Chapter I
INTRODUCTION

1.0. INTRODUCTION

Research on urban planning and urban growth has been an area of emphasis of the urban geographers, planners, and policy makers in the recent years. The main aim of urban planning and management is the development of urban space and its environment. Land use planning is an important base for urban planning. The development of Indian Cities is largely controlled by land use. Therefore land use has become a central component in urban planning, for managing the available natural resources and the changes in the environment. Land Use may be defined as the use of land by humans, usually with emphasis on the functional role of land in economic activities (Campbell, 1987). Rubenstein and Bacon (1990) defined land use as the type of activity on a piece of land, such as residential, commercial or industrial. In other words land use simply means the use to which the land is being put or the utilization of land devoted to human activities. Urban Land Use refers to the utilization of urban land for various human activities. According to Blumenfield (1972), urban land use, at its broadest, can be seen as the adaptation and utilization of space to accommodate different human activities, all of which stem from the concentration of large numbers of people in urban areas, and all of which require, if not create, specific land uses. The layout or arrangement of the uses of the land in a specific urban area is known as Urban Land Use Pattern. In other words, while examining the internal structure of city and cities, a number of distinctive land uses are seen, like residential, commercial, industrial, etc. The nature, distribution and extent of these land use define the urban land use pattern. The land use pattern of a
region is a product of interaction between physical conditions and their utilisation by man under various socio-economic conditions, in time and space. The intention of studying land use of an urban area is to find out if the land is used optimally and to inspect the extent to which current land uses are hindering the progress of an area. Land use analysis helps in determining a suitable pattern for the present and the future needs of a city. The values and attributes of the people have changed over time, which has a direct impact on the land use. Land is becoming a scarce resource due to rapidly increasing population and its characteristics. Therefore, knowledge on land use and the potentiality and possibilities for the optimal use of the available land is essential for planning strategies for land use to meet the increasing demands of human and their welfare.

Land use change indeed has been governed by the physical conditions, but it also to a large extent is determined by social, economical, political conditions as well, in time and space. Other conditions like market forces, land management technologies, infrastructure and land use policies also have significant role in taking the decision to alter land use. The changes in the economic policies, with replacement of direct government controls on the economic activities by a regulatory system has altered the entire social and economic landscape, which in turn has brought a significant change in the urban land use.

Moreover, the 74th Constitutional Amendment Act (Nagar Palika Act, 1992) has entrusted the urban local bodies with an added responsibility to look into the civic needs of the urban dwellers and the infrastructural development. This has resulted in a remarkable alteration in the land use pattern in Indian cities.
The effect of policy implementation was widespread and small developing towns like Ranchi have also experienced transformation in the existing conditions, which brought a remarkable change in its land use. The City of Ranchi has been administratively significant ever since the British period, but its importance increased after getting the status of the capital of Jharkhand, in November 2000. The new secretariat, high-court, headquarters and other administrative buildings, came into existence with the formation of the new state. Moreover in order to cater to the needs of the city, the basic amenities and infrastructure has been strengthened. There has been a mass migration of people from rural areas to cities. The major cause is the search for better employment opportunities in these urban centers. As urban population increases, the demand of land for various urban activities also increases. A remarkable increase in education has also resulted in a huge influx of migrants; with consequent increase in the urban and demographic pressure on land. All these have significantly altered the land use and the resultant landscape of the city. Such conditions are dynamic in nature and are expected to bring about changes in the existing conditions of land use in future, the consequences of which is unpredictable.

Therefore, it is of paramount importance to understand the spatio-temporal patterns and driving forces of the urban land use change, which may play an important role in developing rational economic, social and environmental policies in an area. Therefore in this research an attempt has been made to monitor the land use changes and the underlying causes in Ranchi city, in the period before the state formation and after the inception, keeping in view the changes in the economic policies and the 74th Constitutional Amendment Act (Nagar Palika Act, 1992)
1.1. LITERATURE REVIEW

As per the report of the 2005 Revision of World Urbanization Prospects, Department of Economic and Social Affairs’ Population Division of the United Nations (United Nations 2006), in 1900, only 13 percent of the world’s population lived in urban areas, which increased to 29 percent by 1950, and reached 49 percent in 2005. The latest U.N. population projection also indicates that the proportion of urban population is anticipated to rise to 60 percent by 2030, which means that about 4.9 billion people out of a total world population of 8 billion are expected to be urban dwellers in 2030 (United Nations 2006). Urban growth is a dynamic and multifaceted spatial process that may have severe environmental and social impacts. Negative impacts of urban growth can be observed both internally and externally. Internally, it can be seen as more congestion, longer transports, economic segregation, social disconnection, poor health, cost of infrastructure, and lately even as economic decline. Externally, it can be seen in loss of farmland, open land, carbon sinks, biodiversity, pollution of ground water and increased risk of flooding (European Environment Agency and E.C.J.R. Centre, 2006, Deal and Schunk, 2004, Sheehan et al., 2001). Urban planning and policy making are the means to limit the impact but cities are complex systems and the consequences of policies are often unknown. (Lahiti Johan, 2008). For the purpose of an efficient planning, land use studies are important, keeping in view a sustainable form of development.
1.1.1. Concept of Land Use and Land Use Change

