PLANNING FOR RURAL INDUSTRIAL DEVELOPMENT OF PATNA REGION

A DISSERTATION

Submitted in partial fulfillment of the requirements for the award of the degree of

MASTER OF URBAN AND RURAL PLANNING

By

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CANDIDATE'S DECLARATION

I hereby declare that the work which has been presented in this dissertation entitled as **'PLANNING FOR RURAL INDUSTRIAL DEVELOPMENT OF PATNA REGION'** in partial fulfillment of the requirement for the award of the postgraduate degree of **MASTER OF URBAN AND RURAL PLANNING**, submitted in the Department of Architecture and planning, Indian Institute of Technology, Roorkee, is an authentic record of my own work carried out by me during the period from August 2010 to June 2011 under the supervision and guidance of Dr. V. Devadas.

The matter embodied in this dissertation has not been submitted by me anywhere else for the award of any other degree elsewhere.

Date: 29-6-2011

Rashmi Kumari

Place: Roorkee

(Rashmi Kumari)

CERTIFICATE

This is to certify that the above statement made by the candidate Rashmi Kumari is correct to the best of my knowledge and belief.

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CERTIFICATE

Certified that this dissertation entitled **'PLANNING FOR RURAL INDUSTRIAL DEVELOPMENT OF PATNA REGION'** which has been submitted by Ms. Rashmi Kumari in partial fulfillment of the requirement for the postgraduate degree of **MASTER OF URBAN AND RURAL PLANNING**, submitted in the Department of Architecture and planning, Indian Institute of Technology, Roorkee, is the student's own work carried out by her under my supervision and guidance. The matter embodied in this dissertation has not been submitted for the award of any other degree elsewhere.

Date:

Place: Roorkee

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ABSTRACT

Patna region, the state capital region of Bihar, characterized by good soil, adequate rainfall, favourable hydrological profile, water resources, and moderate climatic conditions, has high agricultural production potential. Yet, its agricultural productivity and processing is very low, resulting in higher degree of poverty, unemployment, and overall deprivation in the region. In fact, the Patna region or the entire Bihar state represents the heart of the great Indo-Gangetic Plains-one of the most fertile plains of the world. But, enigmatically, this plain continues to be "rich State inhabited by poor people". The untapped production reservoir of the State must, therefore, be harnessed judiciously, not only to liberate the State from its socioeconomic and ecological glooms, but also to trigger the process of strengthening of the "Greatest Living Industry" of the nation. The world experience suggests that agriculture sector has been the pre-cursor of economic growth process. Patna region cannot be an exception. It's time to let prosperity be ushered in the region by bringing another farm revolution and agro-industrial development.

The Patna region with a geographical area of 16.96 thousand square km is divided by river Sone into two unequal parts and lies in South Bihar Alluvial Plains, Agro-Climatic Zone III (based on soil characterization, rainfall, temperature and terrain) of Bihar. River Ganga creates boundary on North side of the region, which flows from West to East.

The percentage of working population employed in agricultural operations in Bihar is estimated to be 85%, which is much higher than the national average. About 42 per cent of GDP of the state (2004-05) has been from accrued agriculture sector (including forestry and fishing). The growth rate of Bihar's GSDP during 2004-09 was 11.03% which made it the second fastest growing state in India, just behind Gujrat (growth rate-11.05%). This growth rate is needed to be maintained or increased for achieving the development goals of the region. Two third of the total land area of Patna region is used for agricultural purpose. High concentration of population, largely dependent on agriculture coupled with low agro-industrial development, is main reason for high poverty ratio in the region. The major crops produced in the region are paddy, wheat, pulses, potato, sugarcane and oil seeds. Fruits like, Mango, Guava, & Lichi, and Vegetables production is good in terms of quantity and quality. Sudha, a dairy cooperative, is a shinning and one of the most successful enterprises of its kind in India. The State with the abundance of water bodies has very high potential for fisheries

and aquaculture, but it has not been fully realized till today. Livestock is also a major resource in this region.

Despite the strength of the agriculture sector, it is a paradox that this sector is much below than potential. Agriculture productivity in Bihar was much better, compared to other states in fifties, which is now much below the national average. In last two years, there has been an appreciable growth, due to improved seeds, technologies and inputs, but the state has to go miles to achieve responsive agriculture and agro based industrial development. This would need infrastructure, technology and other inputs. R&D has a vital role to play. There is need of Agro-industrial development of the region to minimizing the huge wastage of agricultural products and employment generation within the region which will not only ensure the proper utilization of region's resources including human resource but also help in minimizing the pressure on other urban centres outside the region, which have their own acute problems of traffic congestion, in migration, housing shortage, slum formation, water scarcity etc.

Rural industries have major role in Indian economy due to scarcity of capital; unemployment; regional imbalances and disparities; inequalities in the distribution of income and wealth; un-utilization and/or under-utilization of rural resources. This study analyses the potential of rural industrialization and their impact using system approach, based on resource availability in untapped areas of Patna region. This study aims at analyzing the present scenario and forecasting the production and demand in future using survey research techniques and Input-Output model. Based on these analyses, the location and type of rural industries have been identified on the map of the Patna region (SHEET No. 8). This study proposes planning model to ensure sustainable development in the system by imparting rural industrialization in the study area.

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Chapter 1. INTRODUCTION

Rural industrialization is an effective way to achieve a balanced development of the rural and the urban system, and the agricultural and the manufacturing, sectors of a nation's economy. Industrialization is a key element in the promotion of sustainable development by creating productive employment and generating value added income, and hence making a significant contribution to minimizing the poverty. Channel of development in the rural system takes place due to rural industrialization. An increase in the agricultural productivity releases labour for manufacturing employment and thus contributes towards modernization and growth of the manufacturing sector. A higher income raises the demand for manufacturing products. Further, aggregate savings increase and finance industrialization.

Sustained industrial growth has been widely acknowledged as an engine of economic and social development (Figure 1.0.1). The development of the rural industry can help stabilize and make agriculture more lucrative and create employment opportunities in different stages of production and distribution in the rural system.

Rural Industries can be categorized as resource based industries, demand based industries and need based industries. Further rural Industries are also categorized on the basis of investment scale in the following types: (i) Run by rural households with very little capital investment and a high level of manual labour; products include pickles, papad, etc. (ii) Small scale industry characterized by medium investment and semi-automation; products include edible oil, rice mills, etc. (iii) Large scale industry involving large investment and a high level of automation; products include sugar, jute, cotton mills, etc.

The lack of processing and inadequate storage of fruits and vegetables result in huge wastages. Food processing industry can address the key issues of wastages, value addition and attract new investment in the sector. Global experiences indicate that agriculture development in the country can be given a big boost by developing agro and food processing industries in the rural system itself. Agro-industry directly interfaces with both the agriculture and industry and thereby provides a link between the two sectors. This industry, as the name suggests, refers to the subset of manufacturing that processes raw materials and intermediate products derived from the agricultural sector. For instance it transforms products originating from agriculture, Livestock, forestry and fisheries, and processes them into canned food, beverages, fruit juice, meat and dairy products, marine products, textile and clothing, leather, wood and rubber products, animal feed etc.

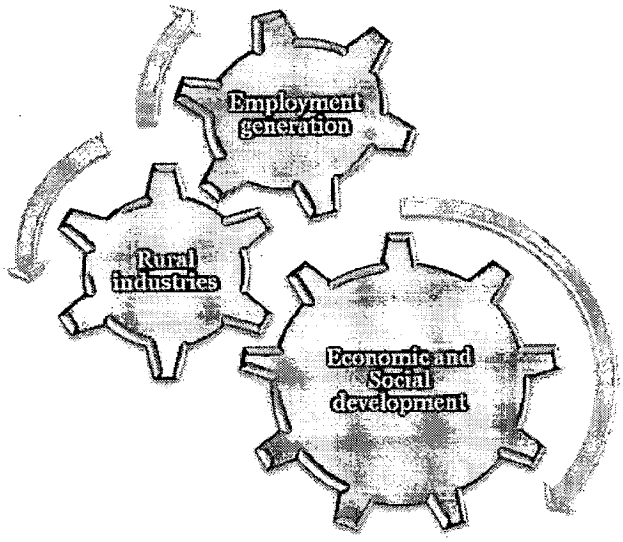


Figure 1.0.1 Dynamic wheel of development

1.1 Need for the study

The Indian economy is poised to achieve a double-digit growth rate. Against this, Bihar state is being talked about as a sleeping giant of Indian agriculture based economy (agro-industries). The development potential of untapped resources in Bihar can be achieved by increasing production by ensuring the growth of food processing industries for revitalization of agriculture sector. The lack of processing and inadequate storage of fruits and vegetables result into huge wastages. Food processing industry can address the key issues of wastages and value addition, and further attract new investment in this sector.

Patna region, the state capital region of Bihar, possessed with a long hiatus in socio-economic history till the independence, and today displays all degree of unevenness in inter-regional and intra-regional urban and economic development. Two third of the total land area of Patna region is used for agricultural operations, and is one of the leading producers of agro-products. Still, the region is struggling with the problems of underdevelopment, unemployment, lack of infrastructure in terms of quality and quantity and absence of plausible government policies. There is a great pressure on other urban centers of the country due to migration of human resources from this region for better employment opportunities as there is negligible industrial development within the region. The available resources in region can be judiciously utilized for production purposes within the region which can not only save transportation cost, preservation cost and time, but also generate employment opportunities and income earning opportunities in the system.

At present, it becomes very much essential to look at the regional imbalance and inequality prevailing since long time in the region and creating a healthy environment for developing the region encompassing the following goals:

1. Industrial development
2. Employment generation
3. Income generation
4. Poverty alleviation
5. Improvement in socio-economic condition of the region

Persisting problems are:

- Persistent poverty and unemployment
- Complex social stratification
- Poor infrastructure
- Regional imbalance

1.2 Aim of the study: Planning for rural Industrial development of Patna region.

1.3 Objectives

- To access the present position of all subsystems of the system (the study area).
- To analyze the present industrial development, and their potential for future development in the system.
- To forecast the demand and supply of resource and infrastructure for industrial development in the system.
- To evolve a set of policy guidelines for sustainable industrial development in the system.

1.4 Scope of the research

- The study aims at to evolve a sustainable development plan for the development of the study area, by considering industrial development in the system.
- It is anticipated that, if the proposed planning model, is implemented successfully in the region, it will ensure sustainable development in the system, definitely.

- The dissertation is area specific and will be applicable to the study area only.
- The location specific resources are utilized for the formulation of policy planning guideline.
- Physical and Land use planning for location with type of industries in the study area dealt with.

1.5 Methodology

Selection of Topic has been done on the basis of problems identified. The study area of Patna region has been selected for the present research. This region is the administrative geographic unit of Bihar. Few homogeneous characteristics, which were taken into consideration, while the delineation. The region is least prone to flood hazard, has same soil type: gangetic alluvial plane, agro climatic conditions are same, comes in same agro-climatic zone (zone-iii). Similar kind of agricultural production, similar language, socio-economic condition and demographic condition persists in the region.

Data have been collected from literatures, case studies, observations and by conducting the primary survey at the grassroots level. Both secondary and primary data has been analyzed to obtain the inferences and do the forecast (Figure 1.5.2).

Pre-testing the Schedule on site after Preparing the Schedule has been done. Revision of Schedule, then identification of area and sample for survey has been identified. After conducting the survey, data vetting and data feeding in the Ms excel sheet has been done for tabulation and generation of diagrams. Statistical techniques have been implemented to analyze the data and get the findings.

Theories like Input-output analysis, population projection techniques; system approach has been applied to get the optimum and feasible results and findings. Based on these findings, the recommendation has been set.

METHODOLOGY

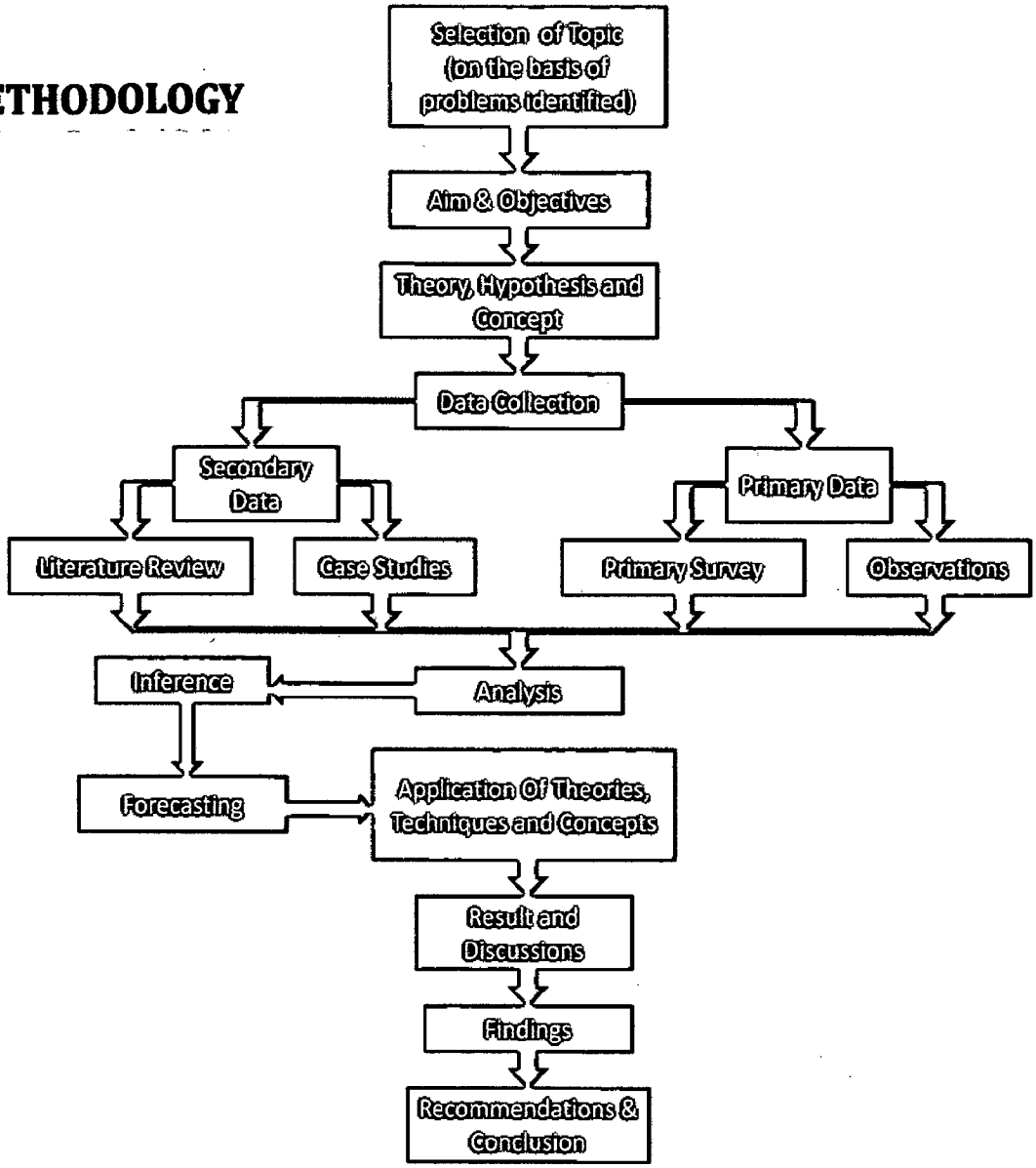


Figure 1.5.1 Methodology

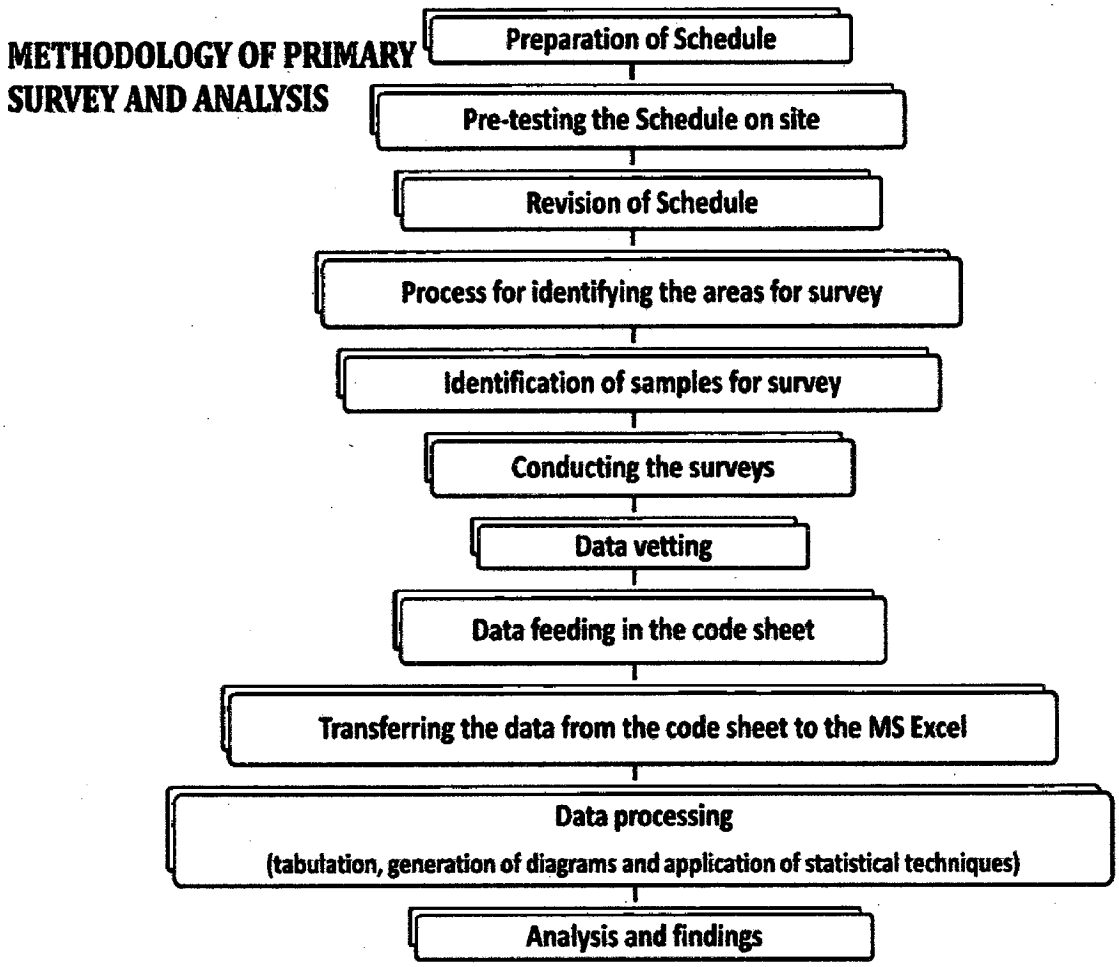


Figure 1.5.2 Methodology of Primary Survey Analysis

1.6 Concept

Rural industries have major role in the Indian economy due to scarcity of physical capital, unemployment, regional imbalances and disparities, inequalities in the distribution of income and wealth, un-utilization or under-utilization of rural resources. This study analyses the potential of rural industrialization and their impact using system approach, based on resource availability in untapped areas of Patna region. This study aims at analyzing the present scenario and forecasting the production and demand in future using survey research techniques and Input Output analysis. Based on these analyses the location and type of rural industries have been identified on the map of the Patna region. This study proposes planning model to ensure sustainable development in the system.

1.7 Research design

To access the present position of all subsystem of the system of study area for acquiring substantial knowledge and understanding the concept of sustainable industrial planning, a set

of objectives have been framed to study the impact of industrial development thoroughly for evolving plausible and fiscal policies guidelines for the balanced development of the study area.

1.7.1 Data

The data required for the research purpose of the study area of Patna region are collected from both Primary sources and Secondary sources.

Primary surveys and opinion polls have been conducted at the grassroots level. For collection of data random sample survey technique has been employed. Secondary sources of data include books, websites, government documents, journals, e-books, etc., can also considered.

1.7.2 Tools & Techniques

Survey schedule, questionnaire, random sample survey technique were used for conducting the primary survey. Data vetting, data feeding, graph generation for analyzing the data has been done by using Ms Excel software; maps digitization was done by using Autocad software and the proposed rural industrial locations were identified by using the same software; report and presentations were made by using Ms word and Ms power point software, respectively.

1.7.3 Administering the survey

To administering the survey some practicalities were needed to be considered and accordingly arrangements were made.

1.7.4 Analysis

Comprehensive analysis has been done in interactive manner to find out the feasibility and employing input-output analysis, the present scenario, problems, inadequacies, forecasting, probable solutions, and forecasting have been done for future development.

1.7.5 Forecasting

Projections have been done in order to arrive at the real situation in future, i.e., optimal and feasible solution for 2031 AD. Forecasting the demand & supply of resources & products respectively and finding the gaps for future have been done for industrial development in the study area.

Population Projection has been done to decide the demand for future. According to the future demand, planning for the rural Industrial location has been done. Following methods have been employed for population projection.

1.7.6 Application of theories/ models/ techniques

To understand the real life situation different theories have been employed and model is generated. For this, all the required techniques were applied. For example, trend analysis, growth pole theory, Input Output analysis, theories of industrial location, etc.

1.7.7 Research and discussion

The result of the secondary and primary data analysis are done thoroughly to arrive at plausible findings. Research has been accomplished and discussions have been made to come across the optimal and feasible solution among all the alternatives for the development of the study area, based on the model generated.

1.7.8 Findings

Findings have been evolved to frame recommendations on the basis of statistics and other analytical work done in this investigation. Potential and impact of rural industrialization in the study area has been determined.

1.7.9 Evolving set of policy guidelines

Plausible policies and guidelines were evolved for the sustainable industrial development in the study area, based on the projected future requirements

1.7.10 Recommendation and conclusion

Proper industrial locations have been identified on the basis of analysis done during the investigation within the study area based on the availability of resources, labour, transportation facilities and projected demand for future. On the basis of results of Input-Output analysis, the area required for agricultural resource production has been demarked for particular amount of industrial output. Areas having surplus of resources (human resource, agricultural resource and bovine resource) have been identified and clubbed for the establishment of industries at optimum location to get maximum profit. These identified areas for the purpose are shown in the maps.

Chapter 2. LITERATURE REVIEW

2.1 Concept of rural industrial development planning

Rural industries plays major role in the Indian economy due to scarcity of capital, unemployment and under employment, regional imbalances and disparities, inequalities in the distribution of income and wealth, un-utilization or under-utilization of rural resources. The government has accorded utmost importance for the growth of these industries through five year plans and industrial policies because of their high employment intensity. Since employment is a means to achieve growth with social justice, a number of programmes and schemes have been designed and implemented for their development since the dawn of the planning era. It will help in the redistribution of income and wealth.

Improving the quality of life for rural people is an enormous and challenging problem. Solutions to this problem are to be found within the rural areas. In essence, it comes down to generating employment, increasing income, harnessing and utilizing the primary and secondary resources that the rural areas are endowed with. Diversification of manpower is required from already saturated agricultural sector to industry and secondary sectors. It has been recognized that in the long run agriculture and other land based activities, even with a high rate of growth, will not be able to provide employment to all the rural workers at adequate levels of income. Over one fifth of the rural workers are engaged in non agricultural activities. This proportion has shown a remarkable increase in recent years. Policies are needed to be evolved to further strengthen this trend. The development of small business especially in rural segments is a viable remedy. Tiny units have been found to constitute that segment of small scale industries that is most prone to sickness or least likely to be viable.

At present, rural small scale and cottage industries comprise of handicrafts and artisan enterprises. The handicraft industry is cottage or small scale industry. It's products are artistic in nature and require individual skills and craftsmanship in the manufacturing process. The handicraft industry is a labour intensive industry, its products are of higher value added ones articles, whereas the village industry produces articles of daily use.

2.2 Agriculture and allied industries

Agriculture and allied sectors are considered to be the mainstay of the Indian economy. They are the important source of raw material and demand for many industrial products, particularly fertilizers, pesticides, agricultural implements and a variety of consumer goods.

They contribute nearly 22 per cent of Gross Domestic Product (GDP) of India. About 65-70 per cent of the population is dependent on agriculture for their livelihood.

'Agriculture and allied' industry is further divided into several segments, namely:- horticulture and its allied sectors (including fruits and vegetables, flowers, plantation crops, spices, aromatic and medicinal plants); fisheries sector; animal husbandry and livestock; and sericulture.

India is the second largest producer of fruits and vegetables in the world. It is also second largest producer of flowers after China. It is also leading producer, consumer and exporter for spices and plantation crops like tea, coffee, etc. While, sericulture is an agro-based cottage industry, India is ranked as the second major raw silk producer in the world.

Fisheries sector occupies a very important place in the socio-economic development of the country. It is a big source of employment opportunities for the large number of people in the country, especially rural population. It has a huge export potential. Similarly, India has vast resource of livestock and poultry, which play a vital role in promoting the welfare of rural masses. The Indian Dairy Industry has acquired substantial growth momentum from 9th Plan onwards. India's milk output during the year 2006-2007 reached the level of 100.9 million tonnes (provisional), which has placed the country on top in the world in this field.

The Ministry of Agriculture is the main authority in India for regulation and development of activities relating to agriculture, horticulture, fishing, animal husbandry, etc. It is implementing various schemes and policies for the sector through its divisions like 'Department of Agriculture and Cooperation' and 'Department of Animal Husbandry, Dairying and Fisheries'. Further, the Ministry of Food Processing Industries is actively engaged in promotion of entrepreneurial activities in the segments of fish processing as well as fruits and vegetables processing. Besides, commodity boards, like tea board, coffee board, rubber board, medicinal plants board, etc. have been set up to boost the growth of the sectors like tea, coffee, rubber, medicinal plants, respectively.

Hence, there exists innumerable business opportunities in the agriculture and allied sectors. Investors from all over the world are making more and more investments into the sector for unleashing its existing potentialities as well as for exploring the untapped areas.

2.3 India's industrial policies

Objectives of the Industrial Policy of the Government are to maintain a sustained growth in productivity, enhance gainful employment, to achieve optimal utilization of human resources, to attain international competitiveness and to transform India into a major partner and player in the global arena.

Policy focus is on deregulating Indian industry, allowing the industry freedom and flexibility in responding to market forces and providing a policy regime that facilitates and fosters growth of Indian industry.

Policy measures

Some of the important policy measures announced and procedural simplifications undertaken to pursue the above objectives are as under:

i) Liberalization of Industrial Licensing Policy

The list of items requiring compulsory licensing is reviewed on an ongoing basis. At present, only six industries are under compulsory licensing mainly on account of environmental, safety and strategic considerations. Similarly, there are only three industries reserved for the public sector. Rural industries do not come under compulsory licensing.

ii) Introduction of Industrial Entrepreneurs' Memorandum (IEM)

Industries not requiring compulsory licensing are to file an Industrial Entrepreneurs Memorandum (IEM) to the Secretariat for Industrial Assistance (SIA). No industrial approval is required for such exempted industries. Amendments are also allowed to IEM proposals filed after 1.7.1998.

iii) Liberalization of the Locational Policy

A significantly amended locational policy in tune with the liberalized licensing policy is in place. No industrial approval is required from the Government for locations not falling within 25 kms of the periphery of cities having a population of more than one million except for those industries where industrial licensing is compulsory. Non-polluting industries such as electronics, computer software and printing can be located within 25 kms of the periphery of cities with more than one million populations. Permission to other industries is granted in

such locations only if they are located in an industrial area so designated prior to 25.7.91. Zoning and land use regulations as well as environmental legislations have to be followed.

iv) Policy for Small Scale Industries

Reservation of items of manufacture exclusively for the small scale sector forms an important focus of the industrial policy as a measure of protecting this sector. Since 24th December 1999, industrial undertakings with an investment upto rupees one crore are within the small scale and ancillary sector. A differential investment limit has been adopted since 9th October 2001 for 41 reserved items where the investment limit upto rupees five crore is prescribed for qualifying as a small scale unit. The investment limit for tiny units is Rs. 25 lakhs.

749 items are reserved for manufacture in the small scale sector. All undertakings other than the small scale industrial undertakings engaged in the manufacture of items reserved for manufacture in the small scale sector are required to obtain an industrial license and undertake an export obligation of 50% of the annual production. This condition of licensing is, however, not applicable to those undertakings operating under 100% Export Oriented Undertakings Scheme, the Export Processing Zone (EPZ) or the Special Economic Zone Schemes (SEZs).

V) Non-Resident Indians Scheme

The general policy and facilities for Foreign Direct Investment as available to foreign investors/company are fully applicable to NRIs as well. In addition, Government has extended some concessions especially for NRIs and overseas corporate bodies having more than 60% stake by the NRIs. This inter-alia includes (i) NRI/OCB investment in the real estate and housing sectors upto 100% and (ii) NRI/OCB investment in domestic airlines sector upto 100%.

NRI/OCBs are also allowed to invest upto 100% equity on non-repatriation basis in all activities except for a small negative list. Apart from this, NRI/OCBs are also allowed to invest on repatriation/non-repatriation under the portfolio investment scheme.

vi) Policy for Foreign Direct Investment (FDI)

Promotion of foreign direct investment forms an integral part of India's economic policies. The role of foreign direct investment in accelerating economic growth is by way of infusion of capital, technology and modern management practices. The Department has put in

place a liberal and transparent foreign investment regime where most activities are opened to foreign investment on automatic route without any limit on the extent of foreign ownership. Some of the recent initiatives taken to further liberalise the FDI regime, inter alia, include opening up of sectors such as Insurance (upto 26%); development of integrated townships (upto 100%); defense industry (upto 26%); tea plantation (upto 100% subject to divestment of 26% within five years to FDI); Encenhancement of FDI limits in private sector banking, allowing FDI up to 100% under the automatic route for most manufacturing activities in SEZs; opening up B2B e-commerce; Internet Service Providers (ISPs) without Gateways; electronic mail and voice mail to 100% foreign investment subject to 26% divestment condition; etc.

The Department has also strengthened investment facilitation measures through Foreign Investment Implementation Authority (FIIA).

vii) Policy initiative taken by state government of Bihar in 2006

New Agricultural Policy was made by the State government in 2006, to build upon the natural advantages that state has in agriculture. Its fertile land, huge water resources and moderate climatic conditions imply tremendous potential to the agricultural sector. Despite this, productivity of crops in Bihar compare poorly with other states. Thus, at the core of the new agricultural policy for Bihar is the focus on increasing productivity of crops, not merely in comparison with the national average but in comparison with the best productivity standards achieved in any state in India. Following major initiatives have been taken by the State government in year 2005 (**Source:** NSSO 50th and 55th Rounds):

1) Food security; Increase in farmer's income; Increase in crop productivity; and Environmental conservation has been fixed as the four targets of new agricultural policy regime.
2) ATMAs (Agricultural Technology Management Agency) have been constituted in 23 districts of the State which did not have its ATMA coverage under the centrally sponsored programme. Thus all the districts of the State now have ATMA coverage.
3) A megaproject for establishment of soil testing laboratories in all 534 blocks of the State has been sanctioned, to take soil testing facilities right to the door of the farmers.
4) 31 new seed testing laboratories are to be established in the State to give each district its own seed testing laboratory.

5) Chief Minister Horticulture Mission has been started in 19 districts of the State which were not covered under National Horticulture Mission, thereby universalizing the programme in the State.
6) Micro-nutrient testing laboratories have been established in 3 districts of the State.
7) Research and Educational infrastructure of Rajendra Agricultural University, which happens to be the only agricultural university of the State, has been strengthened.
8) Agricultural Produce Marketing Board has been abolished
9) Bihar State Seed Corporation has been revived, and seed production has been started on 45 state agricultural farms which were lying inoperative.
10) Agricultural Produce Marketing Board has been abolished.
11) Farmers' Commission has been established.
12) Land Reform Commission has been established

2.4 Related theories/ models

2.4.1 System Approach

Region is considered as a system and it has different subsystems, which are physical, social, economic, ecology, environment, infrastructure and institution (Figure 2.4.1). All these subsystems of the system are inter-connected and interdependent to each other. System approach (Forrester. J.W., 196,1969; Chadwick,G., 1971; Batty, M,1974; Mohapatra,1994; Ogata Katsuhiko,2004) establishes the strong relationship between different subsystem in a given system, and all the subsystems function as an integral whole in a system. All the subsystems of the system are interlinked and interdependent on one another and function as a whole with dynamic characteristics. If one of the subsystems of this system is defunct or partly function or make advance functions, it's effect can be seen in the entire system. For example, If he social subsystem takes lead role (population growth occurs exorbitantly) it's effect can be seen in entire system.

