for social fairness. Their research focused on the governance component of sustainability. Additionally, the effort primarily concentrated on environmental and other aspects that contribute to environmental sustainability. Nevertheless, these factors seem to not adequately balance one another and the other facets of sustainable development. In the end, Saha, and Paterson (Saha & Paterson, 2008) merged the methodologies employed in prior studies and concentrated on eleven

initiatives relating to economic and social fairness. Saha and Paterson contend that while economic activity aids in establishing a sustainable environment, it does not contribute to economic progress. However, certain actions could lead to economic progress. The focus on low-income, homeless, and destitute individuals on the one hand, and on women, young people, and minority groups, on the other is one of this research's strong suits. The governance component was not covered by this research; rather, it concentrated primarily on the three variables of environmental preservation, economic growth, and social justice. The study done by Saha and Paterson was more thorough than that of other pioneering scholars.

2.5 Three Pillars of Sustainability

"Fulfilling present demands without jeopardising the potential of succeeding generations to satisfy their own wants" is the most popular definition of sustainability. By using fewer finite resources or finding resources with a reduced environmental effect, a company implements sustainable practises. Economic, social, and environmental sustainability are its three fundamental pillars. The three pillars are known as the planet, the people, and the bottom line. The concept of the "three main pillars" of the environmental, the economic, and society has gained widespread acceptance despite the relative dearth of literature examining the intellectual foundations of "sustainable" and "sustainable development." This is frequently realized as the weighing of trade-offs between objectives in these 3 groups that seem equally desirable, but implementations vary. A problematic feature of this conceptualization is its need for theoretical development; it appears to have had no sources and is instead merely cited in the literature and frequently taken at face value. This approach has been presented as a "shared perspective" of environmental sustainability from 2001 Giddings (Spangenberg et. al, 2002) and is so well-known that a reference does not seem necessary.

Despite how frequently the "three pillars" occur in literature, they are not always accurate. In addition to institutional considerations, several studies also include cultural, technical, and institutional foundations (Milbrath, 1989). Some theories

completely eschew segmenting sustainability. Whereas the "Natural Step" model is built on four guiding principles, Milbrath (Milbrath, 1989; Pezzey, 1992) proposes the concept of a "sustainable future" centered on a set of predetermined ideals. In addition, the UN's Sustainable Development Goals have recently undergone an "integrated" approach with 17 overarching goals in fewer categories.

The "three-pillar" model has been variously attributed to "Agenda 21", "Brundtland Report", and the 2002 World Conference on "Sustainable Development" (Hicks & Streeten, 1979); however, no clear framework or theoretical foundation is made explicit in any of these studies. The Intergovernmental Union for Nature Conservation, which gave the first generally acknowledged formulation of the "three pillars," and the United States, whose 1987 report is often regarded with helping popularize environmental sustainability, are both examined in the following sections (Goodland, 1995). The academic research from the 1980s and 1990s that looked at sustainability from a theoretical standpoint before it was mentioned as a "shared perspective" in 2001 comes next.

2.6 Economic Sustainability

A system that satisfies existing intake levels without endangering the needs of the future is referred to as being economically sustainable. For there to be "economic sustainability," the market economy itself must be resilient. Hicks (Hicks & Streeten, 1979; Gray et. al., 2017) is credited with creating the idea of "economic sustainability." Hicks defined "income" as "the amount one may spend throughout a time and yet be well after the period" in his seminal book Value and. Since it was supposed that there was a limitless quantity of environmental resources, economic theory has traditionally overemphasized the market's capacity to allocate resources efficiently.

They also believed that as economies expanded, technology would develop, enabling the replacement of natural resources depleted during manufacture. However, the existence of limited natural resources is now universally accepted.

The capital base is under strain due to the growing space of the economic system. As a result, several observers, including Goodland (Malik et. al., 2021; Goodland, 1995) have questioned whether unchecked development and exponential consumption are possible. He adds that to adequately discuss "economic sustainability," "extrapolating the concept of Hicksian income from its primary concentration on the sentient property and its surrogate money to encompass the other three types of capital natural, social, and human" is essential.

Economic sustainability highlights the increase employment rate, fiscal stability, and precise documentation of cost-benefit analyses. Due to the resource stability that employment offers, research suggests that high levels of employment benefit both the economic and social wellbeing of the population (Xavier et. al., 2021). Economic considerations that push firms to recruit staff and people to look for work may thus also improve social sustainability if employment brings stability to individuals. But there is a tension between social and economic sustainability in the modern economy. Many people contribute to the financial stability of businesses as a result of the gig economy without benefiting from the social safeguards that come with employment. Initiatives to be more environmentally friendly can also improve an organization's economic side. Recycling valuable materials like textile and electronic waste, for example, might reduce operational costs and the quantity of resource extraction required to keep businesses operating. Initiatives to be more environmentally friendly can also improve an organization's economic side. Recycling valuable materials like textile and electronic waste, for example, might reduce operational costs and the quantity of resource extraction required to keep businesses operating.

The demands of "environmental sustainability" limit any economic system created following the principle of "economic sustainability." It limits resource usage to preserve the "sustainability" of natural capital. The goal of "economic sustainability" is not to sacrifice "environmental sustainability." It has become standard in the literature on sustainable development that to argue for replacing the

dominant economic growth ideology with a new economic development philosophy that promotes improving skills rather than the focus on business (Ilo & Berghofer, 1999). Since the 1930s, macroeconomists have worked to create meaningful macroeconomic indicators that represent the performance of national economies. The underlying Keynesian idea that society can be "perfectly all right" to avoid or decrease economic fluctuations is based on the capacity to predict when business output is essential and the type and quantity of the necessary involvement. This macro-level approach includes, among other things, the advancement of Total Revenue Accounting.

Economic indicators at the federal level have rarely performed well. They occasionally move in opposition to one another, which is common when the economy experiences major turbulence. For instance, the steadily rising rate of female labor force participation has increased household income in many nations, however, this increase has often been accompanied by slower income growth. Due to this, evaluating hourly wage levels might not be a trustworthy measure of the expansion of the economy's overall purchasing power. Other times, acquiring the data requires patience, which is a well-known difficult problem for statistics on international commerce (de-la-Hoz-Aguilar et. al., 2013). Under this kind of framework, urban economies are a much more recent issue. It grew as the bulk of industrialized countries' inner-city economies completely vanished in the mid-1950s, and the desire for excessive urban congestion rose in many emerging nations in the 1970s. A theoretical basis for producing at least some economic indicators was also made available by the development of national input-output models and national corporate income models. Important applications have been hampered by the dearth of suitable data and the speed with which all data comes.

Macroeconomic success indicators include the Gross Domestic Product, unemployment rate, public saving and investment, public sector indebtedness, and inflation rate. The allocation of resources, like those from the Infrastructure Fund, is also done more frequently using the triple EU parameters of GDP, jobless, and

migration. These indicators are typically useful for understanding and making forecasts about current trends; however, they are notoriously bad at spotting watersheds and pivotal moments. Many have inherently extrapolative roots.

The situation is notably less obvious at the urban location of aggregation. There are major restrictions on even commonly used measures like GDP Ratio and youth unemployment. They pay disregard to significant geographic variations inside cities. For example, aggregate measurements for many cities in the 1960s showed relatively consistent wage gains, but this masked significant changes in the spatial development of income activity and the transfer from the manufacturing to the services sectors. Even migration can sometimes be insignificant at the urban level if there are no further variations in socioeconomic position and occupation. A variable that indicates zero immigration hides major longer-term, detrimental impacts on a city's economy when these categories are replaced by unskilled labor. The development of new nearby companies depends greatly on the middle classes.

Additionally, as will be discussed further below, city economics is distinguished by inefficiencies (both positively and negatively) that are not fully captured by typical national income accounting criteria. While there is often a clear link between these and the conventional economic indicators, this only has a scalar influence, and substantial advances will still be represented in leading indicators. When this relationship breaks, the patterns in global development are only partially reflected by traditional economic indexes. Although globalization has enhanced affluence, it has also resulted in some labor market weakness, raising inequality (Backeberg et. al., 2018).

Promoting employment for jobless young people is the aim of sustainable development growth. By doing this, worker poverty may be prevented while promoting economic progress. The current situation has demonstrated that getting a job does not automatically lift one out of poverty. Young people are probably more connected to the informal sector, which gives them access to unstable occupations, pays less, and has worse working conditions, which makes it harder

for them to get good jobs. This will be addressed in more detail later. De-la-Hoz-Aguilar (de-la-Hoz-Aguilar et. al., 2013; Ruesga Benito, 2018) emphasized the societal and economic nature of the issue of youth unemployment. He said that it is a multi-cause phenomenon with long-lasting impacts on the lives of people impacted, even becoming a method of social exclusion, perpetuating poverty, and escalating problems like urban violence, which is predominantly manifested in juvenile gangs. High rates of youth unemployment point to resource wastage and reduce an economy's capacity for long-term growth, which has the unfavorable effect of lowering income, aggregate demand, and GDP growth rates, setting up a vicious cycle that is hard to escape.

The long-term repercussions of young unemployment have received considerable attention in scholarly papers, highlighting substantial implications in various domains, such as the absence of possibilities to build up financial resources (Harris, 1990). On the other hand, a group of "idle young people" who can contribute to social issues or become discouraged and eventually join the so-called NEET group may result from the prolonged persistence of youth unemployment. This group wastes economic resources. It lowers the economic welfare. Due to their apparent lack of interest in the job, these young individuals would not be considered "unemployed" from a traditional perspective. However, they still (Harris, 1988) constituted a significant societal issue that, in this fashion, would not manifest elsewhere.

Adulthood transitions are never simple, but young individuals with little career prospects are made significantly more difficult. If no employment offers a minimum wage, job stability, or respectable working conditions—in other words, a respectable job—it becomes more and more difficult. This not only delays the passage from adolescence to adulthood but also complicates social mobility. Some young individuals are deprived of future chances due to a lack of work opportunities. On the other hand, access to school and the labour market, two significant macro-social risk variables, are substantially connected with the

likelihood of socialization. It is critical to stress that the danger of exclusion should be considered within the framework of the global socioeconomic system rather than being the main issue for any one group.

When cities experience economic growth, their productivity hinges on the fact that activities start or are already taking place; there are benefits disproportionately from scale economies. These could originate from inside the sector or come about due to urban agglomeration (or some combination of the two). They include various economies, including those with cheap communication costs between enterprises for inventions, market data, etc. Also, to produce the greatest levels of productive output through long runs of production; with only focusing on specialized inputs to the outcome of other firms. In addition, labor market economies in having to search for and try to match diverse as well as scarce skills to demand, generating combinations of abilities, lowering the requirement to hold workers in postseason (Kingsley et. al., 2013). Also, economies in the provision of common services - ports, transit, power, storage of goods, financial and technical services, tel Additionally, the control of transportation systems by metropolitan areas provides the most affordable access to the biggest market sizes and, thus, the best opportunity for production-related economies of scale.

Greater economies are possible because of the concentration of facilities, but higher costs also result. To counterbalance the greater expenses, city-based businesses must use the elements of production more effectively than those in rural areas or small towns. There is proof that in certain cities in Developed Countries, the economies of scope of urban location cannot balance the inefficiencies of the metropolitan regions, resulting in closure or outmigration in significant manufacturing sectors. Therefore, the development of the urban sector, the allocation of the urban population among settlements of various sizes, and the patterns of consumption are all largely determined by the degree to which economies of scope seem to be possible in the freshly formed and changing amount of goods and services of the developing nation. Of course, other factors influence

the problem, such as the supply of natural resources, the cost, and availability of infrastructure, transportation costs (for the inputs into the city and the output traded outside the city), consumption and income trends, government policy, trade relations, etc.

The roles and relative proportions of cities change as the production of goods and services shifts from the conventional (natural fiber fabrics, warehousing, processing and transit of agricultural and mineral goods, food manufacturing, leather and wood fabrication, printing and publishing, retail and personal services) to the unconventional (heavy equipment, transport equipment, chemical products, synthetic fabric processing, electronics, and practical examples equipment, pulp and paper, etc.). It may be true, as Mills and Becker have noted for India (Kingsley et. al., 2013) that manufacturing is of diminishing importance inside urban boundaries. However, industrial growth depends heavily on urban services associated with manufacturing, from finance, markets, and transportation hubs to research and science support, even when the industries are located outside the cities. Settlement patterns are often more stable in nations with a long history of cities. The inherited system makes some attempts, albeit not totally, to adjust to the new demands. New towns are expensive to construct, and even if they are, they can struggle for a long time to offer the same level of amenities as older ones. Because new cities are not being established at a rate that is even remotely equal to the rate at which existing towns are expanding into greater and larger size classes, the distribution of communities by size becomes much more "unbalanced." Which cities expand quickest depends on the disaggregated pattern of national production, which shows which industries and subsectors grow comparatively more or less quickly. This is the case if the expansion of cities in industrializing countries is a consequence of changes in national output. Each city's output is as distinctive as a nation, and the cities collectively comprise a system of interconnected manufacturing sites.

Henderson (Kingsley et. al., 2013; Vallance et. al., 2011) has made some key advancements in recognizing the geographical specialization trends in several nations. According to the study, in the United States, around 50 to 60 percent of the labor force in cities is employed in manufacturing goods and services that are not exchanged outside of the city. It is defined as the ratio that fluctuates depending on, among other things, the extent to which transportation expenses provide a "natural" barrier to imports outside the city. The "export base," or the specialty traded by the city, employs 40% of the labor force. About half of the 243 urban areas in the United States, with 50,000 or more people in 1970, specialized in specific manufacturing subsectors, while the remainder provided non-industrial services, such as those related to agriculture, government, banking and commerce, medical and educational services, etc.

2.7 Social Sustainability

As a key component of sustainability, social sustainability has recently gained increased attention. Although there is general agreement on the importance of sustainability practices in the agenda for sustainable development, there is still a lack of clarity regarding this term's formulation and operational definitions (Vega et. al., 2018). Additionally, there is currently no consensus about the criteria to consider when evaluating social sustainability. Among other important societal components, social sustainability includes environmental justice, economic security, health, and education. Businesses may prioritize staff retention over financial concerns as part of their attempts to achieve social sustainability. Spending on employee welfare may benefit the organization financially by increasing staff motivation, for example.

Social sustainability is boosted by environmental sustainability. For example, promoting healthy eating might be advantageous for the environment as nutrition has a significant influence on both human health and the health of the ecosystem as a whole (Gallup et. al., 1999). In addition to the lack of a clear definition of social viability, there does not appear to be consensus on the standards and points of view

that should be applied in conceptualising and assessing this idea. It seems that academics from various disciplines have differing ideas on what social sustainability means. For example, Sachs (Masnavi, 2007; Gallup et. al., 1999) stated that sustainable social development is rooted in justice, democracy, and inclusivity. At the same time, they also suggested that sustainable construction encompasses six dimensions, including social infrastructure, job opportunities, ease of access, townscape design, retention of regional characteristics, and the capacity to meet psychological needs. Masnavi (Masnavi, 2007) describes social sustainability in terms of its two primary aspects, which are social interaction and neighbourhood satisfaction, as well as its elements of participation, social justice, security, and solidarity.

The "City Form" study effort by Bramley inside the context of British cities is one of the most thorough investigations of urban social sustainability. Urban social sustainability was also described by the researcher as "a city's ongoing capacity to serve as a sustainable, long-term environment for cultural growth, human interaction, and communication." The two broad elements of "social equality" and "community sustainability" are emphasized in their examination of urban social sustainability. Hemani (Hemani et. al., 2017; Manisaldis et. al., 2020) most recently created a framework for social sustainability based on the "CityForm" research project, and social sustainability was defined as "a combined highest and underside method for developing urban spatial shapes that nurtures the 4'S," or social capital, community stability, social inclusion, and social equity."

Analyzing urban sustainability objectives at the local level has attracted more attention recently. Recent research has mostly addressed the micro levels, in contrast to earlier studies that concentrated more on the national level (region and city) (community and neighborhood). The chronological examination of the social sustainability dimensions reveals a change in the research's level. Such a temporal approach also illustrates how new "soft" and intangible social sustainability factors, including social involvement, enjoyment, sense of place, and identity, are

supplementing or replacing more conventional "hard" factors like employment and poverty reduction. Even though this change in the social benefits makes measuring and interpreting the term more difficult, it reflects the evolving societal demands and expectations of communities and individuals.

2.8 Environmental Sustainability

This pillar focuses on reducing environmental issues and challenges such as GHG, air quality, and water quality. Environmental conditions and human health are closely linked, with environmental quality having a big effect on human health and health related expenditure. Consequently, efforts to protect and enhance the environment are beneficial to humanity (Afros et. al., 2003). The environment also provides the natural resources required to support sustained economic growth. For businesses to succeed economically, natural resource exploitation is essential. Resources will continue to be available if efforts are made to extract money at environmentally friendly rates, which will also guarantee economic sustainability. Finding trustworthy indicators of the condition of something like the urban environment to develop a knowledge of new changes in environmental circumstances and the kinds of urban management techniques to be used requires consideration of a few important factors.

First, there are several interrelated stages in the chain between the underlying factors contributing to severe environmental degradation and their outcomes. Take the comparatively simple case of high urban traffic pollution. Pricing, regulations, and limits are sending road users the wrong message, which is the root cause of the problem. As a result, they make excessive trips while frequently employing unsustainable modes of transportation and operating inadequately built vehicles. This results in a mixture of local pollution and environmental degradation, which has the knock-on effects of disease, social unrest, noise, etc. The chain applies to practically every facet of urban life, encompassing energy generation and waste disposal, and not only transportation. The ultimate purpose of the indicator requirement is to provide direction on the damage caused to the urban environment

and the relationships this has with economic activity. However, suppose an urban management plan is to be proactively instead of merely concerned with post hoc, spotless operations. In that case, indications must provide the previous direction to trends at earlier nodes in the chain.

A theory about what contributes to environmental degradation in cities and how significant economic and political elements interact underlies any collection of indicators, which is connected to this predicting function. The signals also provide insight into the validity of these assumptions. The linkages between the economic and policy problems have become clearer to us in recent years, which has greatly contributed to our developing knowledge of these difficulties. Prices give comprehensive indications of the costs of alternative activities and provide advice on the impact of policy change in fully competitive economic marketplaces when, among other things, ecological costs are entirely internalised and information is perfect. Other environmental indicators won't need to be made under these perfect conditions. However, there are two crucial situations in which this scenario fails, calling for a variety of signs (Malilay, 1999).