India like other countries experienced rapid urbanization since the beginning of the 20th century, which has brought forward the concept of urban structure and urban land use (Haloi, K. (1984). Land use refers to man’s activities on land which are directly related to land. Land use is dynamic in nature. The change may be in terms of nature or intensity and may also include spatial and time aspects. Land use changes also involve the modification, either direct or indirect, of natural habitats and their impact on the ecology of the area (Prakasam, 2010). It is an important factor for the comprehension of the interaction and relationship of anthropogenic activities with the environment. Knowledge of the nature of land use change and their configuration across spatial and temporal scales is consequently necessary for sustainable environmental management and development (Turner et al 1994). Within urban areas alteration is possible to a large extent, mainly because of its ability support a broad range of services, but it may prove to be costly. For instance urban renewal in the form of reconstruction may be undertaken. Similarly insufficient housing facilities can be replaced with more efficient residences. As urban development takes place both physical and socio-economic conditions undergo a change. According to Long et al (2008), urban landscapes are exemplified by the large concentration of population, and rapid expansion of urban zones which lead to alteration in the land use configuration that consequently influences the landscape.

Land use primarily comprises of physical characteristics and processes on the one hand and socio-cultural processes and human behaviour on the other. The monitoring of such systems includes the identification and prediction of land use
changes in a holistic manner at various levels (Singh, 1992). The section 6 of the Development Act 1993 deals with the Concept of “change in the use of land” and explains that a change of land use occurs when that use:

a) replaces a previous use of the land;

b) represents an initiation or reinforcement of a use following a period of non-use; or

c) is supplementary to an existing established use of the land which persists despite the new use.

The land use of an urban area is a consequence of growth process and a response to social, economic, demographic and technological evolution and changes over time. The urban environment has consequently undergone significant changes. The intra-urban disparities are quite evident. These disparities are apparent not only in form and area, but also in the nature of mobility. This results in a two-way process of outward expansion and internal reorganization, where the components of land use are transformed or restructured. This process ultimately results in the form of accretion outward and replacement within. That is to say that there is expansion of urban area outwards while within there is transformation of land use. This process of change contributes to the shape, the physical and functional patterns of the cities and to the formulation and the testing of general principles of urban growth and structure (Mayer and Kohn, 1967)

According to Macleod and Congation (1998) change detection is an important process in monitoring and managing natural resources and urban development because it provides quantitative analysis of the spatial distribution of the population of
interest. They list four aspects of change detection which are important when monitoring natural resources:

i. Detecting the changes that have occurred

ii. Identifying the nature of the change

iii. Measuring the area extent of the change

iv. Assessing the spatial pattern of the change

An essential characteristic of land use change detection is to find out what is actually changing to what i.e. which land use class is changing to the other. Knowledge about this would reveal the changes that have occurred over time on land, which may be desirable or not desirable. Moreover it also gives information of the categories of land use that have been relatively steady in due course of time. This also serves as an important tool for making strategies for further land use.

1.1.2. Land Use Classification

Land use classification is a necessary precondition for land use planning and development. A Standard classification and uniform definition of land use was first recommended in 1950, by L.D Stamp, based on the land use of Britain. Most of the classification system adopted by the town planners is more or less generalised, that is the trivial differences in the land uses are not taken into consideration. The actual use of land can be determined only when it is looked into in detail, taking into consideration the minor details. To take details into account Mahadev (1975) suggests a system that brings out the distinguishing features of land utilisation more noticeably.
These are:

- Commercial
- Industrial
- Residential: a) High Density b) Moderate Density c) Low Density
- Education and Research
- Public and Government Offices
- Recreational
- Transportation
- Vacant Spaces
- Water Bodies (Perennial and Non-Perennial)

This categorisation may be considered viable, as it gives detailed information required for planning purposes. This would help in the identification of faulty land use, so that preventive measures can be taken for avoiding such incidences. Moreover, accurate steps may be taken for the optimum use of low density areas. It is also helpful in identifying the classes that are expected to grow over a period of time and others that might not grow at the same rate. Planning should keep such factors in view, while estimating future use of land.