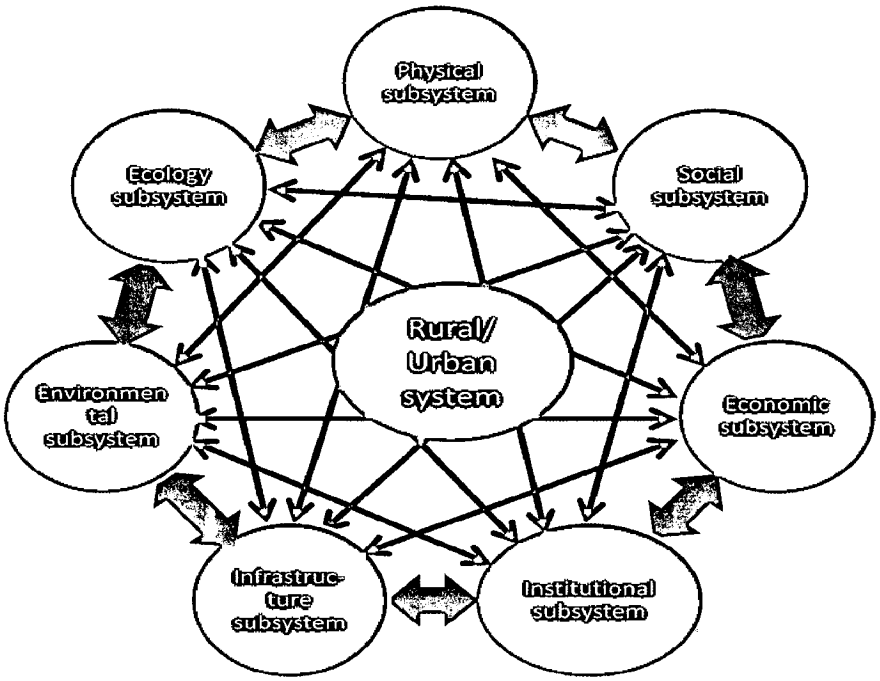


Figure 2.4.1 Rural / Urban System

2.4.2 Growth pole theory

The core idea of the growth poles theory is that economic development, or growth, is not uniform over an entire region, but instead takes place around a specific pole. This pole is often characterized by a key industry around which linked industries develop, mainly through direct and indirect effects. The expansion of this key industry implies the expansion of output, employment, related investments, as well as new technologies and new industrial sectors. Because of scale and agglomeration economies near the growth pole, regional development is unbalanced. Transportation, especially transport terminals, can play a significant role in such a process. The more dependant or related an activity is to transportation, the more likely and strong this relationship. At a later stage,

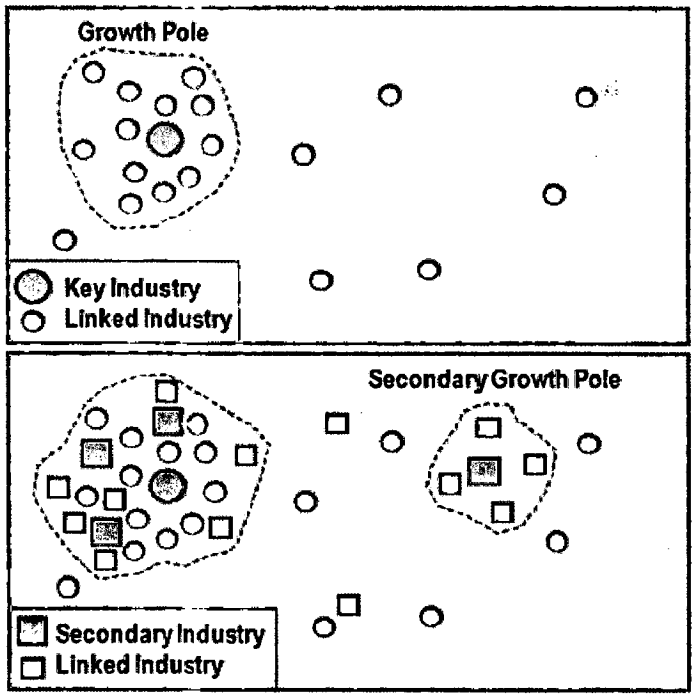


Figure 2.4.2 Growth Pole

the emergence of a secondary growth pole is possible, mainly if a secondary industrial sector emerges with its own linked industries (Figure 2.4.2).

This concept was first introduced by François Perroux in 1950, was further sharpened in following publications, and finally evolved into an idea that came to take on a meaning rather different from the one posited by Perroux. While he had conceived a growth pole to be a focus of economic development in an abstract economic space, it was interpreted by his disciples, particularly Jacques Boudeville, to be a focus of development in geographic space.

The close relationships between scale of operations, dominance, and impulses to innovate become the most important features of Perroux's theory and lead to the concept of dynamic propulsive firm and leading propulsive industry. The characteristics of a leading propulsive industry are, (i) highly advanced level of technology and managerial expertise, (ii) high income elasticity of demand for its products, (iii) marked local multiplier effect, (iv) strong inter industry linkage with other sectors, etc.

There are two cornerstones on which Perroux based his theory:

Schumpeterian theory of development, and Theory of inter industry linkages and industrial interdependence.

According to him, "growth *does not appear everywhere and all at once; it appears in points or development poles, with variable intensities; it spreads along diverse channels and with varying terminal effects to the whole of the economy*".

The growth poles of a region are basically of the following three types:

1) Economies internal to the firm: These are the lower average costs of production resulting from an increased rate of output. These are the economies which any single firm can enjoy by its own organization and effort.
2) Economies external to the firm but internal to the industry: these are associated with localization of industry. On account of close location proximity of linked firms, as industry expands at a particular location, cost per unit output of a firm declines.
3) Economies external to the industry but internal to the urban area: These can be termed as urbanization economies. They include development of urban labour markets, access to a larger market, and provision of a wider range of services.

2.4.3 Central place theory

Central place theory is a geographical theory that seeks to explain the number, size and location of human settlements in an urban system. The theory was created by the German geographer Walter Christaller, who asserted that settlements simply functioned as 'central places' providing services to surrounding areas.

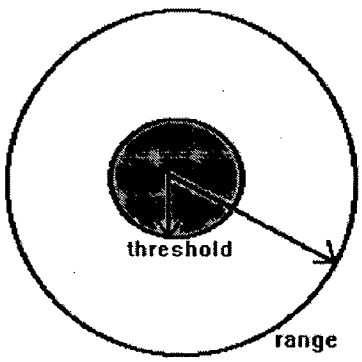
To develop the theory, Christaller made the following simplifying assumptions:

a) an isotropic (all flat), homogeneous, unbounded limitless surface (abstract space)
b) an evenly distributed population
c) evenly distributed resources
d) all consumers have a similar purchasing power and demand for goods and services
e) Consumers visit the nearest central places that provide the function which they demand. They minimize the distance to be travelled
f) no provider of goods or services is able to earn excess profit(each supplier has a monopoly over a hinterland)
g) Therefore the trade areas of these central places that provide a particular good or service must all be of equal size
h) there is only one type of transport and this would be equally easy in all directions
i) transport cost is proportional to distance traveled in example, the longer the distance traveled, the higher the transport cost

The theory then relied on two concepts: *threshold* and *range*.

Threshold is the minimum market (population or income) needed to bring about the selling of a particular good or service.

Range is the maximum distance consumers are prepared to travel to acquire goods - at some point the cost or inconvenience will outweigh the need for the good.



From these two concepts the lower and upper limits of goods or services can be found. With the upper and the lower limits, it is possible to see how the central places are arranged in an imaginary area.

Arrangement of the Central places/ settlements:

As transport is equally easy in all direction, each central place will have a circular market area as shown in C in the following diagram:

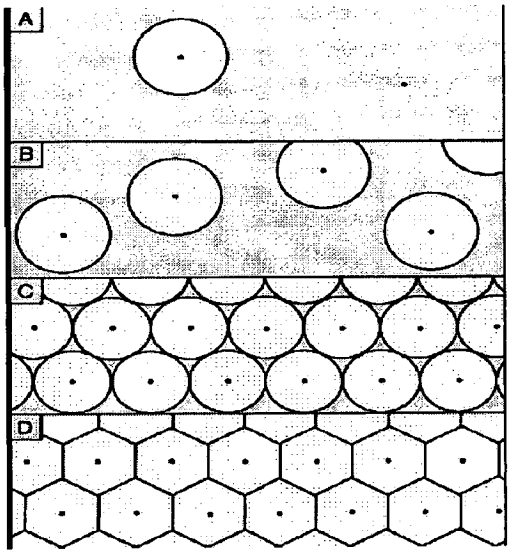


Figure 2.4.3 Arrangement of the central places/ settlements

However, circular shape of the market areas results in either un-served areas or over-served areas. To solve this problem, Christaller suggested the hexagonal shape of the markets as shown in D in the above diagram. Within a given area there will be fewer high order cities and towns in relation to the lower order villages and hamlets. For any given order, theoretically the settlements will be equidistance from each other. The higher order settlements will be further apart than the lower order ones.

Central Place, low order, high order, sphere of influence

- A Central Place is a settlement which provides one or more services for the population living around it.
- Simple basic services (e.g. grocery stores) are said to be of low order while specialized services (e.g. universities) are said to be of high order.

- Having a high order service implies there are low order services around it, but not vice versa.
- Settlements which provide low order services are said to be low order settlements. Settlements that provide high order services are said to be high order settlements.
- The sphere of influence is the area under influence of the Central Place.
- The result of these consumer preferences is that a system of centers of various sizes will emerge. Each center will supply particular types of goods forming levels of hierarchy. In the functional hierarchies, generalizations can be made regarding the spacing, size and function of settlements.
- The larger the settlements are in size, the fewer in number they will be, i.e. there are many small villages, but few large cities.
- The larger the settlements grow in size, the greater the distance between them, i.e. villages are usually found close together, while cities are spaced much further apart.
- As a settlement increases in size, the range and number of its functions will increase .
- As a settlement increases in size, the number of higher-order services will also increase, i.e. a greater degree of specialization occurs in the services.
- The higher the order of the goods and services (more durable, valuable and variable), the larger the range of the goods and services, the longer the distance people is willing to travel to acquire them.
- Examples for low order goods and services are: newspaper stalls, groceries, bakeries and post offices. They are supported by a smaller threshold population and demand. Examples for high order goods and services are: jewellery, large shopping arcades and malls. They are supported by a much larger threshold population and demand.

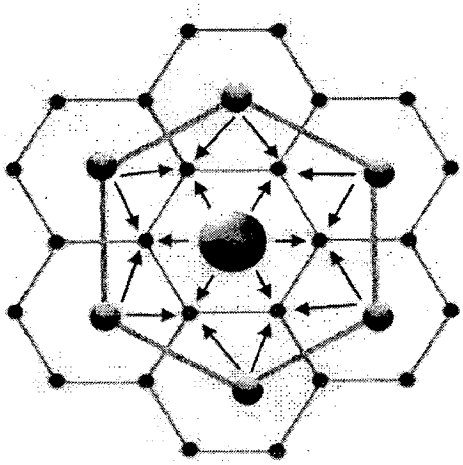
'edictions of the theory

From this he deduced that settlements would tend to form in a triangular/hexagonal attice, this being the most efficient pattern to serve areas without any overlap.

In the orderly arrangement of an urban hierarchy, seven different principal orders of settlement have been identified by Christaller, providing different groups of goods and services. Settlement is regularly spaced - equidistant spacing between same order centers, with larger centers farther apart than smaller centers. Settlements have hexagonal market areas, and are most efficient in number and functions.

The different layouts predicted by Christaller have *K*-values which show how much the Sphere of Influence of the central places takes in — the central place itself counts as 1 and each portion of a satellite counts as its portion:

$K = 3$ Marketing principle

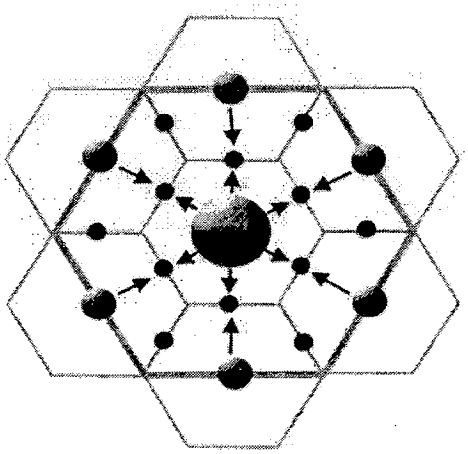


$K = 3$ Principle

According to the marketing principle $K = 3$, the market area of a higher-order place includes a third of the market area of each of the following size neighbouring lower-order places and each is located at the corner of a hexagon around the high-order settlement. Each high-order settlement gets 1/3 of each satellite settlement, thus $K = 1 + 6 \times 1/3 = 3$.

However, although in this $K = 3$ marketing network the distance traveled is minimized, the transport network is not the most efficient, because the important transport links between the larger places do not pass through intermediate places.

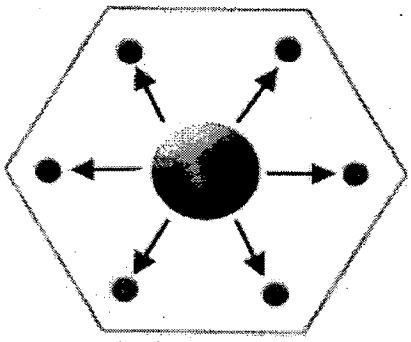
$K = 4$ Transport principle



$K = 4$ Principle

According to $K = 4$ transport principle, the market area of a higher-order place includes a half of the market area of each of the six neighboring lower-order places, as they are located on the edges of hexagons around the high-order settlements. This generates a hierarchy of central places which results in the most efficient transport network. There are maximum central places possible located on the main transport routes connecting the higher order center.

$K = 7$ Administrative principle



$K = 7$ Principle

According to $K = 7$ administrative principle (or political-social principle), settlements are nested according to sevens. The market areas of the smaller settlements are completely enclosed within the market area of the larger settlement. Since tributary areas cannot be split administratively, they must be allocated exclusively to a single higher-order place. Efficient administration is the control principle in this hierarchy.

Evaluation

The validity of the central place theory may vary with local factors, such as climate, topography, history of development, technological improvement and personal preference of consumers and suppliers.

Economic status of consumers in an area is also important. Consumers of higher economic status tend to be more mobile and therefore bypass centers providing only lower order goods. The application of central place theory must be tempered by an awareness of such factors when planning shopping center space location.

Purchasing power and density affect the spacing of centers and hierarchical arrangements. Sufficient densities will allow, for example, a grocery store, a lower order function, to survive in an isolated location.

Factors shaping the extent of market areas:

- Land use: industrial areas can provide little in the way of a consuming population
- Poor accessibility: this can limit the extent of a center's market area
- Competition: this limits the extent of market areas in all directions
- Technology: high mobility afforded by the automobile allows overlapping of market areas

Market area studies provide another technique for using central place theory as a retail location planning tool. The hierarchy of shopping centers has been widely used in the planning of "new towns". In this new town, the hierarchy of business centers is evident. One main shopping center provides mostly durable goods (higher order); district and local shopping centers supply, increasingly, convenience (lower order) goods. These centers provided for in the new town plan are not free from outside competition. The impacts of surrounding existing centers on the new town centers cannot be ignored.

Demerits

The Central Place Theory has been criticized for being static; it does not incorporate the temporal aspect in the development of central places. Furthermore, the theory holds up well when it comes to agricultural areas, but not industrial or postindustrial areas due to their diversified nature of various services or their varied distribution of natural resources.

2.4.4 Theory of Location

Alfred Weber (1868-1958) formulated a theory of industrial location in which an industry is located where it can minimize its costs, and therefore maximize its profits. Weber's least cost theory accounted for the location of a manufacturing plant in terms of the owner's desire to minimize three categories of cost:

1) Transportation: the site chosen must entail the lowest possible cost of A) moving raw materials to the factory, and B) finished products to the market. This, according to Weber, is the most important.	**2) Labor:** higher labor costs reduce profits, so a factory might do better farther from raw materials and markets if cheap labor is available (e.g. China – today).	**3) Agglomeration:** when a large number of enterprises cluster (agglomerate) in the same area (e.g. city), they can provide assistance to each other through shared talents, services, and facilities (e.g. manufacturing plants need office furniture).

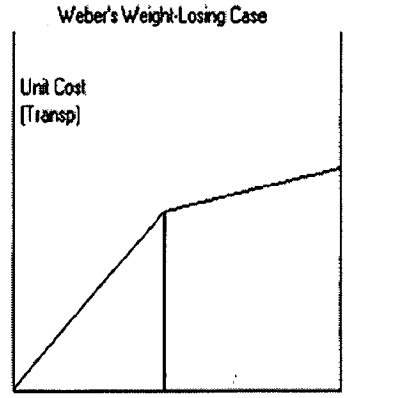


FIGURE 1

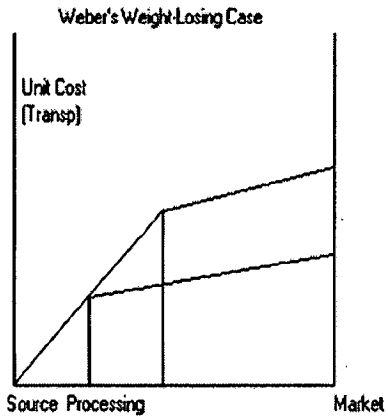


FIGURE 2

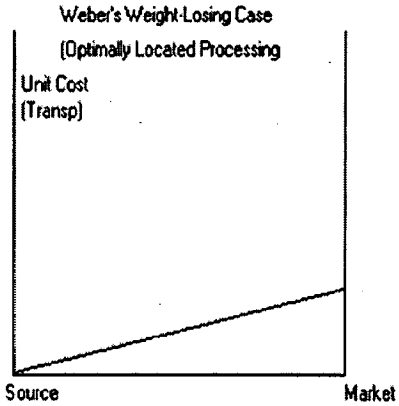


FIGURE 3

Figures 1-3 show the weight-losing case, in which the weight of the final product is less than the weight of the raw material going into making the product. In Figure 1, the processing plant is located somewhere between the source and the market. The increase in transport cost to the left of the processing plant is the cost of transporting the raw material from its source. The rise in the transportation cost to the right of the processing plant is the cost of transporting the final product. Note the line on the left of the processing plant has a steeper slope than the one on the right.

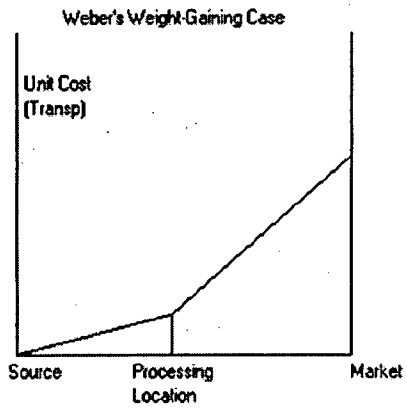


FIGURE 4

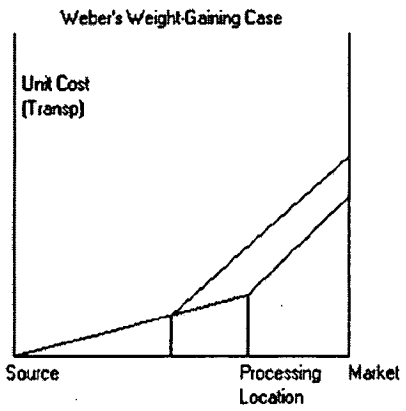


FIGURE 5

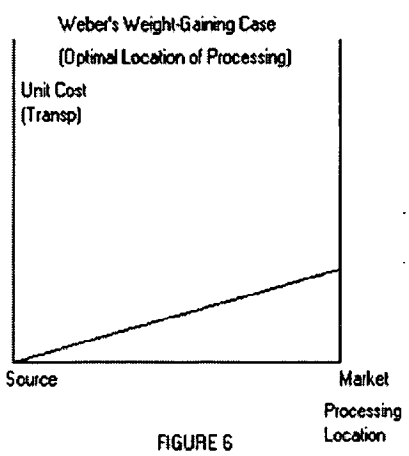


FIGURE 6

The weight gaining case is illustrated in Figures 4- 6, where the final product is heavier than the raw materials that require transport. Usually this is a case of some ubiquitous (available everywhere) raw material such as water being incorporated into the product. The optimal location of the processing plant in this case is at the market. Weber established that firms producing goods less bulky than the raw materials used in their production would settle near to the raw-material source. Firms producing heavier goods would settle near their market. The firm minimizes the weight it has to transport and, thus, its transport costs.

August Losch criticizes the main protagonist of this approach, weber for omitting the demand considerations. Losch assumed an isotropic plane, that is homogeneous land surface with an evenly distributed population of self-sufficient farm households each having the same tastes and similar technical capabilities; in short, a surface from which all irregularities and non-economic factors have been abstracted.

2.4.5 Export base model

The export-base model, initially developed by Douglas C. North, emphasizes the role of exogenous factors in regional growth. It continues to be one of the most widely used in regional economic analysis. It points to the fact that regions are not 'closed areas' but are 'open' to the flows or trade. Therefore, the growth of a region depends upon the growth of the regional export base, which, in turn, depends upon expansion in demand external to the region.

As originally formulated, the economic base model focused on regional export growth. According to this theory total economic activity, *ET* is assumed to be dichotomous, with a

distinction being made between basic economic activity, *EB* (activities devoted to the production of goods and services ultimately sold to consumers outside the region), and nonbasic economic activity, *ENB*, which includes activities involved in producing goods and services consumed locally:

$$ET = EB + ENB \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This division of regional economic activity into these two distinct sectors is the central concept of the model.2 A serious empirical concern is immediately raised by this approach, however, because appropriate export data are available at any sub national level only at high cost and with long lags. Various alternative measures have been proposed and analyzed in the literature over the years, but none has been found entirely adequate. Data problems, therefore, have always complicated economic base research.

While the central concept of the economic base model is the duality of regional economic activity, its fundamental behavioral assumption is that non basic economic activity depends on basic economic activity. In this perspective, external demand for a region's exportable goods and services injects income into the regional economy, in turn augmenting local demand for non exportable goods and services. The model assumes that the income injected into the regional economy and the accompanying potential for developing locally oriented, non basic industries are in proportion to the size of a region's export base. Static and demand-oriented, the model ignores factors that affect the supply of a region's output and other changes, such as the introduction of new products, which affect demands.

$$ENB = f(EB) = \alpha + \beta * EB \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Equations (1) and (2) can then be combined into the reduced-form expression in equation (3), which indicates that total economic activity is primarily a function of basic activity:

$$ET = \alpha + (1 + \beta) * EB \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The expression $(1 + \beta)$ is commonly referred to as the economic base multiplier, and the parameter, β, is called the economic base ratio.

When applied to analyzing regional growth, the economic base model suggests that the growth process will be led by industries that export goods and services beyond regional boundaries. It even offers a prediction, captured in the multiplier, of the total regional impact

likely to result from a change in basic economic activity generated outside the region. Understanding the future path of a regional economy, the model implies, requires simply concentrating on the prospects for the base industries. These few important industries are often dubbed "engines of regional growth."

This simple model captures the essence of economic base theory. Although the model has been enhanced over the years to include additional variables as well as to capture more explicitly the dynamic nature of the regional growth process, most changes have been made within the scope of this simple demand-oriented specification. In general, economic base models have not evolved to acknowledge the potential impact of many important variables that may affect regional growth—interregional capital flows; labor migration patterns; changes in products, tastes, and production processes; demographic shifts; and changes in state and local tax laws, to name a few. Because these issues are generally too important to ignore, many regional scientists have concluded that economic base theory lacks the complexity to provide a useful framework for analyzing many regional economic issues and policies.

2.4.6 Harrod-Domar model

The Harrod-Domar model (Harrod, 1939, and Domar, 1946.) is one of the elementary models, which consider growth as an internal process and is popular in regional economic analysis.

Harrod's mode has two basic assumptions:

(i) The saving of a community in period t is a constant proportion(s) of the income received during that period:

$S_t=sY_t$ ..... *(1) and*

(ii) The desired investment during period t is a constant proportion (g) of the amount by which the income during period t exceeds that of the previous period (t-1):

$I_t=g(Y_tY_{t-1})$ ..... *(2)*

National Income (Y_t) in period t is taken as the summation of consumption (C_t) and investment (I_t) in that period:

$Y_t=C_t+I_t$ ..... *(3)*

Harrod-Domar Model in regional context

Since regions are open economies it becomes it becomes necessary to introduce imports and exports. Then,

S+M=I+X.....(4)

Where M refers to imports and X to exports.

If m is the constant propensity to import, we have

(s+m) Y=I+X

or,

$$\frac{I}{Y} = s + m - \frac{X}{Y}$$

Region i's exports (X_i) can be expressed in terms of the imports of other regions as

$X_i = M_{i1} + M_{i2} + \ldots\ldots\ldots + M_{in} = \sum_{i=1}^{n} mij\ Yj$

Where n is the total number of regions.

Thus the growth equation for region I can be written as

$Vi = \frac{1}{gi}(si + mi - \sum_{j=1} mij.Yi/Yj)$.....(5)

There are two considerations that must be kept in view:

(i) Even if saving exceed investment, there can still be equilibrium between saving and investment if there is an export surplus equal to the gap; and

(ii) The requirement with regard to labour is that excess labour should be eliminated by outmigration and if there is a deficiency in labour supply, it should be met by in-migration from other regions.

The two other observations that can be made on the basis of equation (5) are:

(i) Regions with high propensity to save and/or a lower capital-output ratio will grow at a faster rate than other regions. This is so because a higher S_i will increase the numerator in the equation and a lower g will cause a higher S_i will increase the numerator in the equation and a lower g will decrease the denominator. Both of them will have the effect of increasing V_i.

(ii) Regions with net import surpluses, i.e., those regions where,

$$mi = \frac{1}{Yi} \sum_{j=1} mij.Yj > 0$$

Can grow faster than other regions.

2.4.7 Input-output analysis

In economics, an **input-output model** uses a matrix representation of a region's economy to predict the effect of changes in one industry on others and by consumers, government, and foreign suppliers on the economy. Wassily Leontief (1905-1999) is credited with the development of this method of determining interdependence among the various sectors of the economy. The word 'inter-dependence' or 'interaction' is used to convey the idea that each industry employs the output of other industries as inputs while its output is used by other industries as input.

Consider the production of the ith sector. We may isolate (1) the quantity of that production that goes to final demand,c_i, (2) to total output, x_i, and (3) flows x_{ij} from that industry to other industries.

Table 2.4.1: Transaction in three sector economy

Economic Activities	Inputs to Agriculture	Inputs to Manufacturing	Inputs to Transport	Final Demand	Total Output
Agriculture	5	15	2	68	90
Manufacturing	10	20	10	40	80
Transportation	10	15	5	0	30
Labor	25	30	5	0	60

or,

$$x_{11} + x_{12} + x_{13} + c_1 = x_1$$
$$x_{21} + x_{22} + x_{23} + c_2 = x_2$$
$$x_{31} + x_{32} + x_{33} + c_3 = x_3$$
$$x_{41} + x_{42} + x_{43} + c_4 = x_4$$

Note that in the example given we have no input flows from the industries to 'Labor'.

We know very little about production functions because all we have are numbers representing transactions in a particular instance (single points on the production functions):

$$x_1 = f(x_{11}, x_{12}, x_{13}, x_{14})$$
$$x_2 = g(x_{21}, x_{22}, x_{23}, x_{24})$$
$$\vdots = \quad \vdots$$

The neoclassical production function is an explicit function

$Q = f(K,L)$,

where, Q = Quantity, K = Capital, L = Labor,

and the partial derivatives ($\partial Q/\partial K = f_K > 0; \partial Q/\partial L = f_L > 0$ are the demand schedules for input factors.

Leontief, the innovator of input-output analysis, uses a special production function which depends *linearly* on the total output variables x_i. Using Leontief coefficients a_{ij}, we may manipulate our transactions information into what is known as an input-output table:

$$\begin{aligned} x_{11} &= a_{11}x_1 \\ x_{12} &= a_{12}x_2 \\ x_{13} &= a_{13}x_3 \\ x_{14} &= a_{14}x_4 \\ \vdots &= \quad \vdots \end{aligned}$$

or

$$x_{ij} = a_{ij}x_j$$

Now

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + a_{14}x_4 + c_1 &= x_1 \\ \vdots &= \vdots \\ a_{41}x_1 + a_{42}x_2 + a_{43}x_3 + a_{44}x_4 + c_4 &= x_4 \end{aligned}$$

gives

$$\begin{aligned} x_1 - a_{11}x_1 - a_{12}x_2 - a_{13}x_3 - a_{14}x_4 &= c_1 \\ \vdots &= \vdots \\ x_4 - a_{41}x_1 - a_{42}x_2 - a_{43}x_3 - a_{44}x_4 &= c_4 \end{aligned}$$

Rewriting finally yields

$$\begin{aligned} (1 - a_{11})x_1 - a_{12}x_2 - a_{13}x_3 - a_{14}x_4 &= c_1 \\ \vdots &= \vdots \\ -a_{41}x_1 - a_{42}x_2 - a_{43}x_3 + (1 - a_{44})x_4 &= c_4 \end{aligned}$$

Introducing matrix notation, we can see how a solution may be obtained. Let

$$x = \begin{pmatrix} x_1 \\ \vdots \\ x_4 \end{pmatrix}; \qquad c = \begin{pmatrix} c_1 \\ \vdots \\ c_4 \end{pmatrix};$$

$$I = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}; \qquad A = \begin{pmatrix} a_{11} & \cdots & a_{14} \\ \vdots & \ddots & \vdots \\ a_{41} & \cdots & a_{44} \end{pmatrix};$$

denote the total output vector, the final demand vector, the unit matrix and the input-output matrix, respectively. Then:

$$\begin{aligned} Ax + c &= x \\ (I - A)x &= c \\ x &= (I - A)^{-1}c \end{aligned}$$

provided $(I - A)$ is invertible.

There are many interesting aspects of the Leontief system, and there is an extensive literature. There is the Hawkins-Simon Condition on producibility. There has been interest in disaggregation to clustered inter-industry flows, and the study of constellations of industries. A great deal of empirical work has been done to identify coefficients, and data have been published for the national economy as well as for regions. This has been a healthy, exciting area for work by economists because the Leontief system can be extended to a model of general equilibrium; it offers a method of decomposing work done at a macro level.

Transportation is implicit in the notion of inter-industry flows. It is explicitly recognized when transportation is identified as an industry – how much is purchased from transportation in order to produce. But this is not very satisfactory because transportation requirements differ, depending on industry locations and capacity constraints on regional production. Also, the receiver of goods generally pays freight cost, and often transportation data are lost because transportation costs are treated as part of the cost of the goods.

Walter Isard and his student, Leon Moses, were quick to see the spatial economy and transportation implications of input-output, and began work in this area in the 1950s developing a concept of interregional input-output. Take a one region versus the world case. We wish to know something about interregional commodity flows, so introduce a column into the table headed "exports" and we introduce an "import" row.

Table 2.4.2: Adding Export And Import Transactions								
Economic Activities	1	2	...	...	Z	Exports	Final Demand	Total Outputs
1								
2								
...								
...								
Z								
Imports								

A more satisfactory way to proceed would be to tie regions together at the industry level. That is, we could identify both intra-region inter-industry transactions and inter-region inter-industry transactions. The problem here is that the table grows quickly.

Input-output is conceptually simple. Its extension to a model of equilibrium in the national economy is also relatively simple and attractive but requires great skill and high-quality data. One who wishes to do work with input-output systems must deal skillfully with industry classification, data estimation, and inverting very large, ill-conditioned matrices. Moreover, changes in relative prices are not readily handled by this modeling approach alone. Of course, input-output accounts are part and parcel to a more flexible form of modeling, Computable general equilibrium models.

Two additional difficulties are of interest in transportation work. There is the question of substituting one input for another, and there is the question about the stability of coefficients as production increases or decreases. These are intertwined questions. They have to do with the nature of regional production functions.

2.4.8 Cost-benefit analysis

Cost-benefit analysis is a term that refers both to:

- Helping to appraise, or assess, the case for a project, programme or policy proposal;
- An approach to making economic decisions of any kind.

Under both definitions the process involves, whether explicitly or implicitly, weighing the total expected costs against the total expected benefits of one or more actions in order to choose the best or most profitable option. The formal process is often referred to as either CBA (Cost-Benefit Analysis) or BCA (Benefit-Cost Analysis).

Benefits and costs are often expressed in money terms, and are adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different points in time) are expressed on a common basis in terms of their "present value." Closely related, but slightly different, formal techniques include cost-effectiveness analysis, economic impact analysis, fiscal impact analysis and Social Return on Investment (SROI) analysis. The latter builds upon the logic of cost-benefit analysis, but differs in that it is explicitly designed to inform the practical decision-making of enterprise managers and investors focused on optimizing their social and environmental impacts.

2.4.9 Sector theory

The **sector model**, also known as the **Hoyt model**, is a model of urban land use proposed in 1939 by economist Homer Hoyt. It is a modification of the concentric zone model of city development. The benefits of the application of this model include the fact it allows for an outward progression of growth. As with all simple models of complex phenomena its validity is limited.