The first is brought on by market imperfections, in which the marketplace cannot effectively reflect the costs of consumers and producers for several reasons. The primary issue with environmental products is that their sources are frequently outside the functioning of the market and, thus, outside the costing processes. Therefore, it is implied that any environmental harm brought on by economic consumption and production is free of charge. However, even if external conditions are intrinsic to the business, if they exhibit characteristics that are beneficial to the public, or if there are defects in how marketplaces are set up, such as monopolistic pressures, misleading cost indicators may arise. Additionally, despite the lack of these problems, the related transaction costs may prevent decision-makers from fully understanding the price of environmental deterioration. Once more, it would not be ideal for addressing the urban environment in financial judgment processes. All of these are situations when the market fails to provide enough clues regarding

the ramifications of exploiting natural resources. The second scenario in which markets have trouble operating correctly is when government intervention fails. Even though the market would accurately represent resource consumption costs and environmental impact, state interventions may cause pricing distortions that deviate from true societal costs. Market intervention by the government is frequently justifiable for good reasons, for instance, when it may successfully alleviate perverse incentives or when redistributive concerns are thought to be more important to society than rigorously specified efficiency criteria.

Mistakes of government interventions occur when they are either blatantly ineffective in achieving particular social goals or when they fail to account for the long-term ecological repercussions involved adequately. The kind of urban indicator sought after may change depending on which of the two primary causes of economic failure is thought to be more important. Consider the scenario where market failure is thought to be the main urban issue. Then, strategies that take into account industrial concentration, a lower cost, migratory patterns, investment, and the characteristics of local real estate markets could be more successful (Caragliu et. al., 2013). If lack of government involvement is seen to be the deciding factor, the specific feature may be the amount of local government spending, the percentage of urban employees employed in the government sector, or the percentage of public landholdings in urban regions. To effectively manage the urban economy, it is essential to emphasize that urban metrics should reflect the significant causal relationships rather than just being an ad hoc collection of indices. The environmental sustainability indicators are displayed in Table 3.

Table 3 Environment Sustainability Indicators

Factors	Environment significance	Indicators	Unit (measurement)

Air	Urban environmental quality	Pollution of the air in cities	
	Air environmental management	Several permanent monitoring locations.	Sites per 100 km sites for every 100.000 inhabitants
		Number of air pollutants under observation Number of days with traffic restrictions	
		Pollution of the air in cities	
Energy	Energy use	The average person's use of electricity	Mwh per capita
		Residential, commercial, agricultural, commercial/services electricity use	Mwh
		Per-person consumption of methane from gas	M^3 per capita
		Sector-specific gas methane consumption (residential, heating, others)	M^3
	Urban action program	Putting the Environment Energy Plan into Practice	

Green areas	Urban environmental quality	The public green space density	M 2 per capita m 2 per 100 km
		Per kind, the density of public green	M 2 per capita
	Green areas environmental management	Construction of new green spaces over the year	
		Census of the year's green urban areas	
	Urban action programs	Putting the Green Urban Plan into Practice	
	Noise environmental management	Numerous permanent noise monitoring locations	
		Put up noise barriers	Km
		How many noise monitoring campaigns have been run?	
		Number of requests for noise disruption interventions broken down by kind of noise source	
		Per kind of noise source, the number of requests for noise disruption interventions	
		By kind, the number of temporary acoustic pollution	

		permits issued by municipalities	
Noise	Urban action programs	Number of traffic penalties for passenger vehicle noise	
		Acoustic zoning plan implementation Noise abatement plan implementation	
Transport	Supply of infrastructure	Infrastructure for rail length	Km
		Railroad density	Km railway lines per 100 km2
		Line density by typology tram, railroad, metro, and trolleybus	Km lines per 100 km
	The density of road vehicle	Car density for passengers	Cars per 1000 inhabitants
		Vehicle density on roads	Road vehicle per 1000 inhabitants
		Taxis per capita	Taxi per 1000 inhabitants
		The number of vehicles on the road is broken down by type of fuel, category (e.g., passenger cars, buses, motorcycles, and lorries), and average age.	

		Pedestrian area density	M 2 pedestrian areas per 100 inhabitants m 2 pedestrian areas per 100 km
	Transport environmental management	Length of bicycle lanes	Km
		Number of zones with limited traffic	Km2 restricted traffic zones per 100 km2
		The number of paid parking spaces on roadways	
		The number of open parking spaces around public transportation	
	Public transport passenger	Passengers using buses, trams, metros, and trolleybuses in total	
	Urban action programs	Urban Traffic Plan Implementation Innovative Traffic Control Programs	
		Garbage collection for the city	
	Waste generation and management	Collection of municipal refuse separately according to kind	Kg per capita

Waste	Waste environmental management	Number of facilities for garbage treatment and disposal	
		Recycling facilities are available and used inside the municipality or in another commune.	
		The density of the trash can	
		Amount of dustcarts	Dustbin per 10.000 inhabitants and km2
		There are several campaigns to enhance residential garbage collection separately.	Dustcart per 10.000 inhabitants
		Fines for unauthorized garbage disposal, number	
		Intake of water per person	
Water	Water resources	Per-capita household water usage consumption	M 3 per capita
		Residential, commercial, agricultural, commercial/services, and other sectors' water use	M 3 per capita

		Number of wastewater treatment facilities, broken out by kind	M 3
	Water environmental management	Percentage of people using wastewater treatment facilities	
		Passengers using buses, trams, metros, and trolleybuses in total	
Territorial and demographic data	General indicators	Territory inside the city	Km2
		Volume of people	
		Households in Number	

2.9 Sustainable urban development and smart city

Information cities, digital cities, and sustainable cities may all be replaced by smart cities, which is a relatively new concept. However, it has been widely used, especially after 2013, when it began to surpass other terms like "sustainable city" in terms of the number of citations. There is disagreement among experts on what constitutes a "smart city," notwithstanding recent debates surrounding the concept. These ideas are not at opposition with one another, however some writers have trouble conceptualising their work. Instead, they somewhat overlap. However, it is generally acknowledged that smart cities heavily rely on communication and information technology (ICT) to assist cities in creating their comparative edge or that it is a conceptual framework where urban growth is achieved via the usage of human as well as technology-related capital.

According to Caragliu (Caragliu et. al., 2013) a smart city has the following key attributes: By utilizing networked infrastructures, improved administrative and economic effectiveness (a), an underlying emphasis on business-oriented urban development (b), a strong focus on the achievement of the social inclusion of various urban residents in public services (c), and a focus on the substantial role of elevated and creative fields in long-term growth (d) are all factors that contribute to the advancement of culture and society, (e) A viewpoint emphasizing the importance of societal and interpersonal capital in city development; (f) A goal of considering sustainability initiatives as a key component of the creation of smart cities. According to some writers, a smart city must include a variety of components, including a smart economy, smart transport, smart buildings, smart people, smart lifestyle, and smart government. In addition, the term "smart city" encompasses more than what is meant by the terms "information city," "digital city," and "intelligent city" since it contextualizes technology for use in support of processes and services for people.

As mentioned by Marsal-Llacuna (Marsal-Llacuna et. al., 2015; Lazaroiu & Roscia, 2017) the assessment of a smart city should consider prior examples of ecologically responsible and liveable communities, including resilience and life quality, in addition to, of course, the balance of technical aspects. It should, according to Lazaroiu and Roscia (Lazaroiu & Roscia, 2017; Kramers et. al, 2014), symbolize a technological community that is linked, sustainable, pleasant, appealing, and secure. Understanding how smart cities use city information for transportation planning, energy usage statistics, security, and streamlining local services can help you better grasp how they operate. With the use of computing expertise for urban services management, this new reality is promoting the growth of new providers in the smart city particular market.

According to Kramers, (Kramers et. al, 2014; Yang & Khan, 2022), two things must be done to create a smart city: (a) Establish a robust ecosystem of broadband networks that can support digital applications, and (b) Launch massive

participatory change initiatives for the development of apps. Some communities adopting the idea of smart urban have worked hard to reap their benefits and meet their demands. To create a sustainable, greener city with competitive, innovative commerce and a higher quality of life, Barcelona defines a smart city as high-tech intensive, and advanced. In contrast, Amsterdam approaches the issue as technological innovations and is willing to change people's energy-related behavior to address climate challenges. The Doha example shows how urban technology and knowledge-based economy activities interact increasingly in smart city practice. Contents (Cui et. al., 2019); yet, in Brisbane, it is customary to incorporate smart technologies into sensible urban and spatial planning principles. Anxiety (Kramer et. al., 2014).

According to Nam (Nam & Pardo, 2011), a smart city can be bifurcated into: (a) technology (equipment/software infrastructure); (b) population (creativity, variety, and education); and (c) organisations (governance and policy). Taking this into account, investments in people, institutions, and technology geared toward the concept of the smart city create environmental sustainability and quality of life, encourage responsible resource management, and allow institutions to contribute with innovation and improved services for citizens, bolstering debates and political participation. When researching cities, it is important to consider what sustainable urban development means to comprehend the phrase. This may thus be seen as a changing process where resource extraction, investment focus, technological advancement, and structural transformation align with the present and future demands. In the 1990s, the idea of a sustainable city gained popularity. According to Roy (Pietrosemoli & Monroy, 2013) the link between features of economic, social, and environmental sustainability may be inferred from a combination of each of these components' indicators. Although the current plan is to discuss these three challenges to discuss sustainable cities, some authors only pay attention to one. In contrast to Rode and Burdett (Rode et al., 2011) who focus on an understanding of more economic, such as social equality and a greener

environment, Meadows (Meadows, 1998) proposes the addition of metrics such as pollution, waste creation, and use of water and energy.

The growing popularity of smart cities and related ideas is attributed to various issues, such as the fact that most people live in cities, global warming, the depletion of the earth's resources, globalization, and enhanced consumption. A smart and sustainable city should aim to accomplish the following objectives, according to Dhingra and Chattopadhyay (Dhingra & Chattopadhay, 2016), in a flexible, dependable, scalable, open, and resilient manner.

It has been noted that the debate on environmental concerns in smart cities tends to be more political, considering global agreements and cutting-edge solutions to difficult urban problems. The same author lists four characteristics of sustainable and smart cities: Sustainability, life quality, urban features, and intelligence, the first four factors. These are examined concerning four major themes: the environment, the economy, and society; (d). According to some academics, the city should be environmentally healthy, use cutting-edge technology, have environmentally friendly and economically successful companies, have a conscientious and harmonious systemic culture, and have a physically appealing and functionally functioning landscape.

2.10 Sustainable Urban Development

In order to help people understand environmental sustainability in urban areas, the phrase "sustainable urban development" was developed. It focuses on the strategies that support sustainable growth in cities. Sustainable urban development arose from the environmental debate of the issues facing the urban environment, which was given in the form of sustainable development theories to support the environmental assets..

Sustainable urban development aims to give impoverished areas a sustainable means to get food in urbanized areas. Through tolerant, wealthy, and inclusive urban settings that comprehend social harmony, economic necessity, and

environmental sustainability, sustainable urban growth is made feasible. Sustainable urban development has altered the nature of development, preserved non-inexhaustible resources, reduced resource degradation, and integrated economic decisions with environmental decisions (Hiremath et. al., 2013).

The term "sustainability" is now frequently used in a global context to refer to the ability of human and natural systems to survive in an unreachable future, but Hall (Boons et. al., 2012) defines it as the current developmental stage that can ensure the future constant enhancement of urban communities.

Camagni (Camagni, 2017) describes sustainable urban development as "a process of synergistically integration and founder among the excellent subsystems attempting to make up a city (financial, social, physical, and ecologic). These assures the local population a quasi-level of health in the long run, without making compromises the options of advancement of nearby areas and contributing by towards minimizing the harmful consequences of advancement on the biosphere." In this case, the three sustainable development pillars are used to mold the urban scale for sustainable urban development.

The foundation for sustainable urban expansion should be a vision for planning and administration that supports connected green spaces, a multi-modular transportation system, and mixed-use development.. Various public and private organizations should be used to create enduring and sensible organizations that guarantee social and environmental assets. Legislators, managers, and developers should also encourage eco-friendly site design and construction methods that lessen pollution and foster harmony between manmade and natural systems.

The Institute for Sustainable Communities found that "most people want to live in an area where they understand their neighbors and feel comfortable" for a sustainable city to flourish. A community with quality housing, nearby businesses, plenty of employment, and chances for young individuals to pursue a solid education. Researchers that connected SUD with a more well-rounded social, economic, environmental, and communal balance went further. The supply of social infrastructures, such as jobs, economic production, and the preservation and

improvement of natural ecosystems & resources, are all mutually interrelated, according to the statement that "sustainability may be characterized as a dynamic equilibrium among these three factors such as education, employment, and health". In response to the deterioration of the urban environment during the 20th century, the concept of a sustainable city emerged as a political movement. As a result, the concerns related to the administration and planning of human communities were urgent enough to be discussed at the 1972 United Nations conference in Stockholm. The UN created a center for human communities to encourage and support workable practices in rural and urban communities (Spangenberg et. al., 2002).

Cities serve as centers for ideas, business, culture, technology, efficiency, social improvement, and much more. This promotes both economic and social progress. They oversee founding civilization. Cities are at a crossroads, fending off notable challenges posed by growing populations, accelerating environmental change, widening disparities, and frequently shifting reasonableness.

According to Pradhan (Pradhan et. al., 2017) a sustainable city has been planned with the environment in mind, using less water, energy, and food while also producing less waste, soil, air, and water pollution. The UN goes on to characterize it as a metropolis that can advance socially, economically, and physically while maintaining its number of natural resources and being safe from environmental dangers that would impede such growth.

According to Rogers (Leach et. al., 2016) a sustainable city serves its residents' physical, economic, cultural, social, and political demands without depleting the district's resources or other metropolitan areas. It also ensures that residents have equal access to all services. Murrain characterizes it as a city where inhabitants make decisions on the town's layout, but not at the expense of other tenants.

2.11 Related Articles

In 2015 Antar A. Abou-Korin and Faez Saad Al-Shihri (Abou-Korin, & Al-Shihri, F.S., 2015) proved Saudi Arabia's fast urbanization and sustainability. In the opening paragraphs of their article, they emphasized the quick urbanization of Saudi Arabia overall and the Dammam Metropolitan Region in particular. The next

section of their article included a survey of the literature on methods and standards for sustainable urbanization, emphasizing developing nations. The authors' article recommended the ways and measures needed to implement the planned "Urban Sustainability" strategy in the Dammam Metropolitan Area.

In 2013 Yang Dongfeng et al., (Yang Dongfeng et al., 2013) addressed China's complex interplay between urbanization and sustainability. They first constructed the Kuznets-curve urbanization hypothesis and tested its validity using data from China's urbanization. According to the results, China could be able to strike a balance between urbanisation and sustainability. In order to combine an inclusive regional policy agenda with an urban planning system in diverse regions of China, they advised the government to adopt a flexible urbanisation strategy.

In 2018, Peilei (Fan et al., 2018) investigated the relationships between urbanization and sustainability using satellite pictures to assess the spatiotemporal changes in urban dynamics. They then developed a sustainability score and thoroughly examined their dynamics using structural equation modelling. Their research revealed that Asian Russia enjoyed stronger economic development despite the population decline. Additionally, they discovered that the sustainability and levels of Asian Russia and its various federal districts had improved.

In 2016 Shen et al. (Shen et al., 2017) applied an elastic measurement approach and a fresh McKinsey matrix to evaluate the dynamic sustainability initiatives during urbanization in these nations. They gathered data from the World Database server from 1990 through 2011 to conduct the analysis. According to the results of their study, whereas China and South Africa's urbanization processes are unsustainable, Brazil, Russia, and India engaged in sustainable urbanization practices over the period under review. The report served as an invaluable resource for anyone looking for ways to promote sustainable urbanization practices internationally.

In 2022 Xiaotian Yang and Irfan Khan (Yang & Khan, 2022) in the context of population growth and industrial value-added in the 30 International Energy

Agency member countries, examined the connections between economic growth, urbanization, and environmental protection. They used sophisticated econometric models to do empirical studies from 1992 to 2016. The short-run findings of their study revealed that capital creation and biocapacity short-run enhance ecological footprint. Their analysis of long-term estimates showed that capital development and industrial value addition increase environmental sustainability. However, they discovered that long-term environmental sustainability is negatively impacted by population expansion, urbanization, biocapacity, and economic growth.

In 2019 Xuegang Cui (Cui et. al., 2019) suggested by integrating systems theory and complexity research, a fast urbanization complex system to assess the sustainability of urbanization can be developed. To express the internal connectedness and impact of urbanization, resources, and environmental subsystems as well as to denote the sustainability of urbanization, authors created the URE Complete Coordinated Development Index. Their study used statistical data gathered from 2005 to 2015 to assess trends seen in URE for China. According to the analysis, urbanization efficiency, resource utilization efficiency, and environmental quality have the biggest effects on the indices. Within JJJ, coordination between URE subsystems was poor, but it did show an upward trend between 2005 and 2015. The URECDI also showed significant differences among 13 cities.

In 2018 Yuheng Li et al. (Li et. al., 2018) skewed urban-rural relationships and the trend for village demise. They also looked at China's new urbanization strategy and future rural development, which isn't covered much in the plan. They discovered through their analysis of the notions that the rural areas are now able to provide raw resources, labor, capital, and land to the metropolis due to the urban biassed policy that treated cities and the countryside differently. Additionally, they concluded that rural China had made significant sacrifices during this process to reduce the cost of urbanization.

In 2017 Vishwambhar Prasad, (Sati et al., 2017) studied the influence of urbanization on rural lives in the Xichang city government. They gathered information from Xichang city government income records and demographic censuses. Then used a purposive-random selection technique to interview 110 homes in the chosen villages, and they used descriptive statistics, correlation analysis, and regression modeling to examine the data. The investigation revealed a significant change in urban landscapes and an increase in the area for public transit buildings.