1.1.3. Determinants of Land Use Change

The urban land use has experienced diverse changes. The present pattern of land use is fundamentally a consequence of long continuous process of an array of physical, socio-economic and environmental factors, which are principally modified by interaction of various forces that operate at different geographic scales. The forces may be summarised as follows:
• **Economic Forces:** The structure and the functioning of an urban economy largely determine the use to which a particular piece of land is put into. Both the regional and local forces act together to determine the pattern of land use. The land economists often, in the framework of the Equilibrium Theory, regard land as a commodity in the market, which is subject to the forces of demand and supply, where the price of the land is a function of the costs of making that land productive and a function of the net return realisable after the development of that piece of land. The choice to buy or sell a land is determined by the opportunities which maximise the return from a transaction in the market in which the land is put, keeping in consideration its potential in future.

Scholars like Hurd (1929), Ratcliff (1949) and Alsonso (1964), recognized that the pattern of land use is resultant of land value, a function of the rent paying ability of the land, which is determined by the relative location and the functional use it is put into. The use that can extract maximum return from a given site will be the successful bidder (Ratcliff, 1949). Therefore it is principally a competition between different land uses and it is the most efficient pattern that persists.

With new economic policies and associated liberalization an era of competitive capitalism (Picone, 2005) has emerged, which is characterized by free market competition between locally oriented businessmen and laissez-faire economic and urban development, which to a large extent is not determined by government regulations. There has been an augmentation in business activities. The consumer markets have experienced expansion both locally and globally. There has been
specialization in labour and the labour markets have become well-structured. There has been an increase in the awareness of the norms of wage rate. Moreover, government intervention in the economy increased with the increasing need for regulation of public affairs. All these have led to the advent of ‘organised capitalism’ (Picone, 2005). Currently a shift is observed from industrial production towards provision of services, particularly the financial services in particular.

- **Social Forces:** The location and arrangement of land use activities is a result of social values and the result of the social interactions. The physical configuration of a City largely is determined by the behaviour of the society and social institutions, which are a function of existing social values and principles. According to Chapin (1957), human behaviour is a product of human wants and needs. He gave a framework of the cycle of human behaviour, leading to a specific land use pattern. Social changes have a considerable influence on the nature of the urban area. The point of view towards lifestyle largely determines migration flows, while ethnicity determines the underlying patterns of segregation of residences within cities. Similarly, social outlook towards groups like single parent households, the unemployed, disabled people and elderly people and towards women, determine their status and location in the city.

- **Political Forces:** A City is fundamentally a picture of the political ideology of its society. In a democratic country like India, a welfare society is fostered with a national economic development in place of a capitalist development. Therefore, urban industrial development and the erection of public housing facilities have been emphasised. Changes in political
principles and the resultant modifications in economic and urban policies have largely influenced the development of the cities. Presently there has been a decrease in public expenditure and there has been a remarkable increase in the dependency on private sector for urban development, which is apparent from the rise of agencies like urban development corporations and enterprise zones, public-private partnership schemes, property-led urban regeneration and strategies such as the private finance initiative.

Political conditions largely influence the economy of a region, which largely influence the urban change. Political forces to a large extent influence the formulation of urban policies. Conversely political decisions also determine future landscape of the urban areas and the prosperity of the residents.

- **Culture:** Lately there has been a greater inclination towards materialism, which is apparent in the society. As Picone mentions, it is manifested in the appearance of a ‘cuppoccino society’ characterized by stores selling designer clothes, wine bars, pavement cafes, gentrification, yuppies (young upwardly mobile professionals), marbles (married and responsible but loaded executives) and bumper stickers (like- Dear Santa, I want it all). This has resulted in an increase in the fissure between the rich and poor society in the cities. This cultural change in the present urban areas shows a post-modernism society, comprising of social differences in urban environments. This variation may be in terms of architecture or social variation. Youth cultures have emerged, like hip hop and rap music and branded lifestyle in the traditional areas. This post modern urban society
has also experienced growth of cultural industries, like media and arts and renewal of historic sites, especially for tourism.

- **Demography:** There is a direct impact of demographic changes on the process of urbanisation and change in urban land use. The process of immigration and out-migration to a large extent determine the size and socio economic composition of a city. An anticipation of a better lifestyle pulls the migrants towards the cities. The demographic structure of the cities is also influenced by the urban environment, which influences the balance between rate of fertility and mortality. Intra-urban variations in health conditions are distinct in the cities where higher mortality rates are recorded in the slum areas. Demographic changes also affect the economic development of a City. On the other hand the potential of economic development of an area also depends on the demographic change of that particular area.

- **Technology:** Technological changes and economic change go simultaneously. Technology largely influences the pattern of urban growth and change. The structure and functioning of the economy has been significantly influenced by the technological development especially in the field of telecommunications. Besides determining the character of the economy and its rate of development, technology also determines the rate and nature of urbanization and resultant urban land use change. These changes have direct influence on the urban form. Development in transportation to a large extent has promoted sub-urbanisation of activities.