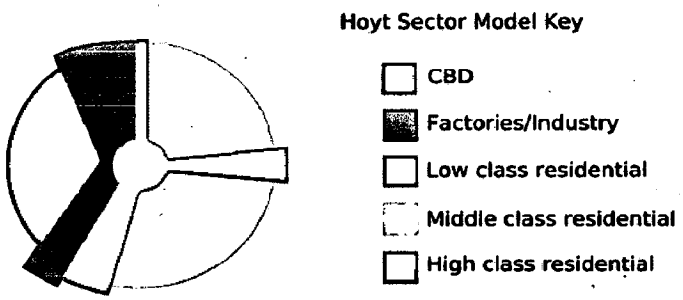


Figure 2.4.4 Sector theory

While accepting the existence of a central business district, Hoyt suggested that zones expand outward from the city center along railroads, highways, and other transportation arteries. Using Chicago as an example, an upper class residential sector evolved outward along the desirable Lake Michigan shoreline north of the central business district, while industry extended southward in sectors that followed railroad lines.

In developing this model Hoyt observed that it was common for low-income households to be near railroad lines, and commercial establishments to be along business thoroughfares. Recognizing that the various transportation routes into an urban area, including railroads, sea ports, and tram lines, represented greater access, Hoyt theorized that cities tended to grow in

wedge-shaped patterns or sectors emanating from the central business district and centered on major transportation routes. Higher levels of access meant higher land values, thus, many commercial functions would remain in the CBD but manufacturing functions would develop in a wedge surrounding transportation routes. Residential functions would grow in wedge-shaped patterns with a sector of low-income housing bordering manufacturing/industrial sectors (traffic, noise, and pollution makes these areas the least desirable) while sectors of middle- and high-income households were located furthest away from these functions. Hoyt's model attempts to state a broad principle of urban organization.

Limitations

The theory is based on early twentieth century transport and does not make allowances for private cars that enable commuting from cheaper land outside city boundaries.[3] This occurred in Calgary in the 1930s when many near-slums were established outside the city but close to the termini of the street car lines. These are now incorporated into the city boundary but are pockets of low cost housing in medium cost areas.[2]

- Physical features - physical features may restrict or direct growth along certain wedges
- The growth of a sector can be limited by leapfrog land use

2.4.10 Regression model

In a typical regression analysis the given data relates to the present day values of dependent variable, and independent variable (X_1, X_2, X_3,.... ,X_n) for all the households of the study area. The regression coefficients are estimated using least square technique. Variables are selected as indicators of urbanization level. For all these variables a correlation matrix is made with the Pearson's formula:- PEARSON (F1:F743, R1:R743)

From this matrix, the values that are above 0.85 are selected. Some variables are directly related and some are indirectly related to each other, we take only one variable from those two indicator. From the raw data chart, mximum and minimum values are calculated. Now, for these selected variables, index number is calculated. Index number=(F1-Min)/(Max.-Min.).

Chapter 3. CASE STUDIES

3.1 Case Study 1: Rural Industrial development in Punjab.

3.1.1 Objective of study

The objectives of this case study are as follows:

- To study the rural industrial development in the Punjab state.
- Identification of the factors affecting industrial growth of the region.
- To analyse the prospects and consequences of rural industrial development of the region.
- To analyse the policies implemented for the rural industrial development of the region.
- To analyse the problems and their solutions pertaining to rural industrialization of the region.

3.1.2 Scope of study

Assembling the available infrastructure and resources was a part of the study conducted and then finding optional location for the industries. This will evidently form an important aspect for the planning for rural industrial development of Patna region. Then the limitation of the study defined as leaving out the technical details. Technical details shall be left out in the current study as well.

3.1.3 Methodology

Methodology adopted for the study purpose includes the study of the socio-economic condition of the region and the growth of the industries, assessment of the resources for industries, their impact on the development of all subsystems of the region, studying the existing policies and framing the guidelines for the future development of the industries and the socio-economic development of the region.

Studying the development process of the region of Punjab shall form a part of the present study. Moreover the impact of rural industries on the region shall be meticulously analyzed.

3.1.4 Reasons for selection of the case study

Following are reason for selecting Punjab as a case study:

- The economy of Punjab is based on agriculture and has seen the revolutionary increase in production of agricultural goods.
- The food-processing and cottage industries developed in the region for minimizing the wastage of the resources and transportation cost.
- Due to rural industrialization in the region Punjab has seen the development of the region in all aspects.
- The geo-climatic conditions of the Punjab region are similar to the study area.

3.1.5 Study area profile

3.1.5.1 Location

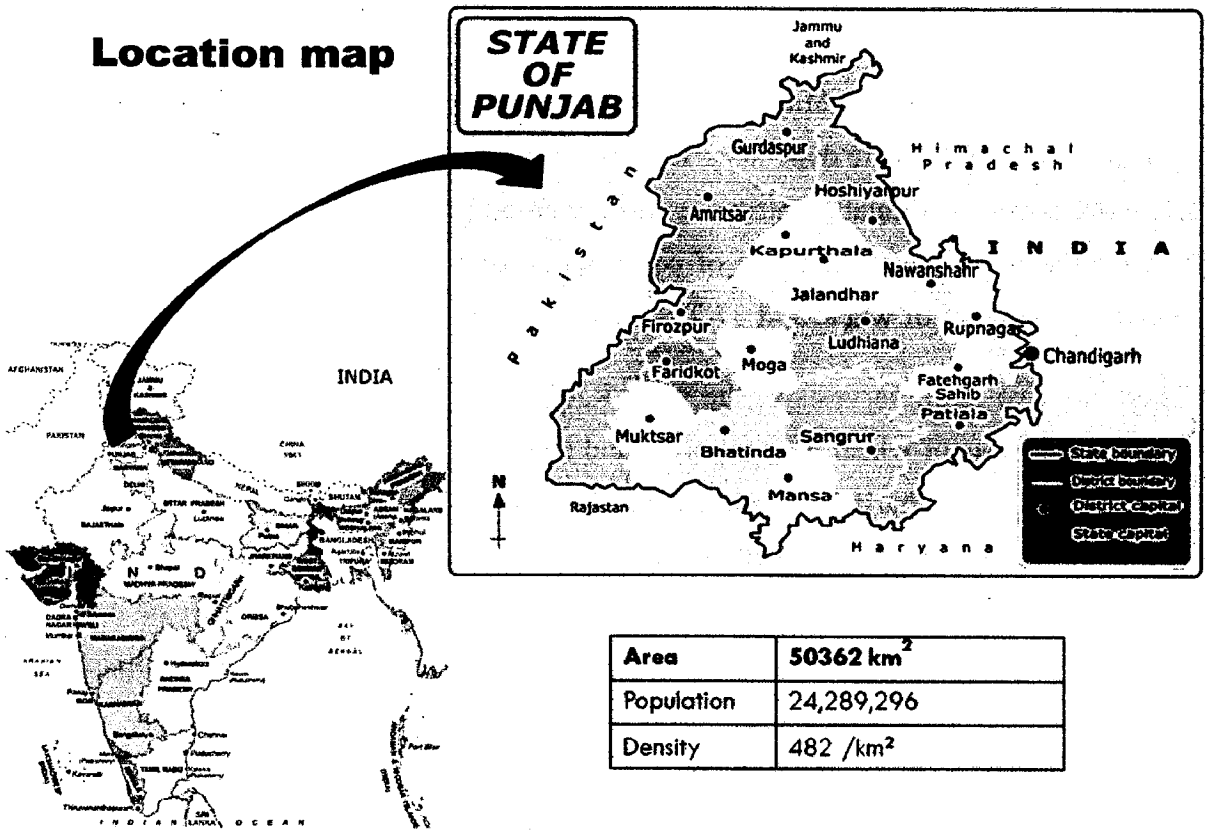


Figure 3.1.1 Map showing location of Punjab

Punjab is situated in the northwest of India, it is bordered by Pakistan on the west, the Indian states of Jammu and Kashmir on the north, Himachal Pradesh on its northeast and Haryana and Rajasthan to its south. Punjab occupies 1.54 percent of the country's total geographical area, that is, 5,0362 sq. kms. Punjab is on the globe at 29'30" N to 32'32" N latitude and 73'55 E to 76'50 E longitude.

3.1.5.2 Economic condition

Punjab is India's granary. It is famous for its success in developing into a rich state based on rapid agricultural growth. It produces about 22 per cent of India's wheat. It had a sustained economic growth of about 8 percent in 2005-2006. The principal crops of the state are barley, wheat, paddy, maize and sugarcane. Among the fodder crops are Bajra and Jowar. The state gross domestic product (SDP) contributes around 3 per cent of the gross domestic product of the country. Services held the largest share of 39 per cent in Punjab's SDP, closely followed by agriculture holding a share of 38 per cent. The industrial sector is relatively small, accounting for 23 per cent of the SDP. The State boasts of three thermal power plants and six hydro-power plants. It was the second largest producer of spun yarn in the country and the third largest producer of mill-made fabric. International Trade for Punjab in 2005-06 was US$200 billion. The GDP of Punjab in 2004-05 was US$ 17.30 billion.

3.1.5.2.1 State of Agriculture: Major Crops and Farming Sector

The economy of the state depends primarily upon agriculture. With 1.56 percent of area, the agriculture sector of Punjab contributes more than 68 percent to the country's food pool. Punjab leads the other States in terms of contribution of wheat and rice to Central Pool. It contributed 55.0 percent of wheat and 37.2 percent of rice to Central Pool in 2004-05.

There are two main harvests in the year: Rabi (hari) and Kharif (Sawani). The rabi or spring harvest consists of wheat, gram, barley and some oil seeds, fodder crops, potatoes and winter vegetables. The Kharif or autumn harvest consists of rice, maize, sugarcane, cotton, pulses other than gram and peas, bajra, jowar and vegetables like chillies, onions and gourd. Vegetable crops are about 1.13 lakh hectares in 2004-05. Potato with an area of 0.68 lakh hectares in 2004-05 is the major vegetable crop of the state. As in other states in India, food processing industry is in a nascent stage in Punjab.

Fruits

Presently the total area under fruit cultivation is 0.47 lakh ha and the production is 6.80 lakh tonnes. The major fruit crops of Punjab are citrus, mango, litchi, guava, ber, and pear. Among the citrus group most of the processable varieties are grown in the state.

The variety Kinnow has established itself as the lead citrus variety in the state. Its productivity of 15 MT/ha is the highest amongst citrus fruits in the country. The demand of this fruit is also increasing in the foreign markets.

Table 3.1.1: Fruits and Vegetables production in Punjab (in Metric Tonnes)

Kinnow/Orange	2,22,456
Mango	58,380
Grape	36,666
Pear	43,780
Peach	17,745
Lichi	11,580
Lemon	4,697
Potato	1,167,000
Root Crops	2,63,000
Tomato	1,75,000
Cabbage	32,700
Cauliflower	85,000
Brinjal	35,000

Source: Punjab – Opportunities in Agribusiness27

Litchi is one of the important tropical fruit crops of Punjab and of great nutritional value and a very popular fruit in India. It also finds great favour in export markets. The export of canned Litchi has been virtually static for the last 2 – 3 years. It is exported mainly to gulf countries like Saudi Arabia, UAE, Qatar, Oman and Bahrain as well to some EU countries. There is good export potential provided quality fruits are produced employing appropriate pre – harvest and post – harvest practices. The total area under litchi cultivation during the year 2004- 05 is 1263 ha with the total production of 12630.

Vegetables

Punjab is a leading state in terms of production of vegetables. The total area under vegetable crop is 1.58 lakh ha. with the production of 27 lakh tonnes. The annual productivity of the state is 16.8 MT/ha as compared to the average national productivity of 14 Mt/ha. The major vegetables grown in the state are cauliflower, peas, potato, onion, chilies, tomato and brinjal.

Spices

Some of the important spices like chili, ginger, and turmeric are also grown in the state. The total area under spices production during the year 2002-03 was 10957 ha with the production of 30249 tonnes.

3.1.5.2.2 AEZs in Punjab

There are three AEZs in Punjab. Among these, one AEZ focuses on 'basmati rice' the other two AEZs on 'vegetables' and 'potatoes'. The vegetable AEZ, setup with investment of

Rs. 26.77 crores, covering areas of Fatehgarh Sahib, Patiala, Sangrur, Ludhiana and Ropar, have given special emphasis on the cultivation of Cabbage, Broccoli, Okra, Peas, Carrot, Baby Corn, Green Chillies, Green Beans and Tomato. The private sector contribution is Rs. 14.94 crores in the vegetable AEZ .The Potato AEZ covers districts like Singhpura, Zirakpur, Patiala and satellite centres at Rampura Phul, Muktsar, Ludhiana and Jullundur.

The concept of value added agriculture development also calls for more food processing initiatives. According to the Agricultural Production and Export Development Agency (APEDA), the central agency that promotes AEZs, five vegetable processing units have been set up with an investment of Rs. 33 crore in the vegetable AEZ region. With the State Government providing the grant up to Rs. 5000 per product for development of packaging as per international standards, and providing 25 percent of the actual custom duty paid with a cap of Rs. 25 lakh, the AEZ is now in a take off stage. Plans are afoot to create a marketing hub in U.K., and Dubai. APEDA sanctioned Rs. 50 lakh for setting up of mechanized handling facility and Rs. 25 lakhs have been provided as financial assistance for setting up of cold storage for the AEZ. The Agri Export Zone for potatoes was also sanctioned during the same period. Around 100 MT of table variety potato worth Rs. 15 lakhs have already been exported from the zone.

3.1.5.2.3 Contract Farming in Punjab

Punjab, with its amended Agricultural Produce Marketing Act, is fast turning into a hot choice for contract farming. Pepsi, the multinational soft drink major, had a successful contract farming story in tomato. Basmati, which had almost vanished from Punjab due to un-remunerative prices, is now being grown abundantly in the state, mostly due to contract farming. Several corporates including Hindustan Lever (HLL), the UB group of Vijay Mallya, PepsiCo and Escorts are increasingly becoming involved in the contract farming of agri-products. Ahmedabad-based textile major Arvind Mills is identifying locations to start a contract farming project to grow cotton.29 Punjab government has signed agreements for at least five projects taking the total area under cultivation to 3,00,000 acres.

States like Punjab and UP are amending the rules to promote contract farming. The UP government has recently amended the Agriculture Produce Marketing Committees' (APMC) rule what said that the entire farm produce has to be kept with mandis. Because of this amendment, corporates can now directly procure goods from farmers. Punjab has also amended a similar rule.

3.1.5.3 Historical Background

The Partition of India in 1947 split the former Raj province of Punjab; the mostly Muslim western part became the Pakistani province of West Punjab and the mostly Sikh and Hindu eastern part became the Indian province of Punjab. Many Sikhs and Hindus lived in the west, and many Muslims lived in the east, and so partition saw many people displaced and much intercommunal violence. Several small Punjabi princely states, including Patiala, also became part of India. In 1950, two new states were created; the former Raj province became the state of Punjab, while the princely states were combined into the Patiala and East Punjab States Union (PEPSU). Himachal Pradesh was created as a union territory from several princely states and Kangra district. In 1956, PEPSU was merged into Punjab state, and several northern districts of Punjab in the Himalayas were transferred to Himachal Pradesh.

3.1.5.4 Geo-Climatic Condition

Most of the Punjab is a fertile, alluvial plain with many rivers and an extensive irrigation canal system. The southwest of the state is semi-arid, eventually merging into the Thar Desert. The Siwalik Hills extends along the northeastern part of the state at the foot of the Himalayas.

The soil characteristics are influenced to a limited extent by the topography, vegetation and parent rock. The variation in soil profile characteristics are much more pronounced because of the regional climatic differences. Punjab is divided into three distinct regions on the basis of soil types; southwestern, central, and eastern.

Punjab falls under seismic zones II, III, and IV. Zones II and III are referred to as Low Damage Risk Zone while zone IV referred to as high damage risk zone.

The temperature range in Punjab is from –2 to 40 °C (min/max), but can reach 47 °C (117 °F) in summer and –5 °C in winter. Climatically, Punjab has three major seasons as under:

- Hot weather (April to June) when temperature rises as high as 110 °F.
- Rainy season (July to September). Average rainfall annual ranges between 960 mm sub-mountain region and 460 mm in the plains.
- Cold weather (October to March). Temperature goes down as low as 40 °F.

3.1.5.5 Demography

The State has a population of 2.43 crore, accounting for 2.36 per cent of the national population. The population is dominated by the land-owning Jatt Sikhs, who constitute 14-15% of the total population, while Dalits account for 35%. The merchant castes (Banias, Khatris andAroras), who constitute 10% to 12% of the population are also very influential. Brahmins are only 5% of the population; the remaining 30% to 35% is composed of numerically smaller people like the Gujjars, Kambohs, Ramgarhias, and Sainis plus migrants.

3.1.5.6 Education

Punjab is served by several institutions of higher education, which provide undergraduate and postgraduate courses in all the major arts, humanities, science, engineering, law, medicine, veterinary science, and business courses. Punjab Agricultural University is a leading institution globally for the study of agriculture, and played a significant role in Punjab's Green Revolution in the 1960s-70s. Among the alumni of the Panjab University, Chandigarh include Manmohan Singh, the current Prime Minister of India, and Har Gobind Khorana, a biochemistry nobel laureate. One of the oldest institutions of higher education is the Christian Medical College, Ludhiana which has existed since 1894.

3.1.5.7 Infrastructure

3.1.5.7.1 Post Harvest Infrastructure

To strengthen the post harvest infrastructure to meet the present level of production as well as the anticipated increase in production volumes, quality at the consumer level can be increased with appropriate post harvest infrastructural facilities like:

Collection Centres

Nine collection centres, three in each identified district is proposed under the national horticulture mission plan. The collection centre will consists of mechanical sorting, grading and packing line. The estimated cost for each unit is 15.00 lakh and the proposed assistance is credit linked back – ended subsidy at 25 percent of the capital cost of the project in general areas and 33.33 percent in case of hilly and tribal area.

Multi Product Processing Unit

One multi product processing unit is proposed to be set up in Abohar (Firozpur) for processing of citrus and guava. The unit will be an integrated facility which will be basically for guava and citrus, tomato.

Cold Storage

Two cold storage facilities proposed to be set up, one in Hoshiarpur and one in Firozpur for storage of citrus under controlled condition. The estimated cost of this storage Rs. 2 crore per unit and the assistance is credit linked back – ended subsidy at the rate of 25 percent of the capital cost of the project in general areas and 33.33 percent in case of hilly tribal areas.

Rural/Apni Mandi

The present haats or weekly bazaars which constitute first contact point with commercial circuits for the producers do not provide even the most basic of amenities and facilities such as shelter, water, electricity, roads etc. Bringing about an improvement in market facilities at rural level has a direct impact on farmer's income. Once developed the rural markets provide improved services for buyers and create an element of market security for the growers. Haats need to be provided with mobile banks on haat days by Gramin Banks.

Marketing and Storage Facilities

Marketing and storage facilities are crucial components of post harvest technology. As on 31st March, 2005 there were 144 regulated markets and 519 sub yards in Punjab. The average number of villages and area served per market was 86 and 350 (sq. kms.) in 2004-05. The total storage capacity for foodgrains decreased from 273.66 lakh tonnes in 2003-04 to 223.84 lakh tonnes in 2004-05 which comprises of 147.13 lakh tonnes of covered and 76.71 lakh tonnes of open capacity.

3.1.5.8 Industries

3.1.5.8.1 Food Processing Industry in Punjab

Punjab is a land of boundless opportunity for agro based industry, 4.2 million hectare sown area with 186 percent cropping intensity and 100 percent assured irrigation makes Punjab granary of India. With 24.86 million tons of food grain production, 9.85 million live stock and 15.3 million poultry population, Punjab is very suitable for agri business. Apart from the food grains large quantity of fruits and vegetables is available for processing.

Agriculture in Punjab is highly intensive in terms of land, capital, energy, nutrients, agriculture inputs and water etc. The area under cultivation is about 85 percent. Punjab has essentially an agrarian economy with a low industrial output. There are 194,000 small scale industrial units in the state in addition to 586 large and medium units.

Punjab has entered the global business mainstream, with major players from around the world forming joint ventures in the field of agri-business. The state is determined to accelerate

its annual industrial rate of growth. Going by the availability of raw materials and the thrust areas identified by the government, investment opportunities exist in the following areas:

- ☐Processing of major and minor crops
- ☐Industries based on agricultural waste/ residue (wheat/ paddy straw, paddy husk)
- ☐Processing of fruits and vegetables
- ☐Dairy or poultry based units
- ☐Meat processing
- ☐Infrastructure modernization and development
- ☐Export oriented units

To encourage diversification in agriculture and to build up a climate for industrial investment by providing linkage between agriculture and industry, the Governor of Punjab is pleased to provide the additional incentives to the defined Agro-Industries, under the Punjab Industrial Incentive Code under the Industrial policy.

Incorporated in 1996, as a state government undertaking, Punjab Agro-Industries Corporation (PAIC) today has a strong extension service network and excellent rapport with the farmers. The corporation has an equity capital base of Rs.466.6 million and employs about 1000 people at different levels in its regional, district and corporate offices. It is the nodal agency of the state government for promotion of agro-based industries in Punjab.34

PAIC has launched 21 successful projects costing about Rs.3,500 million. The valued partners are Pepsi, Inc. USA, Food Engineering Services, USA, Dairy Tek, USA, Institut Armand-Frappier, Canada, Imporio Lader Wahen, Germany, Westfalia Separator, Germany Schulle, Germany, Carmeltech, Israel, Chemtec, Israel, Sandvik Process System, Italy, AG Seeds, Australia, Rice Engineering, Thailand, Fletcher Challenge, New Zealand, TMCI, United Kingdom Raisio, Finland, Dalsem Holland, Meijer Holland, and IMV, France.

PAIC is currently implementing 15 agro-industrial projects in the areas of agro products, agro-chemicals and food and horticulture at the total capital cost of about Rs.15,000 million. Livestock also plays an important role in the economy of the state which contributed 11.77 percent to the Gross State Domestic Product (GSDP) at constant (1993-94) prices in 2004-05(Q). The per capita availability of milk in the State was 901 grams per day in 2004-05. There are 57 milk plants and chilling centers in running condition in the State. The production of poultry eggs was 3,680 million in 2004-05.

3.1.6 Findings

3.1.6.1 Opportunities in Agro-Business

National Productivity Council of India after a survey found that in Punjab availability of crop residue is of the order of 31.5 million tons. The major crop residues are rice straw, wheat straw and cotton stalk. In addition to that industrial residue/by product such as rice husk is also available. Approximately 2 million tons of these two products are generated every year. Keeping these things in mind Punjab offers tremendous investment potential in agro based projects in following area:

- Processing of major and minor crops
- Processing of fruits and vegetables
- Processing of crop and agro industrial residue
- Poultry and animal husbandry
- Dairy and milk processing

In Punjab farmers produce: 20 million tons of grains every year, 3 million tons of fresh produce every year and 30 million litres of milk every day. There are more than 115 food processing units and 16 beverage companies in the large and medium scale sector that are active in the state. The number of SSI units in food and beverage sector is known to be 9689 and 174 respectively. Three major companies have invested US$ 2 billion in Punjab, they are: Reliance Industries, Bharti-Rothschild, and ITC Ltd.

There is large scope for business and investment opportunities in agri sector, viz., processing, grading and packaging; handling system; cold chain and logistics; largest food retailing network; massive export drive; productivity focus in F&V, dairy, coarse grains; farm inputs & mechanization; credit & insurance risk management; and facilitating creation of 'Common Indian Market'.

Reliance is planning for a mega foray into the farm and dairy sector to strengthen its food retailing arm.

Fast-food retailer McDonald's, for instance, has invested over US$ 175 million in building its back end logistics which has helped everyone in the chain to grow and set benchmarks in farming, processing, distribution and retail.40

A mega food is planned to be set up in Punjab, with an investment of 100 million USD. A memorandum of understanding (MoU) has already been signed between the Confederation

of Italian Food Processors and ASSOCHAM (The Associated Chambers of Commerce and Industry of India), for developing this park. The food park will process food based on European Union standards (penne, pastas, tortillas from corn), besides cookies, so that 50 per cent of the food is bought back by the European Union.

3.1.6.2 Agriculture Supply Chain

Several studies have indicated that the introduction of green revolution technology since the mid sixties to meet domestic food shortages amplified the role of regulated markets – being pulled out from wheat / atta (whole wheat flour) distribution to wheat procurement in the major wheat producing states, Punjab being one of these. This brought into existence dual market structures for wheat procurement in the State. Punjab State Mandi Board regulated the wholesale food grain markets. Due to the availability of assured markets for wheat disposal farmers shifted the area under wheat cultivation from the alternative crops during the rabi (winter) season.

Coupled with the availability of technology as it led to a fabulous increase in the market supplies, public sector has emerged as a market leader for the procurement of this primary product. It is distributed primarily through a network of fair price shops for the public distribution system in the deficit areas of the country.

As regards fruits and vegetables, the overwhelming problem is one of lack of modern cold storage facilities in the State where farmers can store produce and market the same when the prices are favourable. Investment in food processing industry on the part of the private sector is being encouraged, which would also help farmers of fruits and vegetables through backward linkages of such investments.

The State amended its Agriculture Produce Market Act to enable the private sector to set up such markets. Punjab Agro has been instrumental in introducing post harvest management technologies for increasing shelf-life and transportability of perishable horticultural crops such as kinnows; grapes, exotic flowers by creating grading and waxing facilities, pre-cooling centers, refrigerated vans, flower auction house etc. Avenues are being explored for export of fresh fruits, vegetables and flowers, and some success has already been achieved in this direction.

3.1.7 SWOT analysis

3.1.7.1 Strength

1. Round the year availability of raw materials.
2. Social acceptability of agro-processing as important area and support from the central government.
3. Vast network of manufacturing facilities all over the country.
4. Vast domestic market.

3.1.7.2 Weakness

1. High requirement of working capital
2. Low availability of new reliable and better accuracy instruments and equipments
3. Inadequate automation w.r.t. information management.
4. Remuneration less attractive for talent in comparison to contemporary disciplines
5. Inadequately developed linkages between R&D labs and industry.

3.1.7.3 Opportunities

1. Large crop and material base in the country due to agro-ecological variability offers vast potential for agro processing activities.
2. Integration of developments in contemporary technologies such as electronics, material science, computer, bio-technology etc. offer vast scope for rapid improvement and progress.
3. Opening of global markets may lead to export of our developed technologies and facilitate generation of additional income and employment opportunities.

3.1.7.4 Threats

1. Competition from global players
2. Loss of trained manpower to other industries and other professions due to better working conditions prevailing there may lead to further shortage of manpower.
3. Rapid developments in contemporary and requirements of the industry may lead to fast obsolescence.

3.1.8 Inference

(a) National plan for improvement and extension of agro-processing technology at farm, traditional small industry and modern industry levels should be prepared. The plan should

take into account the diversity in resources and needs of different regions in the state. It should include programme details and implementation schedule for the first four or five years. The progress of plan implementation should be periodically reviewed to allow adjustments and corrective measures, and to develop programme details for the years beyond the period under review.

(b) Thrust areas for research and development should be identified and medium term research and development programme should be prepared and implemented to support the national plan for improvement and extension of agro-processing technology at different levels. Treatment and utilization of effluents from agro-processing industry should be included in the R.D. programme.

(c) Emphasis should be put on the establishment of new agro-industrial plants in the production catchments to minimize transport cost, make use lower cost land and more abundant water supply, create employment opportunity in the rural sector and utilize process waste and by-products for feed, irrigation and manure.

(d) Infrastructure in the production catchments selected for agro-industrial development should be improved. Because of uncertain grid power supply to rural areas, decentralized power generation using locally available resources may become an integral part of agro-industrial development. Similarly, if the raw materials and processed products are perishable or semi perishable in nature, cold chain will have to be established.

(e) The national plan should provide for management of agro-industrial activities in the catchment area, both by private companies and individuals as well as cooperatives.

(f) Financial incentives and support should be provided on liberal scale to promote the modernization of agro-processing industry and for establishing new such industries in production catchments.

(g) Arrangements to supply market information to the farmer and agro-processor should b put in place.

3.2 Case Study 2: Industrial growth in Karnataka.

3.2.1 Objective of study

The objectives of this case study of industrial growth on the urban system of Saharanpur city are as follows:

- To study the rural industrial growth in Karnataka.
- Identification of the urban problems resulting from urban development and technological changes in industries.
- To analyse the proper industrial location in Karnataka state.
- To identify the inadequacy of the infrastructure present.
- Framing of policies for future development and growth.

3.2.2 Scope of study

Assembling the available infrastructure and resources was a part of the study conducted and then finding prospect and consequences of rural industrial development in Karnataka. This will evidently form an important aspect for the planning for rural industrial development of Patna region. Then the limitation of the study defined as leaving out the technical details. Technical details shall be left out in the current study as well.

3.2.3 Methodology

Methodology adopted for the study purpose includes the study of the socio-economic condition of the region and the growth of the industries, assessment of the resources for industries, their impact on the development of all subsystems of the region, studying the existing policies and framing the guidelines for the future development of the industries and the socio-economic development of the region.

Studying the development process of the region of Karnataka shall form a part of the present study. Moreover the impact of rural industries on the region shall be meticulously analysed.

3.2.4 Reasons for selection of the case study

Following are reason for selecting Punjab as a case study:

- Karnataka has medium human development index and have a growing economy in India.

- It's achievement in rural industrialization are remarkable.
- The food-processing and cottage industries developed in the region for minimizing the wastage of the resources and transportation cost.
- Agricultural production of the state is also good.
- Proper location of industries in Karnataka has given a boost in the economic development of the state.
- The plan and policies implemented regarding industrial location will help in forming proper policies in the study area.

3.2.5 Study area profile

3.2.5.1 Location

Karnataka is bordered by the Arabian Sea to the west, Goa to the northwest, Maharashtra to the north, Andhra Pradesh to the east, Tamil Nadu to the southeast, and Kerala to the southwest. The state covers an area of 191,976 square kilometres (74,122 sq mi), or 5.83% of the total geographical area of India.

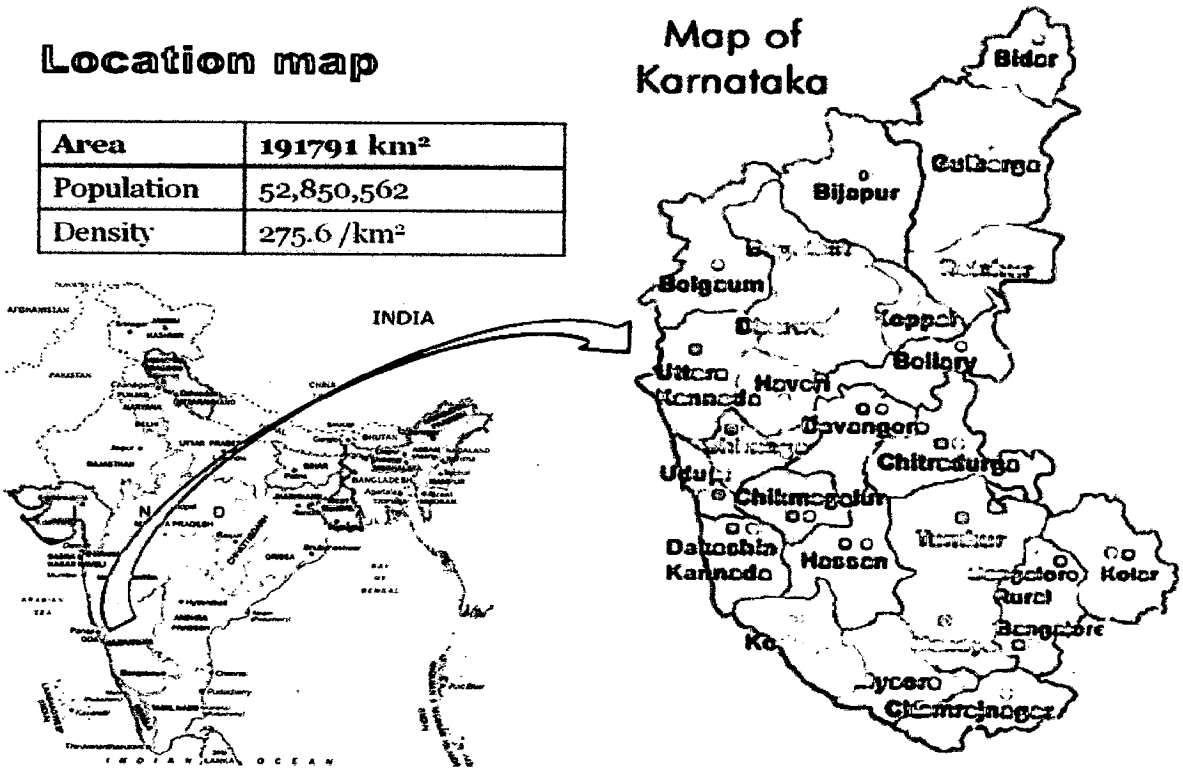


Figure 3.2.1 Map showing location of Karnataka

3.2.5.2 Economic condition

3.2.5.2.1 Agricultural production in Karnataka

The area of Karnataka State is 5.8 percent of the total geographical area of the country, but the state produces 37 percent of ragi, 17 percent of jowar, 12 percent of tur, 43 percent of sunflower, 12 percent of sugarcane and groundnuts, and 11 percent of fruits comprising national production.