In 2019 Kassahun Gashu and Tegegne (Gashu et. al., 2019) Created a set of metrics and indices for Ethiopia's sustainability evaluation. They built an indicator framework and focused their analysis on the main indicators. Their study used the lowest and maximum readings for each indicator as independent indicators, which followed a typical methodology [0, 1]. According to a study, economic, socio-cultural, and institutional factors are functioning rather poorly in Ethiopia's cities.

In 2018 Stanislav E. Shmelev and Irina A. Shmeleva (Shmeleva & Shmeleva, 2018) examined the connections between several aspects of sustainability and smart cities. Their study evaluated 57 worldwide cities using a multi-criteria approach and a panel of 20 indicators. They focused on the factors that influence CO_2 emissions in cities, such as the percentage of power generation in the electricity sector, public transportation and cycling habits, waste recycling, the water-energy nexus, and the role of the smart and creative economies. Their analysis covered crucial energy transitional issues. Their findings showed that whereas San Francisco led in environmental and economic issues, Stockholm led in social and intelligent city activities.

In 2022 Emily O. Iduseri et al. (Iduseri et al., 2022) studied the factors that contribute to young unemployment as well as the degree to which people of working age are aware of SDGs 4 and 8 (Decent Work), as well as the government's and these SDGs' involvement in addressing unemployment. Low education levels, a lack of marketable experience and abilities, with bad policies and regulations were

identified as the main driver of unemployment within youths. The findings showed that the sampled population had low levels of knowledge and achievement. They also concluded that education is essential for accomplishing the SDGs, which may lessen unemployment and encourage decent jobs.

In 2019 Maijama'a Rabiu et al., (Maijama'a et. al., 2019) [158] explored how Nigeria's population expansion has affected unemployment. From 1991 to 2017, they extracted information from yearly time series data. Utilizing unit root tests, they examined information on the population, unemployment, CPI, currency rate, and foreign direct investment. According to their analysis, all the variables remain stationary at the same level.

In 2021 Nwosa, Philip Ifeakachukwu et al. (Nwosa, 2021) studied the link between Nigeria's unemployment rate and agricultural finance. They employed the distributive autoregressive lag approach for their investigation, which encompassed the years 1981 to 2019. According to their study technique, government expenditure on agriculture and the agricultural credit guarantee program fund harmed the unemployment rate in Nigeria. However, commercial bank loans to agriculture had a negligible impact.

In 2015 Uzonwanne et al. (Uzonwanne et al., 2015) researched the issue of urbanization and urban illiteracy in Nigeria and how it impacts the viability of the Nigerian economy. The Bureau of National Statistics and the Nigerian Central Bank Statistical Bulletin provided the information for their analysis. Their research demonstrated how urbanization and urban unemployment affect Nigeria's economy. To come to their conclusion, they likewise used the descriptive statistical approach. They also used the Harris-Todaro model of immigration and unemployment to support their claim.

In 2014 Shingirai Sikomwe et al. (Sikomwe et al., 2014) assessed the reliability of collective performance indicators were used to asess the performance of Zimbabwe's manufacturing sector. They obtained the necessary data from the

relevant manufacturing sector agencies and performed the analysis using both secondary data and information. The study discovered that the criteria employed to gauge the performance of Zimbabwe's manufacturing industry are not accurate measures of that industry's performance.

In 2013 Algis Šileika and Jurgita Bekerytė (Sileika et. al., 2013) examined sustainable development on the connections between unemployment, poverty, and crime. Additionally, they examined the connections between unemployment, poverty, and criminality. As a result, they discovered that poverty and unemployment, crime and poverty, and poverty and crime all showed that the three factors are connected through a negative context with socioeconomic consequences, which further supports the country's socioeconomic policy's disregard for sustainable development principles.

In 2014 Kemi F. Akeju and Dayo B. Olanipekun (Akeju et. al., 2014) analyzed the connection between the unemployment rate and economic expansion. They used the Johansen cointegration test and the Model of Error Correction (ECM) to analyze the variables' short- and long-term connections. Their empirical results demonstrate a link between Nigeria's unemployment rate and economic growth over the short and long terms.

In 2015 Mirela Ionela Aceleanu et al., (Aceleanu et al., 2015) identified some strategies to minimize it in the framework of European environmental sustainability after analyzing the evolution, causes, and disparities reported at the level of the European Union on the magnitude and structure of young unemployment. They gathered pertinent data and did the pertinent analysis. They concluded from the analysis that active policies significantly impact investments in education and sustainable employment.

In 2018 Chinnah Promise Chinwe (Chinnah, 2018) explored the definitions of national development, problem, and unemployment conceptually. The researcher also covered the many forms of unemployment, their causes, their effects, and the

government of Nigeria's efforts to counteract it. The researcher analyzed after gathering the necessary data from Nigeria's jobless. The researcher concluded from the findings that the unemployment problem in Nigerian development is incomprehensible since the programs and policies implemented in Nigeria to combat poverty and unemployment had no discernible effect on the chronic problem.

In 2020 R. Bali Swain and F. Yang-Wallentin (Bali Swain & Yang-Wallentin, 2020) showed the methodology for accomplishing sustainable development objectives. To determine which of the three SDG pillars—economic, social, and environmental—are most useful in attaining sustainable development, researchers used structural equation modeling (SEM). Their findings showed that although developing nations benefited best from maintaining their focus on economic and social variables, industrialized countries benefited most from concentrating on social and environmental factors.

In 2019 Syed Abdul Rehman Khan et al. (Khan et. al., 2019) explored the possible connections between public health spending, logistical performance metrics, renewable energy, and environmental sustainability in ASEAN member nations. Their study used secondary data collected from the World Bank database and utilized structural equation modeling to evaluate hypotheses. The utilization of renewable power in logistics activities will enhance the environment and the economy to reduce emissions, but environmental efficiency is negatively found to correlate with public healthcare expenditure, suggesting that huge environmental sustainable development can improve human quality of life and economic growth.

In 2019 Muhammad Azam (Azam, 2019) compared the effects of energy, pollution of the environment, human capital, financial sector development, and capital equipment on economic growth in the BRICS-4 (Brazil, India, China, and South Africa) countries between 1981 and 2015. For an empirical examination, they used the Dumitrescu-Hurlin Causality Test, Robust Least Squares (R.L.S.), and Panel Accommodates A large Ordinary Least Squares (F.M.O.L.S.). The conclusion

showed that environmental pollution retards economic growth whereas energy consumption, capital equipment, human resources, and financial development support it.

In 2019 Faiza Manzoor et al. (Manzoor et al., 2019) examined the tourism affected Pakistan's employment and economic expansion. To examine the stability of variables, they employed enhanced Dickey-Fuller and Phillips-Perron unit root tests. Regression methods were used to analyze the data. Their findings demonstrated that there is a long-term association between the variables and that tourism has a favorable and considerable influence on Economic growth in Pakistan as well as the employment sector.

In 2018 Robi Kurniawan and Shunsuke Managi (Kurniawan et. al., 2018) examined how sustainability and economic growth are related in Indonesia. They gathered data from 1990 to 2014, and their findings supported the notion that the country's growth has been characterized by wealth-building and a transition from natural to creating human capital. Additionally, they discovered that during the research period, population growth was faster than total wealth growth, which made per capita income growth negative. According to their research, Indonesia's GDP per capita rise during that time did not always correspond to increases in per capita wealth.

In 2018 António Cardoso Marques et al. (Marques et al., 2018) examined food consumption, economic expansion, and sustainable development interaction. Their report explicitly evaluated the impact of food consumption on the economy. They used the Distributed Lag Autoregressive model for 77 nations, and their findings confirm that, when considering different socioeconomic categories, meat intake has various effects on economic growth. Additionally, they concluded that there is a clear conflict between economic development and sustainable growth since meat consumption negatively impacts both.

In 2019 Nataliya Dalevska et al. (Dalevska et al., 2019) estimated the degree of development of trade and investment relations, the level of average lifespan, the standard of living, and the economic success of un organizations under the impact of sources of economic growth, a methodology and tools for financial and mathematical modelling had been proposed. To produce results supported by science, they used various general scientific and specialized research methods, including analysis methods and synthesis, organizational system and abstract thought, modelling, qualitative and quantitative comparison methods, and systematic approach and modelling. Their suggested technique can be used when creating the nation's national economic development plan to attain sustainable development.

In 2020 Batara Surya et al. (Surya et al., 2020) studied how spatial structures, spatial interaction, and urban agglomeration interact to form urban activity systems and how that factors influence ecological sustainability in the major city of Mamminasata by influencing the national economy, land clearing, and pollution levels degradation. They obtained the required information and performed the appropriate analysis. Their study's conclusions advise authorities and urban planners that, to reach 2030 national targets for metropolitan city growth, land use change, multiple layers to extract progressively, and urban spatial exchanges on various scales shall demand the adoption of environmentally friendly development principles. These ideas are intended to promote social cohesiveness, consistent economic access, and environmental protection.

In 2019 Collins Adjei Mensah et al. (Mensah et al., 2019) between 1991 and 2016, the Sekondi-Takoradi Metropolis's land use and cover changed, and its effects on the viability of the metropolis were examined. Their analysis showed a significant land use and cover shift throughout the period under review. In addition, it was discovered that regions near the water were also being encroached upon by the built environment. Farmlands, open woods, and restricted forests were all turned into

built-up areas. Additionally, their findings provided proof of the Sekondi-Takoradi Metropolis's unplanned physical development.

In 2019 E. Pisoni et al., (E. Pisoni et al., 2019) modelled how the activities they comprise may alter first maneuverability and emissions at the urban level and, after that, urban background proportions of Pollutants and NO2. The findings showed that on a yearly average for both pollutants, urban background ratios of PM2.5 and NO2 reduced by up to 2% and almost 4%, respectively. Their study does not examine the impact of NO2 on lower floors, which will be larger than that in the urban backdrop. They also found that although the simulated SUMP's improved air quality will only somewhat alleviate problems with air quality in urban areas, such a decrease in co2 emission should still be seen as a SUMPS beneficial result.

In 2021 Anne Wambui Mutahi et al., (Mutahi et al., 2021) examined how poor community air quality affects people's health. They gathered the necessary data from remote Kenyan villages that illustrated impoverished areas where indoor cooking, lighting, and heating employ dirty energy sources. Filter-based sampling was done to study black carbon (BC), elemental composition, and particulates with a diameter range smaller than 2.5 m.

In 2013 Kshama Gupta (Gupta, 2013) analyzed the urban region of Dehradun's remarkable expansion. They used data from remote sensing satellites to do an analysis utilizing an 8-directional wind rise technique. According to their data, the urban area of Dehradun increased by 160% between 1987 and 2008 and almost twice as much between 1998 and 2008. Additionally, they found that urban expansion is more pronounced in the south, southeast, and southwest directions. In addition, the expansion radius has grown from just 8 km to 15 km from the city center since 1987.

In 2021 Agnieszka Ptak-Wojciechowska et al., (Ptak-Wojciechowska et al., 2021) confirmed the importance of water- and climate-related factors. They conducted comparative analyses of the 24 QoL evaluation methods they had chosen and

illustrated the domains, standards, and indicators they suggested. The findings demonstrated that only a few cities with the best quality of life score high in sustainable and climate resiliency ratings and that water and weather factors are currently underrated in QoL rankings and guidelines.

In 2020 Chayna Jana et al. (Jana et al., 2020) studied the spatiotemporal urban growth pattern and its effects on thermal behavior and variance in green space in Doon Valley between 2000 and 2019. The land cover change research showed a significant expansion of urbanization with an increase of 184% in Doon valley between 2000 and 2019. They used Shannon entropy analysis to look at how geographical considerations affected urban expansion. According to the research, all the roadways and the city's core have consistently seen a larger urban spread than the surrounding areas, with a relative entropy value of more than 0.9.c

In 2019 Agarwal et al., (Agarwal et al., 2019) analyzed the financing made available by the government to create smart cities throughout India and the influence these monies had on the development process. Their descriptive study found an upward trend in the investment amount, area-based projects, pan-city initiatives, and O&M costs for smart cities between 2016 (for 60 smart cities) and 2017 (for 99 smart cities). They also concluded that Public Private Partnerships (PPP) should be promoted to construct smart cities.

In 2019 Holubava (Holubava, 2019) discussed the key characteristics of smart cities, pointing out that they are characterized by high levels of urban environment management, energy-saving mechanisms, and enhanced social services that enhance the quality of life.

In 2017 Ahvenniemi, Huovila, and Airaksinen (Huovila, & Airaksinen et. al., 2017) analyzed 958 indicators from 16 cities to evaluate the framework for smart cities. Their study's key finding for defining the smartness of the city was the emphasis on technology-enabled business and everyday home activities. Environmental sustainability turned out to be the second key element of the smart

city concept. The authors advised against using the phrase "smart cities" in favor of "smart sustainable cities." Additionally, they saw the necessity to include the idea of environmental, social, and economic sustainability into the smart city framework.

In 2014 Angelidou (Angelidou, 2014) gave a detailed picture of the approach taken and the recommendations made for creating smart cities. In addition to using existing literature and personal experiences, the author offered a development roadmap for smart cities.

In 2011 Caragliu et al. (Caragliu et al., 2011) demonstrated the value of information and communication technology. The study showed that the urbanization of any place depends not only on ICT-enabled infrastructure but also, largely, on the local populace's level of knowledge and social infrastructure.

In 2018 Yigitcanlar et al., (Yigitcanlar et al., 2018) investigated the factors influencing the growth of smart cities and provided a more complete picture of the multifaceted structure necessary to construct smart cities. According to the study, community, technology, and policy are the three main factors determining whether a city will be considered a smart city. These factors, when combined effectively, can produce the desired outcomes of productivity, sustainability, accessibility, well-being, liveability, and governance.

In 2018 Macke, Casagrande et al. (Casagrande et al., 2018) analyzed the key components of citizen happiness in Curitiba and examined how people perceive their quality of life in smart cities (Brazil). The study's methodology involved an in-depth interview with 400 inhabitants to determine the QOL components. The authors concluded that environmental well-being and socio-structural relationships were important. The fundamental four areas of preserving life quality in a city of the future are physical well-being, social integration, financial well-being, and environmental sustainability.

In 2011 Winters (Winters, 2011) investigated the motivations for people's migration to smart cities. According to the report, improved higher education facilities are the main driver of immigration to cities. Since these cities are hubs for education, more and more individuals move there, searching for a better lifestyle.

In 2018 Giorgia Nesti (Nesti, 2018) analyzed Amsterdam, Barcelona, Turin, and Vienna as four smart European cities. In addition, the study underlines the emergent paradigm because of the transformational growth of these smart cities. The essay attempted to explain the degree of governance and transformative architecture in these cities.

In 2015 Castelnovo et al., (Castelnovo et al., 2015) studied literature to provide a comprehensive analysis of the governance and policymaking of smart cities. According to the study, social innovation and the worth of policies to the public are connected. According to the author, one of the key components of smart cities is a mixed-value service with public-centric innovations.

In 2016 Meijer and Bolívar (Meijer and Bolívar, 2016) said that the focus of a smart city is on clever people, smart technology, and smart cooperation. Furthermore, their study claimed that smart city administration is a difficult process that has to consider socio-technical governance visions.

In 2018 Praharaj et al. (Praharaj et al., 2018) explored the urbanization of megacities through a multitude of different state policies. The study concentrated on the intricacy of the legal structure needed to urbanize cities, particularly in India, where the government has set a goal of turning 100 cities into smart cities. This transition needs the full backing of local and institutional stakeholders to develop smart cities.

In 2018 Martin et al. (Martin et al., 2018) did a detailed study of the research on smart cities for countries in North America and Europe. According to the study, trying to promote free market capitalism, emphasizing affluent populations,

disempowerment, marginalization of residents, disregarding protection of the environment, and failing to contest the predominant consumerist culture are the five main challenges that cities must overcome to become smart.

In 2018 Silva et al. (Silva et al., 2018) indicated that organization is a technique of innovative product development with hundreds of organizational features. These innovations would have minimal influence on the environment, democracy, and government. This report also emphasized the significance of technology for information and communication integration in city operations as a component of smart cities. The biggest step toward the creation of smart cities, it was also underlined, is installing the internet of things.

In 2020 Tania Ray Bhattacharya et al. (Bhattacharya et al., 2020) said that the amenities given by the government leaders might satisfy the fundamental prerequisites of a smart and sustainable city in any growing country. According to the paper, the indicators may be used to plan for undeveloped smart cities and evaluate the efficacy of smart cities across a wide range of developing nations. The core criteria for smart city indexes in developing countries might theoretically be the characteristics of civilization, economy, environment, culture, and lifestyle.

In 2017 Randhawa et al. (Randhawa et al., 2017) stated that policymakers concentrate on sustainable urbanization of cities given how the environment has been negatively impacted by rising population and pollution brought on by the overuse of natural resources. India has outgrown its status as a developing country with growing urbanization, where the government launched the smart city project. In this document, the Indian smart city standard is thoroughly discussed. To achieve the quality of life, the report stated that the construction of a smart city in India involves integrating technology for information and communication with urban design.

In 2019 Chris Martin et al., (Chris Martin et al., 2019) examined the smarts-transforming standards. According to their analysis, smart cities offer a solution to

every city's economic, environmental, and social problems. The study principally recognized three key elements of smart sustainability in urban areas: spatial growth, internet connectivity, and coordinated experimentation for low carbon pollution emissions. According to the report, modernization should not be based on ecological imbalance.

2.12 Summary of Literatures

The use of more extensive indicators has been promoted to monitor the blending of social and participative features as well as social equality, Earth's carrying capacity, negative external shocks, and cities' environmental consequences. This is a result of the widespread use of Local Agenda-21 and the Sustainable Development strategy. The size and importance of sustainability indicators have recently drawn much attention. Since so many potential indicators exist, almost every area of municipal performance has been addressed. Due to this, there are several sustainability indication schemes in use today that encompass at least three different viewpoints on cities: some see them as habitats in and of themselves, another is concerned with their influence on wider ecosystems, and a third focuses on their capacity to generate a positive environment both within and outside of their borders.

Local governments in developing countries have undertaken this empirical and philosophical effort to create indicators that may be beneficial for assessing the evolution of protecting the environment and determining which primary challenges are in cities. This endeavor is unquestionably a step ahead in data collection, gathering, modeling, and standardization of environmental sustainability in the urban arena.

