Smart Development in Urban Area: A Case Study

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Abstract— The urban population is expanding at a sensational rate prompting economic development on other hand it is making urban and ecological issues like natural debasement, traffic congestions, lacking framework administrations, unhygienic streetscapes and so on. Along these lines it requires the earnestness to take fitting activities. Smart development has been distinguished as a manageable overall answer for the current urban arranging issues, whose standards targets giving better expectations for everyday comforts; however the idea is dubious to characterize, as no all inclusive definition exists. Different ideas like Sustainability (Sustainable Development), Smart Growth, Livability, Smart City and so forth, are a portion of the models which are identified with the development. The standards of these ideas cover one another and that is the reason the idea can't be characterized with a solitary general definition; in this way, the idea should be institutionalized so as to scale development around the world. India has experienced quick urbanization in the course of the most recent couple of decades and the seeing urban areas are generally of Class-I and II levels. A significant perspective influenced by the wonder of urbanization is the personal satisfaction. Indian urban communities rank nearly at the base of bearableness positioning (EIU-2015) as Delhi is on 110th and Mumbai on 115th at world level. It is apparent that Indian urban communities rank in all respects ineffectively in the overall situation. This incited a discussion whether India as a country needs increasingly bearable urban areas or smart urban communities. As examined by different experts, approach towards urban development, right off the bat, should be towards giving a reasonable and safe condition to the clients and furthermore, create procedures advancing socio-economic development. In any case, as a guide, different instruments can be incorporated in the development approach, to make it proficient and powerful ones like the utilization of ICT in the physical and social framework arranging. As of late, India likewise presented the smart city mission, which is fairly on the comparative lines of smart development. The mission's point is to advance economic development of the distinguished urban areas with prime spotlight on the current debased personal satisfaction. Since, the development has been deciphered diversely among the countries due to non-institutionalization of the idea, it's imperative to see how the idea has been spoken to in Indian setting. The examination expected to dissect the origination of smart development and its centrality in the urban setting. Likewise, as India has received Smart City Mission on the comparable grounds, it is basic to examine whether it accomplishes sustainability in its approach and gives decent condition as it recommends. Further, the examination has been finished up with a city level investigation with region based development as a scale to advance smart development techniques.

Keywords—Urbanisation, Smart development, Livability, Sustainable development and ICT.

I. INTRODUCTION

Urbanization as a phenomenon has been appreciated and criticized at the same time, as it has accelerated the economic development on one hand and on the other has adversely affected the urban environment. The issues associated with urban regions like environmental degradation, traffic congestions, inadequate infrastructure services, unhygienic streetscapes etc., are making them unpleasant to live in. These prevailing issues will worsen over the coming decades as the urban population is increasing at a phenomenal rate, thus highlighting the urgency to take appropriate actions.

Smart development has been identified as a sustainable world-wide solution to the existing urban planning issues, whose principles aims at providing better living standards; though the concept is vague to define, as no universal definition exists. Various concepts like Sustainability (Sustainable Development), Smart Growth, Livability, Smart City etc, are some of the examples which are related to the development. The principles of these concepts overlap each other and that's why the concept can't be defined with a single universal definition; therefore, the concept needs to be standardized in order to scale development world-wide.

Smart and Sustainable Development (Sustainability); are two different terms, misunderstood as one. Sustainable development is a broader ideology and generally defined as a development that has the intention to conserve and protect our various resources while meeting our present needs, so that the future generation is able to fulfill their necessities without any compromise. But, it lacks in-depth understanding of the how a region should grow to attain the objectives of the sustainable development. The solution to the problem of not having specific strategies for urban development was resolved with the introduction of smart development; which is regarded as strategies taken up that are environment sensitive, economic feasible, community oriented and most importantly sustainable. The development is related to land-use planning to avoid un-necessary sprawl through strategies like integrating land-use and transport planning, mixed-use development within a region and most importantly, use of ICT (Information and Communication Technology).

To cater the issues developed by this phenomenon, the governing authorities have taken up initiatives over the years, in the form of programs that have mainly focused on providing basic infrastructure services and utilities to the cities and have not paid much attention in achieving sustainability in the approach. Various initiatives in the form of policies,

schemes and missions have been adopted by the government of India to tackle the above issues. Recently, India also introduced the smart city mission, which is somewhat on the similar lines of smart development. The mission's aim is to enhance the economic development of the identified cities with special focus towards on improving living standards of the population. Since, the development is been interpreted differently among the nations due to non-standardization of the concept, it's important to understand how the concept has been represented in Indian context.

II.   LITERATURE REVIEW

URBANIZATION: Urbanization as a marvel might be characterized as the change time of a district from an agricultural based economy to non-agricultural - industrial or administration division based economy. It is the change from spread out and low thickness settlement to one of concentrated urban zones. **David and Golden** explains urbanization of a city in three fundamental stages; first being, in which a settlement is portrayed by farming based economy and scattered example of settlement. Second stage is the increasing speed arrange where capital is contributed to improve the expectations for everyday comforts through giving framework, communication and transportation. This prompts increment in part of urban population step by step from 25% to 60% and the reliance on the essential based exercises diminishes. Furthermore, the third stage is the place urban population surpasses 70%. At this stage the urbanization stays steady as there is no change in urban population growth rate.

Defining Urban: The term Urban is a vague term as no universal acknowledged definition has appeared till date. UN Population Division planned a rundown for the meanings of „urban" population utilized over the countries. Guidelines used to characterize „urban" incorporate population size, thickness, monetary profile, physical qualities, foundation, or might be a mix of these all. Every definition is based to its own national setting; this has brought about disarray among individuals relating the size of urbanization world-wide. **(World Bank Report, 2007)** Minimum population limits embraced are 2,000 population (in 23 countries), and 5,000 population (in 21 countries). The normal is under 5,000 populations. The most minimal thickness acknowledged as a urban locale is in Germany with just 150 people for every sqkm, and the most elevated one is by China for example 1,500. **(World Bank Report, 2007)**

SMART DEVELOPMENT: Smart Development viewed as an answer for urban development issues which targets accomplishing sustainability in the field of urban arranging. It has been characterized in numerous measurements; in this way, the idea comes up short on a universal definition and differs from city to city, locale to area and country to country. Some researchers regard smart development as the integration of ICT into everyday life and state functions **(N. Komninos, 2011)**, while others highlight the importance of knowledge management **(B.C. Garcia, 2007)**. Still others emphasize the coherence of infrastructure with objectives, the importance of learning, innovation, and networks **(Allwinkle and Cruickshank, 2011)**.

LIVABILITY: Over the years, livability as an idea has been characterized in an assortment of measurements, making it a vague idea. The idea concocted the worry towards the protection of common and fabricated condition, and of late developed into improving the personal satisfaction in the urban communities.