There has been steady growth in the production of food grains in Karnataka. This rose from 3.32 Mt in 1956/57 to more than 8.97 Mt in 2001-02. However, estimates for 2001-02 and anticipated production yields for 2003/04 are substantially lower, respectively, at 6.73 Mt and 6.72 Mt. Shortfall in production is mainly due to severe setbacks during the kharif and rabi seasons. However, oilseed production estimates are expected to improve from 1.02 Mt in 2001-02 to 1.12 Mt and 1.24 Mt, respectively, for 2002-03 and 2003-04. There is ample milling and crushing capacity available within existing plant, except where regional imbalance occurs with significant cross-border trading.

Production of pulses and oilseeds at present (2003-04) is as follows: pulses are grown on approximately 1.85 Mha *(i.e. 1.05 Mha in the kharif season, 760 000 ha in the rabi season and 40 000 ha in the summer season).* Oilseeds are grown on approximately 2.29 Mha *(i.e. 1.26 Mha in kharif, 790 000 ha in rabi and 240 000 ha during summer season)* in Karnataka. Coverage during 2003-04 was slightly lower than typical for pulses (1.98 Mha) and oilseeds (2.75 Mha).

Groundnuts and sunflower are the two major oilseeds and comprise 85 percent of the area under oilseed crops in the state. There have been consistent changes in the type of oilseed crops grown in the nine major oilseed growing districts of northern Karnataka during the 1990s. This reflects a shift from groundnuts to cottonseed to sunflower within the decade. Changes in the cropping pattern have resulted in changes in requirements for the type of oil milling equipment used.

While groundnuts require relatively simple decortication as a primary processing step, cottonseed requires dehulling, delinting and defibering in preparation for oil extraction, and alkali refining as a post-milling step. Sunflower requires only dehulling as a primary processing step. Frequent changes in cropping patterns in the oilseed sector have raised issues within the milling industry, with mixed messages for the extent of the milling capacity

required and loss of investment in plant and equipment that has sometimes resulted. This has led to disharmony between producers and processors.

Table 3.2.1: Agricultural and horticulture production in Karnataka State (Mt)

Sl. No.	Crops	Production in Karnataka	All India production	Share (%)
1.	Rice	4.85	80.50	6.03
2.	Jowar	2.00	11.50	17.40
3.	Ragi	1.58	4.35	36.36
4.	Maize	0.94	9.10	7.02
5.	Tur	0.28	2.40	12.00
6.	Other pulses	0.56	13.15	4.25
7.	Cotton*	0.80	10.70	7.47
8.	Sugarcane	27.60	230.00	12.00
9.	Groundnuts	1.20	8.50	14.10
10.	Sunflower	0.47	0.99	47.47
11.	Vegetables	4.68	74.00	6.32
12.	Fruits	3.56	34.00	10.47

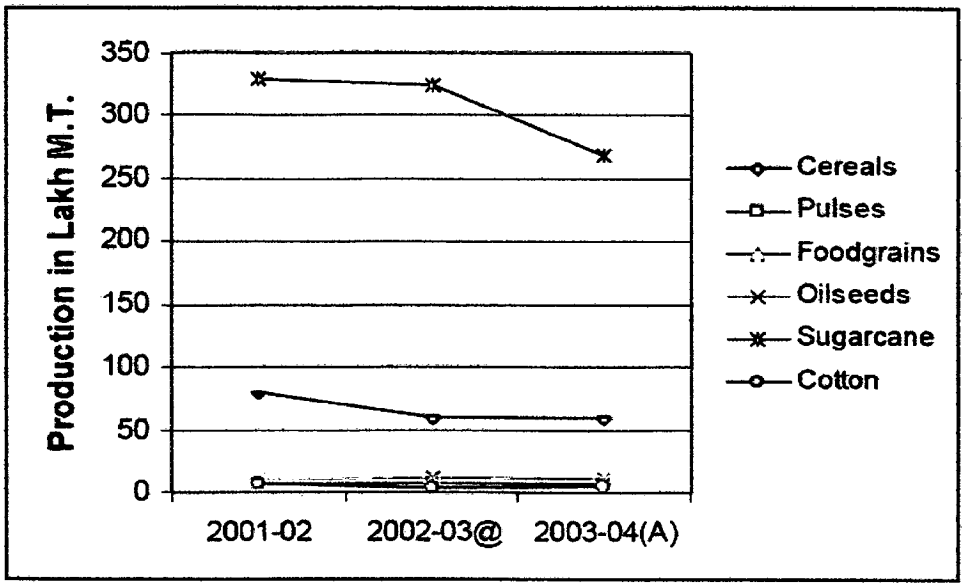
Sources: GOK (1999)a and Ministry Finance (1997).
* In million bales of 170 kg.

3.2.5.2.2 Horticultural crops in Karnataka

Of an estimated 11 Mha of cultivated land in the state, more than 12 percent is given over to horticultural crops. The state produces more than 10 Mt of horticultural crops (excluding coconuts, betal vine and nutmeg). Mango, pineapples, grapes, bananas, guavas, sapotas and coconut are the major horticultural crops grown.

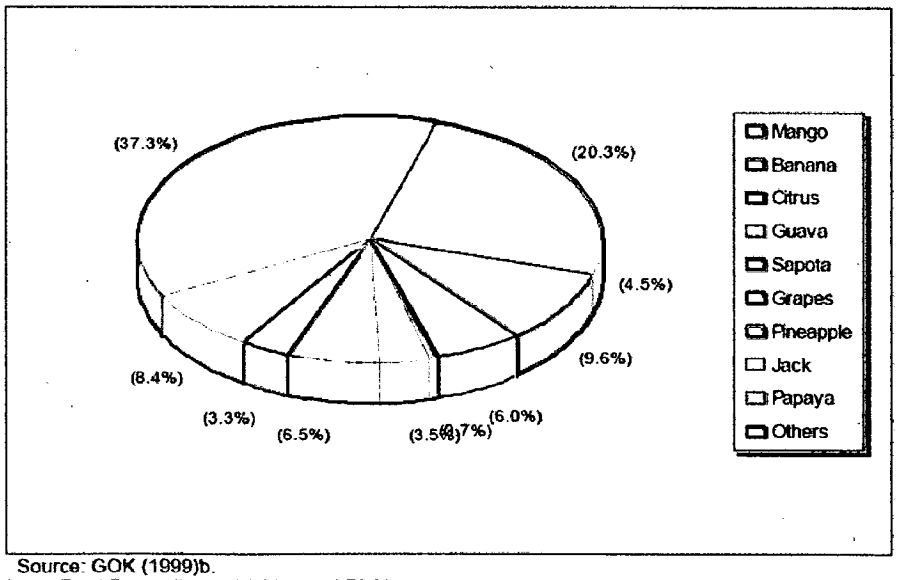
The major horticultural districts in the state are Dharwad, Tumkur, Hasan, Chitradurga and Kolar. Bangalore, Belgaum, Shimoga, Chikamagalore and Mysore Districts are also significant producers.

Agricultural production trends Karnataka State (2001/02 to 2003/04)



Source: GOK (2002), GOK (2003)a and GOK (2004)b. Estimates provided by the High Power Committee (HPC) of th Commissionerate of Agriculture.
Notes: Cotton production in 100 000 bale units of 170 kg in lint form (I lakh is 100 000).

Figure 3.2.2 Agricultural production trends Karnataka State



Source: GOK (1999)b.
Note: Total Production 1995/96 was 4.73 Mt.

Figure 3.2.3 Share of production: major fruit crops in Karnataka

Figure 3.2.4 Share of agricultural production trends in Karnataka

3.2.5.2.3 Production and consumption balance

To determine the quantity of surplus crop available for processing, a production and consumption balance sheet should be prepared. This, unfortunately, is not as easy as it may first appear, for consumption patterns can vary widely. For example, traditional culinary

preferences differ from region to region, from season to season and on the basis of the income available to a family typical of the area or region under review.

3.2.5.3 Historical background

With an antiquity that dates to the paleolithic, Karnataka has been home to some of the most powerful empires of ancient and medieval India[1]. The philosophers and musical bards patronised by these empires launched socio-religious and literary movements which have endured to the present day. Karnataka has contributed significantly to both forms of Indian classical music, the Carnatic (Karnataka Music) and Hindustani traditions. Bangalore is the capital city of the state and is at the forefront of the rapid economic and technological development that India is experiencing.

3.2.5.4 Geo-Climatic condition

Depending on the agricultural capability of the soil, the soil types are divided into six types, viz. Red, lateritic, black, alluvio-colluvial, forest and coastal soils. Karnataka experiences four seasons. The winter in January and February is followed by summer between March and May, the monsoon season between June and September and the post-monsoon season from October till December. Meteorologically, Karnataka is divided into three zones — coastal, north interior and south interior. Of these, the coastal zone receives the heaviest rainfall with an average rainfall of about 3,638.5 mm (143 in) per annum, far in excess of the state average of 1,139 mm (45 in). Agumbe in the Shivamogga district receives the second highest annual rainfall in India. The highest recorded temperature was 45.6 °C (114 °F) at Raichur and the lowest recorded temperature was 2.8 °C (37 °F) at Bidar.

3.2.5.5 Demography

According to the 2001 census of India, the total population of Karnataka is 52,850,562, of which 26,898,918 (50.9%) are male and 25,951,644 (49.1%) are female, or 1000 males for every 964 females. This represents a 17.3% increase over the population in 1991. The population density is 275.6 per km² and 34.0% of the people live in urban areas.

3.2.5.6 Education

As per the 2001 census, Karnataka had a literacy rate of 67.04%, with 76.29% of males and 57.45% of females in the state being literate. The state is home to some of the premier educational and research institutions of India such as the Indian Institute of Science,

the Indian Institute of Management, the National Institute of Technology Karnataka and the National Law School of India University.

3.2.5.7 Infrastructure

3.2.5.7.1 Post Harvest Infrastructure

LOCATING FOOD PROCESSING INDUSTRIES

Primary processing of all foods and processing of perishable foods should be undertaken in, or adjacent to, point of production. The economic value in shifting large quantities of raw materials from farm to factory becomes high when the distances involved are large. Processing close by the production site reduces waste and cuts back on transport and handling costs. Disposal of by-products and wastes at point of production is normally more cost-effective. In a country with the geographic size and population of India, about 310 Mt of foods are required each year to meet basic nutritional needs. The various food items recommended meeting these minimum standards, and shows that about 150 Mt of foods (about 50 percent of total) are perishable.

NEED FOR WAREHOUSES AND COLD STORAGE

Storage requirements are normally of two types, viz. 1. Food grains and oilseed storage facilities, and 2. Cold stores or controlled atmosphere storage. Further, for fresh fruits, controlled ripening facilities will be advantageous. Products of this kind are normally seasonal, and it may be sensible to provide for storage over a period of at least three months post-harvest to prolong fresh market sales or to supply stock to processors. Stores for food grains need to be equipped with adequate facilities for materials handling, fumigation and aeration.

Marketing facilities

Marketing the industrial plots and ready-built sheds is an important promotional activity undertaken prior to construction. The aim is to encourage the best of entrepreneurial talents available to set up business in the new park. Ministerial delegations may also visit other countries to invite non-resident citizens and other commercial leaders in allied fields (such as trading, finance, retail, etc.) to take advantage of the opportunities available. Promotional activities of this kind are typical with considerable effort made at trade shows, international

fairs and other industrial venues. Industry-specific targeting is undertaken, particular within newly industrializing countries in the region.

KIADB

The Karnataka Industrial Area Development Board (KIADB) is the nodal agency for the development of industrial areas in the state. This is undertaken by the subsidiary company Food Karnataka Ltd, which was established in 2003. The KIADB is ratified to meet full ISO 9000 standards for all infrastructure planning and development activities. It follows similar procedures when marketing the plots and allotments, and maintains high professional standards for schedules and applications according to normal business practices in Karnataka State. The KIADB has the full confidence of the State Commissioner for Industries and Commerce of the state government and can access a range of services, expertise and experience to ensure the smooth transition from ideas to commercial reality (KIADB, 2003).

3.2.5.8 Industries

Food processing in Bangalore Rural District

Figure 3.2.4 Food processing in Banglore rural district

3.2.5.8.1 Farmer's market on the outskirts of Bangalore

In India, commodities that are traded locally such as fruits and vegetables, spices, coffee, tea, cocoa, rubber and cotton are processed to a limited extent on the farm to boost quality and to prepare them for processing in the factory. Processing of agricultural commodities increases their availability, boosts local incomes and, on a national scale, helps to reduce imports. This is particularly important for crops that are seasonal or highly perishable. Further, processing can help to maintain or reverse declining self-sufficiency; it

provides for better market opportunities and stimulates increased food production in local communities.

In the newly industrializing countries exemplified by India, most food grains undergo limited primary processing – cleaning, grading, storing, etc. Secondary processing is also becoming increasingly more common for some foods, for example, cereals are converted into extruded snacks, breakfast cereals and other convenience or novel foods. The technologies required are well proven and locally available. Foods of this kind are now widely sold on local markets *(mainly to service an expanding middle class sector).* Insufficient primary processing comes from lack of vision and limited information *(of the technologies and equipment required)* on the part of local entrepreneurs.

3.2.5.8.2 Agro-Industrial Parks

The establishment of dedicated industrial estates started in the southern states of India during the 1980s.

The Central Food Technological Research Institute (CFTRI) at Mysore provided technical support services for the estate, and the Technical Consultancy Services Organization of Karnataka (TECSOK) provided project management services. The CFTRI is the leading R&D institution of its kind in southern India and is located 3 km from the estate. The estate provided the separate industrial units on site with water and power services. Notwithstanding considerable effort on the part of the state administration, however, the estate was not an immediate success. The areas allocated proved to be too small for the activities required of the separate enterprises, infrastructural support was strictly limited and, importantly, there were insufficient number of local food.

There are a number of discrete advantages with establishing a dedicated agro-industrial park that will attract similar or complementary enterprises. Working in close proximity provides for rationalization of management, of supervision, of services and, with a measure of goodwill on the part of the *'Association of Food Producers'* on the estate, of shared market exploitation. Some examples of food processing units:

1. Decorticating units for groundnuts.
2. Dehulling units for sunflower seeds.
3. Cotton ginning and pressing unit.
4. Delinting/dehulling units for cotton seed.
5. Mills for processing paddy rice.

6. Oil expelling units.
7. Vegetable oil refining and packing plants - for refining expeller/solvent-extracted oils.
8. Solvent extraction plants for processing oilseed cake and rice bran.
9. Plants for the manufacture of fuel briquettes from agro-wastes.
10. Plants for the manufacture of furfural from agro-wastes.
11. Plastic blown film plants for suppling oil packaging film.
12. Carton box manufacturing units.
13. Common boiler house - for the supply of steam for processing.
14. Power plant for generating power (using agro-wastes/steam and/or grid electricity).
15. Common effluent treatment facilities as a service unit.

3.2.6 Technical Information - Karnataka State Initiative

The information collated herein and the preparation of a technical bulletin to cover the potential of agro-industrial location is based on an idea first proposed between FAO and the Government of Karnataka in 1996. During this time the Commissioner for Industrial Development and Director of Industries of the Government of Karnataka expressed the interest and intention of the state government to build an agro-industrial park 40 km to the north of Bangalore – the state capital. Part of the early planning involved the establishment of a food processing division within the state government. The park was expected to extend over 10 ha and to specialize in food processing, provide modern buildings, waste recycling, effluent disposal, storage, packing facilities and other services to local industries. This development, which is currently underway, will be market-led *(i.e. encouraging the manufacture of products that can be sold profitably).*

3.2.7 Impact of Agro-Industries on the Region

Wealth creation leads to more socially-secure rural communities, and people are better able to feed themselves, educate themselves and plan for a secure future from the additional employment and incomes that result from the investments that a park brings. There are also gains for the environment with improved management and use of natural resources. People become less exploitive and more responsible where there are long-term issues of socio-economic security involved.

3.2.8 Findings

Priorities are mainly grouped under:

General agricultural development.
Development of sectors in support of agriculture.

hese measures are normally sufficient to encourage farmers, and to provide for food security ı an increasingly urbanizing society. Measures taken in support of general agricultural evelopment include:

Improved use and service delivery of important agricultural inputs.
Investment in agricultural research and development (R&D).
Restoring, protecting and developing arable land and making it more productive.
Promoting agriculture mechanization.
Re-directing agricultural education and training needs to respond to the changing equirements of the agriculture sector.
• Promoting the development of indigenous technologies (particularly biotechnologies).
• Measures to protect the environment and to conserve natural resources.

The success of these efforts can be seen in the growth in productivity of the agriculture sector in many countries. Attaining food security depends upon a number of parallel developments including:

• An understanding of the use of appropriate post-harvest practices (including the introduction or expansion of commercial agro-industries).
• Development of adequate physical and institutional infrastructure.
• Improved macro-economic management and agricultural capacity building.

3.2.9 Recommendations

(a) Plan for improvement and extension of agro-processing technology at farm, traditional small industry and modern industry levels should be prepared. The plan should take into account the diversity in resources and needs of different regions in the state. It should include programme details and implementation schedule for the first four or five years.

(b) Thrust areas for research and development should be identified and medium term research and development programme should be prepared and implemented to support the

national plan for improvement and extension of agro-processing technology at different levels. Treatment and utilization of effluents from agro-processing industry should be included in the R.D. programme.

(c) Emphasis should be put on the establishment of new agro-industrial plants in the production catchments to minimize transport cost, make use lower cost land and more abundant water supply, create employment opportunity in the rural sector and utilize process waste and by-products for feed, irrigation and manure.

(d) Infrastructure in the production catchments selected for agro-industrial parks should be improved.

(f) Arrangements to supply market information to the farmer and agro-processor should be put in place.

3.2.10 Inferences

- Plan for improvement and extension of agro-processing technology at farm, traditional small industry and modern industry levels should be prepared.

- The plan should take into account the diversity in resources, needs and demand of different regions in the state.

- The progress of plan implementation should be periodically reviewed to allow adjustments and corrective measures, and to develop programme details for the years beyond the period under review.

- Thrust areas for research and development should be identified and medium term research and development programme should be prepared and implemented to support the national plan for improvement and extension of agro-processing technology at different levels.

- Treatment and utilization of effluents from agro-processing industry should be included in the R.D. programme.

- Emphasis should be put on the establishment of new industrial locations in the production catchments to minimize transport cost, make use lower cost land and more abundant water supply, create employment opportunity in the rural sector and utilize process waste and by-products for feed, irrigation and manure.

- Infrastructure in the production catchments selected for agro-industrial development should be improved.

- Because of uncertain grid power supply to rural areas, decentralized power generation using locally available resources may become an integral part of agro-industrial development.

- Similarly, if the raw materials and processed products are perishable or semi perishable in nature, cold chain will have to be established.

- The national plan should provide for management of agro-industrial activities in the catchment area, both by private companies and individuals as well as cooperatives.

- Financial incentives and support should be provided on liberal scale to promote the modernization of agro-processing industry and for establishing new such industries in production catchments.

- Arrangements to supply market information to the farmer and agro-processor should be put in place.

3.3 Comparative Analysis

Table 3.3.1: Comparative analysis of secondary data of case study areas and Patna region.

	Case Study I: Punjab	**Case Study II: Karnataka**	**Study Area: Patna Region**
Area (Km^2)	50,362	1,91,791	16,959
Population (2001)	2,43,58,999	5,28,50,562	1,44,48,392
Population Density (/Km^2)	483.7	275.6	852
HDI (2005)	0.679 (9^{th} rank)	0.600 (18^{th} rank)	0.449 (Bihar, 28^{th} last rank)
GSDP Growth Rate (FY00-FY08) at FY00 Prices	4.8%	6.8%	7.5% (Bihar) (2^{nd} fastest growing state during 2004-2009 with 11.03% growth rate, just behind Gujrat having 11.05% growth rate).
Literacy Rate	59.70%	66.60%	59.5%
Sex Ratio	876	965	900
Geo-climatic condition	Most of the Punjab is a fertile, alluvial plain with many rivers and an extensive irrigation canal system. The southwest of the state is semi-arid, eventually merging into the Thar Desert.	The state has three principal geographical zones: the coastal region, the hilly region and the plains of the Deccan plateau.	It has vast stretch of fertile plain. It is drained by the Ganges River, and Sone River. It is mildly cold in the winter hot in the summer.
Institution and Political environment	Developed and good	Good number of institutions	Very less institutional development

Economic condition	Agriculture based	Agriculture as well as industry based	Agriculture and service based
Infrastructure availability	Available in urban area and only few rural areas have not access to infrastructure facilities.	Available in most part of the State	Very poor infrastructure availability (conditions are bad in rural areas). Lack of electricity supply.
Agricultural Resources	The region is ideal for wheat-growing. Rice, sugar cane, fruits and vegetables are also grown. It produces 14% of India's cotton, 20% of India's wheat, and 9% of India's rice.	Food grains like wheat and rice are the agro-products of Karnataka. Oilseeds are also produced.	It has significant levels of production for mango, guava, litchi, vegetables in India. Also wheat, Paddy and sugarcane, pulses, potato, onion are the major products.
Rural industries	Good number of industries	Industries are available	Very less number of rural industries is available.

Chapter 4. STUDY AREA PROFILE

4.1 About Bihar

Bihar state is located in the eastern part of India. The capital of Bihar is Patna which is situated on the banks of the holy river Ganga. Bihar is the twelfth largest state of India in terms of its area and the third largest in terms of population.

Figure 4.1.1 Ruins of ancient university of Nalanda

Bihar, formerly known as Magadha, was once the center power of India's struggle for Independence. The Name Bihar is derived from the Sanskrit word, 'Vihara' which means monasteries. It was also an important center of Education, culture and tradition. The very ancient university Nalanda is situated in Bihar and its ruins can still be seen there. It is a rich and fertile land with a mild climate and is crossed by many major rivers, including the Ganges. Bihar is bounded on the north by Nepal, on the south by Jharkhand, on the east by West Bengal and on the west by Uttar Pradesh. Bihar is a land of varied religions. Buddhism and Jainism were born in the state of Bihar. Today, Bihar lags behind the other Indian states in terms of human and economic development.

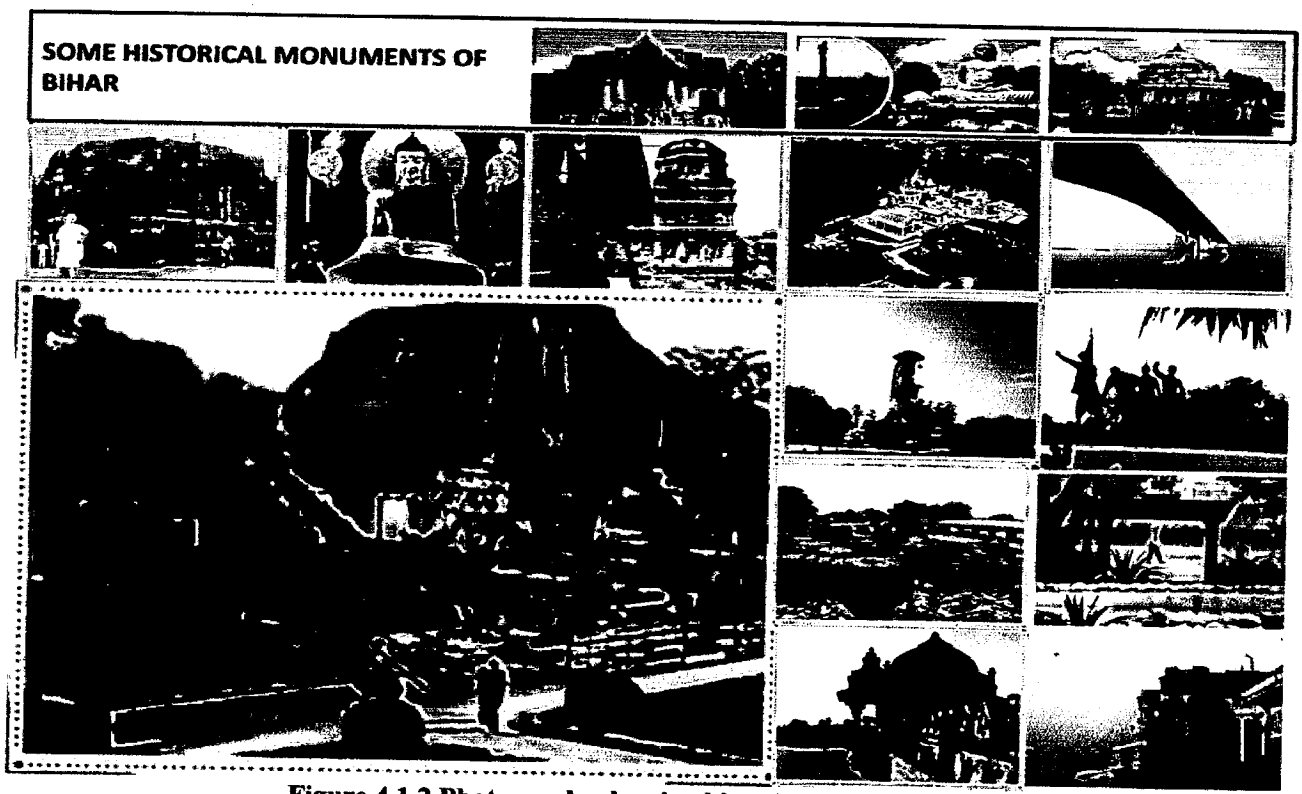


Figure 4.1.2 Photographs showing historical glory of Bihar

4.2 About Patna Region: Secondary Data Analysis

The study area of **Patna Region** considered is an administrative geographical unit of Bihar state of India. Patna is the administrative headquarters. The region consists of Patna Distrit; Nalanda District, also called Biharsharif District; Bhojpur District, also called Arrah district; Rohtas District, also called Sasaram district; Buxar District; Kaimur District, also called Bhabhua district.

PATNA REGION:				
Zone	Districts	Avg. Rainfall (mm)	Soil and Topography	Main Crops
III, south bihar, Alluvial Plains	Patna, Nalanda, Bhojpur, Rohtas, Buxar, Kaimur	1102.1	Old alluviam to sandy loam	Rice, Gram, Wheat. Mango, Guava, Banana, Bael, Jackfruit, Onion, Potato, Chillies.

Table 4.2.1: Comparison of different development indicators and other information

	Patna	Nalanda	Bhojpur	Buxar	Rohtas	Kaimur
Area (Km2)	3203	2327	2474	1624	3907	3424
Population (2001)	47,09,851	23,68,327	22,33,415	14,03,462	24,48,762	12,84,575
Urban Population	41.46%	14.84%	13.55%	9.27%	13.26%	2.90%
Literacy	63.9%	53.2%	59.0%	56.8%	61.3%	55.1%
Headquarter	Patna	Bihar Sharif	Arah	Buxar	Sasaram	Bhabhua
Major Highways	NH-30,83	NH-31, 82, 110	NH-30, 84	NH-84	NH-2	NH-2,30
Sex Ratio	873	915	900	901	909	902
Major crops	Paddy, maize, wheat, pulse, oilseed, cash crop, vegetable etc.	Paddy, Potato. Onion etc.	Paddy, wheat, masoor, khesari, oilseed, gram etc.	Paddy, wheat, sugarcane etc.	Maize, Paddy, gram, lentils etc.	Paddy, wheat, potato, lentils etc.
River	Ganga, sone, punpun.	Phalgu, Mohane.	Sone, Ganga.	Ganga	Sone	Durgawati, Karmansa, Kudra.
Source: directorate of statistics, GOB.						

4.3 Physical aspects

4.3.1 Location

Bihar is located in the eastern part of the country (between 83°-30' to 88°-00' longitude). It is an entirely land–locked state, although the outlet to the sea through the port of Kolkata is not far away. Bihar lies mid-way between the humid West Bengal in the east and the sub humid Uttar Pradesh in the west which provides it with a transitional position in respect of climate, economy and culture. It is bounded by Nepal in the north and by Jharkhand in the south. The Bihar plain is divided into two unequal halves by the river Ganga, which flows through the middle from west to east.

Patna region is located in Bihar on the southern side of river Ganga. The Patna region is divided into two unequal parts by river Sone, which touches the borders of Patna, Bhojpur and Rohtas Districts. On the west side end of Patna region Bihar shares state boundary with Uttar Pradesh.

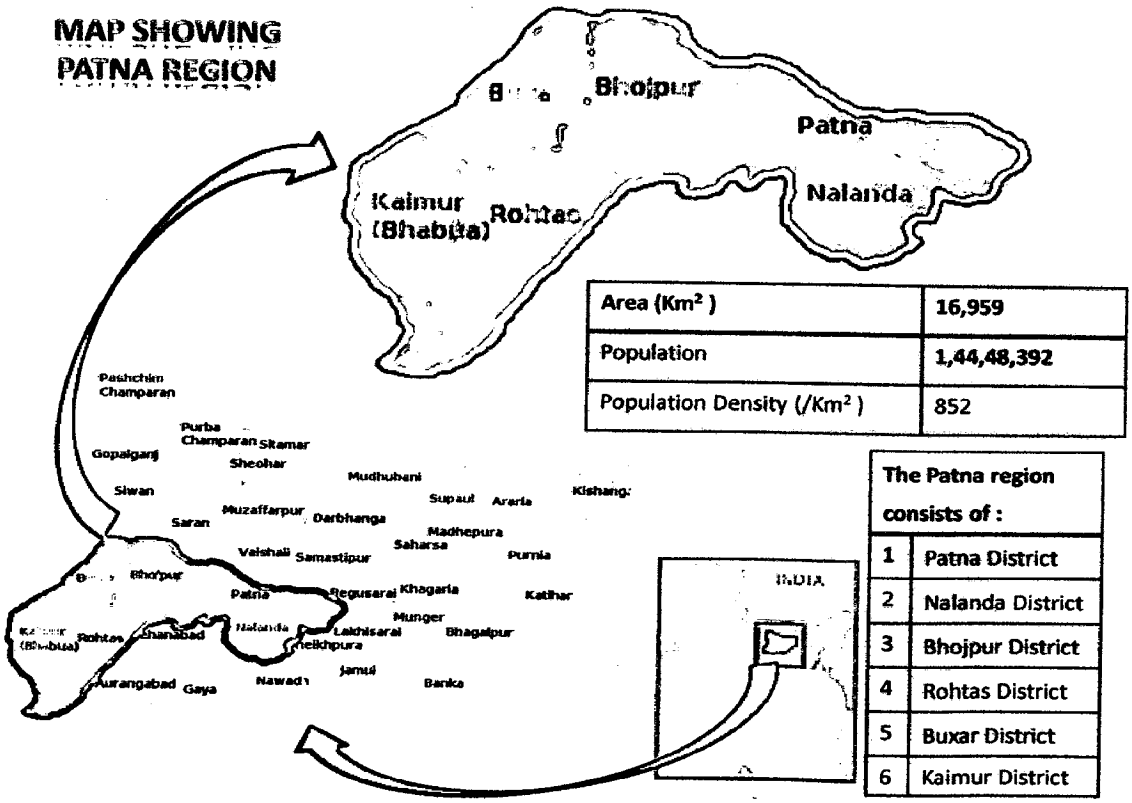


Figure 4.3.1 Map showing location of Patna region

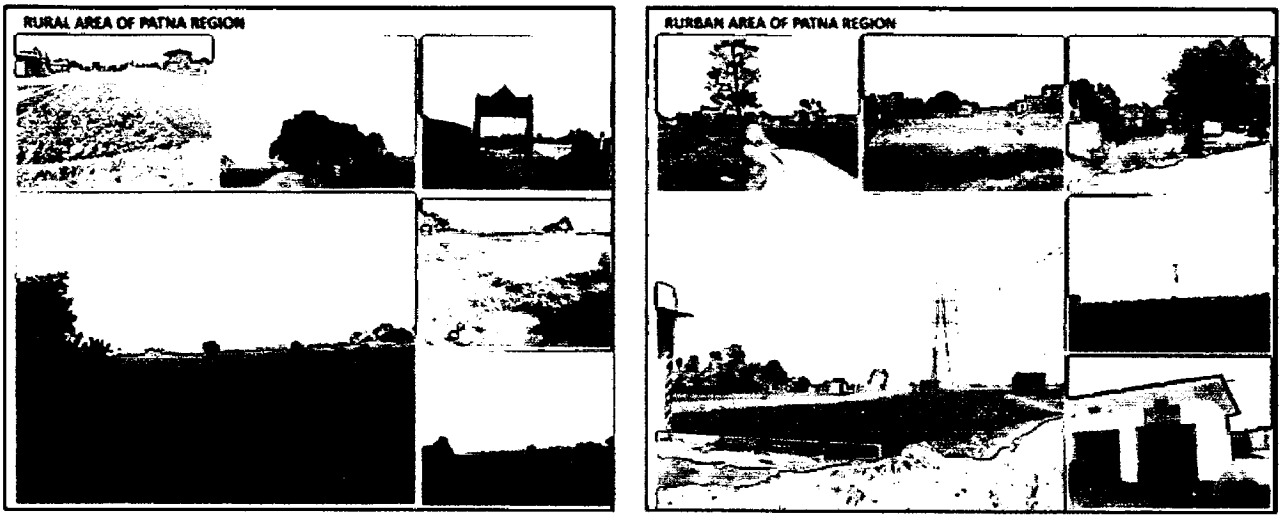


Figure 4.3.2 Photographs showing rural and rurban areas of Patna region

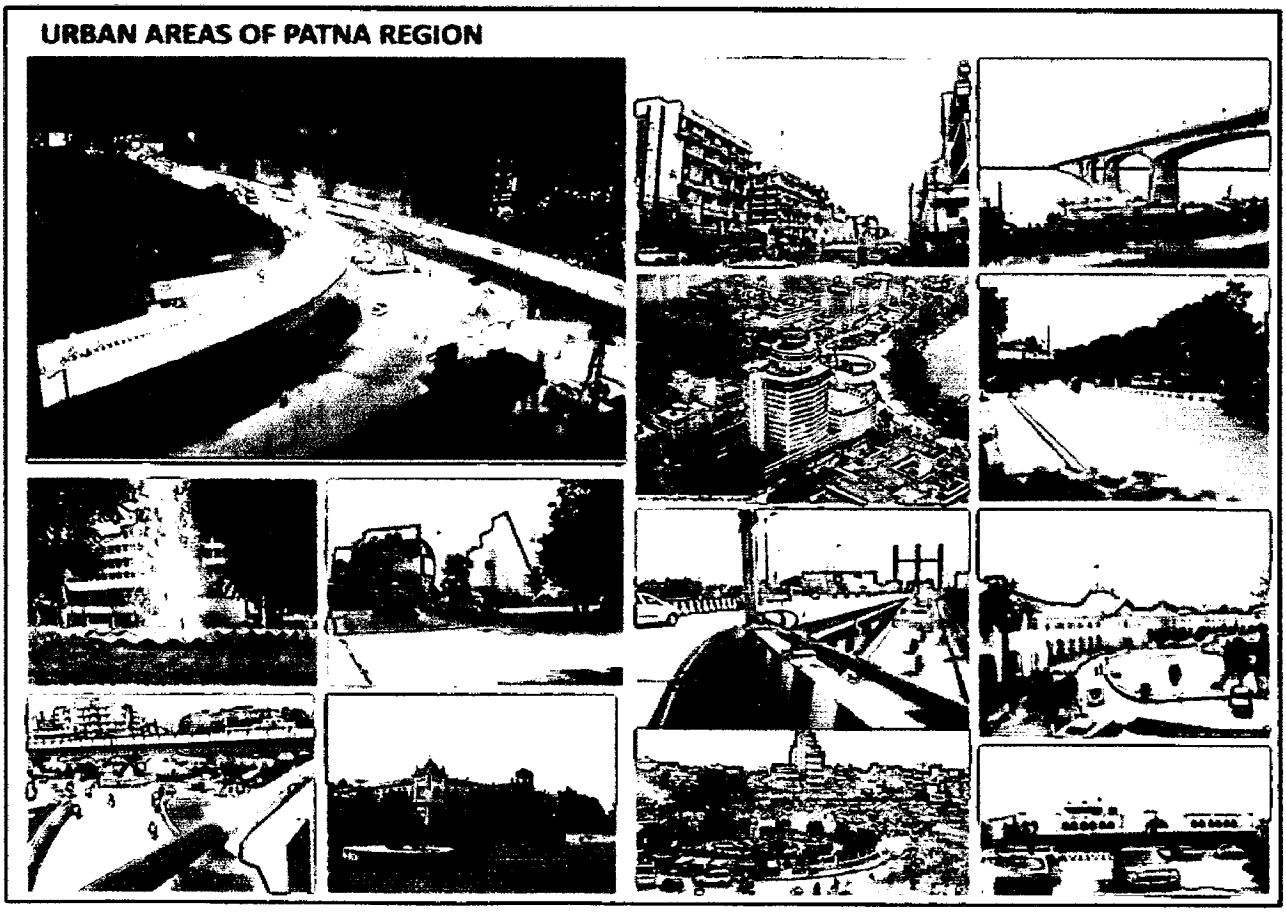


Figure 4.3.3 Photographs showing urban areas of Patna region

4.3.2 Physiography and Climate

Patna region has a vast stretch of fertile flat land. It has several rivers; Ganga and Sone are the main rivers. It is situated on the Gangetic Alluvium plain of Bihar is covered.