Even though each of these pairs of metrics can be used to gauge the sustainability of an urban area at the moment, they have all been restricted to studying only those aspects of sustainability that are directly related to the process of urban development, such as the environment, society, and economy. As a result, there remains a disconnect between the performance of urban planning and the

application of urban & sustainability metrics in plan formulation. These indicators could be highly useful for evaluating and following urban phenomena and figuring out how policies and programs would affect long-term sustainability in terms of social, economic, legal, cultural, and ecological goals over the short and long years. Using sustainable indicators in the early stages of urban planning would support the objective of creating sustainable communities by design, which would arise from integrating sustainable objectives into the planning process.

Furthermore, instruments that will enable this feasibility must be developed if sustainability is to be completely included in city planning. As they have emerged, new problems demand the application of fresh planning strategies and instruments. Due to this, the development of a sustainable world should be founded on an understanding of its conditions and an in-depth knowledge of its unique reality, which will provide urban planners with a clear viewpoint. The indicators are the consequence of an operations and maintenance prognosis that begins by considering several factors, including the city's metabolism, its extent of self-sufficiency, its decrepitude, the security of its land tenure, the reliability of its habitat, as well as local and global effects that the growth of its urban pattern and the urbanization process has.

It is also possible to assert that including a sustainability evaluation in the planning process at an early-stage aids in identifying trends and patterns, measuring urban environment characteristics quality, increasing general understanding of potential constraints placed on urban development by eco-geographic contexts, and integrating sector-isolated elements previously. Finally, it raises awareness and offers spatially strategic possibilities for urban planning and development, which may enhance the sustainability of cities.

2.13 Theoretical Underpinning

As a result of the rapid expansion of cities and the ongoing integration of various areas of research, urban planning is increasingly becoming a field that does not

solely focus on the design of physical forms. This is partly because urbanization is occurring at an increasingly rapid rate. In its place, it has started to pay a great deal of attention to other non-physical aspects (such as individuals and society), in addition to more basic norms that are concealed in the dynamic expansion of cities. The urban system, which is being investigated by urban planners, is becoming more sophisticated in terms of both the shapes it takes and the character it has. Therefore, planners need to find out a way to comprehend, investigate, and demonstrate such a complex system (Wensheng & Qiang, 2013). The study of complex systems, which are characterised by nonlinear behaviour, feedbacks, self-organization, irreducibility, and emergent properties, is the focus of a relatively new field of research known as complex systems science (CSS), which is an offshoot of complexity theory. Complexity theory and complex systems science (CSS) together make up this field. These are the kinds of systems in which the whole is not only more than the sum of its components but also distinct from that total. The field of complexity science encompasses both complexity theory and complex systems science (CSS) (Anderson 1972; Bertalanffy 1972).

Books such as those produced by Johnson (2001), Miller and Page (2007), Barabasi's (2002), Holland's (1998), and Strogatz's (2003) introduce the theories that underlie complexity as well as broad examples of their application. The field of ecological research has also come around to the concept of accepting complexity (see, e.g., Gunderson and Holling ,2002 or Sole and Bascompte, 2006). There is a natural possibility for the application of complexity thinking to ecological explanations of urban function and growth, according to Grimm et al. (2008). This is compatible with the long-standing interest in the urban ecosystem that has existed.

It is possible to think of cities as emerging entities since they are getting close to a key moment in their process of self-organization. On the other hand, cities are not even close to being in a state of equilibrium, and they are fundamentally separate from both the people who live in them and the subsystems that make them up. By

Kay and Schneider's definition (1994), these kinds of systems are known as self-organizing holartic open, or SOHO, systems for short. However, a Zen-like, visual metaphor developed by Holland (1995, 1–2) may be the most effective way to summaries them: "Like a standing wave in front of a rock in a fast-moving stream, a city is a pattern in time". "A city is like a standing wave in front of a rock in a fast-moving stream." Even though there is not a single citizen left in the city, it continues to exist even if they are all gone.

When it comes to dealing with the problems that are caused by urbanization, decision-makers at all levels of government and society must face a wide range of fundamental obstacles. It is difficult to foresee the effects and unintended consequences of public action because the various components of the urban system are tightly intertwined. This gives rise to complex dynamics and makes it impossible to predict the influence of the system. Consequently, it is difficult to foresee the effects and unintended consequences of public action. The best way to think about cities is not as self-contained units but rather as interconnected nodes in wider metropolitan networks. The regulations that control urban expansion may be subject to decisions made at several different levels and throughout a wide geographic range. These policies also have a significant impact on a wide variety of stakeholders, many of whom have goals that are in direct opposition to one another or even in conflict with one another. Traditional research methods, which are founded on reductionist ways of thinking, have a difficult time interpreting, among other things, the formation of urban structure, the evolution of urban space, and the laws that govern human activities in cities. This is because traditional research methods are based on reductionism. Because of this, these methodologies are unable to shed light on the more fundamental reasons and principles that drive the dynamic evolution of urban areas. The founding of the Santa Fe Institute at the tail end of the 1980s was a significant event that had a direct impact on the expansion of the complex systems scientific subfield. The study of complexity has made great progress in the space of less than twenty years, and it has emerged as the dominant focus of attention in the scientific world now. On the one hand,

people's ideas of urban systems are radically shifting because of the theories that have been put forth by complex research. On the other hand, research approaches that concentrate on complex systems give powerful tools with which to explore urban systems (Wensheng & Qiang, 2013). The concept of living systems as self-organizing networks with components that are all linked with one another and dependent on one another has been presented in a variety of different forms on several occasions throughout the course of the development of philosophy and science. These presentations have taken place on a few different occasions. However, full models of self-organizing systems have only been able to be defined very recently because of the availability of new mathematical tools. This is mostly because self-organizing systems have been studied for a comparatively short amount of time. Researchers now have the capacity, for the first time, to quantitatively characterize and simulate the underlying interconnection of biological network systems thanks to the tools at their disposal. Even though there are numerous theories and that there isn't complete agreement on what complexity and complex systems are, the scientific community has reached a few major conclusions on which they all agree. There is an objective reality to complex systems, and this reality is in no way determined by human comprehension. It is difficult to deduce all the system's overall characteristics based on just a few of those traits because complex systems are made up of many minute individual components that interact nonlinearly with one another. There is no doubt that complex systems are dynamic, and that throughout the course of their growth, one-of-a-kind features may and often do arise spontaneously inside them. Moreover, there is no doubt that this phenomenon can be seen. It is not at all evident how complex systems are presented, and openness is an essential prerequisite condition for the creation of complex systems. Adaptability is the most important component that contributes to complexity, and nonlinearity and emergence are crucial properties of complex systems. Adaptability is the most important factor that contributes to complexity. In general, complex systems theory is still a theoretical framework that must be continually improved upon and expanded via the concerns

and efforts of scientists working in a number of fields all over the world. This is the case regardless of where those scientists work. The study techniques of complex systems theory and complex systems have made certain fundamental concepts and procedures available to us for investigating urban problems. We investigate a variety of urban problems and can use these ideas and methodologies. People often use the term "social carriers" to refer to cities since they are the places where major material accumulation takes place. A city may be thought of as a complicated, enormous system if we consider it in terms of its capacity to generate new forms of matter, energy, information, and social components. These enormous material carriers are used to assemble, mix, ferment, and synthesize a wide variety of components, including, among other things, social organizations, the movement of people and material, the accumulation of historical culture, and other components. Every complex system is made up of several distinct components, each of which has its own distinct collection of characteristics, structures, and functions. These components may be broken down into subsystems. An urban system is a term that refers to a structure of this sort that is made up of multiple different sections. Cities are made up of many different parts, some of which are material and some of which are immaterial. These parts may be divided into two categories: material and immaterial. Nonmaterial components include things like belief, religion, thinking, ideology, the economy, and society, whereas material components include things like air, sunlight, soil, water, buildings, and creatures. Material components include things like air, sunshine, soil, water, buildings, and organisms. Not only is there a great variety among these elements, but there are also a lot of connections that can be made between the components of these elements and the sub-elements that make up those components. Consequently, several different kinds of coupling mechanisms come into being, all of which work together to construct a large-scale system like a city.

2.14 Research Gap
2.14.1 From Thematic Literature Review
The application and sustainability models that have been discussed are most suitable for the cities in the plains. As various nations have varying standards for datasets like industry classifications, property valuation, and census figures, the procedures in an international setting would require more translation. In general, the UK is well-positioned for data access and collecting. However, other nations, notably in European and North American contexts, have a vast availability of comparable datasets. The Himalayan range's cities, however, are not included.

Limited research was available in the context of Himalayan cities. The study had been focused on ecological balance and climate change. No study had been done on the perspective of how a city will grow economically or how employment can be generated other than tourism. No literature had been found to resolve the urban transport scenario for urban areas in the Himalayan range and how it will impact climate change or the socioeconomic scenario of the above-mentioned areas.

A substantial body of literature has identified a broad variety of socioeconomic indicators for the sustainable development of cities. But all the indicators might not be applicable for studying the sustainable growth of urban areas of Kashmir, Himachal Pradesh, Uttarakhand, Darjeeling, Sikkim, or Arunachal Pradesh. So, a study should be undertaken to study of the practicality and importance of SE indicators for the above-mentioned states of India.

A sizable body of research from across the globe has been done (Böhringer and Jochem, 2007; Moran et al., 2008; Nourry, 2008; Siche et al., 2008; Bilbao-Ubillos, 2013; Pillarisetti and van den Bergh, 2013, Estoque and Murayama, 2014; Evans et al., 2015) with the aim of reviewing and contrasting the indices created to measure sustainable development. The scientific and political groups have not, however, reached agreement on a single index that would be most useful. Six different types of sustainability indices were thoroughly reviewed and compared by Wilson et al. in 2007, and they concluded that there is "lack of a clear direction at the global level in how to approach sustainable development. Nourry (2008) looked at eight different indices and applied each one to the circumstances in France, concluding that no indicator is flawless, and that no indicator can provide a comprehensive assessment of sustainable development. In analysing five indicators to

determine the sustainable route of nations, Pillarisetti and van den Bergh (2013) noticed the discrepancy between them. When creating sustainability indicators, physical scientists, social scientists, and politicians must all work together more effectively, according to Rametsteiner et al. (2011). There is evidence that the environmental SDGs' goals and metrics are more cohesive than its social ones (Steuer and Hametner, 2013). The positive and negative perceptions of the indicator system were further debated by Krank et al. (2013), arguing for better awareness by the end users and policymakers of the developed indicator systems. Sébastien and Bauler (2013) argued that the quality of developing sustainability indicators should rely not only on methodological science but also on improved reception by policymakers. Morse (2015) examined the contrast between the economics, environment, and community reflected by the sustainability indicators. He also offered a comprehensive analysis of the media mention of several sustainability indicators. In Bell and Morse's (2014) investigation of the current application of indicators, a set of assumptions regarding their application by stakeholders and policymakers were examined.

Even though there is a large body of literature that discusses sustainability indicator metrics, policymakers and scientists who work on the three aspects of sustainable development—economic, environmental, and social—must collaborate during the planning stage for the creation of sustainability indices. There needs to be more widespread scientific consensus and standardisation about the relative weighting of the three aspects and the best way to analyse each of them in terms of sustainable development. The study's main goal is to qualitatively look at how each of the chosen indices has been used to research in the domains of social science, environmental science, and economy. Efficiency, equity, and intergenerational equity must be combined on an economic, social, and environmental level for sustainable development to be effective. There are various topical categories into which arguments on sustainable development in the literature may be divided, including conceptual disputes, settings for sustainable development, academic debates, and geopolitical conflicts.

2.14.2 Thematic Gaps
- Policy & Regulations

The importance of urban size for sustainability as well as the necessity to consider emerging nations' high population trends in the evaluation of global sustainability and how infrequently it is translated into government action. All the sustainability pillars had been

the subject of extensive discussion, but each had also undergone independent variable analysis. There is no literature that links the foundations of sustainability to how complicated a system could get. Transport & Mobility

Given that exposure to environmental stressors throughout a lifetime can hasten ageing and cause disease, there is a need to incorporate long-term temporal dynamics into research inquiries, including the diurnal time-dependent character of some stressors and the life histories of people. There had been no consideration given to the link between transportation, economic development, or social lifestyle change, as there had been for the French city of Nice, and only environmental concerns had been given attention. Lifestyle and social change had been observed after the city of Nice got connected with the High-Speed railway and BRTS corridor.

- Sustainability

Although further study is required, there are several models and ideas of the sustainable city that offer promise for bridging the gap between the three elements of sustainability. Every topic that was investigated contributed to the sustainability industry.

- Urban water & Waste Management

We have identified a knowledge vacuum that has to be filled to generate place-based solutions and policies that will promote health and wellbeing as well as community quality of life. An appropriate strategy for improving the water supply service is required. This plan must be based on transparent renewal, replacement, and system expansion plans as well as clear operating, maintenance, and management processes, including an O&M cost recovery policy. Additionally, it is necessary to develop water quality testing facilities at the proper levels in the field to ensure the quality of the drinking water supply, as well as to improve the design and implementation of several preventive measures at the basin, source, system, and household levels to safeguard water quality. Develop local self-regulation for water demand management. Modify agricultural practices and crop patterns. Use more efficient irrigation systems to ensure source sustainability. Implement measures to conserve, protect, enhance, and manage surface and ground water resources (including building rainwater harvesting and ground water recharge structures).

- Finance & Economics

The long-term effects of urban economic doldrums require greater empirical study. Effective urban poverty prevention and reduction requires routine and reliable data generation and analysis. The political economy of urban areas and the ways in which public and private authorities are implicated requires attention. The place of communities in shaping urban economic growth outcomes is less well understood.

Much of the literature cited above identified and analyzed the factors of sustainability due to Smart urban projects in Europe, Australia, Southeast Asia, Africa & America. The literature is not available where mutual relationship of pillars of sustainability i.e., economic, environmental, social, and natural resources has been studied for any region of India. Further, barring few studies, not much research, even outside India, has been done to identify complexity of urban projects and its impact on Urban sustainability. Hardly any scholars have studied the same in Indian context. In fact, literature is not available on any evidenced based study for enabling factors for understanding sustainability for urban India specially for eco-sensitive region like Himalayas.

In short, *available literature does not provide any concrete insight for developing understanding on about the factors responsible for understanding sustainability for Urban region of Himalayas in India specially for state of Uttarakhand.*

It is, therefore, believed that the proposed study will help in bridging this gap that has been observed in literature.

2.14.3 Gaps from Theoretical underpinning

Between general economic theory and incomplete theories (agricultural and industrial) of localization, there is an inconsistent gap. I would use the marginalists' idea of substituting production factors for localization factors. A scant amount of research has also been done on the relationship between the sustainability model and the complexity theory model. So, research is necessary to determine whether complexity theory is compatible with sustainability. For regional situations, bonding, bridging, and combining social capital with sustainable models had not been explicitly defined.

Research is required to comprehend how uncertainty spreads across time and throughout various model frameworks, as well as to create and implement cutting-edge approaches to address the issue of stochastic variation and related uncertainties in outputs from

disaggregated models that are sustainable. Additionally, it had been noted that any research in the areas of urban planning, sustainability, etc. had employed the idea of complexity as a basis for analysis. Also, for most of Theory of Complexity journals or research papers structural equation modelling had been used for analysis.

The consolidated research gap for the study has been derived as stated by Cresswell (Cresswell 1994) and modified by Miller in 2009.

So, research gap of my study can be stated as;

- *Absence of impact study on sustainable model in a developing country which can drive to achieve the goal of sustainable growth model in the complex urban scenario.*

- *Limited study on relationship of all the pillars of sustainability complexity especially for state of Uttarakhand*

2.15 Research Problem Statement

Although many studies have dealt with urban development but there is a lack of conceptual clarity on the factors that are critical in understanding sustainability of urban development with respect to SDG 11 objective. So, there is a need in finding out the factors of sustainability with respect to SDG, which have impact on the success of the urban development in the Himalayan state of Uttarakhand, India.

Chapter 3

Methodology and Model Building

3.1 Introduction

The goals of this chapter are to first describe the research methodology that was utilized in the study, then to clarify the goals of the research and finally to present the research design. Additionally, it gives background information on how variables were identified and how data was collected for the variables. To highlight specific aspects of the data and provide readers a general idea of the data obtained; this chapter also includes descriptive statistics. The "Data Analysis" next chapter includes a thorough statistical analysis of the data.

Designing a research study for a difficult topic like the impact of sustainable development indicators due to urban development is a difficult task. It requires a systematic approach to identify research variables, develop conceptual framework, and develop research methodology to achieve research objectives.

To encourage urbanization and the creation of smart cities, sustainable urban development has been selected as the study's focus area. Traffic jams, pollution, sewage overflows, urban flooding, traffic accidents, and greenhouse gas emissions are all on the rise in more and more Indian cities today. The conceptual and theoretical content of the thesis relates to debates in the literature over sustainability indicators. The conceptual and theoretical framework of the thesis connects to discussions of sustainability indicators in the literature. This chapter discusses the justification for the thesis's methodological framework.

According to Flick (2006), the reliability, veracity, and authenticity of the data in qualitative research support validity, and this is possible if the investigator uses the right research steps, clearly defined criteria, accepted practices, methodical analysis, adequate argument, and a clear discrepancy between the facts and the interpretation. Additionally, it had been noted that any research in the areas of urban planning, sustainability, etc. had employed the idea of complexity as a basis for analysis (Flick, 2006).

The research process included deductive (based on logic) as well as inductive approaches therefore both Qualitative and Quantitative research methodology has been used.

3.2 Theoretical issues around research design

There are three primary types of research: problem-solving, exploratory, and testing-out (Phillips & Pugh, 2005; Blaxter et al., 2001). These methods can be used in both qualitative and quantitative research, according to Phillips and Pugh (2010). They advised the testing-out or exploratory strategy for a PhD student in management studies or social sciences. The testing-out strategy further provides clarification and in-depth investigation of the difficulties to completely achieve the research objectives, even though the exploratory approach on its own can be effective to address the kinds of challenges and issues discussed in this thesis.

This PhD dissertation in the Indian state of Uttarakhand explored concepts, indicators, measurements, and theories developed by a thorough literature research, which was utilized to highlight gaps, problems, and identification of variables.