The common growth and moving population to the new urban focuses quickened the above abberations because of absence of arrangement of fundamental administrations to the living population. Activities were taken up so as to improve the personal satisfaction like Vancouver Livability Plan and Habitat-I; which were all around acknowledged. Later on, so as to gauge the scale and effect of urban development on the urban communities, PMF's (Performance Measurement Framework) were presented as estimating apparatuses, and were extensively founded on six columns or measurements for example Condition, Economy, Governance, Infrastructure, Living and Society **(Sejal Patel).**

Evidently the idea has a characterized reason for making urban communities decent yet it comes up short on a unified definition **(S. Wheeler)**.

SMART GROWTH: The concept of smart growth came into existence as a growth management movement **(Nelson 2000, Juergenmeyer and Roberts 2003)**. Smart development came as a solution to the phenomenon of urban sprawl. The term sprawl has not yet found a universal acceptance due to varying views of its causes and effects **(Nelson 2000, Juergenmeyer and Roberts 2003)**. In any case, a for the most part acknowledged definition is: A type of urbanization recognized by jump examples of development, business strips, low thickness, isolated land-utilizes, car strength and at least open spaces **(Gillhan, 2002, 08)**.

SMART CITY: The principal question is what is implied by a „smart city". The appropriate response is, there is no universally acknowledged meaning of a smart city. It implies various things to various individuals. The conceptualization of Smart City, along these lines, shifts from city to city and country to country, contingent upon the degree of development, readiness to change and change, assets and desires of the city inhabitants. A smart city would have an alternate meaning in India than, state, Europe. Indeed, even in India, there is nobody method for characterizing a smart city. **(MoUD, 2015)**

SMART CITY MISSION, INDIA: Indian government launched the Smart City Mission on 25th June 2015 with the goal to accomplish economical condition for its urban communities. Smart City Mission consents to the way that there is no universal acknowledged definition for idea Smart City and it changes locale to area. The motivation behind the mission is to drive monetary growth and improve the personal satisfaction, therefore targets giving a structure to the development of smart urban areas in India. Smart City Mission has recognized certain measurements that can be utilized with respect to the urban development in Indian urban communities. These fundamentally center upon blend land-use, comprehensive lodging, walkable neighborhoods, ideal open spaces, different vehicle alternatives, great administration,

giving social personality to urban areas and the latest one use of ICT in the urban development strategies. (**Smart City-Mission Statement & Guidelines, 2015**)

III.   STUDY AREA – LUDHIANA CITY, PUNJAB

Ludhiana city; the principal metropolitan city of the state is arranged on the south banks of the stream Satluj and is viewed as the biggest city of Punjab. The municipal city is spread over a zone of 159.37 sqkm that nearly suits around 16 needs population. The city has seen huge growth over the most recent couple of decades as it is an industrial just as instructive focal point of the state Punjab. Normally, the city has been refereed as the 'Manchester of India, 'Center point of the Indian Hosiery Industry', and 'Industrial capital of Small Scale Industries' in India. The city is well known for its assembling based businesses that produce hosiery products, woolen articles of clothing and cowhide things. Likewise, throughout the years the city has seen growth of engine parts ventures which are sent out to different pieces of countries. Other than business exercises the city is additionally known for its journey bases inside and on the city; Fort of Lodhi, Gurudawaras and so forth. The city has a portion of the esteemed foundations like Agricultural University, DMC College, and CMC College, which have assumed a significant job in the general development of the city.

Fig. 3.1: Map showing the district profile of the state Punjab

The city is also connected to near-by towns and cities through various national and state highways like SH-20 connecting to Sidhwan Bet, NH-5 connecting to Moga and Chandigarh, SH-13 connecting to Rajkot and SH-11 connecting to Malerkotla. The city has also a national airport located on the NH-44 on the south-eastern edge of the road near the MCL boundary. Two important railway lines passing through the city; they are Amritsar-Delhi railway line, Delhi-Jammu and Ludhiana-Ferozpur and Ludhiana-Dhuri railway line.

3.1 Climate: The altitude of the city Ludhiana varies from 230 meters to 273 meters from MSL. The climate of the city can be regarded as semi arid. Various dimensions of the city's climate have been described below:

a. Temperature: From middle of November to March is regarded as the cold reason whereas from March to June is the hot season. Monsoon season is evident in the months of July, August and parts of September. Further September, is stated as the transitional period.

b. Rainfall: The majority of rainfall, i.e. 70% of annual rainfall, received is from July to September. 649.9 mm (25.59") being the average rainfall, out of which only 16% of the rainfall occurs from December to March.

Topography: Ludhiana city and its surrounding typically consists of alluvial plain sue to the close proximity of the river Satluj. Primarily, the city is located in the plain region representing featurelessness.

River and Drains: The region consists of the Satluj River and its tributary; Budha Nala. The river Satluj has its origin from Mansarovar Lake in Tibet and runs north to the city at a distance of 8 kms. Due to the rivers impact on the nearby context, a dam at Bhakhra was constructed in order to checks its flooding during the monsoons seasons. Below the Sutlej

River is a perennial stream ; Budha Nala that crosses the city and has been a source of water in the earliest of times but presently is a waste disposal medium for the city. It rises near Ropar district and enters near village Bholapur.

3.2 EVOLUTION AND SPATIAL GROWTH PATTERN

Historical Development-The Ludhiana of city was founded in 1481 AD by Sikander Lodhi at the village Mir Hota on the banks of River Satluj; establishing a military base. Over the decades, the base matured in size and was known as 'Lodhi-ana' entailing as the town of Lodhis, which later transformed and was known as Ludhiana. Later on, around AD 1799-1838, the city came under Maharaja Ranjit Singh, who gave the city a political dimension. In the 19th century, post Indian independence, the city evolved into a big trade and commerce center. And as the city grew, the first water connection was released in 1907 and the city was electrified later in the year 1932.

Spatial Growth Pattern-Budha Nala was the location for the setting up of first settlement of the city Ludhiana; the initial water source for the civilization, which once used to be a part of the Satluj. The initial urban area of the city was identified on the south side of the Budha Nala, however over the years with population growth the city started to grow on the northern side of the nala. Due to urban sprawl of Ludhiana city, many villages and towns are now part of the Ludhiana city jurisdiction. To understand the spatial growth pattern of the city, the evolution has been divided into 5 phases i.e. 1955, 1979, 1989, 1999 and 2009; as shown in the fig. 3.3.