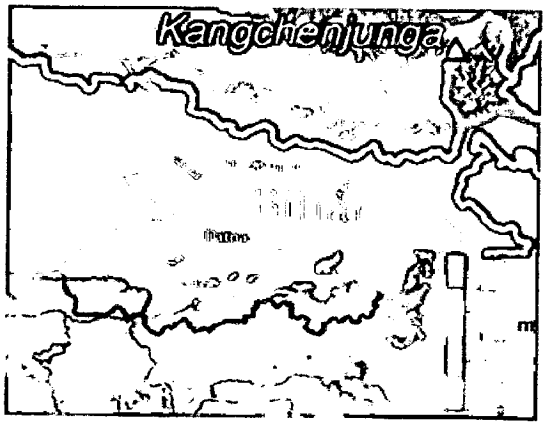


Figure 4.3.4 Topography of Bihar

This region is mildly cold in the winter (the lowest temperatures being around 5 to 10 degrees Celsius). Winter months are December and January. It is hot in the summer (40 to 45 degrees Celsius). April to mid June are the hot months. The monsoon months of June, July, August, and September see good rainfall. October to November and February to March have pleasant climate.

4.3.3 Flora & fauna

Flora of Bihar:

The most important trees are sheesham teek, saal, jamun, mahua, salai, jheengar, siddha and Koraiya, antelope. Shorea Robusta (sal), Dispyros melanoxylon (kendu), Boswellia serrata (salai), Terminalia tomentose (Asan), Terminalia bellayoica (Bahera), Terminalia Arjuna (Arjun) , Pterocarpus Marsupium (Paisar), Madhuca indica (Mahua) are the common flora across the forest of Bihar.

Table 4.3.1 Details of Protected Areas

SL	Name of Park/Sanctuary	District	Area	Flora/Fauna	Type
1.	Kaimur Sanctuary	Rohtas	The largest sanctuary in the state, 500 sq km.	sheesham teek, saal, jamun, mahua, salai, jheengar, siddha and Koraiya, antelope, blue bull, black buck Chital, chinkara, leopard, blackbuck, karakal and bijju	Sanctuary
2.	Rajgir Sanctuary	Nalanda	36 sq.kms	hyenas, leopards, nilgai, barkind deer etc	Sanctuary
3.	Sanjay Gandhi Botanical Garden	Patna	0.62 sq km.	Lion, deer, elephant, monkey, tiger, beer, leopard, amu, peacock, hippopotamus etc.	Botanical Garden

Bauhinia acuminata locally knowns as Kachnaar. Peepal tree.' (The Bodhi Tree at the Mahabodhi Temple is also Peepal tree)

Fauna of Bihar:

The Ganges River dolphin, or "susu" occur in the Ganges, south Asia's largest river systems (Figure 4.3.5). It can now be considered amongst the most endangered mammals of the region. The Ganges River dolphin ranges from 2.3 to 2.6 meters in length. Blue bull, black buck Chital, chinkara, leopard, blackbuck, karakal and bijju are found in the kaimur sanctuary.

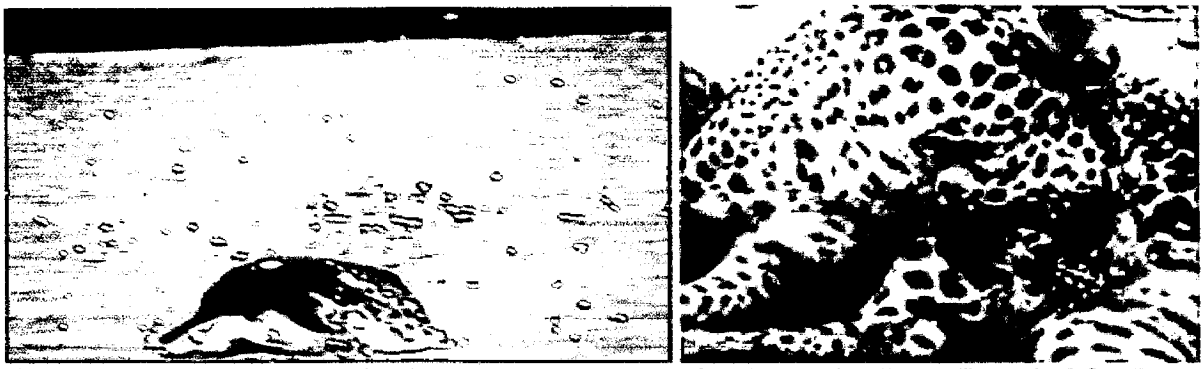


Figure 4.3.5 Gangetic Dolphins (locally known as Soos) & a Leopard at Patna Botanical Garden

4.3.4 Landuse pattern

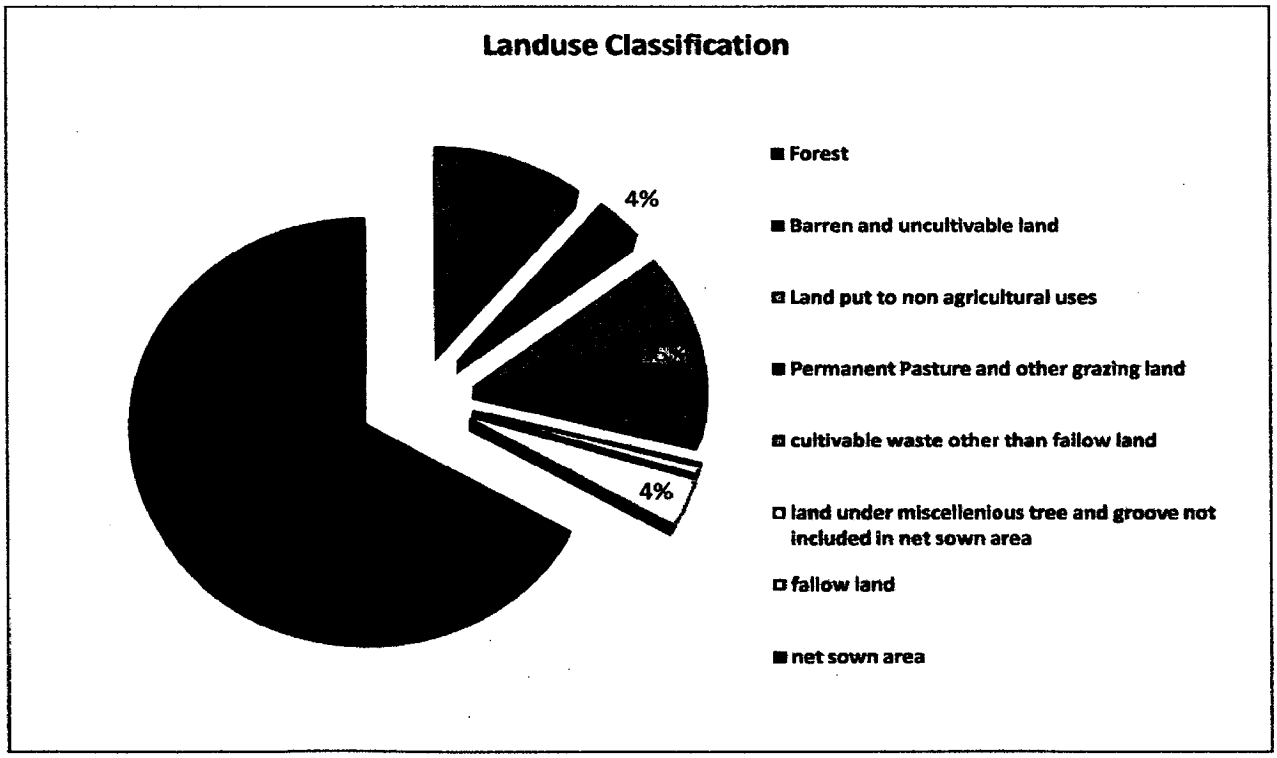


Figure 4.3.6 Landuse classification of Patna region

Table 4.3.2: Classification of land during 2005-06 (Ha)

Districts	Total Area by village paper	Forest	Barren and unculti vable land	Land put to non agricultu ral uses	Permane nt Pasture and other grazing land	cultiva ble waste other than fallow land	land under miscelleni ous tree and groove not included in net sown area	fallo w land	net sown area
Patna	317236	56	13116	75200	119	765	941	19751	207288
Nalanda	232732	4640	1215	40468	4	217	1231	2022	182935
Bhojpur	237339	0	6880	33215	75	627	1946	12412	182184
Buxar	166999	0	2273	16786	30	573	622	7054	139661
Rohtas	390722	66723	16945	46973	103	1117	2839	1635	254387
Kaimur	342447	113039	19267	33610	141	1392	692	18235	156071
Total	1687475	184458	59696	246252	472	4691	8271	61109	1122526

Source: directorate of economics & statistics, Bihar Patna. Statistical abstract (C.S.O.)

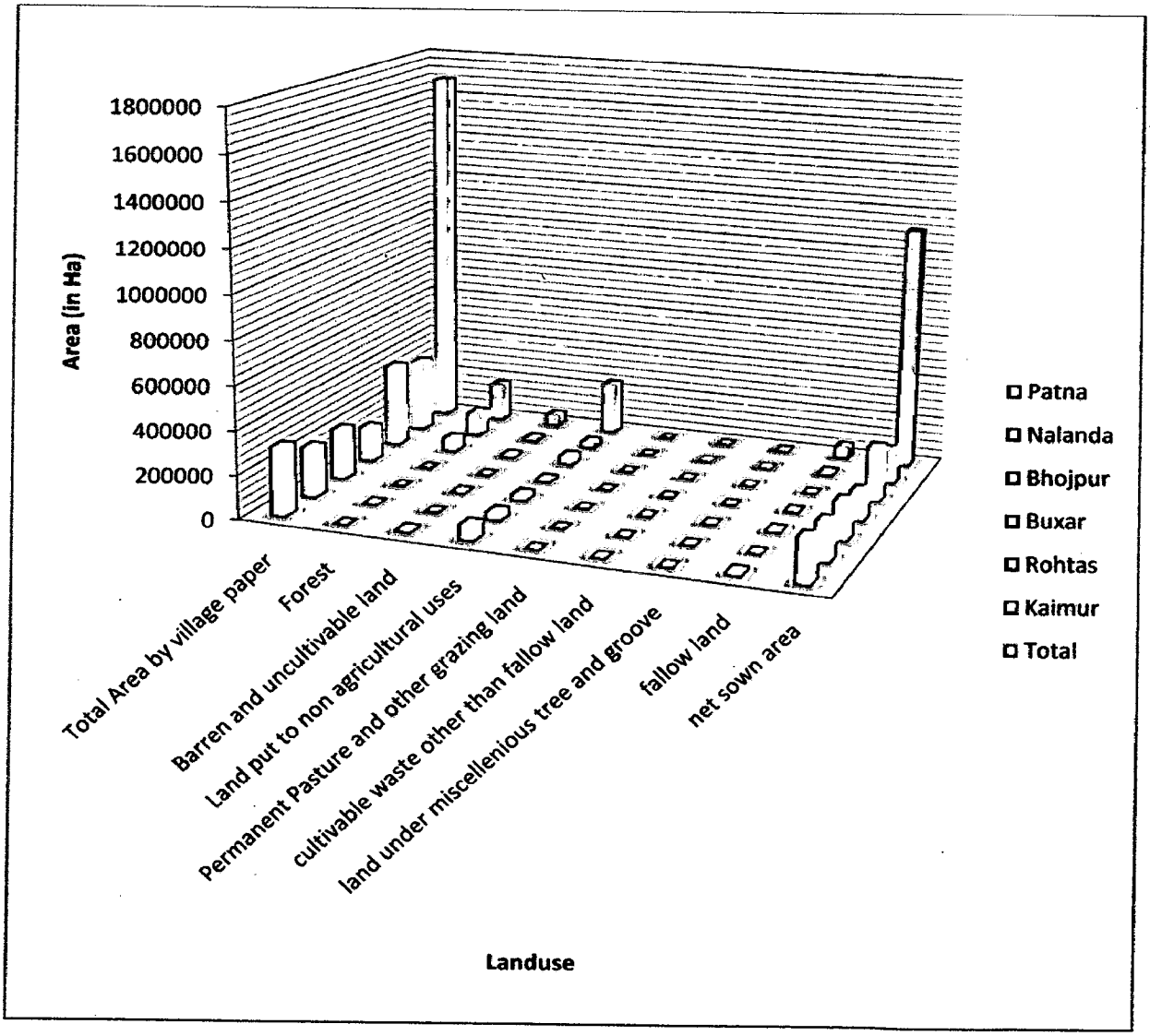


Figure 4.3.7 Chart showing classification of land during 2005-06 (Ha)

Table 4.3.3: Land usage						
Districts	Land area (in hectares)	Net Sown Area (in hectares)	Total Crop Area (in hectare)	Multi cropped area (in hectare)	Total irrigated area (in hectare)	% irrigated area
Patna	317000	206294	253848	47554	179595	56.65
Nalanda	232000	180872	228353	47481	193288	83.31
Bhojpur	237000	185364	227536	42172	188094	79.36
Buxar	167000	138277	144944	6667	113910	68.21
Rohtas	391000	254360	363159	108799	330834	84.61
Kaimur	342000	154226	204719	50493	166537	48.70
Source: Central Water Commission, Department of Water Resources, Bihar and Central Ground Water Board.						

Table 4.3.4: Total irrigated area through different sources				
Districts	Canal	Tube well	Other sources	Total irrigated area
Patna	51115	121049	7431	179595
Nalanda	9442	164270	19576	193288
Bhojpur	40781	135775	11538	188094
Buxar	44421	66410	3079	113910
Rohtas	262570	36037	32227	330834
Kaimur	98493	54414	13630	166537
Source: Central Water Commission, Department of Water Resources, Bihar and Central Ground Water Board.				

Two third of the total land area of Patna **region** is used for agricultural purpose. Only 15 percent of total land area is used for non agricultural purposes. **Irrigation facilities** in **Rohtas** and **nalanda** is better than other districts of the region

4.4 Administrative setup

Bihar is located in the eastern part of the country (between 83°-30' to 88°-00' longitude) in the lower and middle Gangetic region extending 483 Km from west to east. This state embraces some of the most fertile lands of India with a total area of 94,163 km. Bihar is bounded on the north by Nepal, on the south by Jharkhand, on the east by West Bengal and on the west by Uttar Pradesh. The Bihar plain is divided into two unequal halves by the river Ganga which flows through the middle from west to east.

Table 4.4.1: Bihar- Administrative Divisions

Divisions	09
Districts	39
Sub-Divisions	101
Development Blocks	534
Panchayats	8471
Revenue Villages	45,103
Urban Agglomerations / Towns	
(i) Urban Agglomeration	9
(ii) Number of Towns 130	130
(iii) Statutory Towns 125	125
(iv) Non-Statutory Towns 5	5

The State is divided into 9 divisons viz. Bhagalpur, Darbhanga, Kosi, Magadh, Munger, Patna, Purnia, Saran and Tirhut. Patna is the capital city of the state.

4.5 Socio-economic profile

4.5.1 Demography

The total population of study area is *1,44,48,392* (Census of India, 2001) with a sex ratio of 900 females per 1000 males. The work participation rate in the state is quite low i.e. 34.37 percent indicating high dependent population in the state. Among the working population, cultivators and agriculture labourers comprise about 85 percent of the total working population. Literacy rate in the state is 46.42 percent which is lower than the all India national average of 65.38 percent.

Table 4.5.1: Population and area of districts in Patna Region

Sl. no.	Name of the District	Population (2001)	Area in Km^2	Population Density (/Km^2) in 2001	State Rank in 2001
1	Patna	47,09,851	3,202	1,471	1
2	Nalanda	23,68,327	2,327	1018	11
3	Bhojpur	22,33,415	2,474	903	17
4	Buxar	14,03,462	1,624	865	18
5	Rohtas	24,48,762	3,907	627	32
6	Kaimur	12,84,575	3,424	375	37
	Total	*1,44,48,392*	*16,959*	*852*	

Source: census of India, 2001.

Table 4.5.2: Distribution of workers by broad category,2001							
Sl.No.	District	Total main workers '000'	Cultivators '000'	Agricultural labours '000'	Household industry '000'	Other workers '000'	Marginal workers '000'
1	Patna	1162	271	314	43	534	264
2	Nalanda	700	258	274	31	136	203
3	Bhojpur	492	196	155	18	123	162
4	Buxar	305	129	97	11	69	103
5	Rohtas	545	223	163	19	140	199
6	Kaimur	313	119	135	11	49	130
Source: Primary census abstract-2001 (bihar)							

Table 4.5.3: Bihar-Demographic Indicators (According to Census of India, 2001)

Total Population	82,998,509
Male Population	43,243,795
Female Population	39,754,714
Sex ratio (Females per Thousand Male)	919
Total Urban Population	8,681,800
Percentage of Rural Population	89.54%
Total SC Population	13,048,608
Total ST Population	758,351
Percentage SC	15.7 %
Percentage ST	0.9 %
Work Participation Rate	34.37%
Literacy Rate	46.42%

4.5.2 Literacy

Total literacy rate varies from 53.2% to 62.9% in different districts of Patna region, which is more than state's literacy rate (47%) and less than India's literacy rate (65.38%).Female literacy rate of the region is much less.

The literacy rate (47.53%) of Bihar is least among all the states of India. Female literacy rate is (33.57%) and Male literacy rate is (60.32%).

Table 4.5.4: District wise number of literates and their percentage in Patna region (2001)

Sl. No.	District	Literates (in thousands)			Percentage of Literates.		
		Person	Males	Females	Person	Males	Females
1	Patna	2,454	1,536	918	62.9	73.4	50.9
2	Nalanda	1,015	665	350	53.2	66.4	38.5
3	Bhojpur	1,073	714	359	59.0	74.3	41.8
4	Buxar	642	429	213	56.8	71.9	39.9
5	Rohtas	1,205	780	426	61.3	75.4	45.8
6	Kaimur	562	375	187	55.1	69.7	38.9

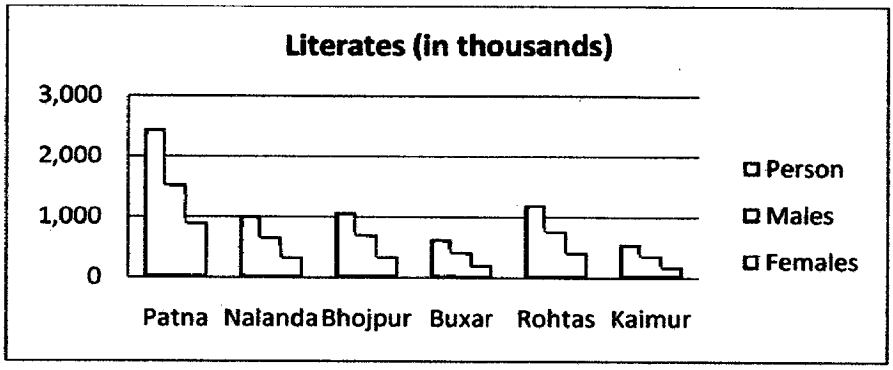


Figure 4.5.1 Chart showing district wise number of literates and their percentage in Patna region (2001)

4.5.3 Health

There are substantial gaps in health sector infrastructure and essential health requirements in terms of manpower, equipment, drugs and consumables in primary health care institutions. There is a drastic decline in the share of public health facilities in treatment of non-hospitalized ailments in both rural and urban areas. Though review of National Rural Health Mission (NRHM) at the end of first year produced a dismal picture, the official figures at the end of second year reflect a better status.

4.5.4 Sectors of economy

The economy of Bihar is largely service oriented, but it also has a significant agricultural base. The state also has a small industrial sector. As of 2008, agriculture accounts for 35%, industry 9% and service 55% of the economy of the state.

Consequently, about 42 % of the State population is below poverty line as against national average of 26%. As urbanization in the state is still very poor, nearly 90 per cent of the population lives in rural areas.

4.6 Resources

4.6.1 Agriculture

The economy of Patna region is predominantly agrarian. More than 85 percent of the working population is directly engaged in agriculture. The topography of the region can be easily described as a fertile alluvial plain occupying the Gangetic Valley. The river Ganges flows through the region from the west to the east. Rich farmland and lush orchards extend throughout the region.

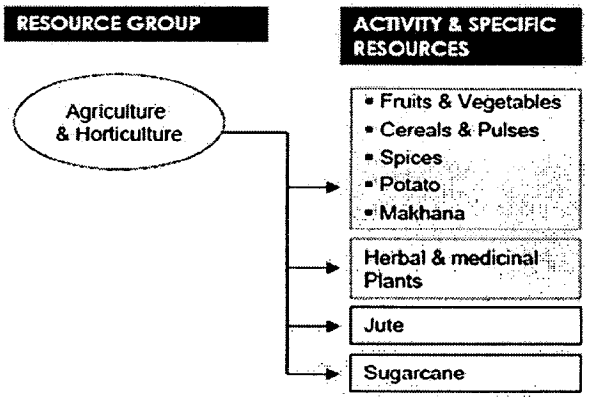


Figure 4.6.1 Agricultural & horticultural resources

Bihar is the seventh largest economy in India in terms of food production. The economy is primarily agrarian with agriculture contributing to more than 38 per cent to the Gross State Domestic Product (GSDP). Bihar is the eighth largest producer of food grains in the country. The major agricultural products of Bihar are cereals, pulses, oilseeds and cash crops. The major cereals are rice, wheat and maize and major pulses are gram, arhar, mung and masoor. In addition, the major cash crops are potato, sugarcane, jute, tobacco and spices.

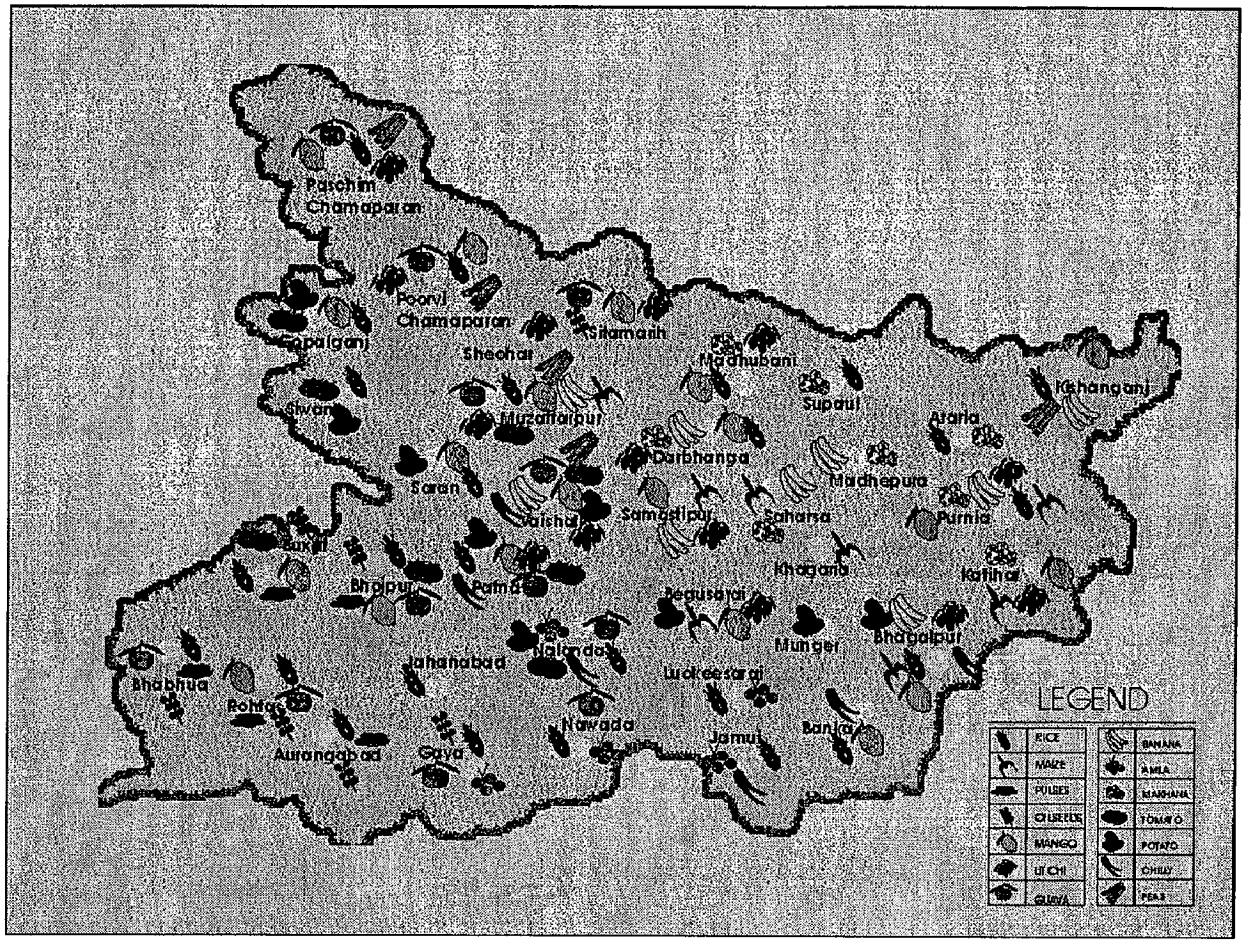


Figure 4.6.2 Agricultural resource map of Bihar

There area around 1.04 crore landholdings in the State of which around 83 percent are marginal holdings of size less than 1 ha. With around 90 percent of the total population living in rural areas, agriculture as the primary feeder of rural economy continues to operate not only on margins of land but also on the margins of human enterprise, its productivity being among the lowest in the country.

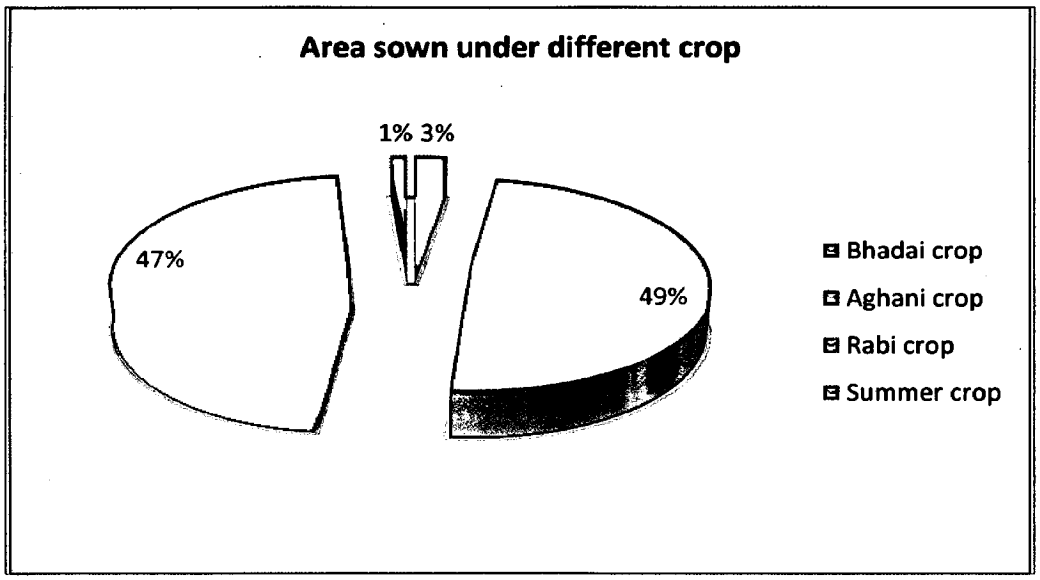


Figure 4.6.3 Chart showing area sown under different crops in Patna Region 2005-06(in Ha)

Table 4.6.1: Area sown under different crops in Patna Region 2005-06(in Ha)

Districts	Bhadai crop	Aghani crop	Rabi crop	Summer crop	total sown area	net sown area	area sown more than once
Patna	15541	86717	123488	8631	234377	207288	27089
Nalanda	4310	105504	110979	2988	223781	182935	40846
Bhojpur	6388	89777	84548	4319	185032	182184	2848
Buxar	6471	86206	82306	2099	177082	139661	37421
Rohtas	1616	196842	156202	431	355091	254387	100704
Kaimur	1468	108821	88092	460	198841	156071	42770
Total	35794	673867	645615	18928	1374204	1122526	251678

Source: directorate of economics & statistics, Bihar Patna.
Statistical abstract (C.S.O.)

Most of the area in the Patna region is sown under Kharif and Rabi crops, very few areas is sown under summer crop. 22.42 percent of net sown area is sown more than once. This double cropping system is practiced in the region which gives more production.

Table 4.6.2: Area under different crops 2005-06 (in Ha)

	Principal Crops				Pulses					Cash Crops		
Districts	Rice	Wheat	Maize	Barley	Gram	Masoor	Arhar	Khesari	Peas	Sugarcane	Potato	Chillies
Patna	85032	59992	13566	1078	11343	24279	409	15098	2064	422	4967	43
Nalanda	102832	82342	4764	284	4019	11930	268	5423	173	182	4196	66
Bhojpur	85200	54956	3723	1597	4813	7705	1349	7121	1304	126	3639	30
Buxar	78344	62194	3605	1266	2025	5884	1122	4211	945	370	2705	-
Rohtas	195646	130262	594	1768	4092	5328	1508	5825	1067	178	2694	106
Kaimur	108101	65727	524	1012	4587	5846	640	4136	1196	285	739	-
Total	655155	455473	26776	7005	30879	60972	5296	41814	6749	1563	18940	245
Source: directorate of economics & statistics, Bihar Patna.												