3.3 Research Design

3.3.1 Research Variables

As a result of extensive literature survey, indicators to define the urban sustainable development indicators of any urban area were identified. In the table below all the indicators/variables identified through literature review are compiled under three pillars of sustainable development that are economic aspects, environment aspects and social aspects.

Table 4: Research Variables

Economic Aspects	1. Market supply and demand
	2. Technology
	3. Budget
	4. Financing channels
	5. Investment planning
	6. Life-cycle cost
	7. Life-cycle benefit/profit
	8. Fiscal risk
	9. Payback period
	10. Internal return ratio (IRR)
	11. Intangible capital
	12. Produced capital.
	13. Natural capital
	14. Gross national savings
	15. Consumption of fixed capital

	16. Economic life to reduce stress and increase security.
	17. Income
	18. Income distribution
	19. Gross domestic product
	20. Public debt
Social aspects	1. Mortality
	2. Access to electricity
	3. Basic human sustenance
	4. Reducing environment related natural disaster vulnerability.
	5. Private sector responsiveness
	6. Science and technology
	7. Expenditures one duration
	8. Motivation for life Relationship and love
	9. Feeling safe
	10. Good health and enough energy
	11. Life expectancy
	12. Education
	13. Experienced well-being
	14. Life expectancy

	15. Sufficient food supply
	16. Sufficient water to drink
	17. Safe sanitation
	18. Healthy life
	19. Education
	20. Gender equality
	21. Employment
	22. Good Governance
Environmental aspects	1. Ecological footprint
	2. Clean air
	3. Clean water
	4. Air quality
	5. Biodiversity
	6. Renewable water resources
	7. Renewable energy
	8. Greenhouse gases
	9. Organic farming
	10. Energy depletion
	11. Metal depletion
	12. Mineral depletion
	13. Net forest depletion
	14. Damage from PM10
	15. Damage from CO2
	16. Critical habitat protection
	17. Change of trend in carbon intensity
	18. Trend in carbon intensity

	19. Marine protected areas
	20. Terrestrial protected areas
	21. Water quality
	22. Reducing ecosystem stress
	23. "Coastal shelf fishing pressure"
	24. Fish stocks
	25. Change in forest cover.
	26. Pesticide regulation
	27. Agricultural subsidies
	28. Wastewater Management
	29. access to sanitation
	30. Access to drinking water.
	31. Household air quality
	32. Reducing population pressure
	33. Greenhouse gas emissions
	34. Reducing water stress

3.3.2 Research Propositions for The Study

The following pragmatic schematic design might serve as a guide for developing research questions and for obtaining answers to the study's central question:

- Describe the issue.

- Assemble data about prior research on the topic and resources.

- Form ideas into hypotheses.

- Create a research tool and gather data.

- Data analysis

- Interpret the information and make inferences that serve as the foundation for fresh hypotheses.

- Validate and test theories.

- Finalize the outcomes.

This step-by-step process has an intrinsic repetitive cycle that moves from the point of creating propositions or hypotheses to drawing conclusions and back to propositions or hypotheses once again. This flow depicts a common proposition/hypothesis testing procedure. The following are the major research claims: All the seventy-six urban sustainable development indicators identified through literature survey are significant indicators to study the impact of sustainability indicators due to urban development for the state of Uttarakhand, India.

1. All the seventy-six factors identified through literature survey are significant factors that contribute to study the impact of sustainability indicators due to urban development for the state of Uttarakhand, India.

2. Factors are enabling factors for the study of the impact of sustainability indicators due to urban development for the state of Uttarakhand, India. The macro success factors influence each other i.e., some macro factors are predictors of one or more of the other macro factors.

3. Are the indicators correlated with each other and are they having complex relationships?

3.4 Research Question

Based on the identified research gap, the fundamental research questions in the proposed study are:

- What are the factors that lead to change in urban development and its socio-economic activities with respect to SDG 11?

- How are the factors of urban development affecting sustainability indicators with respect to SDG 11?

3.5 Research Objectives

The main goal of the study will be to identify, both qualitatively and statistically, urban sustainability indicators and its impact due to urban development in urban Uttarakhand India and the extent to which have an influence.

- To identify the factors that are responsible for changes in urban development and its socio-economic activities with respect to SDG 11.
- To define urban development in relation to sustainability indicators with respect to SDG 11.

3.6 Methodology

The research methodology is a methodical approach that provides a clear concept of the procedures or strategies the researcher will employ in the study to meet its objectives (Saravanavel, 2004). Research methodology, according to Rajasekar et al. (2013), is the science of examining how research may be conducted via the creation of a comprehensive research work plan, which lends credibility to the entire effort of the researcher. In essence, it is also described as the study of knowledge-acquisition processes.

The primary area of interest of the researcher as per Flick greatly influences the research methods utilised in the management and social sciences (Flick, 2006). As a flexible way for broadening the study's scope and refining the method of analysis,

mixed-methods research approaches are recommended (Phillips and Pugh, 2005; Blaxter, et al. 2001). Operationally, mixed-method research also encompasses a virtually infinite variety of combinations of sampling, data gathering, and analysis approaches employing a combination of qualitative and quantitative methodologies (Sutton, 1997 and Sandelowski, 2000). The research wanted to examine and identify the relevant urban sustainability indicators for state of Uttarakhand India and its impact due to urban development. Hence the mixed technique was chosen for this study. For the research to be explored in all its facets, a mixed technique was required.

This research used a mixed-method approach that includes a qualitative method (Systematic Literature Review and set of interviews for validation purpose) and a quantitative method (questionnaire survey and Structural Equation Modelling for studying the impact). This research used two separate rounds of interviews, one before the survey, one after.

3.6.1 Questionnaire survey

According to McLafferty (2003, p. 89), effective questions attempt to convey information that is pertinent to the primary study goal. To get precise and "genuine" data, the researchers can express their specific needs to respondents by using questionnaire surveys.

Considering this, it's critical to remember that surveys permit the inclusion of a range of question forms, including both fixed-response and open-ended inquiries (Oppenheim, 1992). According to McLafferty (2003), open-ended questions enable responders to create their own responses. Respondents can also convey their actual sentiments, opinions, and views. This offers an accurate portrayal and does not compel people to react (Parfitt, 1997). Furthermore, according to Oppenheim (1992, p. 113) "answer questions discriminate with that simple to ask, tough to answer, and still more hard to evaluate."

Consequently, the survey's questionnaire included both open-ended and fixed-response items. To start the investigation, raw statistics for a range of fixed-response questions were added. Along with the fixed-response data, open-ended

questions were combined and merged. In addition to strengthening the fixed-response data, this method of using open-ended questions also encourages new ways of thinking and offers a reliable supply of data.

3.6.2 Pilot Survey

Pre-testing, also known as pilot testing, is the last and most crucial phase in the creation of questionnaires, according to McLafferty (2003, p. 92). Before a comprehensive, industry-wide survey is deployed, a pilot survey is often conducted among a limited sample of respondents (Lim and Low, 1992). Pilot studies provide a chance to define and comprehend the limitations of the research questions and to successfully concentrate the research topics (Walker, 1997). Pilot studies are crucial since they point out any problems with the questionnaire. Frequently, these mistakes are not apparent to the researcher themselves (McLafferty, 2003). According to Parfitt (1997), pilot research should examine the following five factors: questionnaire length, classification questions and serialization, questionnaire outputs, and additional data.

In this research 2 pilot surveys were undertaken. First for validation of urban sustainable indicators relevant for the state of Uttarakhand, India. Second, was to gather real scenario data of the urban sustainable indicators for our research objective two.

The questionnaires were trialed on a group of fifteen participants, before being given to the official participants. They comprised resident of Uttarakhand expert and knowledgeable in the field of Urban development for the state of Uttarakhand. They ranged in age, educational attainment, gender, and experience. This provided some guarantee of the data's consistency and intelligibility, as well as its accurate gathering and insightful analysis (Kometa et al., 1995; Ling et al., 1998). Additionally, this test provided input to assist in enhancing the survey. From the pilot survey, a total of 15 completed questionnaires were gathered. Understanding the requirements of some of the questions on the questionnaire was a frequent source of worry. Several individuals also proposed reducing the duration.

3.6.3 Systematic Literature Review

Using and linking to pre-existing knowledge is the cornerstone of every academic research work, regardless of field. As a result, doing so academically correctly ought to be everyone's first focus. However, this project is getting harder. Understanding creation in the field of business research is increasing at a remarkable rate while remaining fragmented and diverse (Snyder, 2019). A literature review is a methodical procedure for acquiring and summarizing earlier research (Baumeister & Leary, 1997; Tranfield et. al., 2003; Snyder, 2019). A strong basis for facts advancement and the facilitation of theory formation is established by a successful and well-conducted review as a research method. A literature review may address research issues with a power that no one studies have by incorporating conclusions and viewpoints from several empirical data (Snyder, 2019).

The capacity to synthesis inquiry results to give evidence on a meta-level and to indicate areas in which additional study is necessary is crucial for the development of theoretical frameworks and the formulation of conceptual models. However, traditional approaches of summarizing and evaluating literature occasionally lack thoroughness and adhere to a predetermined process (Tranfield et al., 2003; Snyder, 2019). Significant problems might arise when researchers choose only certain pieces of proof to substantiate their claims, neglecting data that supports the opposite conclusion. Additionally, there are frequently disagreements about what counts as a quality contribution even when the review approach is sound (Snyder, 2019).

All research projects and fields of study must consider prior, relevant literature. To be considered a competent research technique, a review must adhere to specified protocols and take steps to ensure that it is accurate, precise, and dependable, just like any other type of study. An academic review's quality is evaluated by its approach, conclusions, and reporting, much like any other type of study (Moher et al., 2009; Snyder, 2019). Systematic reviews, sometimes referred to as the "gold standard" of reviews, were first established in the field of medicine as a mechanism

to combine study findings in a methodical, transparent, and repeatable manner (Davis et al., 2014; Snyder, 2019). Despite all the advantages, this method has not been utilized much in business research, but this is beginning to change (Snyder, 2019). Here is a description of a systematic review as a research method and procedure for discovering, critically assessing, and obtaining and analyzing data from relevant studies (Liberati et al., 2009; Snyder, 2019). Finding all empirical evidence that meets the inclusion criteria and may be utilized to support a certain study subject or hypothesis is the aim of a systematic review. Examining papers using clear and rigorous approaches and considering all pertinent data might help to avoid bias and produce reliable findings that can be used to make decisions (Moher et al., 2009; Snyder, 2019). There are several advantages and potential contributions to doing a systematic review. For instance, research can tell us if an effect is stable and how many additional studies are needed to demonstrate the influence. Techniques can also be used to identify the study-level or sample characteristics that influence the phenomenon under examination, such as whether studies conducted in one cultural environment result in significantly different findings from those conducted in other cultural contexts (Davis et al., 2014; Snyder, 2019).

3.6.4 Structural Equation Modelling

Social and management science studies are increasingly using the potent multivariate approach known as structural equation modelling (SEM) to investigate and assess multivariate causal linkages. SEMs are distinct from other modelling strategies because they examine both the direct and indirect consequences of presumptive causal links. Over the last three decades, social science professionals in urban studies have used SEM to examine a variety of multiple-variable hypotheses. The intricate networks of causal linkages in urban systems may be analyzed using SEM (Shipley 2002; Grace 2006). The conceptual and methodological ties between correlation and causality were made clear by Chang (1981) and Maddox and Antonovics (1983), two of the first experts to use SEM in

urban sustainable development research. Use of SEM in urban studies has now seen a strong growth in the most recent ten years (Eisenhauer et al. 2015).

As Huang et al. noted, because urban development is a complex system involving several factors, the indicators are unable to capture the systemic interactions between these variables and are therefore unable to offer normative recommendations for how urbanization should proceed. Uwasu and Yabar shared this sentiment when they said that the current sustainable indicators and tools can overlook certain crucial components of sustainability and fail to specifically address the connections between environmental and socioeconomic factors (Jiao et. al., 2016). The structural equation model is widely acknowledged as a useful tool for examining the connections between the latent variables. The structural equation model is widely acknowledged as a useful tool for examining the connections between the latent variables (Jiao et. al., 2016).

3.7 Concluding Remarks

The study's objective is to examine a few indicators of urban sustainable development that were found via a thorough assessment of the literature and preliminary validation through a pilot study. To verify the importance of research variables, data collected from a survey of Uttarakhand residents in India will be used. The goal is to investigate the effect factors brought on by the state's urbanization. Structural equation modelling has sought to shed more light on the factors. In later chapters, the research methodology's application is covered.

Chapter 4

Data Analysis and Interpretation

4.1 Data Analysis for Research Objective 1

For the current study, a technique of systematic literature review was used to identify the factors influencing changes in urban development and its socioeconomic components in relation to SDG 11 (Shephard, et al., 2006; Bryman, 2012). The systematic review framework developed by Arksey and O'Malley (Arksey & O'Malley, 2005) was taken into consideration. "To identify the elements that are responsible for change in urban development and its socio-economic activities with respect to SDG 11" is the main research topic of the article. We used the following resources instead of any periodicals for the review of the literature: Science Direct, JSTOR, Wiley Online Library, and EconLit (EBSCO). Journals and publications from electronic databases were searched using a systematic review approach regarding the research topics. To locate important papers and articles, search phrases such as "sustainability," "sustainable development," "urban development," and "urban development of Uttarakhand" were employed. During the evaluation process, words like "social," "ecology or environment," and "economic" were also utilized. For this analysis, government reports were also considered.

Reports from NITI-AAYOG India was also evaluated during the process. The steps included for the systematic review process were identification of journals, articles and reports, its screening, find it its eligibility and finally inclusion.

The flow chart given below in Figure 1 describes the process.

Figure 7:Systematic Review Process

```
┌──────────────────────────┐         ┌──────────────────────────┐
│ Record identification    │         │ Additional records       │
│ through database search  │         │ identification through   │
│ (n = 180)                │         │ other sources (n = 23)   │
└──────────────────────────┘         └──────────────────────────┘
            │                                     │
            ▼                                     ▼
        ┌──────────────────────────────────┐
        │ Records after duplicates         │
        │ removed (n = 97)                 │
        └──────────────────────────────────┘
                        │
                        ▼
        ┌──────────────────────┐      ┌──────────────────────┐
        │ Records screened     │─────▶│ Records excluded      │
        │ (n = 84)             │      │ (n = 13)              │
        └──────────────────────┘      └──────────────────────┘
                │
                ▼
        ┌──────────────────────┐      ┌──────────────────────┐
        │ Full-text articles   │─────▶│ Full-text articles    │
        │ assessed for         │      │ excluded with reasons │
        │ eligibility (n = 77) │      │ (n = 7)               │
        └──────────────────────┘      └──────────────────────┘
                │
                ▼
        ┌──────────────────────┐      ┌──────────────────────┐
        │ Studies included in  │─────▶│ Studies included in   │
        │ qualitative          │      │ quantitative synthesis│
        │ synthesis (n = 77)   │      │ [meta-analysis]       │
        │                      │      │ (n = 77)              │
        └──────────────────────┘      └──────────────────────┘
```

Variables identified after screening which have impact on achieving SDG 11 objectives are:

1. Urbanism
2. Employment scenario
3. Quality of Education
4. Female participation

5. Local Body services

6. Performance of health service

7. Urban waste & Sanitation management and handling

8. Service of public transport

9. Quality and supply of drinking water

10. Safety of Electricity supply

11. Local body expenditure

12. Private firm participation

13. Income level for small vendors MSME/Small Business

14. The population lives in slums and informal settlements.

15. Tourism

16. Urban-Rural synergy

17. Ecosystem

18. Green cover like parks & open spaces

19. Air pollution

20. Renewable energy like Solar etc. and biofuel

21. Water pollution

22. Natural disaster

When the questionnaire was floated for checking the validity and reliability of the variables identified from systematic review the result was as follows:

Variables	Mean
Urbanism	4.01
Employment scenario	3.57
Quality of Education	3.86
Female participation	4.17
Local Body services	3.38

Performance of health service	3.20
Urban waste & Sanitation management and handling	3.58
Service of public transport	3.03
Quality and supply of drinking water	3.48
Safety Electricity supply	2.57
Local body expenditure	2.99
Private firm participation	3.33
Income level for small vendors MSME/Small Business	2.90
Population living in slums and informal settlements	2.84
Tourism	2.84
Urban-Rural synergy	3.52
Ecosystem	3.69
Green cover like parks & open spaces	3.07
Air pollution	3.52
Renewable energy like Solar etc. and biofuel	3.19
Water pollution	2.52
Natural disaster	3.14

Table 5: Survey results

As all the values were above the cutoff value of 2.5, so we can take variables for analysis for research objective 2.

4.2 Analysis for Research Objective 2

The use of the structural equation model (SEM), a major statistical approach, in the investigation of questions pertaining to the social sciences has become more widespread in recent years. The primary objective of structural equation modelling (SEM) is to provide an explanation for the pattern of a set of interrelated dependent relationships simultaneously existing between a set of latent (unobserved) constructs, with each construct being measured by one or more manifest (observed) variables. In these approaches, the emphasis is placed not on individual instances but on covariance. We don't try to minimize functions of observed and predicted individual values; rather, we try to minimize the difference between the covariance of the sample and the covariance that the model predicts (Bollen, 1989). The structural equation model (SEM) offers several benefits, including the following: first, it is able to cope with numerous dependent variables at the same time; second, it is tolerant of measurement errors; and third, it may identify latent variables using multiple observable variables. Dealing with social studies, the indices of which are almost never quantitative, may be simplified with the help of this helpful strategy. Its application is ubiquitous across many different research domains since the Structural Equation Model, or SEM, is such a significant topic within the field of applied statistics. These kinds of areas include studies like sociology, management science, behavioural science, and econometrics. The following features of this approach are advantageous: it can manage multiple dependent variables simultaneously; it is robust to observational error between the dependent and independent variables; and it can allow for the existence of latent variables made up of multiple observation indices even when the latent variables are challenging to measure. The structural equation model is a useful instrument for investigating the way in which the model's observation indices and latent variables are connected to one another.

In the research on sustainable cities, the most important factors that are being considered cannot be quantified directly. Take, for instance, how convenient public

transit is, how developed the neighborhood is, or how aesthetically pleasing and ecologically sound the surrounding environment is. Latent variables are another name for these types of variables. A collection of observable indices is required for us to do research on the latent variables. The SEM is the appropriate approach to undertake the study because of the benefits that were discussed before, and as a result, it was employed in the research study that we conducted.