Fig. 3.2: Maps showing the spatial growth pattern of the city Ludhiana

Source: Dheera Kalota, 2015
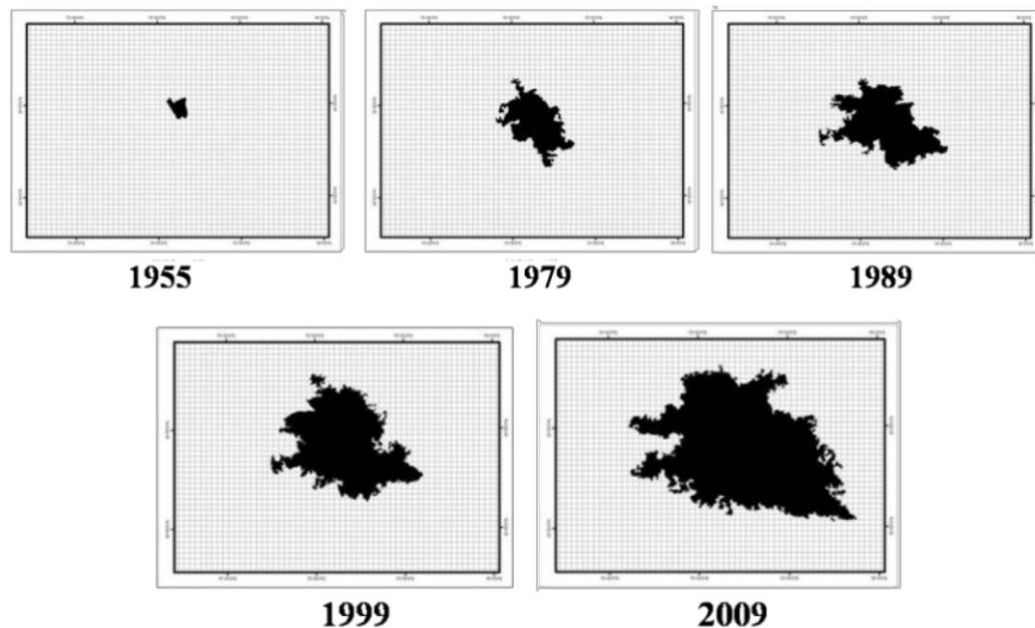
It is evident that the major part of urbanization was witnessed by city in the years 1979 to 1999, where the city was undergoing rapid industrial sector development. The unguided increase in the built-up areas can be observed from 1955 to 2009 which was due to lack of any planning authority and sudden influx of migrant labors.

3.3 MAJOR ROADS AND ISSUES:

Inter City Roads-There are almost 9 major roads connecting the nearby towns and cities, among them are 2 national highways, NH-44, connecting Ambala in the south-east and Jalandhar in the north-west and the second one is NH-5, connecting the capital city of Punjab in the west direction; Chandigarh. The 2 state highways are SH-11 and SH-20 connecting Malerkotla and Harman in the south and west direction respectively. Other remaining towns connected by the Ludhiana road network are Rahon and Tajpur in the north-west and Pakhowal in the south.

Intra City Roads-Intra city roads form the backbone of accessibility within the city limits for all type of transport modes. The Clock Tower Road was the foremost prime accessibility path for the city and even now it witnesses maximum through traffic. So as to avoid issues related to the above situation, the city has almost formed a ring road to divert the through traffic coming from Ambala or Jalandhar.

ISSUES ON ROADS:

Clock Tower Road-The main access road to the city core, which bifurcates the core and the Ludhiana Junction. The road is divided into 2 levels; the elevated road is the Ambala –Jalandhar road that carries the through traffic of the city and the lower one is the Clock Tower Road which provides accessibility to the core and the railway junction.

Fig. 3.3: Chart showing urban development issues of Clock Tower Road (Survey Results)

■ % of Total Respondents
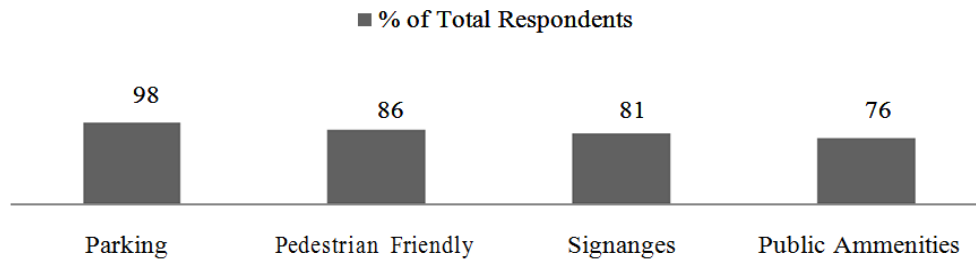
Major Issues:

1. Central median has been provided with parking lanes but lacks in meeting the present demand and hinders the pedestrian movement.
2. Road lacks pedestrian pathways, thus promoting arbitrary pedestrian movement.
3. Absence of signages creates confusion among the people regarding parking and destination nodes.
4. Lack of public amenities encourages unhealthy living environment.
5. Traffic congestions due to encroachments along the road by various informal activities.

Chaura Bazaar Road- It is the one of the major east-west axis of the Old Ludhiana City which acts as the backbone of the economic development of the region. Its incapacity to handle the present demand of urban development activities has created issues related to livability. The street witnesses mixed traffic, dominated by 2-wheelers & pedestrian traffic, creating major congestion in the narrow street. The predominant land use is residential use with formal and informal commercial activities, thus promoting mixed use development; ranging from textile, jewelry shops to restaurants and informal eateries.

Fig. 3.4: Picture showing Chaura Bazaar Road in the Ludhiana City Core

Fig. 3.5: Chart showing urban development issues of Chaura Bazaar Road (Survey Results)
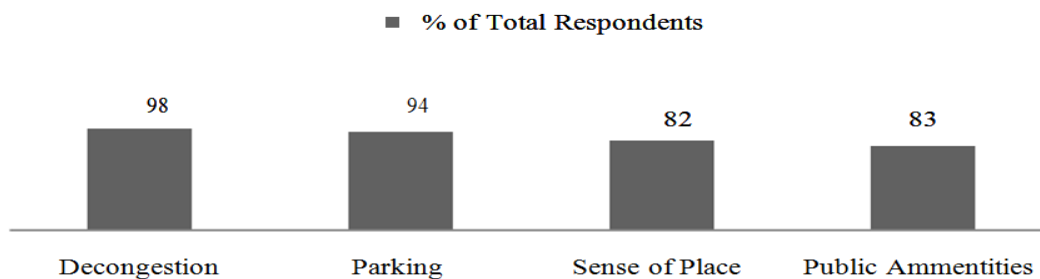
■ % of Total Respondents

Major Issues:
1. The prime issue identified is the congestion which is due to mixture of all the traffic modes in the narrow width of the street and because of spill over by various shops.
2. Non-availability of dedicated parking promotes on road parking, adding to the above mentioned issue.
3. No specific sense of place is observed as per the related activities going on; mentioned by the people visiting the area.
4. Lack of public amenities in presence of high population density leads to unhealthy environment conditions.

Books Market Road- It the part of the Old Ludhiana City that is famous for wholesale market of books and stationery, which is visited by many students living nearby which forms the primary footfall for the core, but its incapacity to handle the present demand of urban development activities, has created urban development issues. The predominant land use is formal and informal commercial activities. The deteriorating infrastructure services and utilities do not favor the footfall in terms of safe and healthy environment.