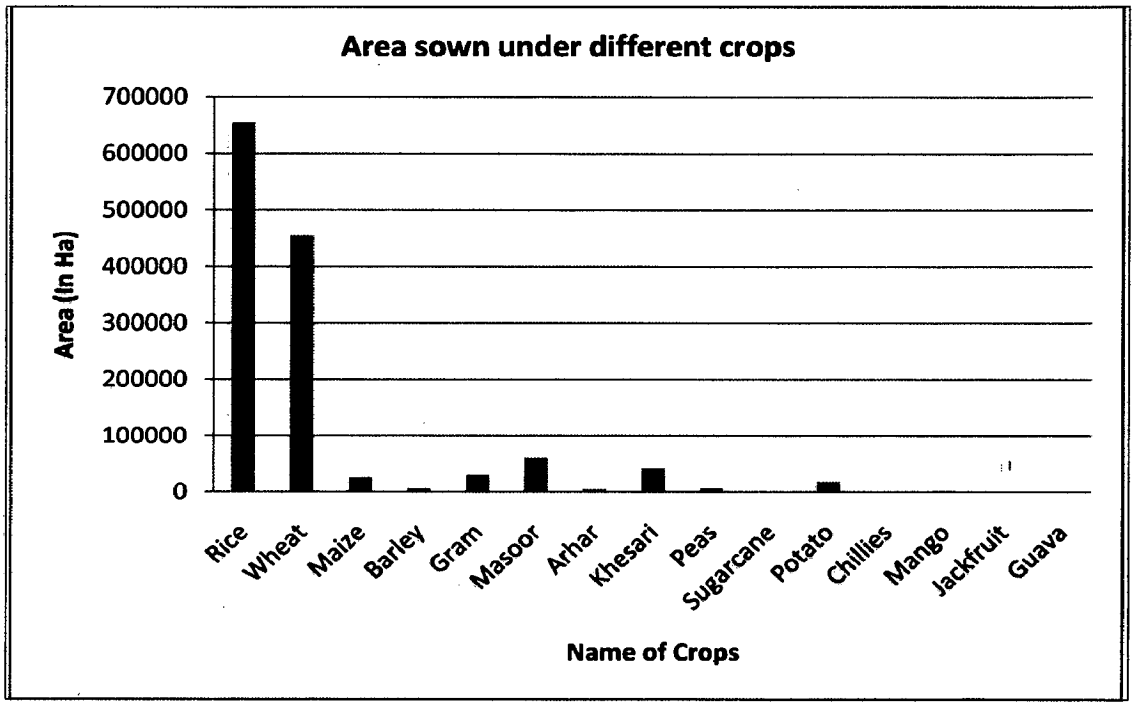


Figure 4.6.4 Chart showing area sown under different crops in Patna Region 2005-06(in Ha)

Table 4.6.3: Production of different crops 2005-06 (in M.T.)

	Cereals				Pulses					Cash Crops		
Districts	Rice	Wheat	Maize	Barley	Gram	Masoor	Arhar	Khesari	Peas	Sugarcane	Potato	Chillies
Patna	135955	127171	25012	2112	13861	32097	276	17952	1886	17445	37270	21
Nalanda	47586	130284	6474	379	3372	8124	503	3097	158	7651	38849	56
Bhojpur	201169	142452	6934	2111	5602	5740	2374	5576	1192	5278	32523	26
Buxar	183080	121865	4694	1213	2009	5978	1365	4948	864	15580	24332	-
Rohtas	480122	283932	1006	2339	4460	5333	1244	4980	975	7485	42649	106
Kaimur	225409	132221	763	1187	4656	5162	731	2982	1093	12001	7803	-
Total	1273321	937925	44883	9341	33960	62434	6493	39535	6168	65440	183426	209
Source: directorate of economics & statistics, Bihar Patna.												

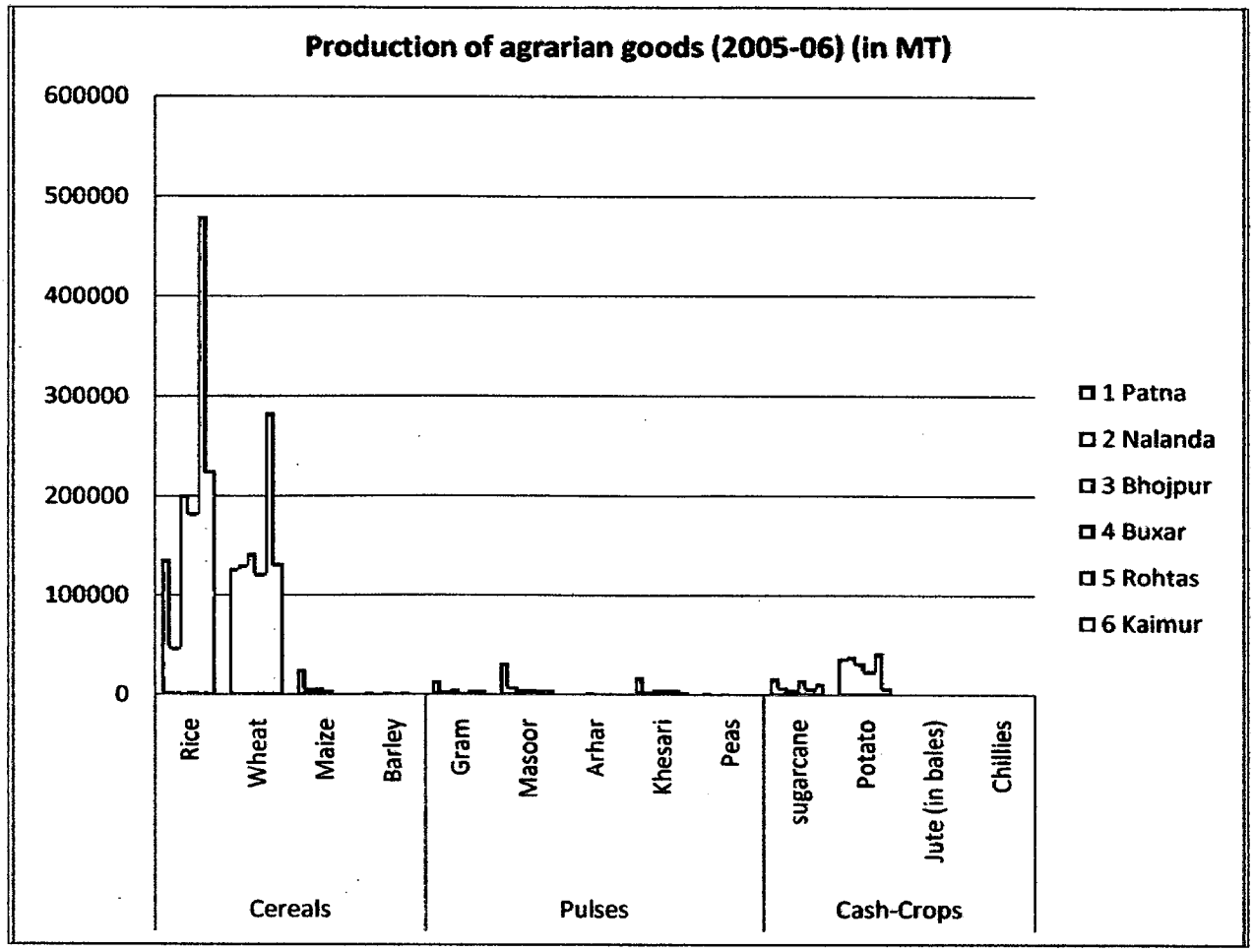


Figure 4.6.5 Chart showing production of agrarian goods 2005-06(in MT)

Rice production is highest in terms of weight in the region. Second major product is wheat. The Production of pulses like, Gram, Masoor is in good amount. Production of Potato is good in this region. Production of Sugarcane and Maize is considerable.

4.6.2 Horticulture

Bihar is the third largest producer of vegetables in India after West Bengal and Uttar Pradesh and the sixth largest producer of fruits (8.3 million MT) and (3.03 million) MT respectively. Gross sown area in the State is 79.46 lakh hectares, while net sown area is 56.03 lakh hectares.

Bihar produces a large quantity of different kinds of vegetables. Bihar is the largest producer of okra, second largest producer of cabbage, third largest producer of potato, brinjal, onion and cauliflower and significant producer of other vegetables within India.

Table 4.6.4: Vegetable production in Bihar vs All India

Vegetables	Production 2004–05 (′000t)	Percentage of National Production	All India Rank Within Producing States
Potato	5656.70	19.38	3rd
Brinjal	1073.00	12.33	3rd
Cauliflower	598.80	13.28	3rd
Okra	730.20	20.72	1st
Tomato	735.80	8.52	5th
Onion	975.20	12.98	3rd
Cabbage	952.00	15.49	2nd
Total	13349.10	13.16	3rd

Source: India Horticulture Database, NHB

Table 4.6.5: Vegetable production in Bihar

Sl. No.	Name of the vegetable	Area (in hect)	Production (in tones)	Productivity (quintals/hect)	Estimated area for 2005-06
1	Cauliflower	59701	955216	16.0	60000
2	Cabbage	36513	598813	16.4	36700
3	Onion	48759	975180	20.0	49000
4	Tomato	42987	601818	14.0	43100
5	Chilly	38070	456840	12.0	38300
6	Brinjal	53651	1073020	20.0	53800
7	Ladyfinger	56173	674076	12.0	56300
8	*Kaddu*	25143	402288	16.0	25300
9	*Nenua*	33606	470484	14.0	33800
10	*Jhigumi*	8078	48468	6.0	8300
11	*Karela*	8424	50544	6.0	8600
12	*Parwal*	4594	45940	10.0	4700
13	*Wodi*	11582	69492	6.0	11700
14	Others	99685	835590	14.0	59800
	Total	**486966**	**7257769**	**14.9**	**489400**

Source : Agriculture Dept., GOB

Table 4.6.6: Area under different crops (in Ha)

	Fruits (2006-07)		
Districts	Mango	jackfruit	Guava
Patna	116	-	-
Nalanda	129	4	5
Bhojpur	1261	65	109
Buxar	1008	32	3
Rohtas	111	7	11
Kaimur	-	-	-
Total	2625	108	128

Table 4.6.7: Production of Fruits 2006-07 (in M.T.)			
Districts	Mango	Jack fruit	Guava
Patna	2504	0	0
Nalanda	2785	105	14
Bhojpur	27225	1708	299
Buxar	21763	841	8
Rohtas	2396	184	30
Kaimur	0	0	0
Total	56673	2838	351
Source: directorate of economics & statistics, Bihar, Patna.			

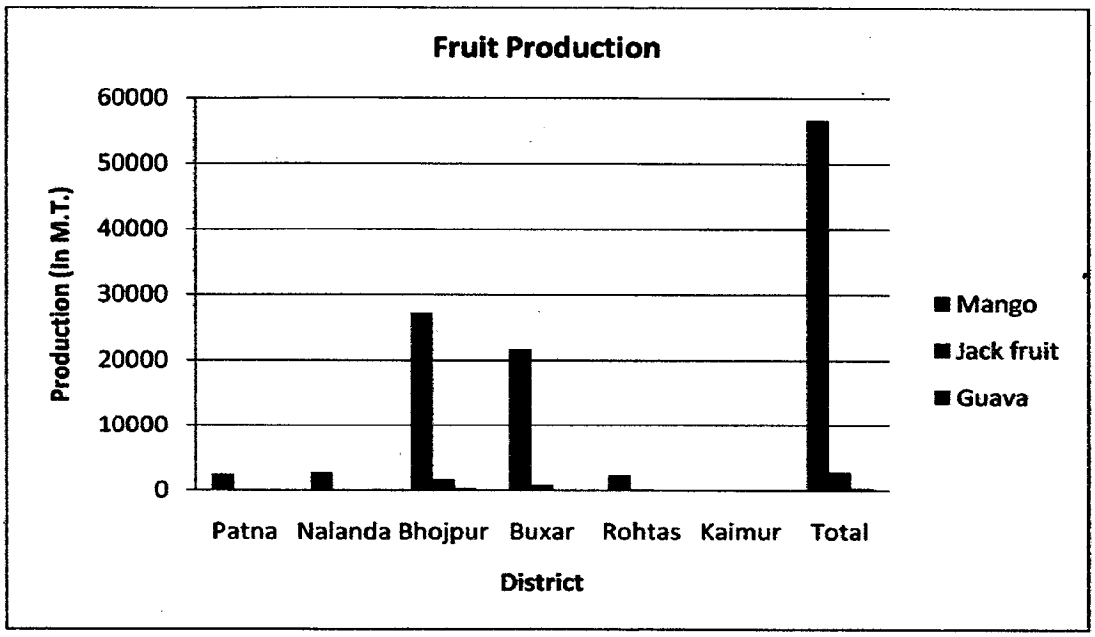


Figure 4.6.6 Chart showing production of Fruits 2006-07 (in M.T.)

Mango production in the region is appreciable. **Bhojpur** and **Buxar** districts are far ahead in mango than rest of the district of the region. Other fruits of the region are jack fruit and guava. Even though Bihar is topmost producer (71%) of **Litchi** in the country, still litchi production in this particular region is in infancy and needed to be improved.

Bihar produces large quantities of a variety of fruits. Bihar is the largest producer of litchi, third largest producer of pineapple and fourth largest producer of mango in India.

Table 4.6.8: Fruit production in Bihar vs All India

Fruits	Production 2004-05 ('000 t)	Percentage of National Production	All India Rank Within Producing States
Mango	865.60	7.46	4th
Banana	920.00	5.67	6th
Guava	256.10	15.20	1st
Litchi	204.90	55.59	1st
Citrus	134.20	8.70	5th
Pineapple	122.50	9.96	3rd
Total	2769.50	5.6	7th

Source: India Horticulture Database, NHB

The major fruit producing districts mostly overlap with the vegetable producing ones. Muzaffarpur and Vaishali districts lead in litchi and banana production. Darbhanga, Champaran (East&West), Vaishali lead in mango production and Rohtas and Bhojpur lead in guava production. The prices with a couple of exceptions are at par with major fruits producing states. Similarly, the prices at the production centres are much lower when compared to the main wholesale markets.

A variety of spices are produced in Bihar. Chilli accounts for 47.6 per cent of the area under spices and 39.5 per cent of the production followed by turmeric, which occupies 26.3 per cent of the area under spices and accounts for 36.4 per cent of the production in the state.

Table 4.6.9: Area and Production of Spices in Bihar

Spice crops	Area (ha)	Area (% to total spices)	Production (t)	Production (% to total spices production)
Turmeric	3,968	26.31	7,326	36.35
Ginger	942	6.25	1,327	6.58
Garlic	2,972	19.71	3,533	17.53
Chilli	7,181	47.62	7,967	39.53
Total spices	15,081	100.00	20,153	100.00

Source: Kumar, A (2005)

Low level of farm mechanisation:
Tractors/1000 ha
Bihar - 17
Punjab – 68 (highest in India)

Farm workers in Bihar

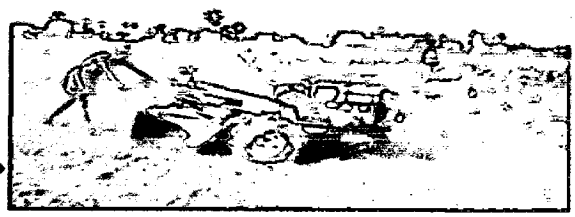


Figure 4.6.7 Farm worker in Bihar

Table: Fertilizer consumption in Patna Region (Kg. Per Ha.) 1998			
N	P	K	Total
87.95	13.76	2.16	103.87
Source:- Fertiliser Statistics, Fertiliser Association of India (Several Volumes)			
In 2005-06 total consumption =125 Kg./ Ha.			
Source:- Economic Survey, Government of India			

able 4.6.10: Use of Modern Farm Inputs 2003-04

	Fertiliser Consumption (Kg/Ha.)	Percent of Farmer Household Using									
		Fertiliser		organic manure		Improved Seeds		Pesticides		Vet. Services	
		Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
ihar	88.02	59	91	32	34	34	43	40	46	19	18
ıdia	88.19	76	54	56	38	46	34	46	31	30	22

ɔurce: Economic survey, GOB.

- Fertilizer consumption in Bihar is equal to the national average.
- Only one third of the households of the region use improved seed for production.
- · Most of the households use fertilizer in Rabi crops.
- Very few households use vet services.

6.3 Animal husbandry

Bihar's livestock sector is crucial not only in terms of its contribution to rural income, ıt also for the section of the population to which this income goes. Bihar's livestock sector :counted for approximately one-ıarter of the total value of agricultural ıtput in TE 2002-03. Livestock :tivity is concentrated among landless ɔuseholds and those with marginal ɔldings of less than 1hectare of land. .pproximately 35 percent of rural ouseholds in Bihar report owning :attle, 20 percent buffalo, and 15 ɔercent sheep and goats (NSSO 2003). Of all rural households owning cattle and/or buffalo in Bihar, more than three-quarters are either landless or have less than 1 hectare of land. Sheep and goats tend to be even more concentrated among landless and marginal rural households Milk is the most important livestock product, accounting for approximately 50 percent of the

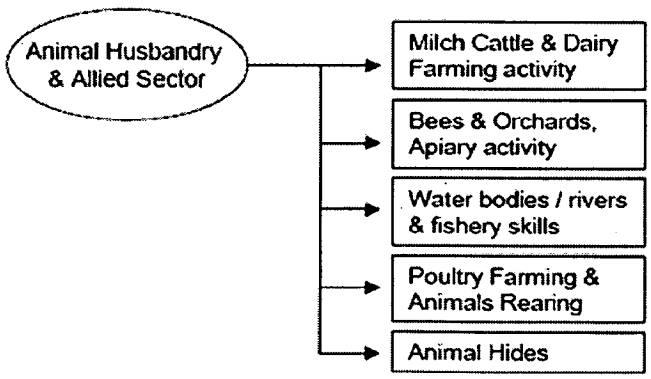


Figure 4.6.8 Animal husbandry and allied sector

total livestock output, followed by meat (24 percent) and other livestock products. Milk production in Bihar has grown by around 92 percent over the period 2001-2006, while meat production has grown by only 12 percent over the same period. Similarly, egg production has increased by 35 percent over this period and that of wool has fallen by almost 50 percent. According to the 2003 livestock census, there were approximately 10 million heads of cattle in Bihar, only 10 percent of which were cross-bred, which explains the low productivity and growth of livestock output in the State. The fact that the number of institutions providing extension services to the livestock sector has remained stagnant over the years and certainly not helped its productivity Scenario.

Table 4.6.11: Growth rates of Major Livestock Products in Bihar (2001-2006)

Sl. No	Item	Based on 1982 Livestock census		Based on census 2003		Growth over the period (in %)	
		2001-02	2002-03	2003-04	2004-05	2005-06	
1	Total milk (in 000. litres)	2632	2869	3175	4743	5060	92.25
2	Eggs (in crores)	74	74	78	79	100	35.14
3	Meat (in 000. tonnes)	156	173	173	176	175	12.18
4	Wool (in lakh kg.)	4.24	3.62	3.94	3.78	2.2	-48.11

Source : Animal Husbandry and Fisheries Dept.. GOB

Table 4.6.12: Livestock Potential in Bihar (2011-12)	
Total Milk (000, tones)	9000
Eggs (millions)	1350
Meat (000, tones)	200
Fish (000, tones)	380
Honey (000, tones)	30
Source: A report of special Task Force, Bihar's Agricultural Development	

- Milk Production is in appreciable amount.
- Fish production is less and can be improved.
- In this region honey production is less.

Table 4.6.13: Milk Production (2005-06)	
District	'000' M.T.
Patna	518.35
Nalanda	90.78
Bhojpur	330.38
Buxar	238.81
Rohtas	259.47
kaimur	184.52
total	1622.31
source: Annual report 2007, GOB	

Table 4.6.14: District wise livestock and poultry population 2003 (in '000')					
District	Crossbread cattle	Indigenous cattle	Buffalo	Bovines	Total
Patna	135.7	179	266	581	1161.7
Nalanda	41.7	158	219	419	837.7
Bhojpur	53.1	168	231	452	904.1
Buxar	32.2	106	162	300	600.2
Rohtas	15.3	240	322	577	1154.3
kaimur	9.6	203	191	404	807.6
total	287.6	1054	1391	2733	5465.6
Source: 17th livestock census, GOI.					

- Total production of milk is 1622310 M.T.
- 31.95 percent of the milk is produced in Patna district.

4.6.4 Fisheries and poultry

There has been a steady increase in fish production in the State over the period 2001-02 to 2005-06 and its share in total agricultural GDP has nearly doubled in last 10 years. However, its production is estimated to fall to 160 thousand MT in 2006-07 because seed has substantially fallen this year. Fishermen in the State are being trained to increase productivity of fisheries sector, loans are being granted for maintenance and renovation of privately owned ponds in the State.

Table 4.6.15: Trends in fish production

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Fish production from all sources (,000 MT)	240.00	261.00	266.49	267.51	279.00	160.50
Seed Production (in lakhs)	3299.57	3679.90	3471.14	3182.11	3449.49	2866.55
Income from Jalkar settlements (in lakh Rs)	296.39	321.61	371.14	382.95	448.44	309.83
Number of Private fish farmers who have been given training in fisciculture	861	1192	5063	1475	134	400 (in process)
Loans accepted for mainetenance/renovation of privately owned ponds (in lakhs)	4.00	14.70	35.08	32.84	73.98	14.55
Free housing plan for fishermen (at the rate of 1 per family)	117	56	243	244	205	405

Source : Fisheries Directorate, Bihar

4.6.5 Forestry

Bihar has notified forest area of 6,764.14 km², which is 7.1 per cent of its geographical area. The sub Himalayan foothill of Someshwar and Dun ranges in Champaran district another belt of moist deciduous forests. These also consist of scrub, grass and reeds. Here the rainfall is above 1,600 mm and thus promotes luxuriant Sal forests in the favoured areas. The hot and dry summer gives the deciduous forests. The most important trees are Shorea Robusta (Sal), Shisham, Cedrela

Figure 4.6.9 Satellite image of Sanjay gandhi botanical garden, Patna

Toona, Khair, and Semal. This type of forests also occurs in Saharsa district and Purnia district. Bihar has 3,208 km^2 (~3.41%)of Protected Forest Area and 76.30 km^2 Protected Non-Forest Area.

Table 4.6.16: Bihar's and National Forest Cover

SL	Item	National	State
1.	Recorded forest area compared to geographical area	23.57%	6.87%
2.	Total forest cover as compared to geographical area	20.64%	5.90%
3.	Tree cover as compared to culturable non-forest area	4.56%	2.04%
4.	Trees/Hectare of culturable non-forest area	12.30	13.80

Table 4.6.17: Bihar Forests - At a Glance

SL	Description	Area (in km^2)	%age
1.	Geographical Area	94,163	100
2.	Forest Area	6,473	6.87
3.	Very Dense Forest	76	0.08
4.	Dense Forest	2,951	3.13
5.	Open Forest	2,531	2.69

Details of Protected Areas:

SL	Name of Park/Sanctuary	District	Area	Flora/Fauna	Type
1	Kaimur Sanctuary	Rohtas	The largest sanctuary in the state, 500 sq km.	sheesham teek, saal, jamun, mahua, salai, jheengar, siddha and Koraiya, antelope, blue bull, black buck Chital, chinkara, leopard, blackbuck, karakal and bijju	Sanctuary
2	Rajgir Sanctuary	Nalanda	36sq.kms	hyenas, leopards, nilgai, barkind deer etc	Sanctuary
3	Sanjay Gandhi Botanical Garden	Patna	0.62 sq km.	Lion, deer, elephant, monkey, tiger, beer, leopard, amu, peacock, hippopotamus etc.	Botanical Garden

4.6.6 Water resources

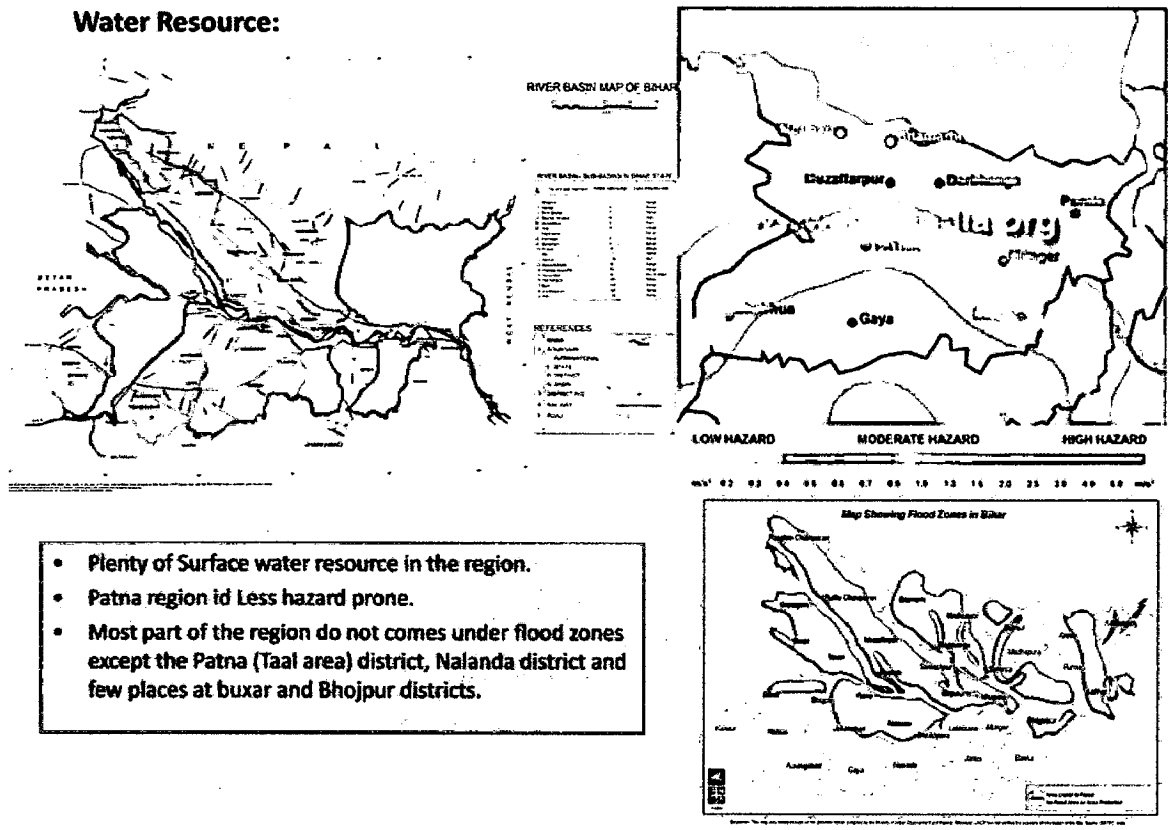


Figure 4.6.10 Maps showing situation of water resource in Bihar

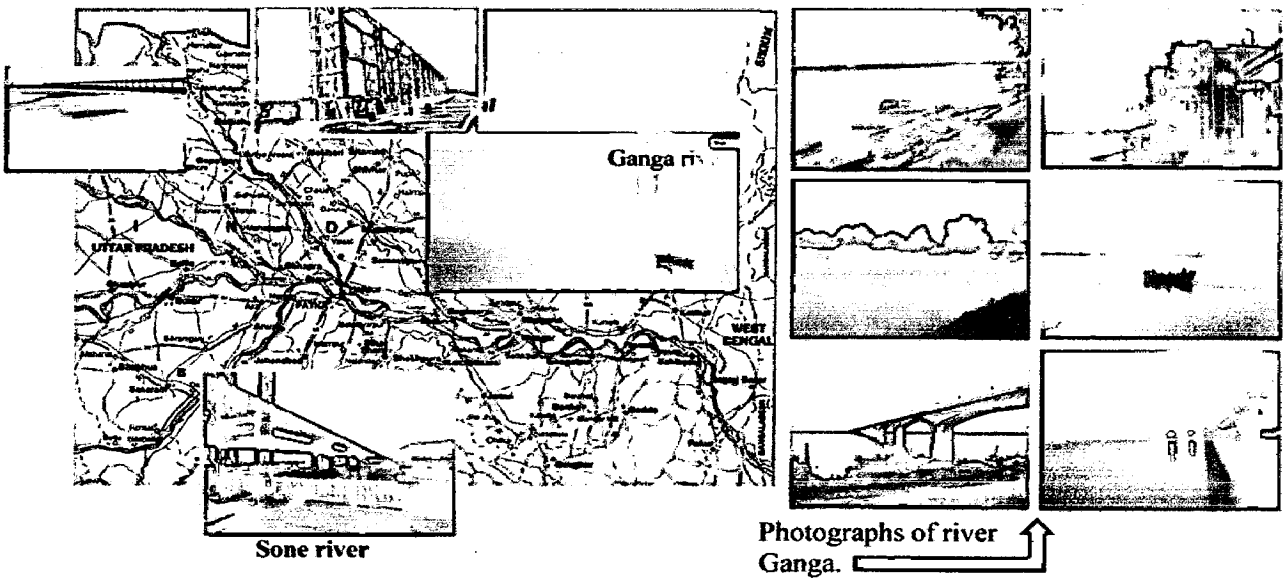


Figure 4.6.11 Photographs of rivers in Bihar

4.7 Industries

The industrial sector in Bihar remains in a poor state-with its growth rate much below the national average. The size of the industrial sector in Bihar in terms of income is hardly 3.2% of net domestic product of the State, whereas, the national average works out to 20.1%. Small industries, dominated by tiny enterprises and artisan based industries play a significant role in the industrial sector of the state. Generally, their contribution to employment generation is substantial, even when the levels of productivity and total production remain low in this sector. The share of tiny industrial units among all the SSI units (both registered and unregistered) is as high as 99.9 percent.

Agro- based industries occupy a prominent place in the industrial scenario of present Bihar as they account for nearly half of the net value added. Food products, tobacco products, leather products, and non metallic products occupy prominent constituents of industrial base in Bihar, though group of industries, comprising of cotton, jute, wool, paper, rubber, plastic and chemicals, also have their presence in smaller ways. During the last two decades, agro-based industries viz;, dairy sector through cooperatives, and makhana industries have shown increasing trend. Yet, these still accounts for a small proportion of State's Domestic Product.

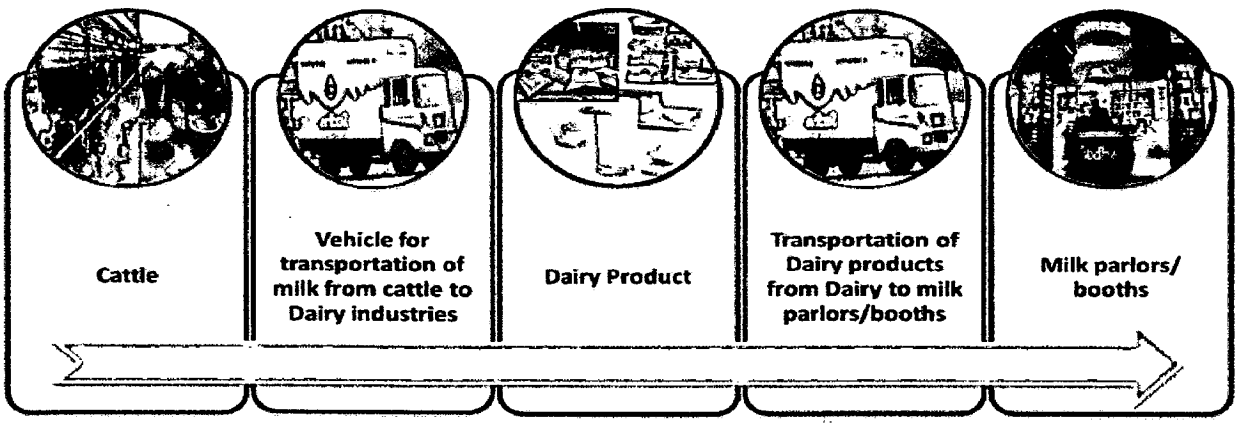


Figure 4.7.1 Sudha Dairy in Patna

Figure 4.7.2 Photographs of Rural Industries

Figure 4.7.3 Brick kilns lined along the bypass road, Industries along the bypass road, and Software Technology Park (respectively starting from left)

Bihar has some of major public sector projects like the Oil refinery of Indian Oil Corporation and Fertilizer manufacturing plant of Hindustan Fertilizer Corporation Ltd (HPCL) at Barauni, Pyrites, Phosphates and Chemicals Ltd (PPCL) at Amjhor; Cotton spinning mills at Siwan, Pandaul, Bhagalpur, Mokamah and Gaya; 13 sugar mills in private sector and 15 in public section located in South and North Bihar. In addition distilleries at Gopalganj, West Champaran, Bhagalpur and Riga (Sitamarhi District); finish leather industry in West Champaran, Muzaffarpur and Barauni; Jute mills at Katihar and Samastipur; Medicine manufacturing unit at Hajipur; Food processing units and Vanaspati manufacturing units at Aurangabad and Patna; Kalyanpur Cement Ltd at Banjari are some of the notable industries in Bihar. Recently, the dairy industry has picked up very well in Bihar. Sugar industry is another one which has started to show up with 25 new sugar factories committed in Bihar.