Additionally, some previous research have established the weights of the indicators by taking into consideration the interactional relationship between the various sustainable development indicators. The traditional techniques of evaluation frequently assumed that each indicator was capable of accurately assessing the performance of sustainable urbanization. However, due to the limits of the original data, there must be observational errors between the dependent and independent variables. Even with little data, this is the case. If these inaccuracies are not considered in the assessment of the performance of sustainable urbanization, the findings cannot accurately represent its level. Nevertheless, the structural equation model approach is an excellent way to handle the problems outlined above.

The measurement model and the structural model are the two types of sub-models that are included in an overall SEM model. The measurement model outlines relationships between a hidden variable and observable indicator variables, all in the SEM model. The measurement model outlines relationships between a hidden variable and observable indicator variables. It is called a confirmatory factor analysis model when a structural equation modelling (SEM) model only comprises one type, a measurement model. Relationships between the latent variables and observable variables that are not indicators of latent variables are defined by the structural model (Hoyle, 1995). It is referred to as a "route analysis model" if a SEM model consists just of a structural model.

The selection of an appropriate technique is an essential component of every research endeavor (Davis, 1996; Stevens, 2002). The Structural Equation Model

(SEM) is a strong analytical tool that incorporates a wide variety of statistical methods (Larsson, 2020). Because SEM calls for the specification of a measurement model in addition to a structural model, it can assist us in determining the link that exists between the constructs and the measurements. It is a multivariate approach of the second generation that is used to evaluate the validity and reliability of any model metrics. The assertion that "each statistical approach has particular properties that indicate applicability to a given situation" is one that we agree with (Stevens, 2002). Methods of the first generation of multivariate analysis, such as multivariate regression, are ideal for evaluating relationships between constructs as well as the components themselves. The correct specification of the model (the exclusion of relevant variables), interval or near-interval data with unlimited ranges, linear connections, and homoscedasticity are the four assumptions that underpin multivariate regression.

In this piece of research, it was neither feasible nor practicable to meet the stringent requirements of multivariate regression. Additionally, simultaneous examination of model-construct connections was not an option due to the impracticality of the situation. It must be completed in the order of the stages presented. Methods of the second generation of multivariate analysis (Fornell, 1984; Chin, 1998) make it possible to analyze all the model's variables simultaneously rather than individually. To do simultaneous evaluations of model constructs, SEM has been used for a wide range of research topics. One of the benefits of using SEM is that the estimating processes for both measurement and structural models may be carried out concurrently. To put it another way, the estimation procedure can be carried out in a single step. However, there is not much use in using these measures to investigate the structural links if the researchers are not certain that the constructs of interest are well represented by the measures (Hair et al., 2011). Before it makes any sense to analyze the structural component of the model, there must first be a measurement model that is reliable (Kline, 2011). As a result, it could be helpful to divide fit measurements into pieces that match at least these two primary components (McDonald and Ringo Ho, 2002).

4.2.1 The model's suitability for the data

Since the choice of whether to accept a certain model or not is of the utmost importance, several indices have been devised as metrics to quantify how well the statistical model matches the observed data. SEM researchers frequently make a distinction between "absolute fit" and "incremental fit" when discussing fit indices. The main indicator of how well the proposed theory fits the data is the absolute fit index. Incremental fit indices are also known as comparative or relative fit indices. They are used to represent the relative goodness-of-fit, or the fit of one's hypothesized model, as an empirical increment over a simpler model.

When it comes to absolute indices, RMSEA is one of the measurements that are most often discussed and published (Jackson et al., 2009). The initial purpose of the development was to act as criteria for the assessment of models. It is the test of model fit that is the most straightforward and evident, and it is currently the sole statistical test available for SEM models. When compared to the degrees of freedom it possesses, a lower number is indicative of a model that provides a better fit to the data. A 2 that is not significant is interpreted as meaning that the model is a good match for the data. Despite this, RMSEA is not a trustworthy pointer to model adequacy since it nearly always has a substantial value (which indicates a poor match) (Iacobucci, 2010). Because of this, many other measures of fitness have been devised, and they have been proposed as credible extra metrics of model validity. The RMSEA is the one and only absolute fit index that comes highly recommended, particularly by MacCallum and Austin (2000). RMSEA quantifies the extent to which a poor fit may be attributed to an incorrect specification of the model as opposed to being the result of sampling error. It is sensitive to model misspecification, and it may create confidence intervals to measure the accuracy of RMSEA estimates. Both features were found in Hu and Bentler's paper. SRMR is another essential component of an absolute index and comes with a strong recommendation. The SRMR index, which measures the degree of divergence between the observed data and the model, is computed using the residuals of the

covariance matrix. Compared to other models, the SRMR model is less vulnerable to violations of the distributional assumptions.

Other forms of fit indices, as opposed to absolute indices, are concerned with the problem of comparing a target model with a restricted baseline model, such as an independent model. This contrasts with absolute indices. The Normed Fit Index (NFI), the first incremental fit index, was initially introduced by Bentler and Bonnet (1980). The null model, which is the worst-case scenario model that assumes no correlation between any of the measured variables, is used by NFI to compare the model's 2 with the 2 of the null models (Hooper et al., 2008). NFI has demonstrated a predisposition to overestimate fit for samples with a size of less than 200, indicating that it is subject to the influences of sample size. Bentler (1990) proposed modifying the NFI to take sample size into consideration to improve the Comparative Fit Index's ability to measure fit. This would result in an overall better fit (CFI). In contrast to the NFI, the CFI should be utilized as the preferred index (Bentler, 1990). Additional details and a discussion on these may be found in the work done by Hu and Bentler (1998). Other indices, such TLI and RNI, are also instances of incremental fit indices. Among these, the Comparative Fit Index (CFI) is the one that is most frequently discussed (Hopper et al., 2008; Jackson et al., 2009; McDonald and Ringo Ho, 2002). The topic of fit indices has been debated by many academics. Despite the possibility that 2 is not a trustworthy pointer to model adequacy (Hu and Bentler, 1998), it is the most essential in a few. According to Kline, it is essential to "always mention the model chi-square and its p value for all of the models tested."

Table 6:SFI and General rules for AF

FI		Shorthand	General Rule for AF
Chi-Square		χ2	p-values: more than 0.05 (Bagozzi, 2012) p-values: must be significant (Hair., 2010) p-values: in between 0.05 and 1.00 for Good Fit; and between 0.01 and 0.05 for acceptable fit (Engel, 2003)
Relative Chi-Square		χ2 / df	Less than 2 (Schreiber, 2006) 0 to 2 for Good Fit; in between 2 and 3 for acceptable fit (Engel, 2003)
Standardized Root Mean Square Residual		SRMR	Less than 0.08 (Yi, 2012) Less than 0.1 with CFI more than 0.91 (Hair, 2010) Less than 0.08 (Schreiberet, 2006) In between 0 and 0.05 for good fit; Between 0.05 and 0.10 for acceptable fit (Engel, 2003)
Root Mean Square Error of Approximation		RMSEA	Less than 0.07 with SRMR less than 0.07 (Yi, 2012) Less than 0.06 (Bentler, 1999).

			Less than 0.07 with confidence interval (Schreiberet, 2006)
			In between 0 and 0.05 for good fit; In between 0.05 and 0.08 for acceptable fit
			(Schermelleh, 2003)
Comparative Fit Index		CFI	More than 0.92 with SRMR less than 0.07 (Yi, 2012)
			More than 0.92 (Hair, 2010)
			In between 0.92 to 1.00 for Good Fit; in between 0.93 ~ 0.97 for Acceptable
			Fit (Engel et al., 2003)

4.2.2 Reliability and Validity of Measurement Models

The MM should be assessed before looking for a substantial bond in the whole structural model, which is a two-step procedure (Hair, 2011). The GoF demonstrated, however, that the presence of a good model does not always imply the validity of all measurement models or the significance of all parameters pertaining to assumed links (Yi, 1988).

Factor loading, composite reliability (CR), and the AVE from a collection of assessments of a latent variable should also be investigated also (Larcker, 1981; Hair., 2011). As per Hair factor loading is the most essential. The factor loadings are the correlation and weight between the variable and the factor. High factor loadings demonstrate a significant relationship between the indicators and the corresponding factor (Hair, 2011). Hair also stated that all factor loadings to be significant (Hair, 2011). In SEM, squared multiple correlations are used to describe the reliability of individual variables (Bagozzi 2012). Factor loadings can also be

stated as squared multiple correlation. Factor loadings can be seen as alternatives to individual-variable reliability as measures of reliability (Hair, 2011). The amount by which a latent factor explains the variance of an observed variable and the accuracy with which an observed variable measures a latent component are both expressed by squared multiple correlation. Factor loadings, according to a rule of thumb, should be at least 0.5 and ideally can be near to 0.7. (Hair, 2011). Even when the measurement models function effectively in a broader model, individual-variable reliabilities can occasionally be rather poor (Yi, 2012). Yi also proposed emphasizing composite dependability more.

A popularly advised method for estimating reliability in SEM is Composite Reliability (CR). Since construct reliability evaluation typically focuses on it, some researchers refer to composite reliability (CR) as construct reliability also (Hair, 2011). The factor loadings can be used to compute CR. While Fornell contends that CR should be more than 0.7 to be considered suitable. Bagozzi believed that a CR value greater than 0.6 is preferred. CR values of less than 0.6 suggest an absence of reliability (Hair, 2011). Cut-off values "could be used with some discretion in mind and indeed attention should be placed more on the hypotheses under testing in, and goodness of-fit of, any SEM," because individual-variable reliabilities can be rather low at times in a bigger model with adequate performance (Bagozzi, 2012).

It has been shown that Cronbach's alpha is neither reliable nor helpful as a decision aid when used with structural equations (Bacon, 1995). Bagozzi contends that SEM shouldn't use Cronbach's alpha to assess reliability or validity. Fornell introduced the Average Variance Extracted (AVE) standard, which is often used to assess measurement models (e.g., Hair et al., 2011). The average variation in observed variables that a latent construct can explain is known as the AVE (Farrell, 2010, p325).

A typical recommendation is that all latent components have an AVE of at least 0.5; an AVE of less than 0.5 is regarded as doubtful (Fornell and Larcker, 1981).

When the AVE is less than 0.5, it means that more than 50% of the observed variables' error or less than 50% of the variation of the observed variables can be accounted for by the latent component, respectively. In other words, if AVE is less than 0.5, then generally speaking, there is greater variation that cannot be explained by the latent component structure that is imposed on the measure in the observable variables (Hair et al., 2010; Fornell and Larcker, 1981).

Fornell and Larcker provide a method for assessing the uniqueness between factors or the discriminant validity of two or more factors (1981). (2009) Hair et al. A factor loading should be greater than all its cross loadings and each factor's AVE should be higher than its greatest squared correlation with any other factor in order to fully satisfy the requirements for discriminant validity (Fornell, 1981).

As was said in the section above, it is strongly advised to use a variety of criteria to evaluate a model. Bagozzi and Yi (2012) recommend that while evaluating a measurement model, researchers pay greater attention to the hypotheses being tested and the goodness-of-fit of any SEM.

SEM is a priori theory-based methodology (Ockey, 2013). It aids us in establishing relationships between the variables of an established theory based on earlier study that are validated by observable facts. As previously noted, SEM involves two main phases. We must examine the Measurement model first, followed by the Path model. Confirmatory factor analysis is the method we use to analyze the measurement model. The data frequently do not meet the CFA assumption of zero cross-loading satisfactorily. This typically results in significant model change to find a model that fits the data effectively. In these circumstances, EFA may be more suited to conduct the search for a well-fitting model (Browne, 2001). Additionally, if zero loadings are not specified, factors get warped and factor correlations are overestimated.

Social	S1	Lifestyle and living in your town/city improved due to recent urban development
	S2	Employment scenario improved due to urban development in your town/city
	S3	Quality of education provided in your town/city improved due to urban development
	S4	Female participation increased in formal and non-formal education and training
	S5	Basic services provided by your Nagar Nigam/Nagar Palika/ Municipality improved due to urban development.
	S6	Quality of the health care facility and level at which they can handle diseases like Cholera, dengue, chikungunya etc changed due to urban development.
	S7	Quality of Health care workers including doctors improved in your town/city due to urban development?
	S8	Urban waste & Sanitation management and handling of your town and city improved due to urban development
	S9	Service of public transport in your town/city changed due to urban development.
	S10	Quality and supply of drinking water for your town/city improved due to urban development.
	S11	Safety of yours and your close one in your town/cities improved due to urban development
	S12	Electricity supply of your town/city improved due to urban development

Economical	EC1	Nagar Nigam/Nagar Palika/ Municipality spending enough on essential services
	EC2	Nagar Nigam/Nagar Palika/ Municipality spending enough for preservation, retrofitting and redevelopment on construction projects and sites
	EC3	Private firm participation in development through Greenfield, retrofitting and redevelopment projects of your city improved.
	EC4	Income level for Small vendors improved in your town/city due to urban development
	EC5	MSME/Small Business in your town/city growing due to urban Development
	EC6	Population living in slums and informal settlements in your town/cities have decreased due to urban development
	EC7	Performance of tourism sector of your town/city due improved due to urban development
	EC8	Urban-Rural synergy improved due to urban development
Environmental	EN1	Condition of ecosystem for your town/city improved due to urban development
	EN2	Green cover like parks & open spaces of your town/city increased due to development
	EN3	Air pollution in your town/city is under control due to urban development
	EN4	People using and are aware of renewable energy like Solar etc. and biofuel of your town/city

	EN5	Water pollution in your town/city is under control due to urban development
	EN6	The town/city you are residing can handle natural disaster by its own resources

Table 7:Identified Variables with Codes

The correlations between the variables, factor loading, and direct effects linking the variables should be determined in accordance with the SEM method's guiding concept. Two key elements of the SEM model are used in the calculations: the MM, which describes the relationships between latent variables and constructs, and the SM, which depicts putative causal relationships between latent variables and constructs.

We got Cronbach's alpha value of 0.809, which is significantly higher than the threshold value of 0.7. So, it can be interpreted that the overall gathered data has high level of dependability. As a result, the analysis's data can be thought of as trustworthy. The four dimensions—economic, social, environmental, and natural resource were then tested for discriminant validity. When discriminant validity is successfully evaluated, it is implied that two dimensions, such as economic and social elements, assess two distinct conceptions. The discriminating validity in this study is assessed using the coefficient R.

Variables	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Lifestyle and living in your town/city improved due to recent	249	1	5	4.01	0.790	-1.009	0.154

urban development							
Employment scenario improved due to urban development in your town/city	249	1	5	3.57	1.131	-0.571	0.154
Quality of education provided in your town/city improved due to urban development	249	1	5	3.86	0.741	-1.209	0.154
Female participation increased in formal and non-formal education and training	249	1	5	4.17	0.815	-0.500	0.154
Basic services provided by your Nagar Nigam/Nagar Palika/ Municipality improved due	249	1	5	3.38	0.989	-0.624	0.154

	N	Min	Max	Mean	Std. Dev	Skewness	Std. Error
to urban development.							
Quality of the health care facility and level at which they can handle diseases like Cholera, dengue, chikungunya etc changed due to urban development.	249	1	5	3.20	1.279	-0.533	0.154
Quality of Health care workers including doctors improved in your town/city due to urban development?	249	1	5	3.58	0.795	-0.259	0.154
Urban waste & Sanitation management and handling of your town and city improved due	249	1	5	3.03	1.139	-0.707	0.154

to urban development							
Service of public transport in your town/city changed due to urban development.	249	1	5	3.48	1.225	-0.884	0.154
Quality and supply of drinking water for your town/city improved due to urban development.	249	1	5	2.57	1.321	-0.067	0.154
Safety of yours and your close one in your town/cities improved due to urban development	249	1	5	2.99	1.131	-0.651	0.154
Electricity supply of your town/city improved due	249	1	5	3.33	1.152	-0.535	0.154

to urban development							
Nagar Nigam/Nagar Palika/ Municipality spending enough on essential services	249	1	5	2.90	1.079	-0.693	0.154
Nagar Nigam/Nagar Palika/ Municipality spending enough for preservation, retrofitting and redevelopment on construction projects and sites	249	1	5	2.84	1.060	-0.706	0.154
Private firm participation in development through Greenfield, retrofitting	249	1	5	2.84	1.260	-0.279	0.154

and redevelopment projects of your city improved.							
Income level for Small vendors improved in your town/city due to urban development	249	1	5	3.52	1.154	-1.277	0.154
MSME/Small Business in your town/city growing due to urban Development	249	1	5	3.69	0.749	-0.585	0.154
Population living in slums and informal settlements in your town/cities have decreased due to urban development	249	1	5	3.07	0.870	-0.947	0.154
Performance of tourism sector of your	249	1	5	3.52	1.150	-1.168	0.154

town/city due improved due to urban development							
Urban-Rural synergy improved due to urban development	249	1	5	3.19	1.020	-1.075	0.154
Condition of ecosystem for your town/city improved due to urban development	249	1	5	2.52	1.257	0.078	0.154
Green cover like parks & open spaces of your town/city increased due to development	249	1	5	2.16	1.248	0.375	0.154
Air pollution in your town/city is under control due to urban development	249	1	5	2.23	1.226	0.275	0.154
People using and are aware	249	1	5	3.14	1.362	-0.431	0.154

of renewable energy like Solar etc. and biofuel of your town/city							
Water pollution in your town/city is under control due to urban development	249	1	5	2.62	1.330	-0.038	0.154
The town/city you are residing can handle natural disaster by its own resources	249	1	5	2.64	1.019	-0.657	0.154

Table 8: Test of Normality

4.2.3 Initial Result

As there is a change in scale for collecting data (as suggested by external experts) we went for exploratory factor analysis (EFA) in first step.

Result of rotated component is given below.