Fig. 3.6: Picture showing Books Market Road in the Ludhiana City Core

**Fig. 3.7: Chart showing urban development issues of Books Market Road (Survey Results)**
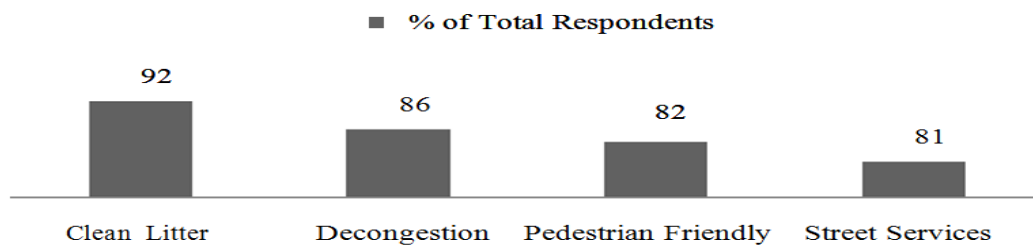
Major Issues:

1. All the packaging material and waste coming from these commercial activities are not properly disposed off and thrown around the shops, resulting in unhealthy street environment.
2. Mixed modal share in narrow streets encourages congestions.
3. As such no pedestrian friendly measures exist; lack of pathways and segregation of traffic leads to unsafe environment for the population.
4. Street services i.e. street lights, power lines etc are in deteriorating conditions adding to the issue of safety.
5. Sense of place is lost among the young generation; thus an independent identity can be provided.

Lakkar Bazaar Road
Major north-south axis of the Old Ludhiana City which serves the regulation of traffic flow within the core is one of the important roads. Its incapacity to handle the present demand of urban development activities is due to the encroachments, on-road parking, commercial spill overs etc. The predominant land use is the formal commercial activities with residential use development; hardware and sewing machine shops dominate the commercial activities. The road has best in class road to building height ratio; providing an example of appropriate density development.

Fig. 3.8: Chart showing urban development issues of Lakkar Bazaar Road (Survey Results)
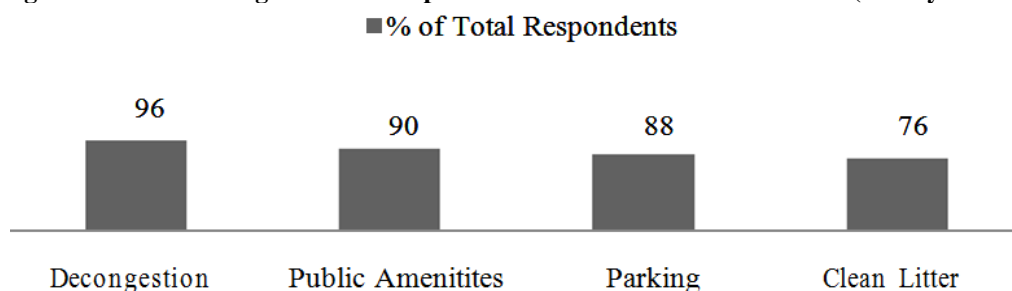
Major Issues:

1. The prime issue identified is the congestion which is due to mixture of all the traffic modes, spill over by various commercial activities and on-road parking.
2. Lack of public amenities in presence of high population density leads to unhealthy environment conditions.
3. Non-availability of dedicated parking encourages on road parking, adding to traffic congestion.

All the packaging material and waste coming from these commercial activities are not properly disposed off and thrown around the shops, resulting in unhealthy street environment

3.4 SOCIO-ECONOMIC PROFILE
Social demographic profile plays an important role in determining the social as well as economic character of the area. The concept of population growth puts valuable weight as it tells us population per unit area. It is very important to analyze social economic and demographic factors in order to define the urban limits of a city.

Population- Ludhiana, the first metropolitan centre of Punjab, has the largest population in the state, Punjab. The city has experienced immense growth in its population post independence and industrialization. Although, in 1980-81, Ludhiana was among the bottom of the list of metropolitan cities but the rate of growth was very similar to these growing cities. 2001 census declared Amritsar with a population of ten lakh plus became the second city of the state to be called a metropolitan city. It was observed that out of every six urban dwellers residing in the state, one was residing in Ludhiana city and out of every nine in the state one was in Amritsar city. Making it evident that out of 10 urban dwellers in the state, 3 were from the city of Ludhiana and Amritsar. The gross density of the city Ludhiana is about 8800 persons per sqkm which was very comparable to that of New Delhi.

3.4 LAND-USE ANALYSIS
The city Ludhiana has an area of 159.37 sqkm, where the land-use is dominated by the residential and industrial sectors, being an industrial town. The city lacks recreational or the breathing spaces for the residing population as only 1-2% are under recreational land-use.

Existing Land-Use: The existing land-use is evidently dominated by the residential land-use, followed by the traffic & transportation, and industrial land-use; clearly indicating the urban planning approach is towards promoting economic development with excellent accessibility to the maneuvers. Recreational activities need to be promoted in order to provide a livable environment to the population as only 1-2 % is under this land-use. Also, a major share of land-use is still under agricultural activities i.e. 22 %, needs to be restricted for change to any other land-use as it may damage the natural environment.

3.5 TRAFFIC AND TRANSPORTATION
Ludhiana, the largest metropolitan city in Punjab; has seen an immense increase in the traffic volume over the years; the credit goes to the share of high income level population which has resulted in growth of private vehicles. The present road web occupies about 12.72 sqkm in the Ludhiana City, which is about 8%. The existing road network of Ludhiana is based on radial pattern where all the roads are converging to the center of the city i.e. the core city. Also, a circular ring road meets all the major regional roads.

Traffic Condition
The increasing trend in ownership of personalized vehicles on the narrow roads of the Ludhiana city has resulted in slow movement of traffic within the city. These roads are highly congested during the peak hours. The most affected zone is the old city where the roads are less than 5 M wide. Due to which a survey was conducted by RITES in the year 1991.

The objective of the survey was to evaluate the performance of existing traffic scenario of the city. In the survey, the city was divided into various zones with 70 internal and 12 external zones.

Parking

The parking scenario of the city Ludhiana is towards inadequacy in providing spaces for the vehicles. The reason being narrow roads and insufficient availability of parking spaces, making all the city roads congested; especially in the peak hours of morning and evening.

The scenario is divided in following categories:
1. **Road-side parking**   2. **Parking-Lot**   3.**Multi-Storied parking**

Public Transport
Public transport is an old player that contributes in movement of population within the city but due to some reasons it has been a failure. The city bus service is owned and operated by Punjab Roadways which started its service in 1997 with 36 buses. Currently the services provided are in cable to handle the present demand, for which private operators have been hired by the corporation to meet the demands. These services generally run along the major roads connecting all the commercial and residential nodes, but due to adequate availability of NMT in the city core, these services provide accessibility till a point. NMT provides further accessibility till the household level.

Some major services are:
1. **Auto Rickshaws**   2. **Cycle Rickshaw**   3.**Taxies**

3.6 HOUSING
It is evident that as with urbanization the demand of housing is going to accelerate and the same has been witnessed in the city of Ludhiana. The various governing institutions like PUDA, Improvement Trust etc have contributed towards the availability of household stocks in the city. Housing stick has been provided in the form of either developed plots or build up structures.