- **Local Authorities:** The decision making power on the supply of sites, housing and public services lies with the local authorities. However the
demand for these facilities is beyond their control. In conditions when the supply of services is higher than the demand, there is prioritisation of land use and it is the choice of the individuals that plays the decisive role in the evolution of land use. But if the case is opposite, the local authorities play an important role in controlling the process of urban change, by imposing restrictions and rules and regulations, keeping in view the sustainability of the urban area.

1.1.4. Modeling Land Use Change

A prerequisite to the development of realistic models of land use change is the identification of the most important drivers of change (Veldkamp et al., 2001). An associated issue is the best representation of these drivers in a model. Simulation of decisions by and competition between multiple actors and land managers is required. Models should have the ability to produce dependable projections into the future conditions or, should be able to produce the past conditions. This necessitates relating the processes and models of land use change to physical processes and models, to represent physical feedbacks to land use changes and land use adaptations to physical changes. Earlier land use change models have focused primarily on physical factors. But practically socio-economic drivers of change are also required to be emphasised. The role of policies in driving land use changes has often been emphasised (Lambin et al., in press). Alternative variables, which are easier to measure spatially, are often used for root underlying driving forces. Moreover, land use change models also need to take into account the inner lying variables like land management skill, infrastructures and land use policies.
1.1.4.1. Traditional Models of Urban Land Use

- **Burgess’s Concentric Zone Theory (1925):** This theory proposes, the growth of a city took place outwards from its central area to form a series of concentric zones of various land uses.

- **Sector Theory proposed by Hoyt and Davie (1939):** according to this theory, patterns of urban land use were influenced by the road networks radiating outwards from the city centre. The accessibility to roads created a sectoral pattern of land values, which in turn influenced the urban land use pattern.

  Both the above theories assumed that the city grew around single nucleus, but this doesn’t happen always (Maithani S., 2010)

- **Multiple-Nuclei Theory:** This theory was proposed by Harris and Ullman in 1945. It suggested that urban growth in large cities took place around a number of nuclei rather than a single nucleus (Knowles and Wareing, 1976)

  Urban growth modeling flourished in the 1950s and 1960s. These models were mainly spatial interaction models, which were used to study diverse intersections resulting due to human activities within an urban system.

  However, none of the above traditional theories were entirely satisfactory and were criticized on the following points:

  - Rigidity
  - Static nature
  - Comprehensiveness, data hungry and complicated
• Required only to represent visually the spatial arrangement of urban socio-economic systems

• Poor handling of spatio-temporal dynamics

• Coarse representation of data with a top-down approach, which fails to produce realistic representation of urban systems.

• Most of these models imagine the city as stagnant and try to simulate the location of a particular land use with respect to each other in a particular time.

1.1.4.2. Contemporary Practices in Urban Land Use Modeling

In the 1980s, new ways of looking at cities and their development emerged, which led to noteworthy advancement in urban modeling both theoretically and practically. Theoretically, studies on non-linear systems have led to looking at urban development as an irregular process, in the manner of bifurcation and chaos (Allen 1997; Batty and Longley 1994; Wilson 1981a, b). Practically, the emergence of new data sources, specifically digital in nature and advances in GIS techniques have provided rich data sources and new platforms and techniques for data management, data analysis, and visual interpretation (Fischer, Scholton, and Unwin 1996; Fotheringham and Rogerson 1994; Anselin and Getis 1992; Fischer and Nijkamp 1992; Goodchild, Haining, Wise 1992, Sui 1998, Nyerges 1995). Moreover, the application of the fuzzy set theory and fuzzy logic in urban modelling has provided ways of soft computing that are closer to the real process of the progress of systems (Wu 1998b, 1996; Openshaw and Openshaw 1997). The fuzzy set theory was introduced to handle issues that have no definite boundaries. In such situations the events are fuzzily defined.
1.1.5. Importance of GIS and Remote Sensing in Land Use Change Detection and Modeling

Data on land use change are immensely important for urban planners in the process of monitoring the essential drivers of land use change and to find out the consequences of this change on an area. These data are also important for resource management and organisations that monitor and plan land use patterns and model and predict future changes.

Land use change is a process that occurs in space and time. In order to understand this dynamic process of such development, both the spatial and temporal dimensions of this process need to be taken into account. Many efforts have been made to improve the spatio-temporal dynamic representation in GIS (Claramunt and Theriault 1995; Peuquet and Duan 1995; Peuquet 1994; Langran 1993; Hazelton, Leahy, and Williamson 1992).

It is mainly appropriate for mapping environmental processes like land use change, as field based mapping is practically difficult, remote sensing observations provide continuous monitoring across varied spatial and temporal scales (Gibson and Power, 2000). The spatial, temporal and spectral characteristics of the remote sensing data are effectively used in land use change mapping, hence helping in decision making for sustainable land resource management (Berlanga-Robles and Ruiz-Luna 2002). Remote sensing and Geographic Information Science technologies have been taken use of creatively to detect changes in the landscape and make a quantitative assessment of the change. Moreover it has been helpful in the assessment of the resultant environmental impacts. Studies have utilised remote sensed data to examine urban land changes in modern times with conclusions
showing varying degree of different patterns of urban expansion and development in which could be associated with specific environmental factors (Long et al 2008).