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5

S3	0.729			
S4	0.721			
S1	0.698			
S2	0.681			
S5	0.680			
S10				
EN5		0.695		
EN4		0.665		
EN2		0.656		
EN6		0.633		
EN3		0.561		
E6		0.508		
E3			0.810	
E2			0.749	
E5			0.723	
E4			0.722	
S9				0.765

S8				0.678	
S6				0.562	
EN1					0.647
E7					0.611
E8					0.471

Table 9: Rotated Component Matrix

So, after EFA we identified 5 latent constructs

F1: Happiness Index

F2: Ecosystem Protection

F3: Change in Wealth

F4: Well Being Index

F5: Environmental Performance

So, the next step we taken up was confirmatory factor analysis for which we used SPSS Amos version 24 for this purpose.
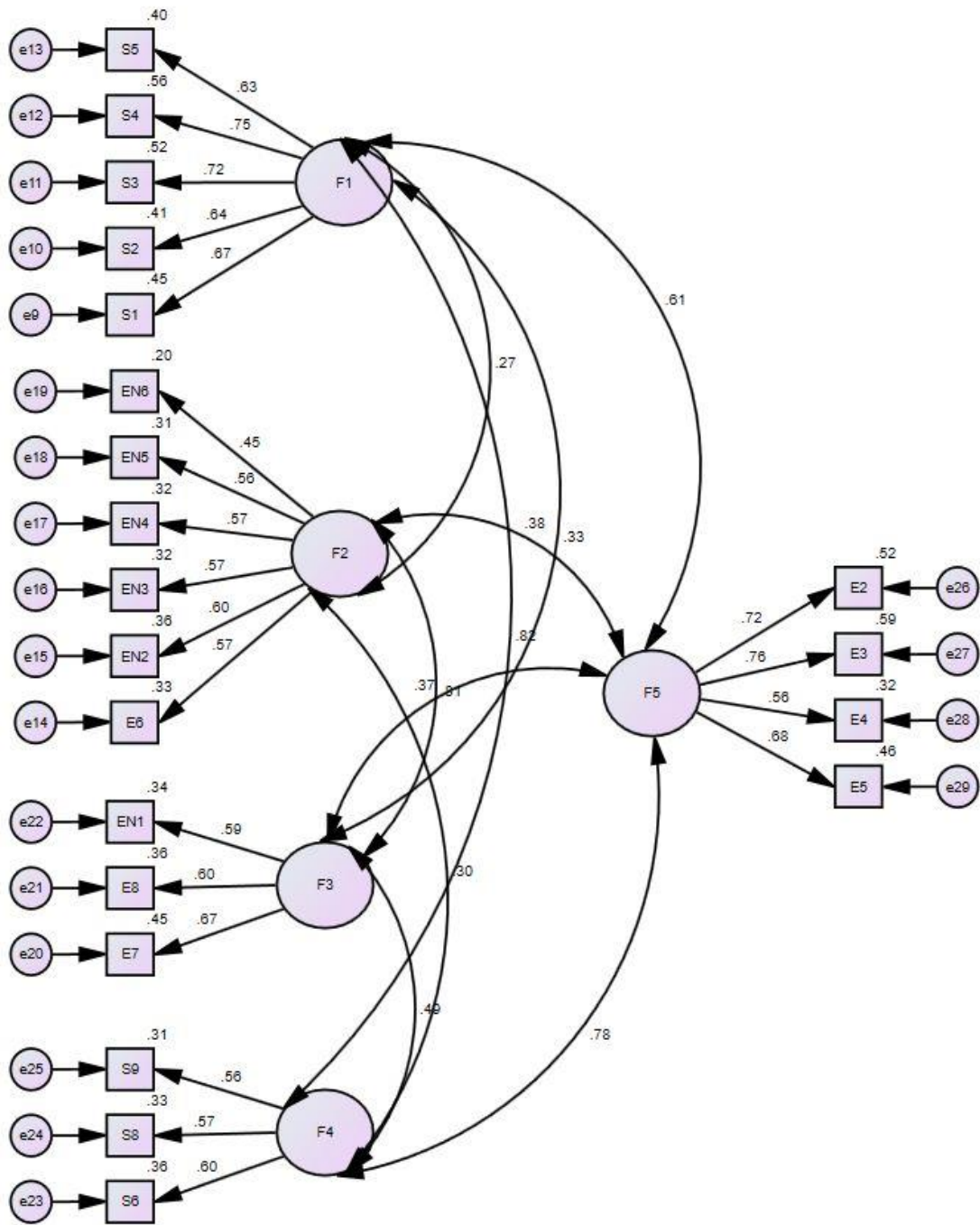
1st stage of CFA

Figure 8: CFA 1ˢᵗ Stage

GOF Measures	Initial SEM	Suggested Levels
X2/degrees of freedom	2.31	2-3
GFI	0.845	> 0.9
AGFI	0.807	> 0.9
RMSEA	0.073	< 0.05

Table 10: Model Fit Analysis after stage 1

The model showed a good fit, and all the GOF measure values were found to be satisfied with the suggested levels after covariance error paths between variables or latent factors were added to the hypothetical model in accordance with the recommendations of the GOF measures and the MI.

From the 1st stage we can identify that model fit can be improved. As Convergent and Discriminant validity was not achieved as CR value was more than AVE for some of the factors, so model of CFA was improved. Other model parameters were also taken up for change in CFA 2nd stage like Normality check of data through Mahalonobis distance and Modification indexes. After building up new measurement model through Bootstrap we observed that most of the factors are significant ($p < 0.05$) and validity was achieved. Also, we observed the Good of Fit parameters improved. Details are given below.

GOF Measures	Refined SEM	Suggested Levels
X2/degrees of freedom	1.2	2-3
GFI	0.90	>0.9
AGFI	0.91	>0.9
RMSEA	0.038	<0.05

Table 11: Model Fit after stage 2.
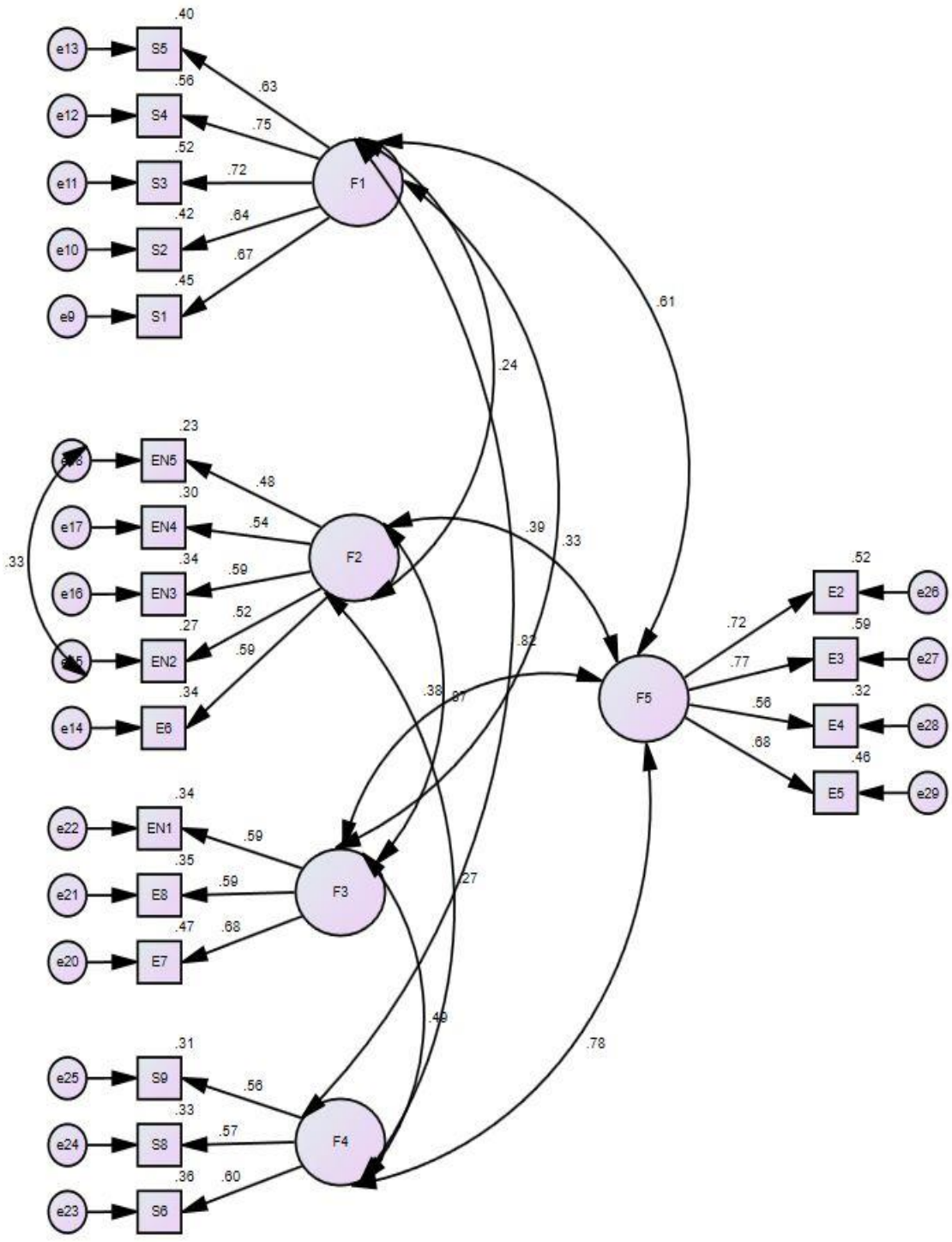
Figure 9: CFA Stage 2

			Estimate	S.E.	C.R.	P	Label
S1	<---	F1	1				
S2	<---	F1	0.915	0.121	7.588	***	par_1
S3	<---	F1	1.061	0.127	8.328	***	par_2
S4	<---	F1	1.143	0.134	8.548	***	par_3
S5	<---	F1	0.903	0.121	7.475	***	par_4
E6	<---	F2	1				
EN2	<---	F2	0.911	0.171	5.325	***	par_5
EN3	<---	F2	1.031	0.178	5.8	***	par_6
EN4	<---	F2	0.974	0.176	5.526	***	par_7
EN5	<---	F2	0.79	0.158	4.996	***	par_8
E7	<---	F3	1				
E8	<---	F3	0.843	0.131	6.442	***	par_9
EN1	<---	F3	0.869	0.135	6.416	***	par_10
S6	<---	F4	1				
S8	<---	F4	0.965	0.157	6.157	***	par_11
S9	<---	F4	0.947	0.157	6.051	***	par_12
E2	<---	F5	1				
E3	<---	F5	1.043	0.116	8.957	***	par_13
E4	<---	F5	0.772	0.112	6.892	***	par_14

E5	<---	F5	0.915	0.112	8.176	***	par_15	

Table 12: Level of Significance

Validity Analysis

	CR	AVE	MSV	MaxR(H)	F1	F2	F3	F4	F5
F1	0.824	**0.502**	0.697	0.829	**0.696**				
F2	0.691	**0.51**	0.75	0.694	0.251*	**0.557**			
F3	0.666	**0.54**	0.75	0.67	0.318**	0.866***	**0.633**		
F4	0.598	**0.532**	0.697	0.599	0.835***	0.255*	0.493***	**0.576**	
F5	0.782	**0.575**	0.642	0.793	0.614	0.388	0.361	0.801	**0.689**

Table 13: Validity Analysis; Source: Author)

Also, there were no HTMT concerns as shown in table 14.

HTMT Analysis					
	F1	**F2**	**F3**	**F4**	**F5**
F1					
F2	0.255				
F3	0.292	0.811			
F4	0.836	0.263	0.501		
F5	0.617	0.41	0.368	0.796	

Table 14: HTMT Analysis; (Source: Author)

Now as we got valid CFA result, we start preparing the model path in SPSS Amos
for structural equation modeling

For the 1st step we taken up F2, F3, F4 & F5 as independent variables and understand its impact on F1 which is taken up as dependent variable. The path model is only reflective model (as SPSS AMOS can handle only Reflective model).

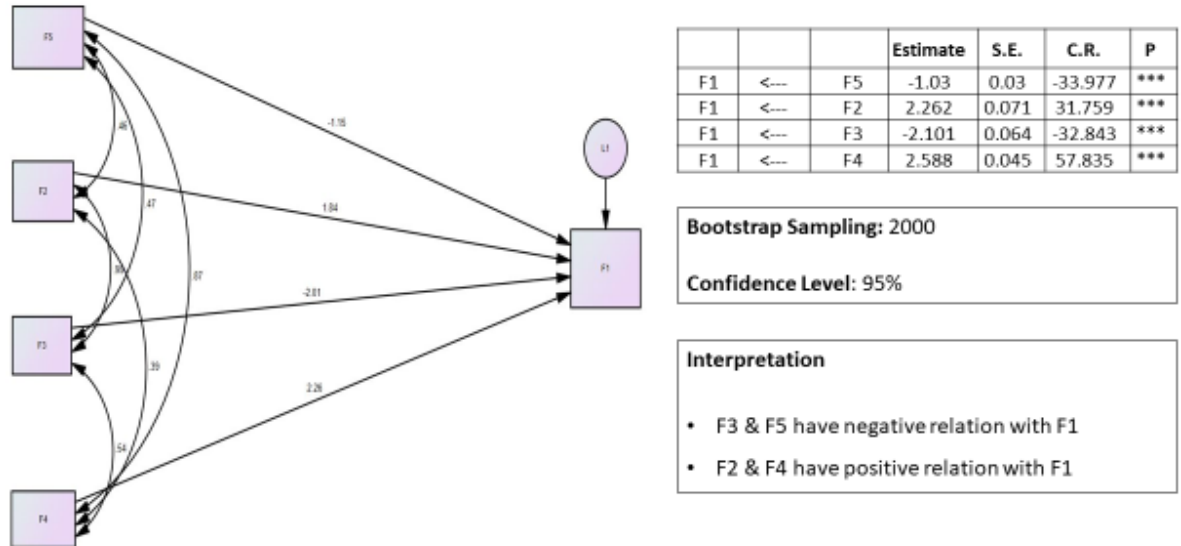We got the following result.

Path Model-1

			Estimate	S.E.	C.R.	P
F1	<---	F5	-1.03	0.03	-33.977	***
F1	<---	F2	2.262	0.071	31.759	***
F1	<---	F3	-2.101	0.064	-32.843	***
F1	<---	F4	2.588	0.045	57.835	***

Bootstrap Sampling: 2000

Confidence Level: 95%

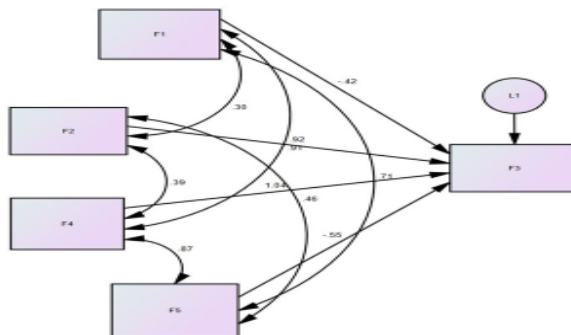**Interpretation**

- F3 & F5 have negative relation with F1
- F2 & F4 have positive relation with F1

Figure 10: Path Model 1

For the 2nd step we taken up F1, F3, F4 & F5 as Independent variables and understand its impact on F2 which is taken up as dependent variable. The path model is only reflective model (as SPSS AMOS can handle only reflective model).

We got the following result.

Path Model-2
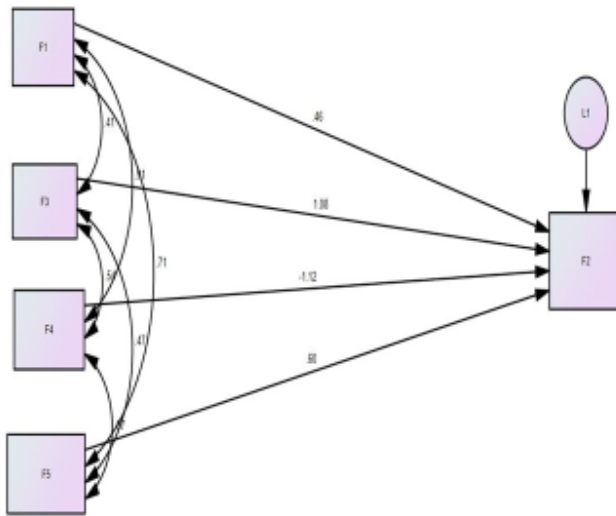
			Estimate	S.E.	C.R.	P
F2	<---	F1	0.372	0.012	31.759	***
F2	<---	F3	0.921	0.006	164.817	***
F2	<---	F4	-1.043	0.02	-52.357	***
F2	<---	F5	0.434	0.009	49.83	***

Bootstrap Sampling: 2000

Confidence Level: 95%

Interpretation

- F4 have negative relation with F2
- F1, F3 & F5 have positive relation with F2

Figure 11: Path Model 2

For the 3rd step we taken up F1, F2, F4 & F5 as Independent variables and understand its impact on F3 which is taken up as dependent variable. The path model is only reflective model (as SPSS AMOS can handle only reflective model).

We got the following result.

Path Model-3

			Estimate	S.E.	C.R.	P
F3	<---	F1	-0.405	0.012	-32.843	***
F3	<---	F2	1.079	0.007	164.81	***
F3	<---	F4	1.134	0.02	56.11	***
F3	<---	F5	-0.47	0.01	-48.759	***

Bootstrap Sampling: 2000
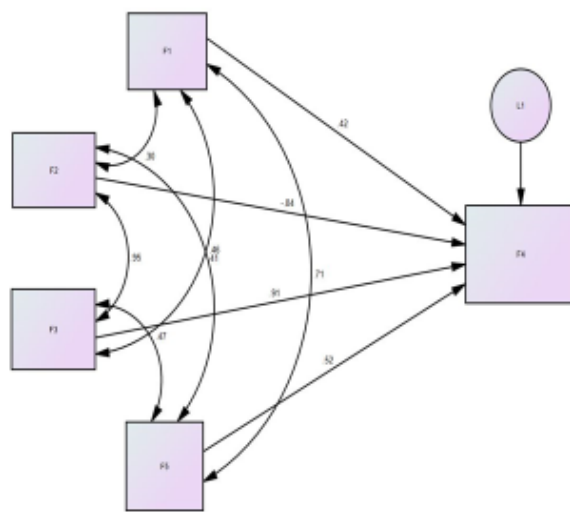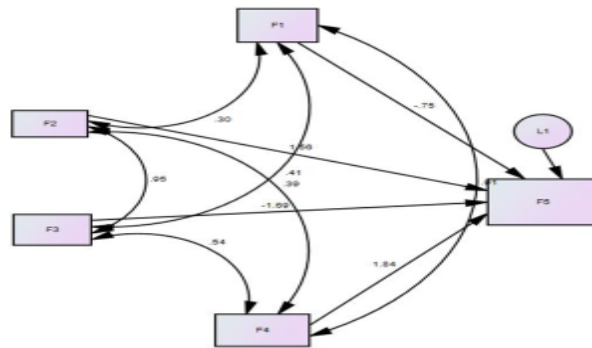
Confidence Level: 95%

Interpretation

- F1 & F5 have negative relation with F3
- F2 & F4 have positive relation with F3

Figure 12: Path Model 3

For the 4th step we taken up F1, F2, F3 & F5 as independent variables and understand its impact on F4 which is taken up as dependent variable. The path model is only reflective model (as SPSS AMOS can handle only reflective model).