Growth Trend
Growth of city population has always been in pace with the housing stock demand. It is observed that the housing stock has almost doubled in number in the last two decades. The highest growth was observed in the decade 1981-1991 with a peak of 72.3%. The growth of the city population has been dominated by the migrating people in search of better economic opportunities.

3.7 SOCIAL INFRASTRUCTURE
For any urban centre to have a quality of life, it is necessary to make standard infrastructure available and accessible to its people. Appropriate Social infrastructure, like various facilities (health, education, post offices, recreation parks etc.) available to the people, plays a crucial role in better growth and development of the human population of urban areas.
Educational Facilities
Ludhiana city is considered as an educational hub as it houses huge amount of institutions at all levels; primary to higher levels. The city has the most famous Agriculture University that has contributed towards the green revolution of the state Punjab post independence. Other than this, the city has 5 medical colleges that provide medical education at higher level. All over the state people visit these facilities for serious treatments. Also, some homeopathic colleges along with dental ones have been established over the years. The city has an engineering college known as Guru Nank Engineering College that provides education in many technical fields of engineering. Also, B.Ed. colleges exists along with a law college exists within the city limits. The city houses about 500 schools in various levels; out of which 394 are primary and rest are of senior education.
Medical Facilities
The city of Ludhiana has been considered has a health care hub in the state of Punjab that serves both city and state population. The city has about 251 healthcare centers divided into various levels i.e. 104 are primary health centers, 147 are with bed facilities, 4 hospitals with 500 beds; among some of the famous are DMC Hospital, CMC Hospital, Apollo Hospital etc. these healthcare centers are landmarks in the healthcare field that attracts patients from all over the state for various expert operations. The city is also known for Ayurvedic treatments as there are about 21 units' spreads across the city; mainly out which are operating at local level. The city also has healthcare facilities form animals in the form of veterinary units; there are 23 dispensaries and 19 hospitals. Though having such facilities, the left ones are the population residing in the slums.
Recreational Facilities
The major portion of the city c=recreational activities are performed in the city level parks locate throughout the city. The city has almost 263 parks, out of which majority are present in the planned colonies developed by the various governing authorities. Also, colonies developed by the private players have also developed open spaces but there are of low standards. The city lacked a planned approach throughout its initial years of growth that has resulted in lack of open spaces for the residing population.

3.8 URBAN ENVIRONMENT
(Source: CDP and MDP 2021, Ludhiana City)
Ludhiana has started to become industrialized and also nucleus for trade and commerce that has led the city to join the group of the top industrialized and commercial capital state of Punjab. Industries have not only contributed to the growth of the city but also contributed to pollute the city environment. That being the reason, in northern India, Ludhiana is ranked as the second most polluted city. As a result of immense pollution in the city, the quality of air and water has reduced, natural resources are getting degraded. The pollution is affecting every aspect of the city's environment.
Air Pollution-The air quality of the city is adversely affected by the existence of large amount of industries within the city limits. All the emissions emitted from various industries like SO_2 and NO_2 has been identified by PPCB to be on the higher levels due to theses industries.
Water Pollution- Budha Nala within the city limits is currently the medium of waste disposal, which earlier used to be a perennial river. All the waste generated from the residential, commercial and industrial uses are disposed into the nala which has degraded the quality of water. As a result the river has been converted into an open sewer. This has also affected the ground water quality of major part of the city.
Noise Pollution-The city witnesses overcrowding in almost all the major roads with slow moving traffic that constitutes of all the modal shares, which has resulted in problem towards noise pollution.

IV.   **INTERVENTION ZONE**
Zone Selection Criteria

It is evident from the secondary data that the city core has the highest residing population density due to the prevailing mixed land use; dominated by residential and commercial. Also, small scale industries have been identified in the city

core, declaring the zone as an economic growth pole to the city. The core being adjacent to the Ludhiana City Junction has witnessed high commercial development along all the edges of the major roads, which further attracted informal commercial activities; encroaching along the same. Presently, oldest settlement along the Budha Nala with such economic base is facing urban development issues related to livability; issues like high density development, traffic congestions, lack of open spaces, inadequate physical and social infrastructure services and utilities.

4.1 DATA COLLECTION
Intent of the Survey
The intent for the primary analysis was to, firstly; identify what are the urban development issues related to livability in the city core and secondly, understand what people interpret from the concept of smart development. The solution to these questions would help in adopting appropriate smart development strategies that are indigenous to the context.

Approach Adopted
The approach adopted to carry out the survey as intended consists of three methods:
1. **Reconnaissance Survey:** an approach defined as an examination of an area, accomplished in sufficient detail to make generalized statements towards the prevailing situation. In this case it is exploring the identified city core for identification of existing urban development issues.
2. **Open Ended Interviews with Government and Private Professionals:** undertaken to identify existing urban issues that need to be paid urgent attention.
3. **Schedules:** used for the purpose of surveying the local and working population of the city core to understand the urban development issues.

4.2 Data Sampling
The approach adopted for data sampling is purely based on the characteristics of the different zones in the city core. Sectors with different land-uses, formal & informal commercial activities, major roads etc are some of the criteria of locating the samples in the different zones. The total number of samples surveyed is 124, out of which 10 were tourists, 40 were people working there and 75 were residents of the core city. The numbers are of definite ratio in order to under the situation holistically.

Fig. 4.1: Chart showing the various types and numbers of the samples for the primary survey of city core
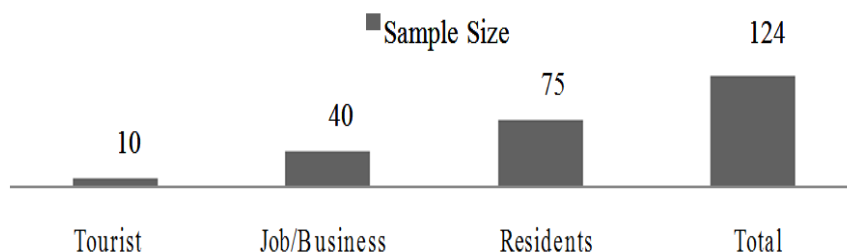
Schedules
Specific schedules were prepared for the primary survey in order to understand the urban development issues from the local population perspective; as to promote public participation in the planning process.
Pre-Conditions
The socio-economic profile of the surveyed respondents has been shown below that consist of sex ratio, age distribution and the income level. This provides a basic background understanding of the surveyed samples.