Tourism Bihar was the main scene of activities of the Buddha and the 24 Jain Tirthankaras. It is also one of the important places in the annals of Indian history which has seen the rise and fall of major empires. With its historical past, there are many tourist destinations especially pilgrim centres in the state like Patna, Bodhgaya, Rajgir, Vaishali and ruins of the world famous, ancient university of Nalanda, etc. Bihar State Tourism Development Corporation organises trips for Rajgir, Nalanda, etc. from its headquarters in the capital Patna. Bihar's Buddhist circuit to places includes Bodhgaya, Gaya, Vaishali, etc. Apart from that, it has places of historical and national parks.

Figure 4.7.4 Photographs showing some tourist places in Bihar

4.8 Infrastructure

4.8.1 Transport

The Patna region has a vast network of National and State highways. **National highways like 2, 30, 31, 82, 84 and 110** connect the region from places all over India. Region is **well-connected by railway** lines to the rest of India. Most of the towns are interconnected among themselves.

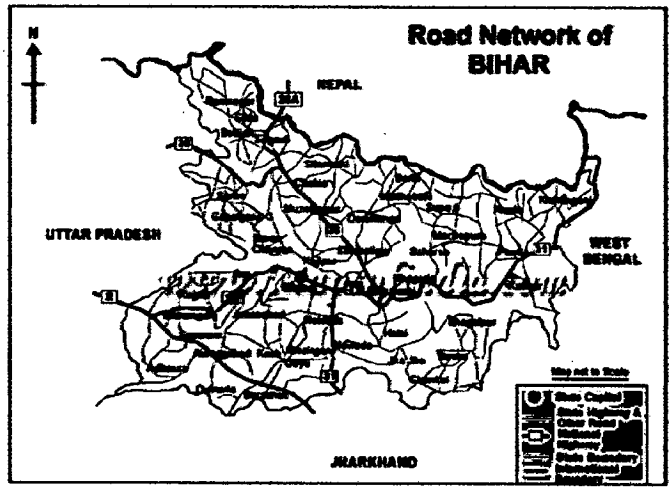


Figure 4.8.1 Map showing road network of Bihar

Bihar has three airports - Patna, Bhagalpur Airport and Gaya. Patna airport is connected to Delhi, Mumbai, Kolkata, Lucknow and Ranchi. It is categorised as a restricted international airport, with customs facilities to receive international chartered flights. Gaya airport is a small international airport connected to Colombo and Bangkok.

Bihar is well-connected by railway lines to the rest of India. Most of the towns are interconnected among themselves, and they also are directly connected to Kolkata, Delhi, and Mumbai. Patna, Bhagalpur, Muzaffarpur and Gaya are Bihar's best-connected railway stations.

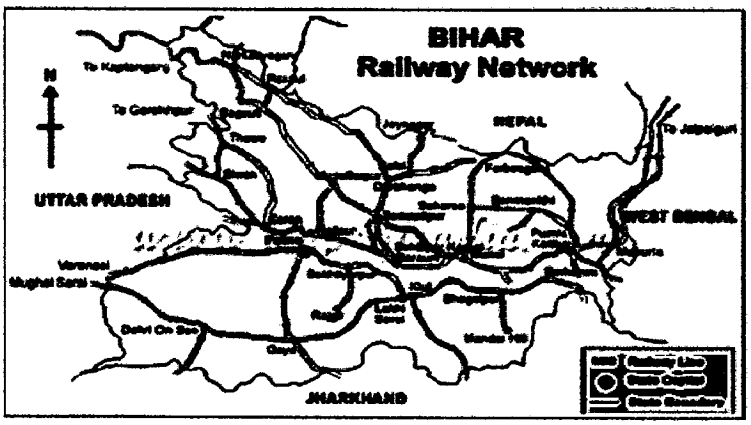


Figure 4.8.2 Map showing railway network of Bihar

Table 4.8.1: Accessibility of Villages by Roads in Bihar and India

Types of Villages	%age of villages accessible by roads	
	India	Bihar
Villages with population < 1000	37.4	27.7
Villages with population 100-1500	75.9	53.2
Villages with population .>15000	91.7	70.6
All villages	47.9	36.1

Source: Basic Road Statistics of India, Min. of Shipping, Road Transport and Highways, Government of India (2004).

ROADS

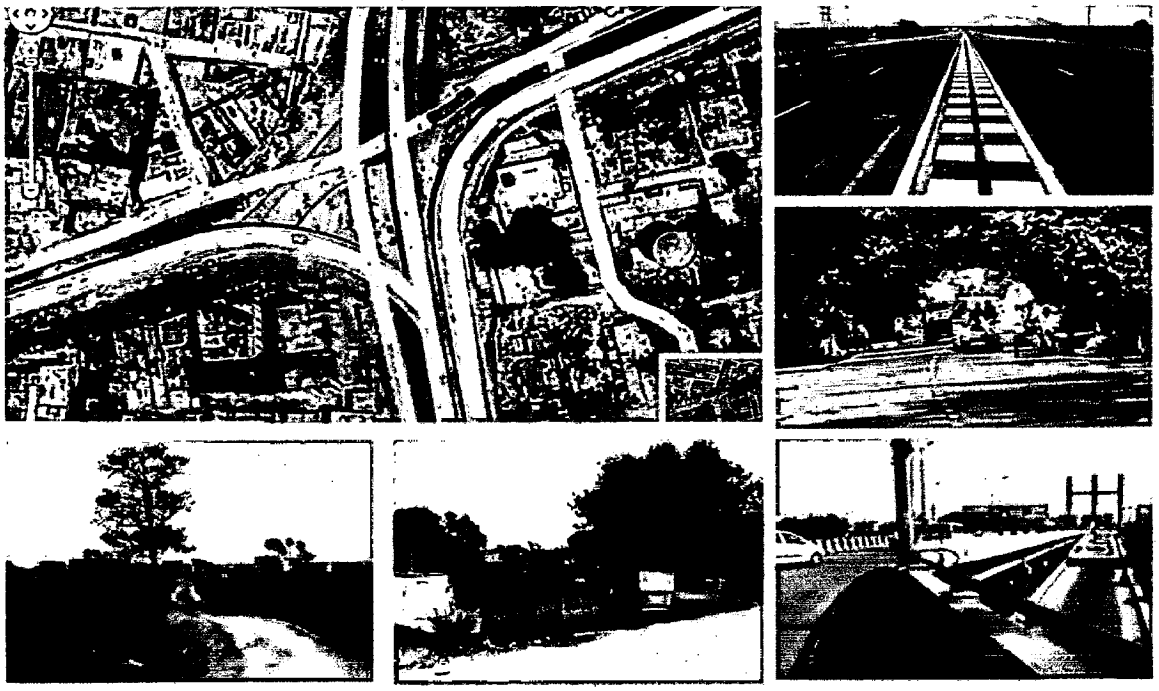


Figure 4.8.3 Photographs showing some important roads of Patna region

4.8.2 Power Supply

Power generation and availability rates are the lowest in Bihar, compared to an all India average annual electricity consumption level of 334 kWh and 895 kWh of Punjab. The average per capita consumption of electricity in Bihar was only 55 kWh. High unit costs, large transmission and distribution losses and low collection rates have created high units of power supply in Bihar. The supply is poor and irregular with large voltage fluctuations resulting in majority of industries opting for captive power units.

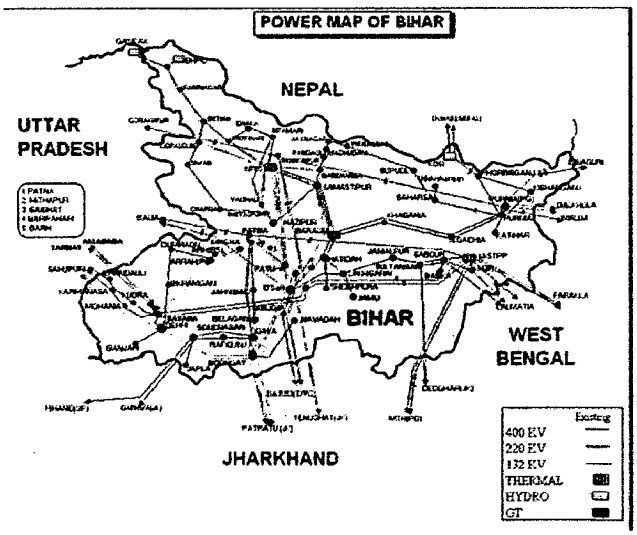
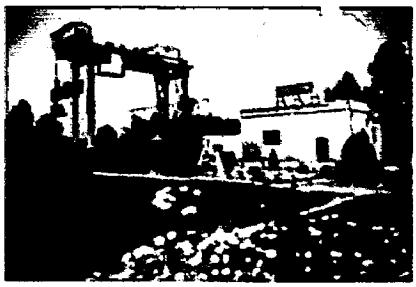
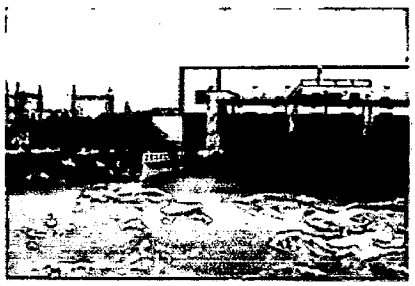
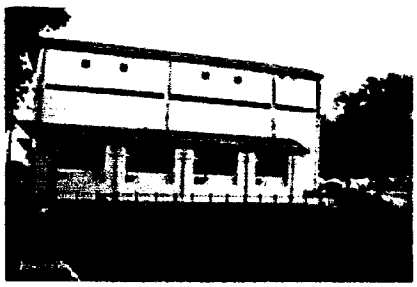


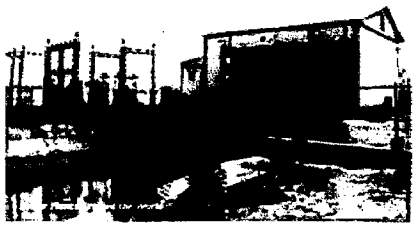
Figure 4.8.4 Map showing power supply network of Bihar

There are many hydro electric power plants in Bihar which generates electricity. Due to existence of plenty of water resource hydro power is the major source of energy in the state.


Sone Eastern Link Canal (Barun)


Eastern Gandak Canal (Valmikinagar)


Dhelabagh


Agnoor

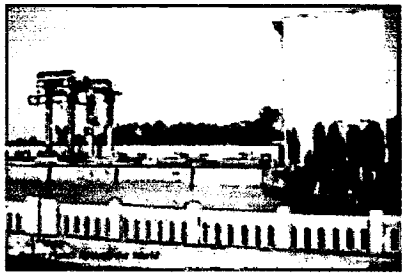

Sone Western Link Canal (Dehri)

Figure 4.8.5 Photograpss: Hydro-electric power plants of Bihar

4.9 Financial Services and Capital Markets

Bihar has one of the least developed financial sectors in India, due to both demand and supply side factors. The NSS survey of private sector perceptions identified weak capital markets as the major impediment. There is considerably low household account usage—21 per cent as compared to 73 per cent nationally. However, banks in Bihar also have higher depositor numbers per branch and very low credit to deposit ratios despite reasonably higher savings rates, thereby reflecting the banks' perceptions of high risk and general lack of quality lending opportunity. The World Bank report concludes that financial services, due to all the above, are relatively undeveloped, more expensive and often unavailable, particularly in rural areas. The major fallout of this is that Bihar is a net exporter of capital, i.e. the capital is being used elsewhere than in the state.

Table 4.9.1: Credit Deposit Ratio in percentage (31st march, 2006)

Bank	Bihar	National
Commercial Banks	31	70
Regional Rural Banks	36	54
Cooperative Banks	77	100
Total	32	73

Source: A report of special Task Force, Bihar's Agricultural Development

Table 4.9.2: Trend in Credit and Deposit in Bihar (In Rs. Crore) (2005-06)		
Bank Category	Deposit	Advances
Commercial Banks	391770	119880
Regional Rural Banks	61820	22250
Cooperative Banks	7750	5950
Total	461340	148080
Source: Leed Bank report, Bihar		

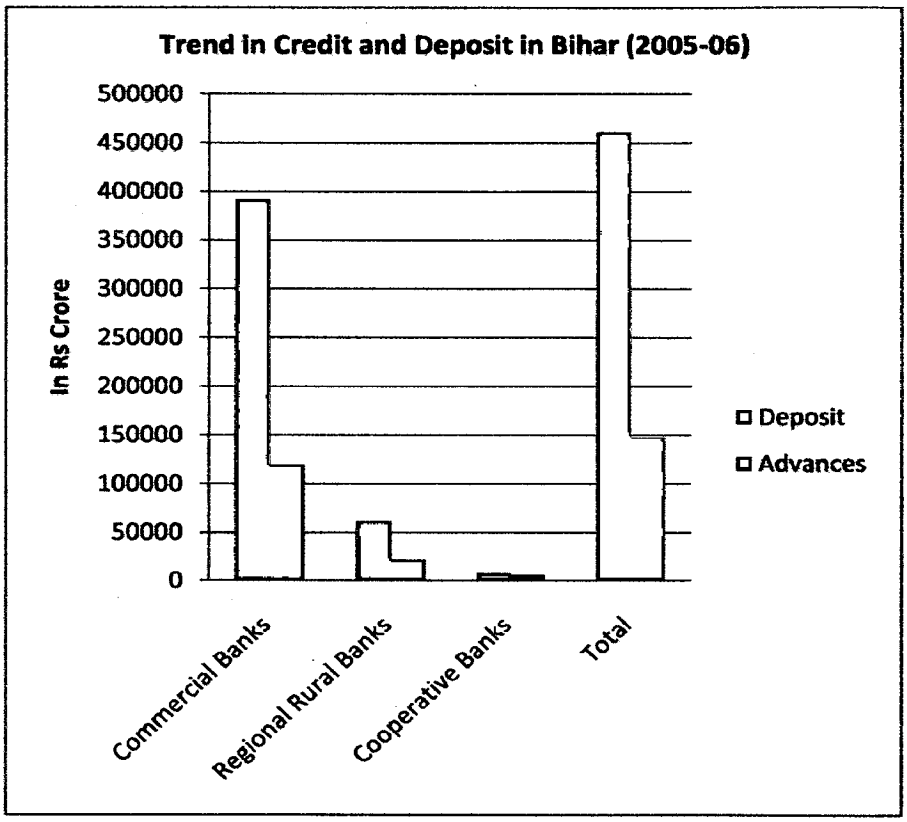


Figure 4.9.1 Trend in Credit and Deposit in Bihar (In Rs. Crore) (2005-06)

Deposit is more than three times of Credit from banks in Bihar. C/D ratio in Bihar is only 32%, which is much less than the national average. Social ideas/thoughts, Banker's attitude & Low recovery rate of loans are the main reasons.

Investment Climate

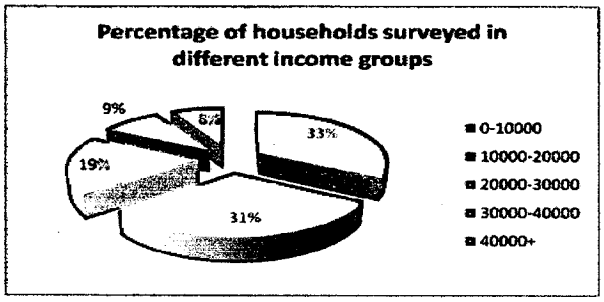
Investment Climate (IC) refers to the institutional, economic, political and infrastructural environment affecting investment in industry. Bihar ranks the lowest, in terms of physical and institutional environment, even below Orissa and Jharkhand. For most of the other IC indicators such as penetration of infrastructure, financial system and workforce quality, Bihar is ranked at or close to the bottom. **Investment flow** is **bleak** in Bihar as only **0.4% (Rs. 7682 Cr)** of proposed investment in India was planned in Bihar.

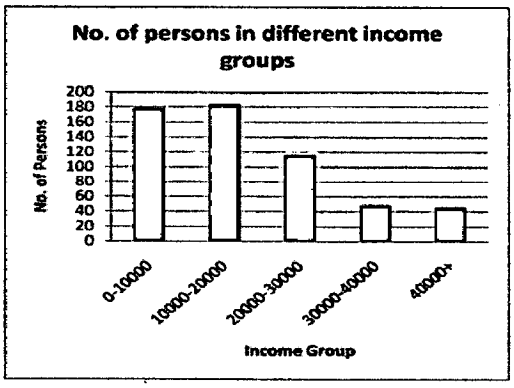
Chapter 5. COMPARATIVE ANALYSIS OF DATA

5.1 Primary data analysis

Table 5.1.1: Number of households in different income group

Table: no. of households			
Income Group	no of households	no of persons	Percentage (%)
0-10000	33	178	(31.23)
10000-20000	31	183	(32.11)
20000-30000	19	116	(20.35)
30000-40000	9	48	(8.42)
40000+	8	45	(7.89)
Grand Total	100	570	(100.00)





- Hundred households had been chosen for the survey.
- Each District within the study area has been covered.
- One third of the household belongs to middle income group of 10000-20000 (Rs/month).
- Less than one-tenth (7.89 percent) of the household belongs to income group 40000+
- Mostly rural areas had been surveyed.

Figure 5.1.1 Chart showing number/ percentage of persons in different income groups in Patna region

Table 5.1.2: Level of Education in different income groups

Table: Education: No. of Persons																
Income Group	Total no of illiterates	(%)	Upto Matric	(%)	Matric	(%)	Senior Secondary	(%)	Graduation	(%)	Post graduation	(%)	Tech./ Vocational education	(%)	Total	(%)
0-10000	113	54.85%	40	25.64%	21	28.77%	2	5.00%	2	3.08%	0	0.00%	0	0.00%	178	31.23%
(%)	63.48%		22.47%		11.80%		1.12%		1.12%		0.00%		0.00%		100.00%	
10000-20000	60	29.13%	50	32.05%	22	30.14%	15	37.50%	27	41.54%	6	66.67%	3	14.29%	183	32.11%
(%)	32.79%		27.32%		12.02%		8.20%		14.75%		3.28%		1.64%		100.00%	
20000-30000	18	8.74%	40	25.64%	18	24.66%	12	30.00%	19	29.23%	1	11.11%	8	38.10%	116	20.35%
(%)	15.52%		34.48%		15.52%		10.34%		16.38%		0.86%		6.90%		100.00%	
30000-40000	13	6.31%	10	6.41%	6	8.22%	6	15.00%	7	10.77%	2	22.22%	4	19.05%	48	8.42%
(%)	27.08%		20.83%		12.50%		12.50%		14.58%		4.17%		8.33%		100.00%	
40000+	2	0.97%	16	10.26%	6	8.22%	5	12.50%	10	15.38%	0	0.00%	6	28.57%	45	7.89%
(%)	4.44%		35.56%		13.33%		11.11%		22.22%		0.00%		13.33%		100.00%	
Grand Total	206	100.00%	156	100.00%	73	100.00%	40	100.00%	65	100.00%	9	100.00%	21	100.00%	570	100.00%
(%)	36.14%		27.37%		12.81%		7.02%		11.40%		1.58%		3.68%		100.00%	

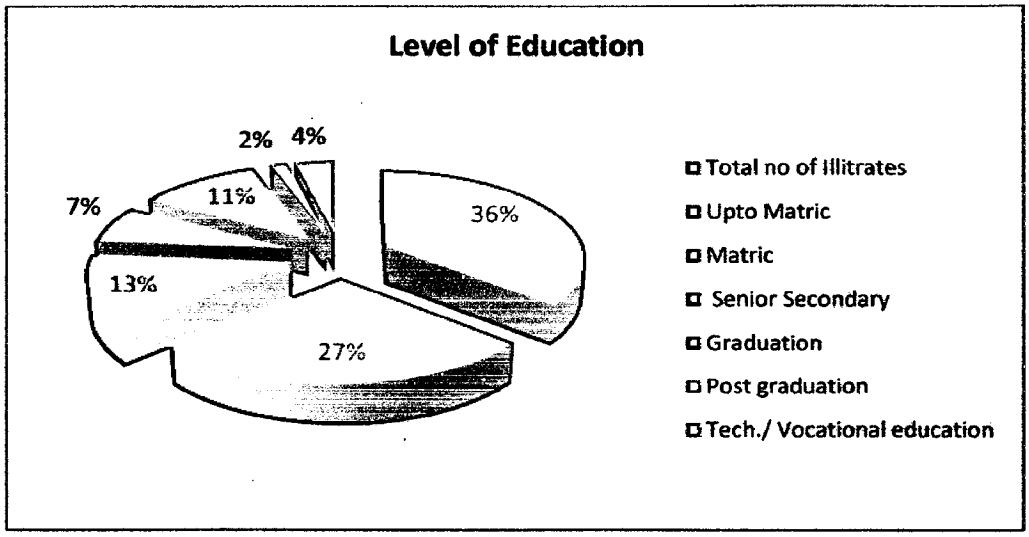


Figure 5.1.2 Chart showing level of education in Patna region

- More than one third (36.14 percent) of the population is illiterate.
- Only 1.58 percent of the population has completed post graduation.
- In the lower income group (0-10000) slightly less than two-third (63.48 percent) is illiterate.
- Level of education is low in the region.

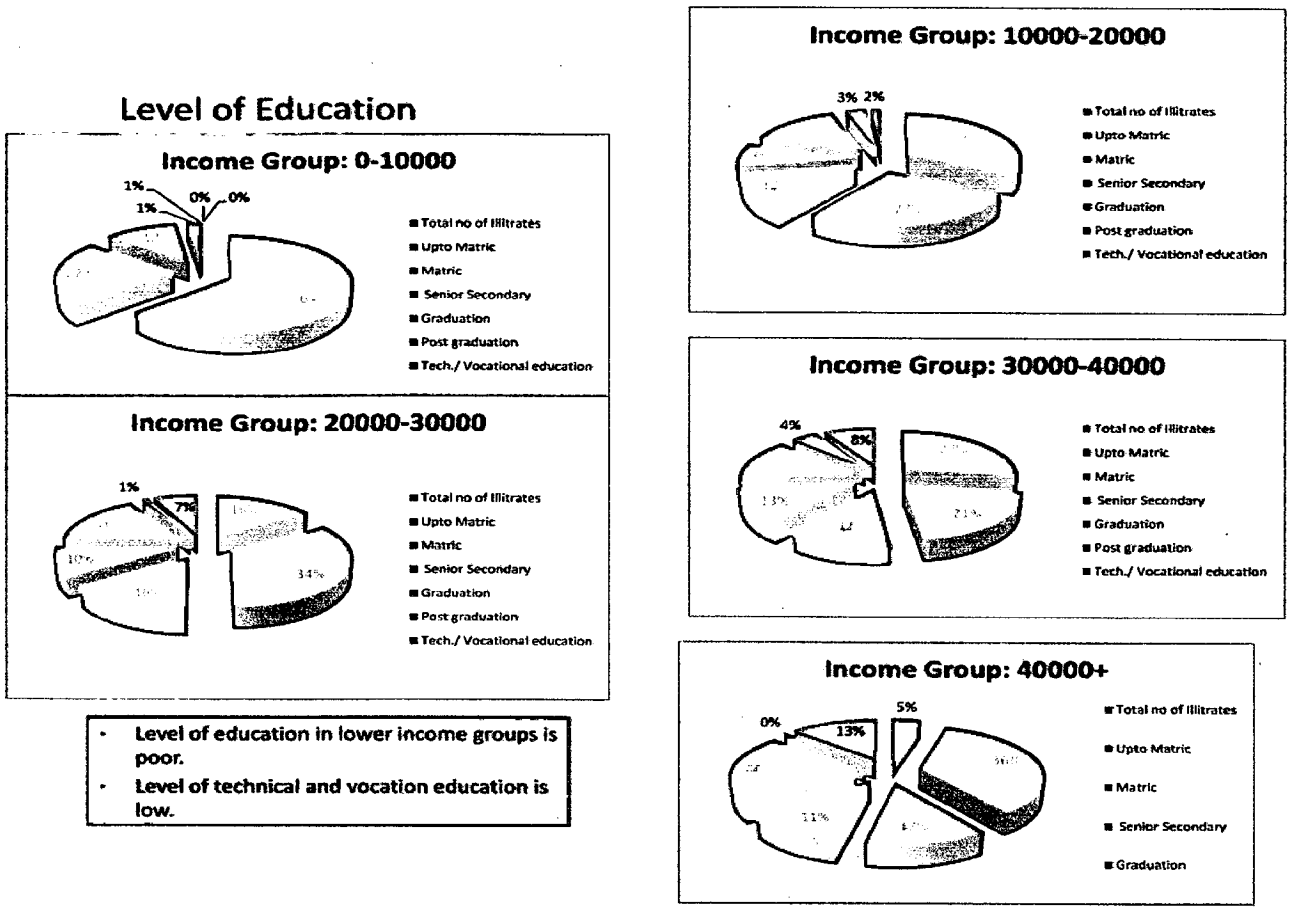


Figure 5.1.3 Chart showing level of education in different income groups in Patna region

Table 5.1.3: No of persons in different age groups:

	Age Group (in Years)											
Income Group	0-15	(%)	15-30	(%)	30-45	(%)	45-60	(%)	60+	(%)	Total	
0-10000	94	37.15%	52	29.89%	25	26.88%	7	19.44%	0	0.00%	178	31.23%
(%)	52.81%		29.21%		14.04%		3.93%		0.00%		100.00%	
10000-20000	71	28.06%	68	39.08%	29	31.18%	6	16.67%	9	64.29%	183	32.11%
(%)	38.80%		37.16%		15.85%		3.28%		4.92%		100.00%	
20000-30000	48	18.97%	27	15.52%	23	24.73%	17	47.22%	1	7.14%	116	20.35%
(%)	41.38%		23.28%		19.83%		14.66%		0.86%		100.00%	
30000-40000	22	8.70%	15	8.62%	7	7.53%	3	8.33%	1	7.14%	48	8.42%
(%)	45.83%		31.25%		14.58%		6.25%		2.08%		100.00%	
40000+	18	7.11%	12	6.90%	9	9.68%	3	8.33%	3	21.43%	45	7.89%
(%)	40.00%		26.67%		20.00%		6.67%		6.67%		100.00%	
Grand Total	253	100.00%	174	100.00%	93	100.00%	36	100.00%	14	100.00%	570	100.00%
(%)	44.39%		30.53%		16.32%		6.32%		2.46%		100.00%	

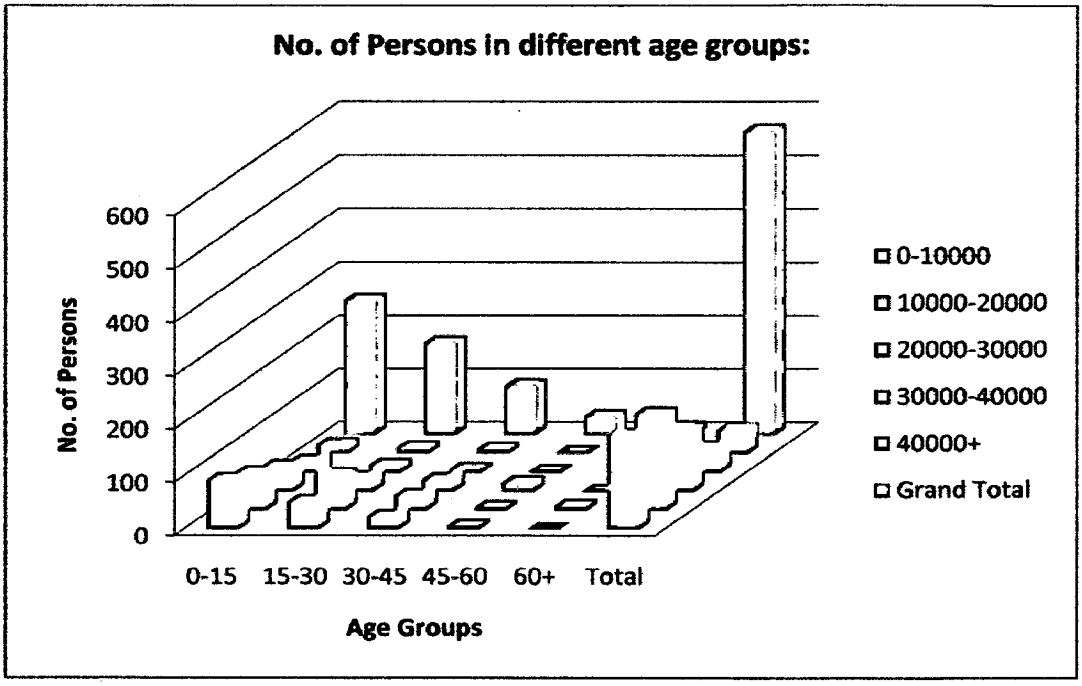


Figure 5.1.4 Chart showing number of persons in different age groups in Patna region

- In lower income group (0-10000) more than half (52.81 percent) of the population belongs to (0-15) years of age group.
- In all income groups more than one third population belongs to 0-15 years age group.
- Also. More than half (53.17 percent) of the population belong to working age-group of 15-60 years.

Table 5.1.4: Marital Status						
Income Group	Married	(%)	Unmarried	(%)	Total	(%)
0-10000	75	28.09%	103	33.99%	178	31.23%
(%)	42.13%		57.87%		100.00%	
10000-20000	94	35.21%	89	29.37%	183	32.11%
(%)	51.37%		48.63%		100.00%	
20000-30000	55	20.60%	61	20.13%	116	20.35%
(%)	47.41%		52.59%		100.00%	
30000-40000	22	8.24%	26	8.58%	48	8.42%
(%)	45.83%		54.17%		100.00%	
40000+	21	7.87%	24	7.92%	45	7.89%
(%)	46.67%		53.33%		100.00%	
Grand Total	267	100.00%	303	100.00%	570	100.00%
(%)	46.84%		53.16%		100.00%	

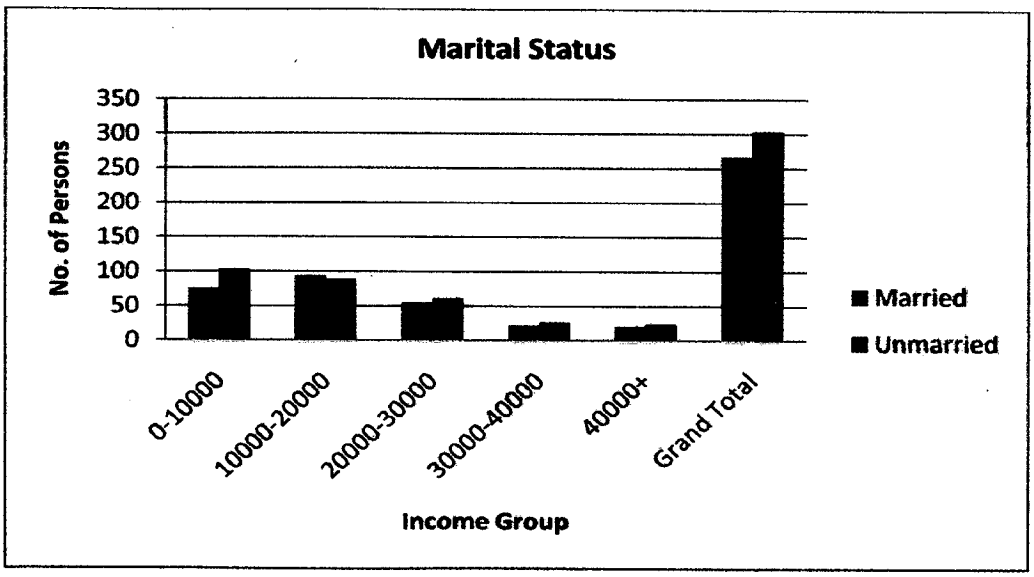
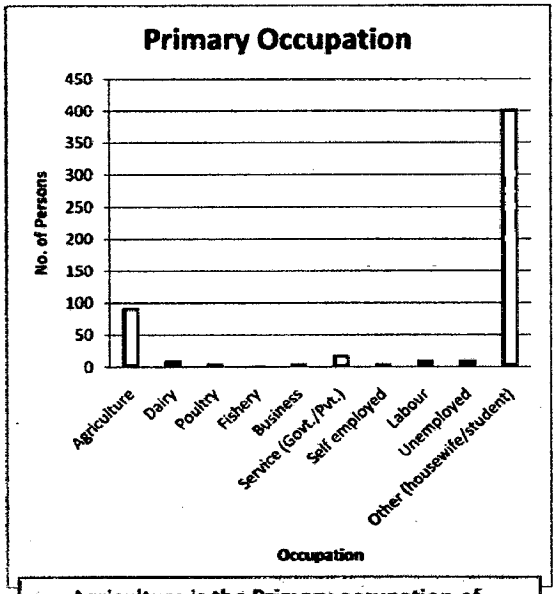


Figure 5.1.5 Chart showing marital status of people in different income groups

- No. of Married and Unmarried persons in all income groups are about equal.
- Slightly less than half (46.84 percent) of the people are married.
- More than half of the persons are unmarried.