The spatio-temporal process of urban development and the social–environmental consequences of such development deserve serious study by urban geographers, planners, and policy makers because of the direct and profound impacts on human beings (Liu Yan, 2009).

1.1.6. New Economic Policies and Land Use Change

The new economic policies seem to have yielded economic efficiency. The overall rate of growth of the economy has increased and there are indications that would further increase in future. The achievements of the new policy measures have been particularly spectacular on the economy in terms of opening up the economy, as a consequence of which the investors have shown considerable interest. Such policies yielding economic liberalisation also include privatization of public undertakings. There has been privatization of services which has reduced the burden of mobilizing resources for promoting resources. Now the state can concentrate more towards developing the areas of social overheads, such as education and health.

With the implementation of these policies and subsequent development in the economy, there has been an alteration of the entire landscape. With the development of the economy there have been changes in the arrangement of occupations, which have become more specialized, thereby creating opportunities for employment, which has attracted people to migrate from the adjoining areas. A clear ordering of the society based on skills and status can be seen. With economic development there has been an increase in the per capita income, which has brought changes in the ways of living the family patterns have undergone alteration. The joint family system has
declined to quite an extent and alternative family patterns have emerged. Also because of an increase in the per capita income there has been an increase in the demand for better housing and other public facilities. As a consequence of this there has been development of public facilities catering to their needs. As per the requirement of the developing economy after the policy implementation the infrastructure has undergone change as well. With increase in retail and wholesale there has been alteration in the business areas. Multistoried buildings have replaced small units and public facilities in such areas have increased. Besides, there has also been suburbanization of activities and residences owing to the increase in population and congestion of the main urban areas. All these have brought a significant change in the rate of change of land use, resulting in the alteration of the entire urban landscape, especially the built up areas.

1.1.7. Land Use Change and the Nagar Palika Act, 1992

Rapid urbanization has been coupled with an increase in the civic amenities. Moreover after the enactment of the 74th constitutional amendment the responsibilities of the Urban Local Bodies (ULBs) has increased manifold. Since, the early 1990s Government of India has undertaken several initiatives aimed at decentralizing urban governance. The 74th Constitutional Amendment Act (Nagar Palika Act), 1992, was one such initiative, which recognized urban local bodies (ULBs) as the third tier of urban government by assigning them specific civic functions. The Nagar Palika Act requires the state governments to amend their municipal laws in order to empower ULBs with such powers and authority as may be necessary to enable them to function as institutions of self governance. These have been entrusted with the responsibility to look after the civic needs of the urban dwellers and the infrastructural
development. As the population and urbanization has increased, there has been a remarkable alteration in the land use with time, in order to cater to the housing and other urban needs of the population. Consequently there has been an increase in the demand for land acquisition. This has necessitated conversion of rural land to urban, which has resulted in a conflict between the locals and the government. Practically the main urban land has already been exhausted with the ever increasing population. Therefore land can be acquired only on the suburban areas. As population increase in an area of city, the boundary of the city expands to accommodate the growth and becoming sprawl. Sprawl can be defined as an unchecked spreading of a city or its suburbs. It is associated with increase in built-up and paved area with impact on loss of agricultural land, open space and ecologically sensitive habitats.

1.1.8. Urban Sprawl and Planning

With the increase in population of an area of city, the boundary of the city expands to accommodate the growth and becoming sprawl. Sprawl can be defined as the increase in built-up and paved area with impact on loss of agricultural land, open space and ecologically sensitive habitats. The main cause of sprawl includes population growth, economy and the pattern and provision of infrastructure (Ghani et. al., 2011). Bruekner (2000) adds rising incomes and falling commuting costs as other reasons for the sprawl. Urban sprawl is related with increase of unappealing land uses and unwanted conditions like traffic congestion, pollution, and concrete jungles. This has resulted in the scarcity of limited land resources. Consequently the population is moving towards the periphery. With the population moving out there is suburban development. Moreover there is suburbanization of jobs too. This suburban development has reduced the motivation for redevelopment of land
closer to the city centers, which results in the decay of the downtown areas (Bruekner, 2000).

Such expansions havelargely encroached into the agricultural land. Although the allocation of land is determined by the competition between the urban and non urban uses, the allocation has mostly been in the favour of urban use, resulting in the growth of the cities. The competition for land between real estate and non urban users largely determine the spatial expanse of the cities. In areas where agriculture land is more productive and is highly valued cities are more spatially compact than regions where agricultural land is unproductive and therefore cheap (Brueckner and Fansler, 1983).