Fig. 4.2: Chart showing the ratio of sex of the samples surveyed in the city core

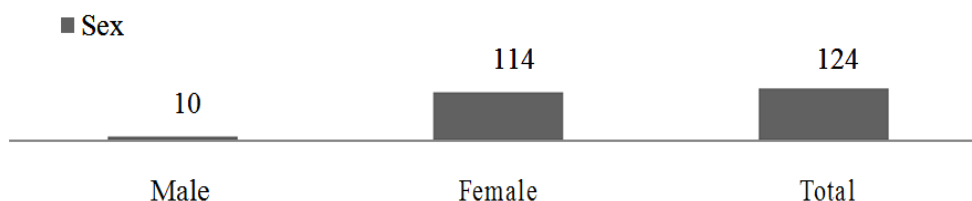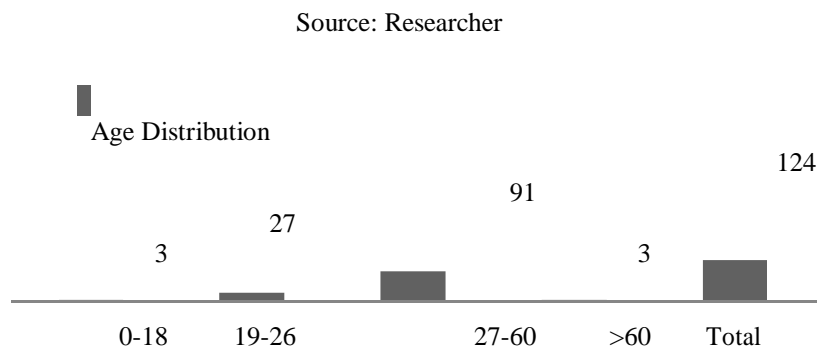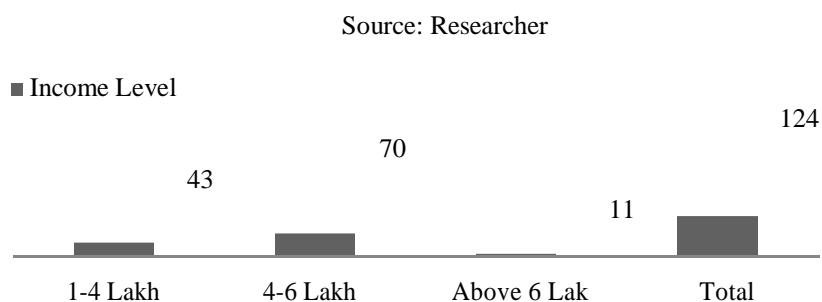**Fig. 4.3: Chart showing the age distribution of the samples surveyed in the city core**

Source: Researcher

Fig. 4.4: Chart showing the income level of the samples surveyed in the city core

Source: Researcher

The samples are dominated by male population as the major workforce in the commercial activities consists of the same. The age distribution also indicated that the maximum samples surveyed are from the age group 19-26 and 27-60 i.e. the working population. The income level suggests that the majority of samples surveyed belong to the middle income group; income ranging from 1 to 6 lakhs per person.

ROAD NETWORKS
Road Hierarchy-Primarily the road network pattern is based on north-south and east-west axis. The road hierarchy ranges from 1-3 M in the dense residential sectors to 9-12 M along the commercial road edges. Clock Tower Road forms the backbone of the core city accessibility with ROW 35-50 M, where as Chaura Bazaar Road, Gokal Road, Brown Road and Field Ganj Road are the Collector Roads carrying the city core traffic.
Major Roads and Intersections-They are about 10 major roads that serve in regulating the traffic of the city core. All the major roads i.e. collector roads, of the city core intersect at 12 different locations that are also dominated by commercial activities. Almost all the junctions witness congestion issues as they are incapable to handle the existing traffic movement.

4.3 POPULATION GROWTH PROJECTION
The current population of the identified core city is 14,040 with an area of 67 H and gross density of 210 PPH. Being an economic growth pole to the city, the population growth has been towards higher side.
The average decadal growth is about 40.43% over the last 3 decades. Hence, it is important to project the future growth in order to estimate the demand of various infrastructure services. The population projections have been conducted using 3 methods i.e. Arithmetic, Geometric and Exponential Mean. The population data taken in the study is from the ward-wise population census data from MDP and CDP – 2021, Ludhiana City.The above mentioned objective can be achieved using land regulation methods; Restriction methods, Amenity method and Scarcity method.

4.4 TRAFFIC AND TRANSPORTATION
Being the economic hub to the city and near vicinity to Ludhiana Junction has resulted in heavy traffic movement in and around the city core. The core witnesses almost all types of modes of transport from auto-rickshaws to cargo trucks. This amount of vehicular traffic hinders the pedestrian movement around both the nodes; also due to lack of adequate infrastructure services and utilities the condition is worsening. The core lacks segregation of vehicular and pedestrian traffic in order to promote livability.
Parking
Parking is a prime issue prevailing in the core city. With major share of parking done on the roads, make the roads insufficient to carrying the moving traffic. Currently the parking demand is handled by 3 parking spots; multi-level parking near LMC (the parking is not of use due to deteriorating condition and low maintenance), informal parking area at the Chaura Bazaar and lastly, informal parking on the Gokal road. Though some private plots have been converted into parking areas on chargeable basis, but due to their existence within the core, adds to the traffic congestions.

4.5 SOCIAL INFRASTRUCTURE

The city core has adequate facilities related to social infrastructure, though there have been some objections towards the quality of the same. Degrading infrastructure is the prime reasons for the above issue; also the core lacks an adequate amount of open spaces for the residing population. The social infrastructure has been divided into Education, Healthcare, Utilities and Services and Religious Nodes; each of them has been briefly described below. Another dimension is added to the study, i.e. walkability to these facilities; it is to understand are these facilities within the walkable range of 450 M, single direction.

Educational Facilities-The city core consists of 10 schools and 4 colleges providing education from primary to college level. 90% of the total area is under walkability with respect to educational nodes. The list of schools and college is shown below. It is evident from the table that the number and standard of the education facilities in the city core are adequately available.

Healthcare Facilities-The core city consists of 7 nursing homes (4 within the core) and 3 hospitals covering almost 70% of the core area under walkable distance. CMC and Civil Hospital are the best in class in the entire Ludhiana City. The list has been shown below.

4.6 HOUSING

The housing typology is very similar to other cities; as mostly the land-use is dominated by mixed-use, all the residential units have seen a transition from residential to commercial. The residential units on the ground floor are used for commercial purposes where as the upper floors are used for the same. Also it is evident that the residential units have a seen a larger part of their life and needs some improvement. Some old houses about age 40 years have also been identified during the survey.

Patter of Use

It is evident from the figure that the residential units in the core are also used as shops, other than their own same use, i.e. residential. Some residential units have also being converted into offices and workshops related to small scale industries which become an income source for the households. Some traces of guest houses are also observed in the residential land-use. Very rare observation has been made that some of the residential units are not in use and are kept vacant. These units are degraded in nature due to lack of maintenance.

4.7 LOCAL PERCEPTION OF SMART DEVELOPMENT

This exercise was conducted to get an idea about smart development and its strategies in the city core by the local and visiting population. This also helped in understanding the priority wise urban development issues that need to be taken care of based on the population's response.