We got the following result.

Path Model-4

			Estimate	S.E.	C.R.	P
F4	<---	F1	0.366	0.004	90.031	***
F4	<---	F2	-0.897	0.005	-179.9	***
F4	<---	F3	0.832	0.004	195.91	***
F4	<---	F5	0.411	0.004	112.975	***

Bootstrap Sampling: 2000

Confidence Level: 95%

Interpretation

• F2 have negative relation with F4

• F1, F3 & F5 have positive relation with F3

Figure 13: Path Model 4

For the 5th step we taken up F1, F2, F3 & F4 as Independent variables and understand its impact on F5 which is taken up as dependent variable. The path model is only reflective model (as SPSS AMOS can handle only reflective model).

We got the following result.

Path Model-5

			Estimate	S.E.	C.R.	P
F5	<---	F1	-0.834	0.025	-33.977	***
F5	<---	F2	2.139	0.043	49.83	***
F5	<---	F3	-1.972	0.04	-48.759	***
F5	<---	F4	2.352	0.032	73.015	***

Bootstrap Sampling: 2000

Confidence Level: 95%

Interpretation

- F1 & F3 have negative relation with F5
- F2 & F4 have positive relation with F5

Figure 14: Path Model 5

4.3 Consolidated Interpretation from Path Models

1. Some indexes are negatively impacting the other indexes.

2. To increase the Happiness Index focus should be given to improving the economic condition of urban areas with a balanced act on environmental performance.

3. To enhance ecosystem protection improvement will be required in urban services like drinking water supply, public transport service, use of electric vehicles etc.

4. To improve economic conditions focus should be on giving proper skillsets to population and framing balanced environmental norms.

5. To improve Wellbeing index population should be protected from disasters and other calamities.

6. To improve Environmental performance awareness programs within the population should be increased and for building infrastructure EIA study should always be a part of Feasibility study.

Chapter 5

Recommendations and Conclusions

5.1 Introduction

The main conclusions of the research are presented in this chapter, in addition to the development consequences and suggestions for addressing the harmful impacts of urban expansion and change on attaining SDG 11. The chapter also discusses the limitations in the research and suggestions for further investigation.

For this study urban areas of western Himalayan state of Uttarakhand, India was selected to better understand how urban development and change affecting sustainable development. The research's specific goals were to: identify urban sustainable development indicators relevant to the state of Uttarakhand and assess the area's progress toward SDG 11 using the selected set of urban sustainable development indicators.

The major findings from the study were:

- To increase the Happiness Index focus should be given to improving the economic condition of urban areas with a balanced act on environmental performance.
- To enhance ecosystem protection improvement will be required in urban services like drinking water supply, public transport service, use of electric vehicles etc.

- To improve economic conditions the focus should be on giving proper skillsets to the population and framing balanced environmental norms.
- To improve Wellbeing index population should be protected from disasters and other calamities.
- To improve Environmental performance, awareness programs within the population should be increased and for building infrastructure EIA study should always be a part of Feasibility study.

5.2 Recommendations

Based on research findings, the thesis tries to make the following suggestions for reducing the negative consequences of urban growth and change on achieving sustainable development.

First highlight of the study is that better urban sustainable development is not always the outcome of higher economic activity, or it will increase happiness index of an urban area. This suggests that the applicability of the compact city concept changes throughout time and location. As has already been said, sustainability affects many aspects of urban life. The utilization of resources by cities—economic, social, and natural—relates to sustainable development. One of the key components in attaining sustainable development might be compact urban development. Higher densities alone, meanwhile, might not be the best course of action. In comparison to cities in rich nations, residential densities are often substantially greater in most developing country cities. In areas where densities are already high, compact growth may have detrimental effects such as pollution and a load on the urban infrastructure. Therefore, it is important to proceed cautiously while advocating compact growth as a method of attaining sustainable development in steep towns like Uttarakhand. A happy city depends on its residents' personal satisfaction, feeling of community, and interpersonal connections. We are aware that there are fundamental building blocks that might inspire inhabitants to view the city as a shared resource rather than merely a physical location. For instance, public plazas, parks, and other meeting places can encourage new social contacts and interactions while encouraging a sense of shared ownership among inhabitants. Opportunities

for community and civic engagement can build the feeling of shared purpose. More social investment consequently produces environments that are safer and more secure since everyone has a stake in the success of the city.

Second, the study showed the possibility that urban areas and the state's economic growth policy could produce inadvertent outcomes within their neighboring urban areas. A greenbelt is one of the most effective growth management measures, helping to prevent current metropolitan areas from growing further while simultaneously working as a carbon sequestration project. Creation of green belts along the urban area periphery will also help in creating a boundary for better administration and jurisdiction. With economic growth energy demand also increases. So financial incentives of those economic activities using renewable energy and green fuels should be promoted.

Local governments must regularly assess their progress toward sustainable development and modify urban policies to account for shifting conditions if they are to improve sustainability. To achieve this, local governments must create a program for each sustainable development indicator and make it a continuous procedure. Since they confront significant sustainability issues, cities in emerging nations that are undergoing rapid urban expansion and transition need to establish a sustainability indicators program to strengthen their capability to promote urban sustainability.

All citizens should give high priority to sustainable development. Integrating appropriate sustainable development goals into individual, private, and nonprofit decision-making processes (Barton, 2000; OECD, 2002a) is necessity of this time. In this regard, for the sustainable development program to function effectively, it should be based on the participatory process to encourage the involvement of many stakeholders in establishing sustainability objectives, creating sustainability indicators, tracking development towards sustainability, and providing better policy solutions. Without equivalent pledges from the commercial sector and civic society, the government's obligations would be pointless (OECD, 2002a).

There are some other recommendations which we want to highlight for achieving sustainable development are:

1. Creating Sustainable Livelihoods

Although there is little poverty in Uttarakhand, there are worries about providing a livelihood for those who live in the hills because they are sometimes left out of the growth process. Two growth-driver sectors will be the mainstays of the plan to give all Uttarakhand residents, both in the hills and the plains, sustainable means of subsistence. The state will be able to generate the necessary options for a livelihood by transforming mountain agriculture with a focus on cultivation of sweet-smelling and therapeutic plants, by improving productivity and creating livelihood, as well as promoting state-wide tourism, both can be carried out in mission mode. The Micro, Small, and Medium Enterprises sector is cross-cutting and will connect to the growth-driver sectors to support the creation of additional jobs down the road. The growth plan will be sustainable and have a stronger foundational element with efforts to develop renewable energy in the form of small hydropower, solar and waste to energy. There is also a need for cooperation between urban and rural areas for economic growth.

2. Tourism

Because of its forward and backward connections and capacity to generate economic growth, this sector is recognized as a growth engine for inclusive social and economic progress. The goal is to transform Uttarakhand into a top-tier, all-encompassing travel destination by utilizing sustainable tourism's untapped potential and creating cutting-edge travel products that capitalize on the state's natural appeal to travelers of all types.

To position "Brand Uttarakhand" in both home and foreign markets, there needs to be a strategy. The short- and medium-term specific plans should be realized and put into action, and the current facilities should be improved. It is important to promote and advertise the state's brand to more nations. Depending on the

performance in the medium term, the long-term strategy would encompass continued expansion. The state's appeal as a destination for pilgrims is already well-known in terms of tourist attractions. However, there is still a ton of room to market the state as a place for yoga, wellness, and other spiritual pursuits in addition to trekking, mountaineering, river rafting, and other such daring pursuits. To position "Brand Uttarakhand" in both home and foreign markets, there needs to be a strategy. The short- and medium-term specific plans should be realized and put into action, and the current facilities should be improved. It is important to promote and advertise the state's brand to more nations. Depending on the performance in the medium term, the long-term strategy would encompass continued expansion. The state's appeal as a destination for pilgrims is already well-known in terms of tourist attractions. However, there is still a ton of room to market the state as a place for yoga, wellness, and other spiritual pursuits in addition to trekking, mountaineering, river rafting, and other such daring pursuits. Uttarakhand is a destination for ecotourism as part of the central government's Swadesh Darshan program. Other themes might include treks, hikes, or tours to see the Himalayas' most famous peaks, treks along the Ganga River, locations of culinary interest, or villages where residents still live according to their traditional ways, which tourists might find interesting.

3. Water and Sanitation, Air and Water Pollution

The development of groundwater and surface water usage systems with an incentive or tariff system to deter users from over-extracting water would be the major solution to address the state's chronic water scarcity. By storing snowmelt in man-made buildings, like in Ladakh, we can encourage water conservation, especially in hilly areas. There is also Singapore's expertise in producing pure, clean water from wastewater in an economical and environmentally responsible manner. As a result, recycled water can be used in industry and even for drinking. Urban Local Bodies can recycle wastewater using this model. Water supply in rapidly expanding peri-urban regions will be supplemented by pumping systems based on

tube wells, and gravity schemes with sources like rivulets and springs. The plan for addressing sanitation issues includes educating the public about the need to uphold cleanliness and fostering the habit of using restrooms. The state of Uttarakhand has been deemed free of open defecation. The Swachh Bharat Abhiyan's effective implementation, the gradual introduction of solid waste management to all villages, and the efficient operation of committees for health, sanitation, and nutrition are all crucial components of the strategy.

Industrialization or expanded service sector activity must make use of cutting-edge, clean technologies, as well as frequent environmental audits and scientific waste management and recycling. A crucial aspect is waste management, particularly in developing cities and towns. To make up for the pollution, taxes might be imposed (polluters pay taxes), and the money raised could then be utilized to repair environmental harm.

Setting goals to reduce air pollution from industrial and vehicular sources and halting illegal construction activities that contaminate rivers and other water sources are two ways to address pollution in cities. Moving toward electric or CNG-powered vehicles instead of those powered by fossil fuels will help with the former. In general, switching to renewable energy sources like small hydropower, solar power, waste-to-energy, etc. will lessen the number of harmful gases in the atmosphere that cause warming.

4. Improving land management and arresting land degradation

An important part of the plan is converting a portion of the open forest into a moderately thick forest and a portion of a moderately dense forest into a dense forest. Another alternative is to include more women in the planning process for land management. To lessen land degradation, watershed management techniques can be used in the communities upstream of hydroelectricity-producing facilities.

Annual revisions to the state disaster management plan are made, and professional assistance and capacity building for disaster risk reduction is part of a long-term

improvement plan. The major pillars of the strategy include analysis of hazards, risks, vulnerabilities, and capacities (HRVC), preparedness, appropriate land use, monitoring, and warning systems for disaster management. The elements include enhancing the hydro-meteorological network, building a decision support system, studying river morphology, and managing disaster risk. A decision support system must be established, a river morphology study must be conducted, the hydro-meteorological network must be strengthened, and a prompt alerting system must be implemented, among other things.

5. Disaster Management

The UN Sustainable Development Goals, objective 11 states "to make cities and human settlements inclusive, secure, resilient, and sustainable". Its objectives include fostering preparedness for catastrophes like earthquakes. As assessed by "seismic micro zonation," several of India's cities located in high-intensity zones are extremely susceptible to earthquakes. Therefore, these cities need to create and implement policies that support seismic sustainability. These include supporting municipal infrastructure, establishing rules for new projects, and modifying older buildings. These regulations should ideally include a plan for financial incentives to support economically sensible seismic resilience building. Cities are increasingly in danger from disasters, so it is foremost to recognize how hazard mitigation strategies related to urban design when creating sustainable neighborhoods. Sustainable cities require sustainable urban planning, which calls for mixed-use development, controlled densities, and user-friendly public places. Above all, it is important to acknowledge that SDGs related to catastrophe vulnerability, Indian cities, and seismic sustainability place limitations on development. Cities are vulnerable to severe disasters like earthquakes if their spatial planning does not take these considerations into account. Unfortunately, the losses that cities would suffer from a seismic disaster are being made worse by the amount of uncontrolled urban expansion and the somewhat unregulated building

construction that is currently taking place in most cities. Therefore, seismic and other disasters must be taken into account while designing cities in the future.

6. Better Urban Planning

Numerous gaps and difficulties must be addressed at various levels of planning and governance to make Indian cities livable. An integrated, long-term approach to urban development and planning must first be established within a national framework that measures it. This concept ought to be incorporated into the National Urbanization Policy and serve as a roadmap for communities looking to move away from an "infrastructure-driven approach" and toward a "people-centric" strategy. Additionally, solid governance frameworks, institutional capabilities at the national and sub-national levels, and empowered ULBs would be necessary for this. To do this, it is advised that ULBs be given a defined mission along with complementary capacity building for data management, interdepartmental coordination, and efficient service delivery and governance. Along with strengthening the institutional capabilities of ULBs, it is advised to stimulate social entrepreneurship and innovation in the private sector. A good strategy to increase the capabilities of ULBs is to strengthen relationships between cities, regional stakeholders, research and academics, the commercial sector, and worldwide networks. The livability of Indian cities can be greatly improved with carefully thought-out national efforts and a well-defined roadmap.

5.3 Theoretical Contributions

The thesis looks at how management theory's lessons and methods may be used for urban sustainable development, specifically to make sustainable development decisions more diverse and resilient. It finds a close match between work on organizational learning and the complex/adaptive policy model, which suggests that the tools of organizational learning such as scenarios would also be beneficial to promoting resilience in urban policy making. The study could be helpful in future research on complexity theory because it also seems to provide a potent research tool for evaluating the impact of sustainable development. The applications show,

albeit in a preliminary manner, how the sustainability scenarios might aid in decision makers' model expansion and the creation of more diverse and resilient sustainable development policies and strategies. In this sense, they validate the theoretical frameworks that were utilized to create the scenarios as well as the scenario approach itself, and they indicate a chance to turn the sustainable development scenarios into an effective instrument for making sustainable development decisions.

5.4 Limitations and Directions for Future Research
By addressing consequences of urban growth and development on sustainable development indicators, this study helps to improve knowledge of the potential and challenges of moving towards urban development in a fast-increasing metropolitan zone in a mountainous terrain of developing nations. However, there are certain restrictions on this study. To fully comprehend how urban development and sustainability are interconnected, more study is required.

First, using the experience of urban areas in the Indian state of Uttarakhand, this study has attempted to analyze how urban development and change affect sustainable development. Their physical traits, political practices, and economic foundations set them apart from other historical communities. Therefore, generalizing study findings to towns in other areas may be limited. To add further empirical data, it is necessary to examine more examples in other contexts.

Second, 22 urban sustainable development indicators were employed in this study. Urban sustainability covers a wide range of city-related issues. As a result, research based on additional sustainability indicators might assist in giving more precise, in-depth information on the development of sustainability.

Third, this research did not give any weight to any of the 22 urban sustainability parameters. Based on the varying weights assigned to sustainability parameters, more study is required. Each city or nation has a varied aim for attaining sustainability since the level of development differs among those two entities. For instance, among the three components of the notion of sustainable development,

affluent nations often place an emphasis on environmental preservation while poor nations typically place an emphasis on economic development. Giving weight might aid in reflecting the features of the topic.

Given the multidisciplinary nature of the thesis, there are a wide range of potential paths in which more research might be conducted to expand upon the theoretical frameworks employed as well as to implement and test them more fully. Modifying cultural theory to correct the issues that have been found is one area where theory may be improved. Artificial life modelling has the potential to investigate the roots of natural myths, institutional structures, and the dynamics of social and institutional development. Such a study may assist in fostering novel and intriguing connections between social scientists and complex systems researchers.

5.5 Conclusions

This thesis has argued that the insights of complexity, when combined with urban development, provide new insights on the urban sustainable development debate. These insights provide both a problem statement on the challenge of finding relevant sustainable development indicators, and an approach to study on its impact, as follows:

Complexity: Complexity is at the core of the case for urban sustainable development since complexity underlies the behavior of any human systems in the natural world. The complexity and non-linearity of global urban biogeochemical systems raise serious concerns about the prospects of a policy approach to urban sustainable development based on predictive modelling, optimization, and finding the one "right answer," even though scientific research will continue to deepen our understanding of natural systems. The underlying complexity also allows for the formation and coexistence of many viewpoints on what sustainability means and the necessary policies to accomplish it. The pursuit of a single definition of sustainable development will thus remain futile, and economic efforts to place a single value on environmental assets are perceived to be foolish in this regard.

Continuous Learning and Resilience: While supporting the problem statement and its critique of the comprehensive/rational policy paradigm, earlier research on chaos and uncertainty does not offer an alternative framework for making decisions. A complex systems study of natural and social systems, however, shows that most complex systems can survive, adapt, and develop without the need of top-down, foresight-based, or optimization-focused decision-making. An important plurality, variety, and experimentation, as well as the co-evolutionary development of higher-order structures and processes, are what instead keep evolutionary processes alive. Considering this, complexity suggests that urban sustainable development policies should focus on fostering learning and resilience rather than pursuing a limited sense of efficiency and optimization. Complexity theory's application, together with cultural theory and management theory, offers fresh perspectives on the kinds of decision-molding processes that might support such learning and resilience.

Since there are currently methods available to encourage fresh perspectives on sustainable development, this thesis shows that we may react constructively to complexity. For instance, scenario-based techniques could contribute to decision makers' increased understanding of the complexity and diversity surrounding the management of urban sustainable development in a complex society, enhancing the resilience of their institutions and policies for sustainable development. The current issue is to aid decision-makers in both comprehending the consequences of complexity and assisting them in using new tools and strategies to enhance the quality of sustainability-related decisions. Greater knowledge and its application in practical action will pave the way to urban sustainable development.

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11