Types of Sprawl

- **Radial sprawl** is the consumptive use of land for urban purposes along the margins of existing metropolitan areas. It is highly affected by provision of public infrastructures such as water, sewer, power and roads.

- **Ribbon Sprawl** is development along the major transportation network that connects urban areas. Lands alongside the network are developed but those without direct access to the network remains rural or undeveloped.

- **Leapfrog Sprawl** is a discontinuous pattern of urbanization in which the developed lands are widely separated from each other. This is the most costly form of development with respect to providing urban services.

  Pullar and Pettit (2002) proposed 3 different urban growth scenarios in their simulation model, to understand land use dynamics for Hervey Bay:
• The ‘business as usual’ scenario provides a good comparison to see what would happen if growth patterns followed the same planning regime. It analyses growth trends and can be applied in a straightforward manner.

• The ‘improved wealth’ scenario defines a preferred land use mix and optimises this to maximise the land values (or rates base for the area). It includes a large number of constraints in developing an optimised solution.

• The ‘sustainable development’ scenario provides a more comprehensive analysis inclusive of the communities aspirations to find a balanced resolve between the environment and the well being of society.

Urban planning is a human centered, cognizant social activity. It is influenced by nature of human society. Research on urban planning and urban space expansion is a leading issue in global urban research. The simulation of urban planning is a kind of effective way to understand how urban space expands (Wei HU et. al., 2009). The aim of urban planning is to foster harmonious development of urban space and improvement of environment. With the expansion of the urban space, the current urban space expansion methods are gradually becoming diversified. (Wei HU et. al., 2009)

The best way of limiting sprawl might not be to stop it totally, but to permit it within certain growth areas (Torrens, 2006). This is one of the elements of smart growth (Batty et al., 1999), for which knowledge of land use and its determinants is quite significant.
1.2. STATEMENT OF THE PROBLEM

The process of urban growth has often been criticized for inefficient use of land and large-scale encroachment on environmentally sensitive area, which is a threat to sustainable development. However, sustainable urban growth, management and development planning need to take account of the dynamic process of temporal urban change. The measurement of urban form can provide a more systematic analysis of the relationships between urban form and process (Yeh and Li, 2001). Therefore, one of the pre-requisite for understanding urban growth is to look into the land use change.

Population of the Ranchi city has been increasing very rapidly due to its position as administrative nucleus, available resources, education and job opportunities, which has caused a remarkable change in the land use. This process has been more rampant after it received the status of a state capital. There has been substantial decrease in agricultural land, water bodies and increase in settlements and road network. Areas are being converted for urban use without any systematic development plan and without a corresponding investment in infrastructure. Poor land management has resulted in urban areas with inadequate services and infrastructure and a corresponding lack of accessibility, that may prove very costly to resolve in future. Moreover the conversion of rural land into urban has resulted in conflicts between the government and the locals. The city on the other hand is an unplanned city and the extension of the urban area has also been haphazard. With the changes in the economic policies and resultant increase in the efficiency and effectiveness in the economy to a large extent has caused a change in the
demographic, social, infrastructural and other realms of the city, which determine the land use of an area. Moreover with an increase in the responsibilities of the Urban Local Bodies, after the Nagar Palika Act, with respect to infrastructural development and civic amenities, the landscape of the city has been significantly altered.

There has been an increase in the area of under residences, commercial and public facilities, education and research facilities in order to cater to the needs of growing urban population, with the increase in the administrative importance of the city, which has also resulted in the emergence of new administrative buildings. With the separation of the administrative cadre, there has been administrative migration from Patna, thereby increasing the population and the facilities required for the increase, which would have not been possible if Ranchi would not have become the capital city. The relaxation of new economic policies and the Nagar Palika Act, has yielded overall economic growth, resulting in an increase in industrial activities and infrastructure development, primarily transport and other civic amenities. On the other hand, the water bodies and open spaces have shrunk in order to accommodate the above facilities.

Therefore, the present research work highlights the causes and effects of land use change, before and after the formation of the Jharkhand State, keeping in view the remarkable changes that have taken place in the history of urbanization of the city, especially after the inception of the new state and the changes in the economic policies, keeping in view the Nagar Palika Act, so that the planning and developmental actions can be taken up accordingly.
1.3. OBJECTIVES

The main objectives of the study are as follows:

i) To study the change in the land use pattern in Ranchi city, after it attained its separate statehood (2000) and Ranchi became the Capital City;

ii) To determine the causes of land use change in the city;

iii) To identify the rate and direction of land use change in the City.

1.4. RESEARCH QUESTIONS

Within the framework of the broad objectives, the following research questions have been addressed during the course of investigation:

i) What are the emerging patterns of land use change in Ranchi city, after the formation of Jharkhand state?

**Justification:** The land use of Ranchi City has been altered to a large extent. There are certain areas which are not suitable for a particular use but being used.

ii) To identify the main drivers of land use changes in the city and the direction of such changes?