Firstly, the concept of sustainable development was understood, where, 82% & 73% of the respondents consider smart development as, effective (result based) and equitable (equal for all); respectively; whereas 35 % of people want the development to be rational (return based policy). Only 10% of the respondents are bothered about the efficiency (performance) of the ongoing development.

Fig. 4.5: Chart showing the understanding of sustainable development (Survey Results)
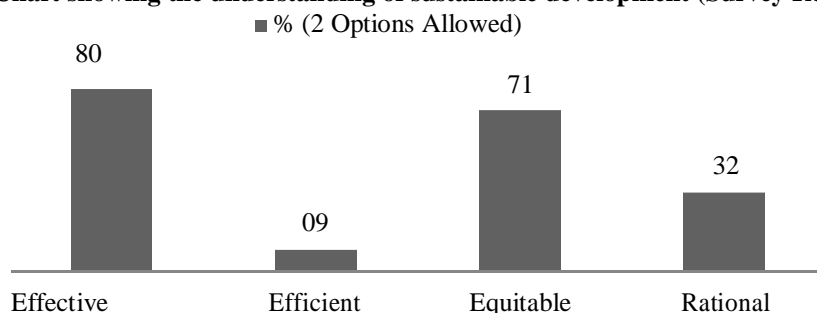
Secondly, as for sustainability, two choices needed to be filled among environment, economy and equity. 97% and 74% of the respondents consider environment and equity; respectively, as the two important dimensions towards achieving sustainability. Economy aspect has not been considered essential due to competiveness among the business people.

Fig. 4.6: Chart showing the priority towards sustainable development (Survey Results)
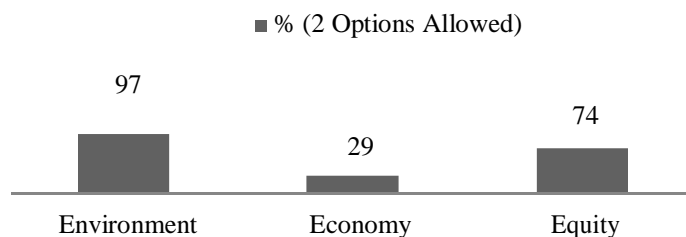
4.8 RESULTS AND DISCUSSION

Based on the above primary study of the city core of Ludhiana, it is evident that urbanization had a positive impact on the city core as there has been an immense growth in economic profile of the zone; but with this there have been some negative ones too. Areas like Chaura Bazaar, Dal Bazaar etc have seen high density development over the years due to transition from residential units to commercial one. The sudden rise in population made entire infrastructure service and utilities inadequate and as no measures were taken for the maintenance, they worsened.

Even population projection suggests that there would a rise in population density over the coming years which will further add load on the existing infrastructure. The current conditions of infrastructure are not that convincing as they are under capacity and due to lack of maintenance. These prevailing conditions will worsen over the years, suggesting urgency towards taking appropriate measures towards urban development. Based on the above study and analysis the major findings identified are briefly described below.

a. Economic Growth Pole -The commercial streets of the core attract a huge footfall all over the year, as they are famous for their wholesale business of hosiery, garments, jewelry, restaurants etc goods. From the older times, the core was famous for its small scale industries and further the establishment of the railway junction accelerated the economic development of the zone. The core attracts buyers, business people etc from all over the state for its cheap rates of goods and services. Hence, the core can be regarded as the first and still contributing economic growth pole to the Ludhiana City.

b. Medium to High Density Development- The current density development pattern is very typical; Chaura and Dal Bazaar have the highest density development with buildings reaching floors up to 6 due to its mixed land-use pattern, whereas the latter developed sectors like Naya Mohalla and Karimpura are too of mixed use character but the density is towards lower side, as plot sizes, road widths etc are more planned as compared to the above sectors. The development along all the major roads is either of commercial or mixed-use character with high density; floors reaching to 5. The inner sectors are generally of medium density in case of Karimpura and Naya Mohalla as they are dominated by residential use with few mixed use units also. The average building heights of the residential units all over the core is 2-3, whereas in the commercial or mixed use sectors, the average height is 5. Also, the plot sizes in Chaura and Dal Bazaar are not uniform and are random in nature, whereas Naya Mohalla and Karimpura have planned and homogeneous plot division pattern.

c. Traffic Congestions- With all the development going on, the road network was not thought of as an integral part of the urban system. As the roads were of narrow since beginning, as earlier they only served low amount of traffic; but with urbanization there has been a significant growth in the vehicular traffic which has added load on the existing road infrastructure. The core is witnessed by almost all type of modes of transport ranging from cycle rickshaw to 4-wheelers, though dominated by 2-wheelers. The commercial streets of the core are the source for traffic congestions as the narrow streets are not capable to handle the present traffic which is a mixture of pedestrian and vehicles. The informal commercial activities and on-road parking are the two prime causes for the congestions long all the major roads of the city. The multi-story parking at MCL is not able to fulfill the parking demand of the core because of its deteriorating conditions and low maintenances. Also, the people don't prefer to use this facility as there is almost no accessibility at nominal rates towards their home.

d. Lack of Open Spaces- Due to unplanned and haphazard growth of residential units in the various sectors resulted in shortage of opens spaces for the residing population; over the years the scenario has been the same. Few traces of open spaces were identified but they were in the form of vacant plots. The population utilizes the streets for their informal meetings and similarly, children use these streets for their recreational activities, which are unsafe in some of the cases; heavy traffic movement along the major roads. The only green open space found was at the junction of Sarafan Bazaar Road and Gokal Road, but currently it is an area used by MCL for water supply purposes; a water tank and tube well are constructed at the site. This clearly indicates that the core lack opens spaces and the existing streets are space for recreational activities.

**Fig. 4.7: Pictures showing traffic congestion in the city core**

Fig. 4.8: Picture showing open spaces in the city core

e. Strategies to be adopted in priority as per Local Population- A survey was conducted to understand what people perceive of the urban development issues and according to theme what issues need urgent rectification. It was observed that decongestion was the prime focus towards achieving a livable environment in the city core. In the survey also it was found that almost everyone visiting the core faces this issue periodically. As the cause for this is mainly because of narrow streets and on-road parking; parking was identified as the second most important issue that needs improvement. Also, as most of the

sectors are of mix used character, people tend to walk to avoid traffic congestions, but the core lacks basic pedestrian friendly measures, thus, not promoting pedestrianization.