**Justification:** There has been a significant increase in the rate of change, in the city after the formation of the state. The factors triggering such change need to be identified and analysed for a better management of the city’s future growth and development.
1.5. JUSTIFICATION OF THE STUDY AREA

Jharkhand is a mineral rich state that has resulted in rapid industrialization and urbanization. And Ranchi has been the capital of this mineral rich state. It has had administrative importance ever since the British period and also it has been an important centre for education with the finest schools and colleges, including engineering and medical colleges, of eastern India. These have been an attraction for the migrants, since long. The city experienced a remarkable urban growth after 1958 with the establishment of Heavy Engineering Corporation and its associated township. The H.E.C. Township was set up with consequent development of infrastructure including roads, markets and other basic amenities. This gave rise to other allied industrial areas along with their respective townships viz. Kokar, Tupudana and Tatisilwai. With this the infrastructure was strengthened further.

Another breakthrough was the year 2000, when it received the status of state capital. Thereafter in order to cater to the needs of the city basic amenities and infrastructure have been strengthened. There has been a remarkable increase in educational facilities and employment opportunities. This resulted in the influx of people from other parts of erstwhile Bihar, Uttar Pradesh, West Bengal and Maharashtra and particularly from the neighboring rural areas. With the increase in its administrative importance it became the hub of headquarters and organizations. There has been incredible increase in residential complexes absorbing the rapidly increasing population in the city. Over the years with the increasing demand of the city, shopping complexes, market areas and recreational areas have come up.

Moreover, the city having hosted the National Games in the year 2011, the land use of the city experienced remarkable change. The infrastructure was
strengthened especially in terms of 4 lane roads and the sport complexes and residences at Khelgaon.

All these have brought a significant change in the landuse and resultant landscape of the city. A large area of agricultural, forest and barren land have been brought under non-agricultural use, leading to the expansion of the urban area. This expansion has gone beyond the planned limit. From the environmental point of view the city has been adversely affected, with the encroachment of river catchment area, deforestation, congestion etc. Keeping in view the potential of the city in terms of existing resources and the growth centres and sectors of development, the city is bound to experience continuous urban growth in the coming years, which shall bring change in the landuse pattern, adversely affecting the ecology of the region. Therefore, the study area has an immense potential for the change detection study to be carried out. Moreover, efforts should be drawn to delineate the sprawl boundary of the city, keeping in mind the carrying capacity of the city, and the planning and developmental actions should be taken up accordingly.

1.6. DATABASE AND METHODOLOGY

The research is based on data collected from both primary and secondary data. Three points of time has been taken into consideration viz. the census years, 1991, 2001 and 2011, that is the period before the state formation and after. These years have been taken because the state was formed in the year 2000, so these would give a picture of the conditions prior to the formation and after that. Also because the effect of the economic policy changes was not very significant in the initial phase of its implementation in 1991 but more remarkable in the later phase, therefore the period 1991-2001 would represent the former and 2001-2011 the latter. Moreover the
Nagar Palika Act came into being in the year 1992 but became influential only in the later phase coinciding with the formation of the state.

At the onset with the aid of secondary data like government documents, non-government documents, books, articles, newspaper magazines, private records and internet sources a theoretical framework for the research has been prepared. After critically reviewing the literature the problem of the research and the research questions have been framed. The records, books and articles, gave an idea of the prevalent conditions. Secondary information regarding the demographic, socio-economic and infrastructure has been taken from Census reports, Jharkhand Development Reports, Reports from Ranchi Municipal Corporation, District Transport Office, RIADA and other government and non-government report, to look into the causative factors for land use change. After having a theoretical framework of the study, primary data comprising of satellite the following has been taken aid of:

<table>
<thead>
<tr>
<th>DATA SOURCE</th>
<th>PATH-ROW/MAP NO</th>
<th>YEAR OF PUBLICATION/ACQUISITION</th>
<th>SPATIAL RESOLUTION (m)/SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI TOPOGRAPHICAL SHEETS</td>
<td>73E/7 NE,NW,SE,SW</td>
<td>1989</td>
<td>1:50,000</td>
</tr>
<tr>
<td>IRS IC LISSIII</td>
<td>1782 and 6906-61</td>
<td>1990</td>
<td>2.3</td>
</tr>
<tr>
<td>LANDSAT TM</td>
<td>140-44</td>
<td>2005</td>
<td>30</td>
</tr>
<tr>
<td>LANDSAT TM</td>
<td>140-44</td>
<td>2015</td>
<td>30</td>
</tr>
</tbody>
</table>
The database and methodology for the different objectives are as follows:

1.6.1. Database and Methodology for Objective 1:

**Database**

**Primary**

a) Satellite Images and Toposheets—Land Use Land Cover Classification maps have been prepared and information about Land Use Land Cover Classes has been extracted.

b) Field Survey—Socio-economic and household characteristics, General Land use characteristics and change in urban units have been found out from the sample survey

**Secondary Data**

Census reports, Jharkhand Development Reports, Reports from Ranchi Municipal Corporation, and other government and non-government report to have an idea of the study area.