Fig. 4.9 Chart showing urban issues in priority as per the local population in the city core
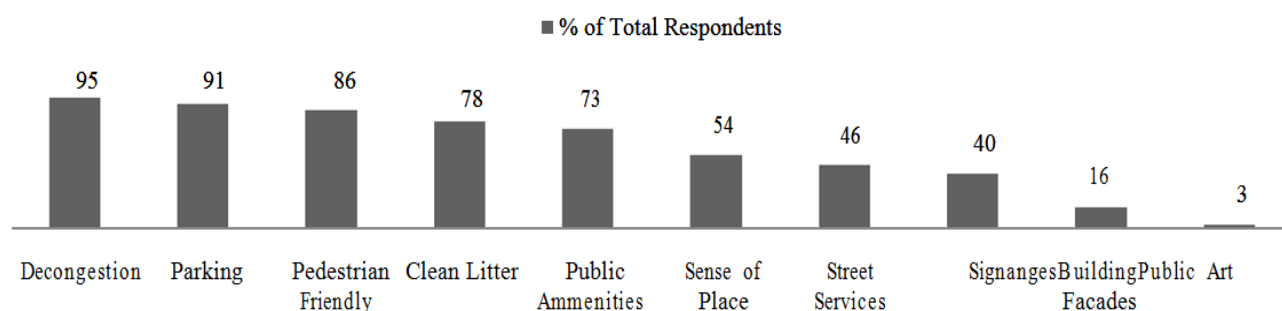
V.   CONCLUSION

The examination began with understanding of the wonder of urbanization. It was understood that term urban is variable all through the world. The regular measurements recognized on which the term is characterized are population, thickness and territory/ward boundary. The term in India has been characterized in Indian as evaluation and statutory towns; statutory towns are those that have either a municipal partnership, municipality or panchayat and statistics towns are those that satisfy the criteria of least of 5000 populations and gross thickness of 150 PPH. Likewise, the effect of urbanization on manufactured condition was a significant measurement to consider. All the significant creating urban communities are confronting issues identified with livability like absence of opens spaces, traffic blockages, spread and so forth; in this manner demonstrating to embrace measures to counter these issues. The most recent intervention in the field of urban planning that aims at reducing the impact of rapid urbanization in the developing cities is known as Smart Development.

Smart development that has advanced as an answer for the current negative effects of the marvel, urbanization, has been into lime light over the ongoing occasions. In this investigation, to understand the idea of smart development in the urban arranging setting, different related ideas were examined for example Livability, Sustainable Development, Smart Growth and the latest one, Smart City Mission. Additionally, different city arranging ideas were recognized in the sequential request; distinguished ideas were Livable City, Global City, Sustainable City and Smart City.

If there should be an occurrence of hypothetical ideas, Livability concocted the plan to give fundamental administrations and utilities to all the moving population in the urban focuses. The idea planned for improving the social measurement, though, in the following stage, Sustainable Development came up as an answer for debasing indigenous habitat; making it compulsory that every one of the developments should have a reasonable point and approach. Further the period line, it

was understood that Sustainable Development was not ready to exhibit its standards in the field of arranging; here the idea of Smart Growth appeared.

If there should arise an occurrence of city arranging ideas reasonable city was the first to come up that planned for improving the personal satisfaction; where personal satisfaction was characterized as the fulfillment or disappointment among the population because of the activities taken. Here again the social measurement was thought about, pursued this, came Global City. The idea planned for improving the monetary background of the urban communities to make enough business and work for the population so as to improve the personal satisfaction. Be that as it may, this idea of quick monetary growth adversely affected our indigenous habitat as deforestation, corrosive downpours and so on. Before long, Sustainable City came as an answer for rationing the regular habitat where activities were taken up to limit the effect of quick urbanization on the common habitat. In the next years, with mechanical headways, innovation was however of to be incorporated in the mission of accomplishing sustainability; the idea was called Smart City.

Along these lines, it was apparent from the writing that Smart City is one more idea that spotlights on improving the personal satisfaction of the population with worries towards moderating the regular habitat and to accomplish this point, ICT has been embraced as a helping device.

With respect to the contextual analysis, Ludhiana City was picked as it is the industrial center of probably the littlest state in India. However, with such low measurements like population and zone count, the state is in India's highest urbanized states. The state has seen tremendous population growth in the ongoing decades, which has helped the wonder of urban spread. Throughout the years numerous new urban focuses have come due that have seen high population movement rates. All the moving population is for the most part from the old urban focuses like Amritsar, Ludhiana, Chandigarh, Jalandhar and so forth. The city of Ludhiana, the principal metropolitan city of the state has seen urbanization at a higher rate. Known for its enterprises identified with hosiery, pieces of clothing, producing businesses and so on has prompted quick population growth in the city. This growth has likewise affected the assembled condition of the city; the city needs numerous elements of livability like absence of open spaces, lacking physical and social foundation, traffic clogs and so on.

The investigation was additionally taken in the details of Smart City Mission, which has an element of region based development. The city center of Ludhiana was browsed the 7 distinguished areas for territory based developments, as it's the monetary growth focus to the city and is confronting serious issues identified with livability. The overseeing specialists have pronounced this distinguished center a business blend land use, thus it was essential to make a base guide for movement design, to understand where the various kinds of land-use exists like private, business, enterprises, blended use and so forth. This movement example guide was identified with the street chain of command so as to understand the portability inside the city. This examination supported in distinguishing the areas and hubs where urban development issues were recognized most extreme.

Closing, the exploration study began at a miniaturized scale level with understanding of the idea urbanization to giving suggestions to improve livability in a city center that is confronting major urban development issues because of the above marvel. The investigation can be expressed as a through and through, large scale to miniaturized scale based methodology, where issues were distinguished at the most astounding level and arrangement were given at the least. This methodology gives a top to bottom sight to every one of the issues existing in the writing to the site level, which supported towards detailing of strategies as indicated by the neighborhood setting. It was understood that smart development strategies should be nearby and can't be more viable than this request. Along these lines closing, this exploration work is a view towards the impression of smart development in India and how the standards and strategies ought to be inferred at the neighborhood generally level.

VI. RECOMMENDATIONS

As per the primary analysis conducted for the city core Ludhiana, major urban development issues were identified for the core city that hinders the promotion of livability for the local and residing population. The major identified issues as per the study and the survey conducted are:

1. **High density Development:** witnessed in the commercial and residential sectors like Chaura Bazaar, Dal Bazaar, Naya Mohalla and Karimpura; causing issues like congestions due to on-road parking and narrow streets. These sectors also face issues related to light and ventilation due to the above density pattern distribution.
2. **Traffic Congestion:** the narrow streets of the core city are unable to handle the present demand of traffic that consists of almost every type of mode ranging from cycle-rickshaws to cargo trucks. Another factor that contributes to the same is the tendency of people to park on road; encroaching the carriage width of the roads. Even informal commercial activities being performed on the same roads adds to the above situation.
3. **Parking:** it is a major issue faced by the core city as major portion of parking is on road that causes major congestion issues at all the nodes of the core city. Though there are a formal and few informal parking areas i.e. a multi storey parking at the MCL, one informal at the Chaura Bazaar Road entrance and few plots by the locals have been converted for the same.
4. **Lack of Open Spaces:** the high density and random growth of the city core has resulted in non-existence of opens spaces. In the core city though only one or two spots were identified but these two are either used up by the utilities and services like tube wells and pump houses or are vacant plots.

Based upon the identified issues following are the recommendations that can be adopted to tackle the existing urban development issues. Use of ICT has been integrated in these suggestions in order to achieve similar approach as the smart development; as discussed in the literature section.

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