**Methodology**

**Sample Selection**

A Stratified Random Sampling Method has been adopted for the selection of sample. A Sample Size of 350 households has been taken. Firstly the Study area has been divided into Urban Units, depending upon the dominant land use activities and the socio-economic characteristic in each ward. A Total of 70 localities covering each
of these units have been selected having varied characteristics, covering 35 wards. In this way 5 households have been selected from each locality.

**Change Detection**

In order to study the change in the land use pattern in the city before and after the state formation, satellite data has been used, which has been further authenticated by ground truthing. Satellite data of different dates (1990, 2005, and 2015) has been collected, to identify the actual changes and determine accuracy. The land use change detection technique has been employed to classify the images during interpretation. With the help of visual interpretation, each image set has been broadly classified into different categories viz.

a) Built-Up Area

b) Agricultural Land

c) Open Spaces

d) Water-Bodies

e) Vegetation

The above categories of land use are prone to changes due to urban growth and with the formation of capital city. Land use Land Cover maps of three points of time under consideration has been prepared using Arc GIS 10. Using visual interpretation each image set has been compared to observe the changes in each land use category in the different time periods. The results have been validated by ground
truthing. The maps prepared from satellite data has been reinforced with the primary data collected from the field and secondary sources. A land use matrix has been prepared based on change detection for 1990 to 2005 and 2005 to 2015.

1.6.2. Database and Methodology for Objective II

To determine the changes for Land Use, causative factors has been categorised as:

a) Formation of the Jharkhand State and Ranchi as the Capital city of the State

b) Changes in Economic Policy (Economic Deregulations) from both the Central and State Governments

c) Impact of 74th Constitutional Amendment Act (Nagar Palika Act, 1992) on the urban governance of Ranchi.

In the light of above the parameters changes have determined on:

i) Demography- Population Growth

ii) Social- Education, Health, New Housing Colonies ;

iii) Economic- Income, Commercial, Land Price; And

iv) Infrastructure and Public Facilities and Industrial Development

Relationship between these parameters and the land use categories has been established. The results have been substantiated with field investigation
1.6.3. Database and Methodology for Objective III:

Database

Primary

Field Survey: Spatial changes in land use classes
Satellite Images: Land Use Classification

Secondary Data

Census of India- Household Density
District Transport Office- Vehicular Growth
Ranchi Municipal Corporation- Road Lengths
Ranchi Industrial Area Development Authority- Industrial Growth, Employment, Land Acquisition
Ranchi Utility Information System- Ward-wise distribution of major activities.

Methodology

In order to get a precise picture of the rate and direction of change in land use, percentage change in each land use has been calculated, with the help of the following equation:

\[
\text{Percentage Change in Area} = \frac{A_0 - A_1 \times 100}{A_0}
\]

Two time periods has been considered viz. 1990-2005 and 2005-2015. Therefore for the first period \( A_0 \) is the area in 1990 and \( A_1 \) is the area for 2005 and for the second \( A_0 \) is the area for 2001 and \( A_1 \) is the area for 2015. The area under each land use category has been calculated from each image set prepared. Similarly the rate of change has been calculated:
Rate of Change in Area= $\frac{A_0 - A_1 \times 100}{A_0}$

In order to have a clear picture of the direction of land use change, as to which land use classes have been undergone changes, a next level land use classification has been done. Thereafter, spatial changes in each land use class have been identified.

At the end, from the facts and analysis an overall picture of the land use change of Ranchi city has been prepared.

1.7. CHAPTER SCHEME

The study has been divided into the following chapters:

**Chapter I: Introduction:** The first chapter gives a broad idea of the design of the research including, introduction, review of literature, statement of the problem, objectives, research questions, an account of the data used and a methodological framework of steps in which the research is carried out, along with the chapter scheme of the study.

**Chapter II: The Study Area:** This chapter gives a detailed geographical account of the study area, Ranchi City, emphasizing the physical and the socio-cultural setting.

**Chapter III: Present Scenario of the City:** This chapter focuses on the existing scenario in the city, including the existing urban infrastructure and the spatial characteristics of the existing Land Use categories.

**Chapter IV: Causes of Land Use Changes in Ranchi City:** This chapter looks into the factors triggering the Land Use Change after formation of the State Capital and the consequences thereafter.
Chapter V: Spatial Analysis of Land Use in Ranchi City: This chapter deals with the identification of the spatial change in each Land Use category and the direction of change which is taking place.

Chapter VI: Conclusion: The chapter summarizes the main findings of the study and generalizes the findings in understanding the causes, processes and consequences of such land use changes on the city population.