- Agriculture is the Primary occupation of most of the people.
- Number of housewives and students is much more than the total working population.
- Unemployment is mostly among middle income group (10000-20000)

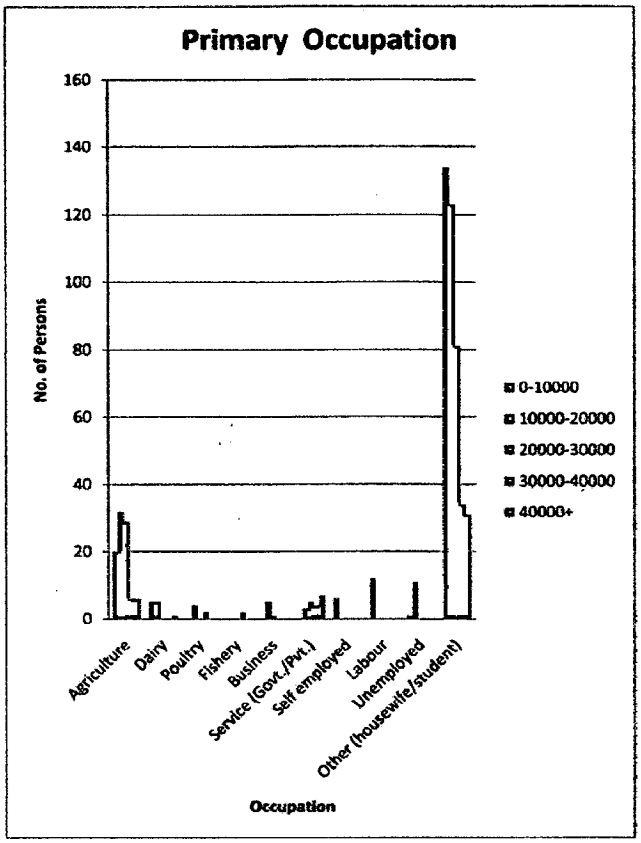


Figure 5.1.6 Chart showing primary occupation of people from different income groups

Table 5.1.5: Primary occupation; No. of Persons

Income Group	Agriculture	(%)	Dairy	(%)	Poultry	(%)	Fishery	(%)	Business	(%)	Service (Govt./Pvt.)	(%)	Self employed	(%)	Labour	(%)	Unemployed	(%)	Other (housewife/student)	(%)	Total	(%)
0-10000	20	21.51%	5	45.45%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	6	100.00%	12	100.00%	1	8.33%	134	33.25%	178	31.23%
(%)	11.24%		2.81%		0.00%		0.00%		0.00%		0.00%		3.37%		6.74%		0.56%		75.28%		100.00%	
10000-20000	32	34.41%	5	45.45%	4	66.67%	0	0.00%	5	83.33%	3	15.79%	0	0.00%	0	0.00%	11	91.67%	123	30.52%	183	32.11%
(%)	17.49%		2.73%		2.19%		0.00%		2.73%		1.64%		0.00%		0.00%		6.01%		67.21%		100.00%	
20000-30000	29	31.18%	0	0.00%	0	0.00%	0	0.00%	1	16.67%	5	26.32%	0	0.00%	0	0.00%	0	0.00%	81	20.10%	116	20.35%
(%)	25.00%		0.00%		0.00%		0.00%		0.86%		4.31%		0.00%		0.00%		0.00%		69.83%		100.00%	
30000-40000	6	6.45%	0	0.00%	2	33.33%	2	100.00%	0	0.00%	4	21.05%	0	0.00%	0	0.00%	0	0.00%	34	8.44%	48	8.42%
(%)	12.50%		0.00%		4.17%		4.17%		0.00%		8.33%		0.00%		0.00%		0.00%		70.83%		100.00%	
40000+	6	6.45%	1	9.09%	0	0.00%	0	0.00%	0	0.00%	7	36.84%	0	0.00%	0	0.00%	0	0.00%	31	7.69%	45	7.89%
(%)	13.33%		2.22%		0.00%		0.00%		0.00%		15.56%		0.00%		0.00%		0.00%	0.00%	68.89%		100.00%	
Grand Total	93	100.00%	11	100.00%	6	100.00%	2	100.00%	6	100.00%	19	100.00%	6	100.00%	12	100.00%	12		403	100.00%	570	100.00%
(%)	16.32%		1.93%		1.05%		0.35%		1.05%		3.33%		1.05%		2.11%		2.11%		70.70%		100.00%	

- Agriculture is the Primary occupation of less than one-sixth (16.32 percent) of the total population.
- More than two third (70.70 percent) of the population are students and housewives.
- Most (91.67 percent) of unemployed persons belongs to(10000-20000) income group.
- Only 12.90 percent of the Farmers belong to income group of 30000+

- More than 90 percent of the persons involved on Dairy related occupation belong to income group of 0-20000.
- Persons involved in poultry are mainly from middle income groups. Two-third (66.67 percent) of the poultry workers belongs to 10000-20000 income group.
- Very few (0.35 percent) people are engaged in fishery occupation.
- All the businessmen belong to income group of 10000-30000.
- All self employed and labours belong to lower income group 0-10000.

Table 5.1.6: Secondary occupation : no of household

Income Group	Agriculture	Dairy	Poultry	Fishery	Business	Service (Govt./ Pvt.)	Self employed	Labour	Total	no of households surveyed
0-10000	3	5	0	0	2	1	5	9	25	33
10000-20000	3	4	1	2	6	2	2	1	21	31
20000-30000	0	0	0	1	8	1	0	0	10	19
30000-40000	3	0	0	1	3	0	0	0	7	9
40000+	1	0	0	1	1	0	0	0	3	8
Grand Total	10	9	1	5	20	4	7	10	66	100

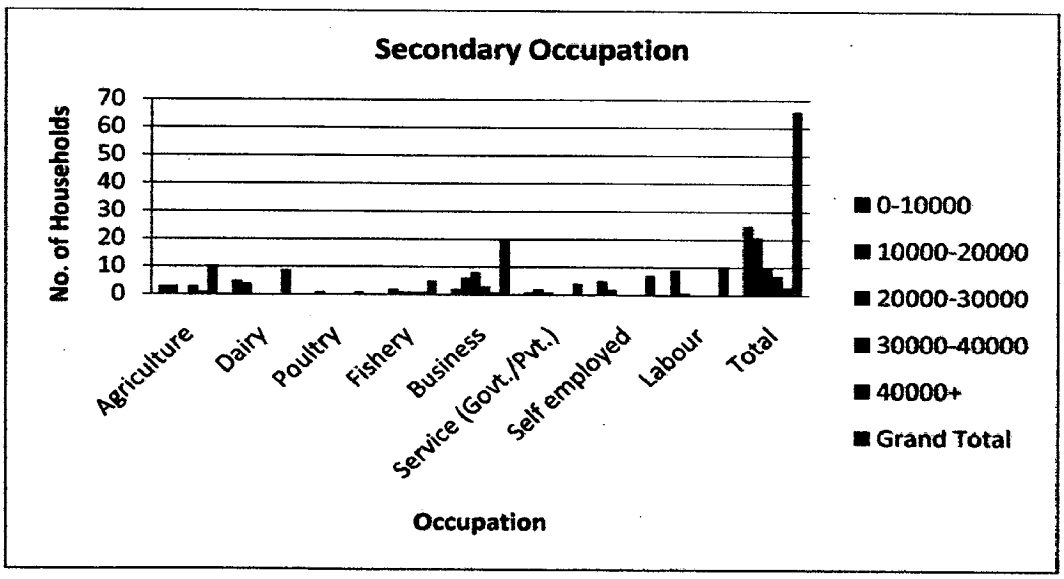


Figure 5.1.7 Chart showing secondary occupation of people from different income groups

- Two third of the household is involved is secondary occupation.
- One-fourth of the households involve in secondary occupation belongs to lower income group 0-10000.
- Business is secondary occupation in one fifth of the households.

- Agriculture, Dairy, poultry and fishery are secondary occupation in one fourth of the households.

Table 5.1.7: Expenditure: no of households						
Income Group	**0-10000**	**10000-20000**	**20000-30000**	**30000-40000**	**40000+**	**Total**
0-10000	32	1	0	0	0	33
10000-20000	29	2	0	0	0	31
20000-30000	16	1	2	0	0	19
30000-40000	6	2		1	0	9
40000+	1	3	1	2	1	8
Grand Total	84	9	3	3	1	100

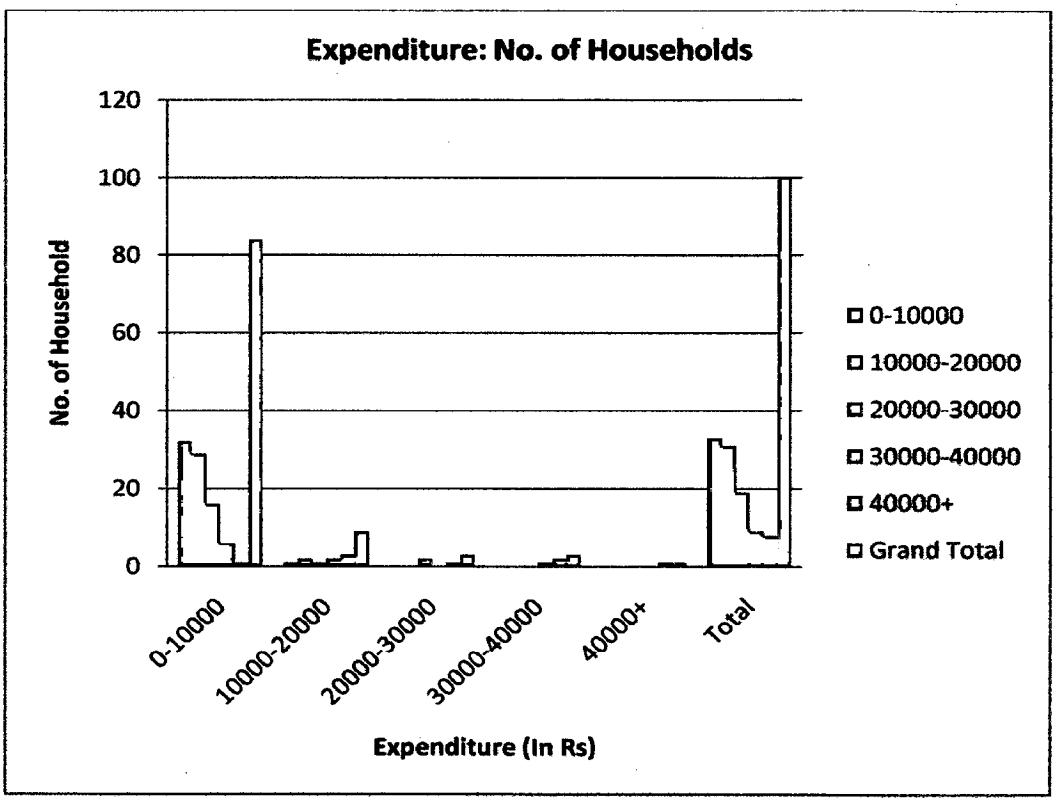


Figure 5.1.8 Chart showing expenditure pattern of different income group people

- More than 4/5th of the household have monthly expenditure 0-10000.
- Higher income groups have higher expenditure trends.
- Most part of the expenditure goes in food items among lower income group consisting of landless labours.
- In middle income groups people after food people tends to spend money on education.
- Expenditure over servants and labours are most in higher income groups.

Table 5.1.8: Savings: no of household						
Income Group	**0-5000**	**5000-10000**	**10000-15000**	**15000-20000**	**20000+**	**Total**
0-10000	31	2	0	0	0	33
10000-20000	3	17	11	0	0	31
20000-30000	2	0	4	11	2	19
30000-40000	1	0	0	0	8	9
40000+	0	0	1	0	7	8
Grand Total	**37**	**19**	**16**	**11**	**17**	**100**

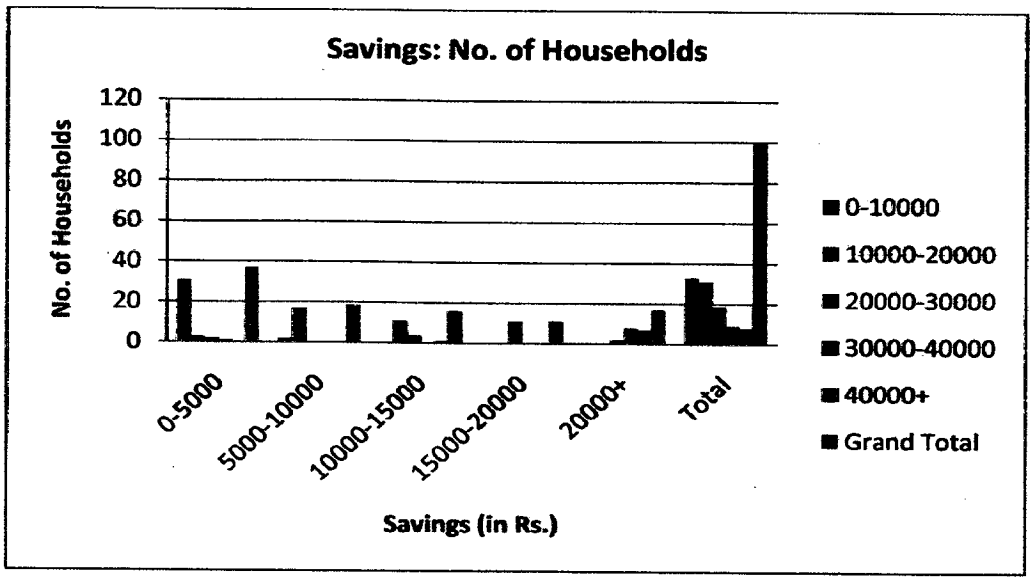
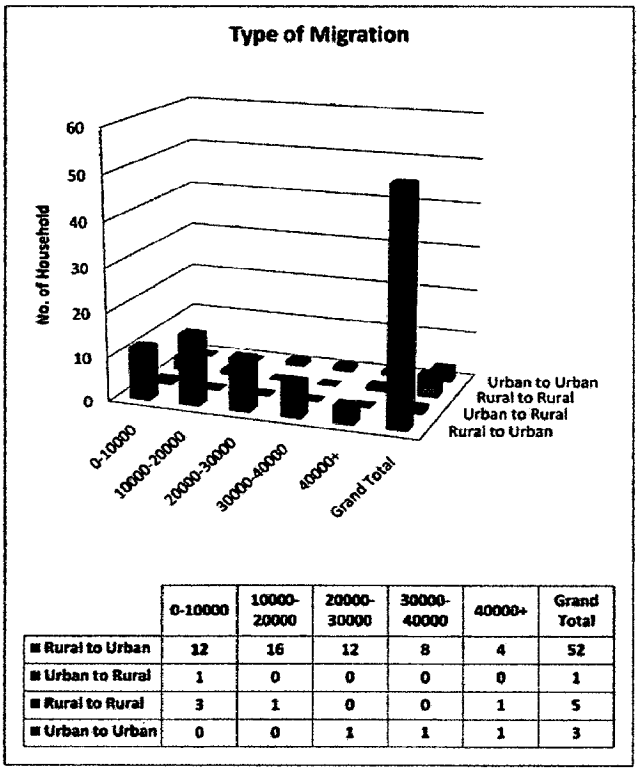
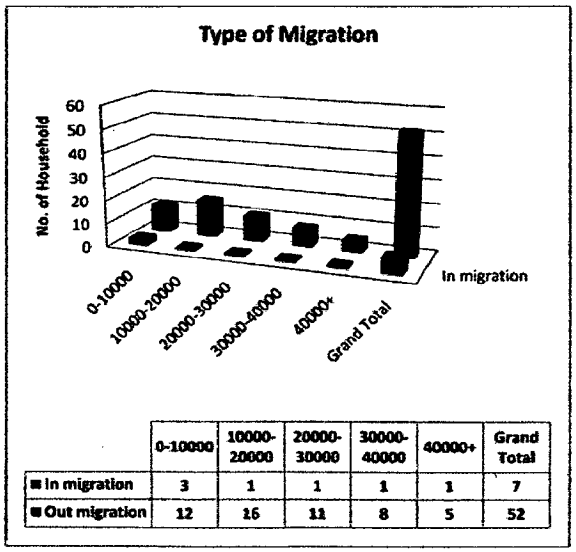


Figure 5.1.9 Chart showing saving pattern of different income group people

- People believe in saving for future. Most of the savings are spent in marriages and dowry.
- People used to deposit saved money in banks.
- Most of the household (93.9 percent), of 0-10000 income group, have very less savings (0-5000) Rs./month.
- Most (88.23 percent) of the household from 30000+ income groups have saving 20000+ Rs./month.



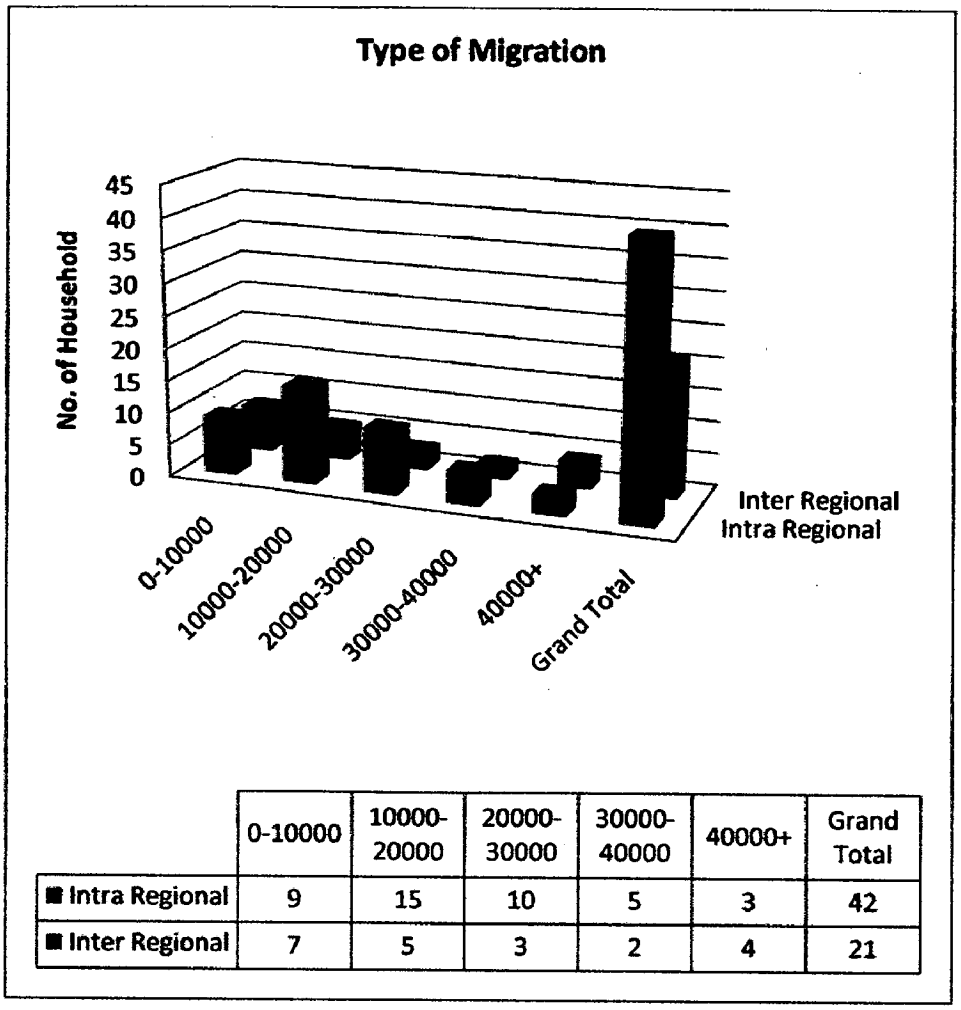
	0-10000	10000-20000	20000-30000	30000-40000	40000+	Grand Total
Rural to Urban	12	16	12	8	4	52
Urban to Rural	1	0	0	0	0	1
Rural to Rural	3	1	0	0	1	5
Urban to Urban	0	0	1	1	1	3



	0-10000	10000-20000	20000-30000	30000-40000	40000+	Grand Total
In migration	3	1	1	1	1	7
Out migration	12	16	11	8	5	52

- Most of the migration is from rural to urban in all income groups.
- Out migration is much more than in migration.
- Most of the in migration is in lower income group 0-10000

Figure 5.1.10 Chart showing migration pattern of different income group's people



	0-10000	10000-20000	20000-30000	30000-40000	40000+	Grand Total
Intra Regional	9	15	10	5	3	42
Inter Regional	7	5	3	2	4	21

Figure 5.1.11 Chart showing type of migration in different income groups

- Intra regional migration is more than inter regional migration.
- One-third of the Inter regional migration is from lower income group 0-10000, which consist of labours and workers.
- Most of the intra regional migration is from 10000-30000 income groups

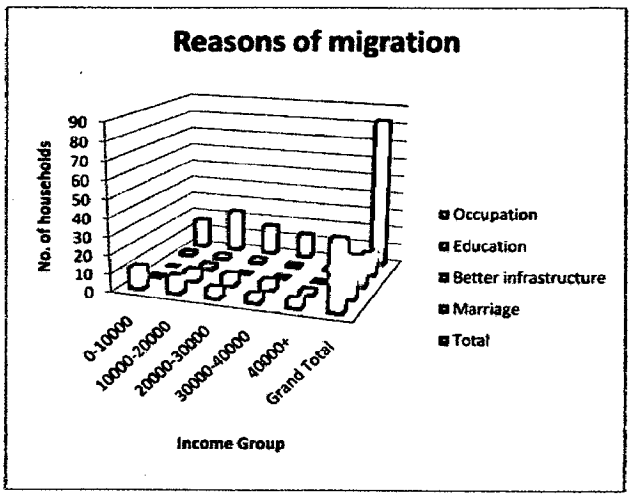
- Occupation & Education is the major reasons of migration.
- Three-fourth (75.9 percent) of the total migration is due to above two reasons.
- Most of the migration took place within ten past years.

Table: Reason of Migration: no of household

income Group	Occupation	Education	Better infrastructure	Marriage	Total
0-10000	13	1	0	3	17
10000-20000	10	7	4	3	24
20000-30000	6	7	1	3	17
30000-40000	5	6	1	2	14
40000+	5	3	1	2	11
Grand Total	**39**	**24**	**7**	**13**	**83**

Table: Period of Migration: no of households

Income Group	0 to 5 yrs.	5 to 10 yrs.	10 to 15 yrs.	more than 15 yrs.	Total
0-10000	28	4	0	1	33
10000-20000	26	5	0	0	31
20000-30000	12	6	1	0	19
30000-40000	5	2	2	0	9
40000+	4	2	0	2	8
Grand Total	**75**	**19**	**3**	**3**	**100**



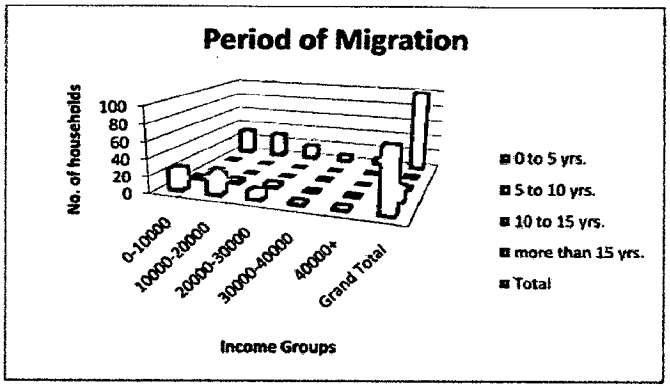


Figure 5.1.12 Chart showing reasons of migration

Table 5.1.9: Total Land ownership: no of households

Income Group	0-1 Ha	1-2 Ha	2-3 Ha	3-4 Ha	>4 Ha	Total
0-10000	30	1	0	0	2	33
10000-20000	7	17	3	1	3	31
20000-30000	3	1	6	5	4	19
30000-40000	1	2	2	1	3	9
40000+	2	1	2	0	3	8
Grand Total	**43**	**22**	**13**	**7**	**15**	**100**

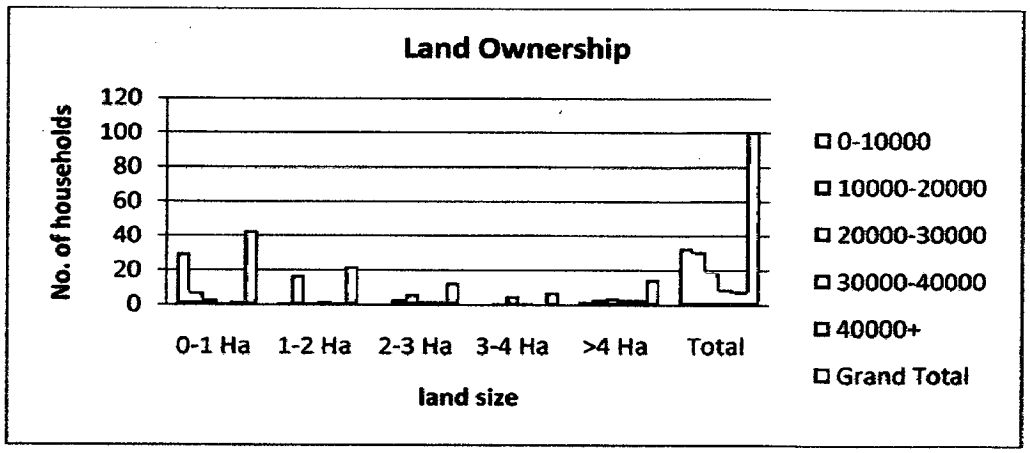


Figure 5.1.13 Chart showing land ownership pattern in different income group

Table 5.1.10: Cultivable Land ownership: no of households						
Income Group	**0-1 Ha**	**1-2 Ha**	**2-3 Ha**	**3-4 Ha**	**>4 Ha**	**Total**
0-10000	30	1	0	0	2	33
10000-20000	7	17	3	1	3	31
20000-30000	3	1	6	5	4	19
30000-40000	2	1	2	1	3	9
40000+	2	1	2	0	3	8
Grand Total	**44**	**21**	**13**	**7**	**15**	**100**

- More than two-fifth of the household have land holding size of 0-1 Ha.
- Only 15 percent of the household have land holding size of more than 4 Ha.

Table 5.1.11: Net annual Income from Cultivation (in Rs) : no of households						
Income Group	**0-1 Lakhs**	**1-2 Lakhs**	**2-3 Lakhs**	**3-4 lakhs**	**>4 lakhs**	**Total**
0-10000	31	0	0	0	2	33
10000-20000	15	16	0	0	0	31
20000-30000	3	5	7	3	1	19
30000-40000	3	2	0	1	3	9
40000+	2	1	0	1	4	8
Grand Total	**54**	**24**	**7**	**5**	**10**	**100**

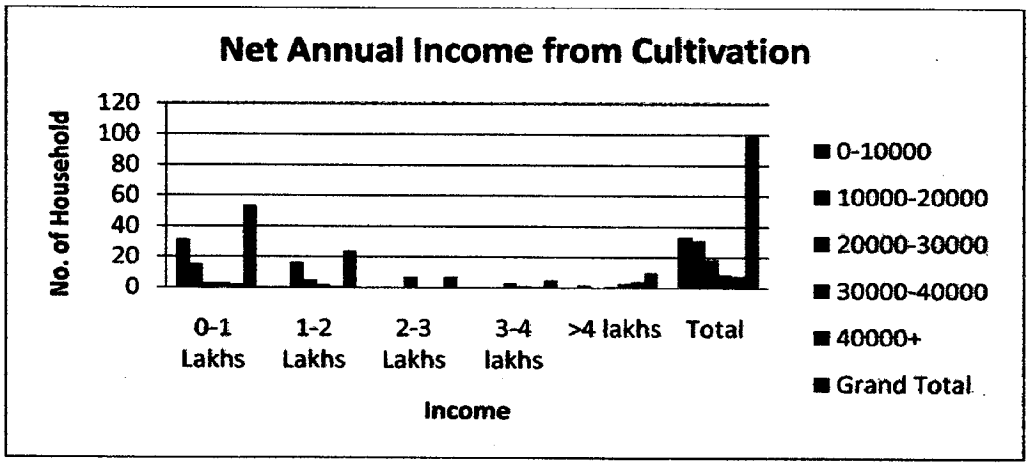


Figure 5.1.14 Chart showing net annual income

- More than half (54 percent) of the household have net annual income from cultivation is 0-1 lakhs.
- Slightly less than one fourth (24 percent) have annual income 1-2 lakhs.
- One-tenth (10 percent of the household have annual income more than 4 lakhs.

Table 5.1.12: Agriculture & Cropping Pattern : no of households			
Income Group	**Agriculture in households**	**double cropping pattern**	**Mixed cropping pattern**
0-10000	20	20	7
10000-20000	26	26	10
20000-30000	17	17	7
30000-40000	8	8	1
40000+	6	6	0
Grand Total	**77**	**77**	**25**

Table 5.1.13: Area Under Kharif crop: no of households						
Income Group	**0-1 Ha**	**1-2 Ha**	**2-3 Ha**	**3-4 Ha**	**>4 Ha**	**Total**
0-10000	30	1	0	0	2	33
10000-20000	8	16	3	2	2	31
20000-30000	3	1	6	5	4	19
30000-40000	2	1	2	1	3	9
40000+	2	1	2	0	3	8
Grand Total	**45**	**20**	**13**	**8**	**14**	**100**

Table 5.1.14: Area under Rabi crop: no of households						
Income Group	**0-1 Ha**	**1-2 Ha**	**2-3 Ha**	**3-4 Ha**	**>4 Ha**	**Total**
0-10000	30	1	0	0	2	33
10000-20000	7	17	3	1	3	31
20000-30000	3	1	6	5	4	19
30000-40000	2	1	2	1	3	9
40000+	2	1	2	0	3	8
Grand Total	**44**	**21**	**13**	**7**	**15**	**100**

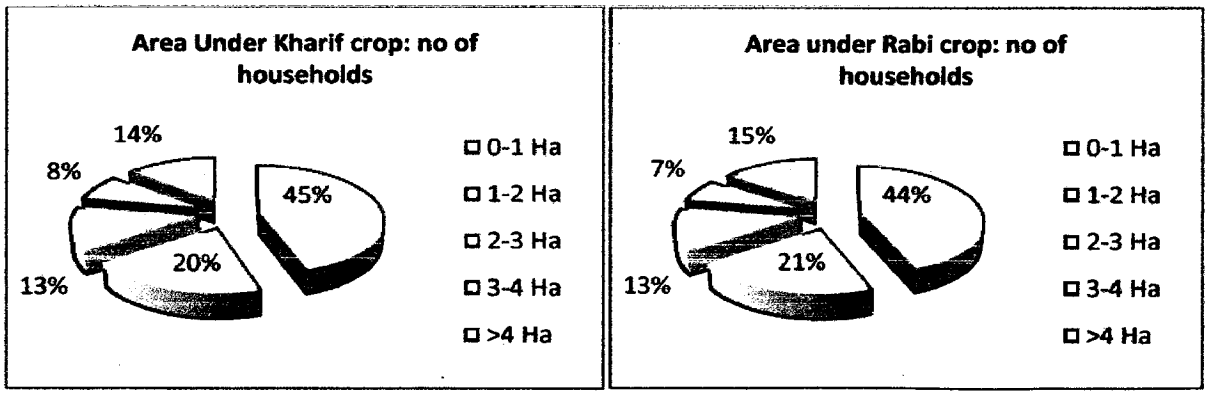


Figure 5.1.15 Charts showing pattern of land area under kharif and rabi crops

- More than three fourth (77 percent) of household have agricultural land.
- All of them practice double cropping pattern.
- Less than one-third (32.47 percent) of above practice mixed cropping pattern.

Table 5.1.15: Area sown under different crops in 100 household's sample: in Ha

District	Paddy	wheat	maize	Pulses	Potato	onion	sugar cane	oilseed	chilly	spices	Total cultivable land	no of house holds surveyed
Patna	18.54	12.93	0.00	25.00	0.24	0.49	0.00	19.39	0.49	0.24	40.24	25
Nalanda	29.06	19.91	0.70	3.78	1.55	0.00	1.95	2.07	0.00	2.19	31.71	15
Bhojpur	24.15	19.27	0.00	2.91	0.68	0.01	2.93	18.17	0.00	0.91	28.05	15
Buxar	24.39	21.09	0.98	3.29	0.73	0.00	2.01	9.02	0.00	0.50	27.80	15
Rohtas	27.07	26.83	2.07	2.56	0.37	0.00	2.20	0.00	0.00	0.00	31.95	15
Kaimur	34.76	12.93	0.24	12.13	0.00	0.00	0.00	2.13	0.00	0.00	29.63	15
Total	157.97	112.96	3.99	49.68	3.57	0.50	9.09	50.79	0.49	3.85	189.39	100

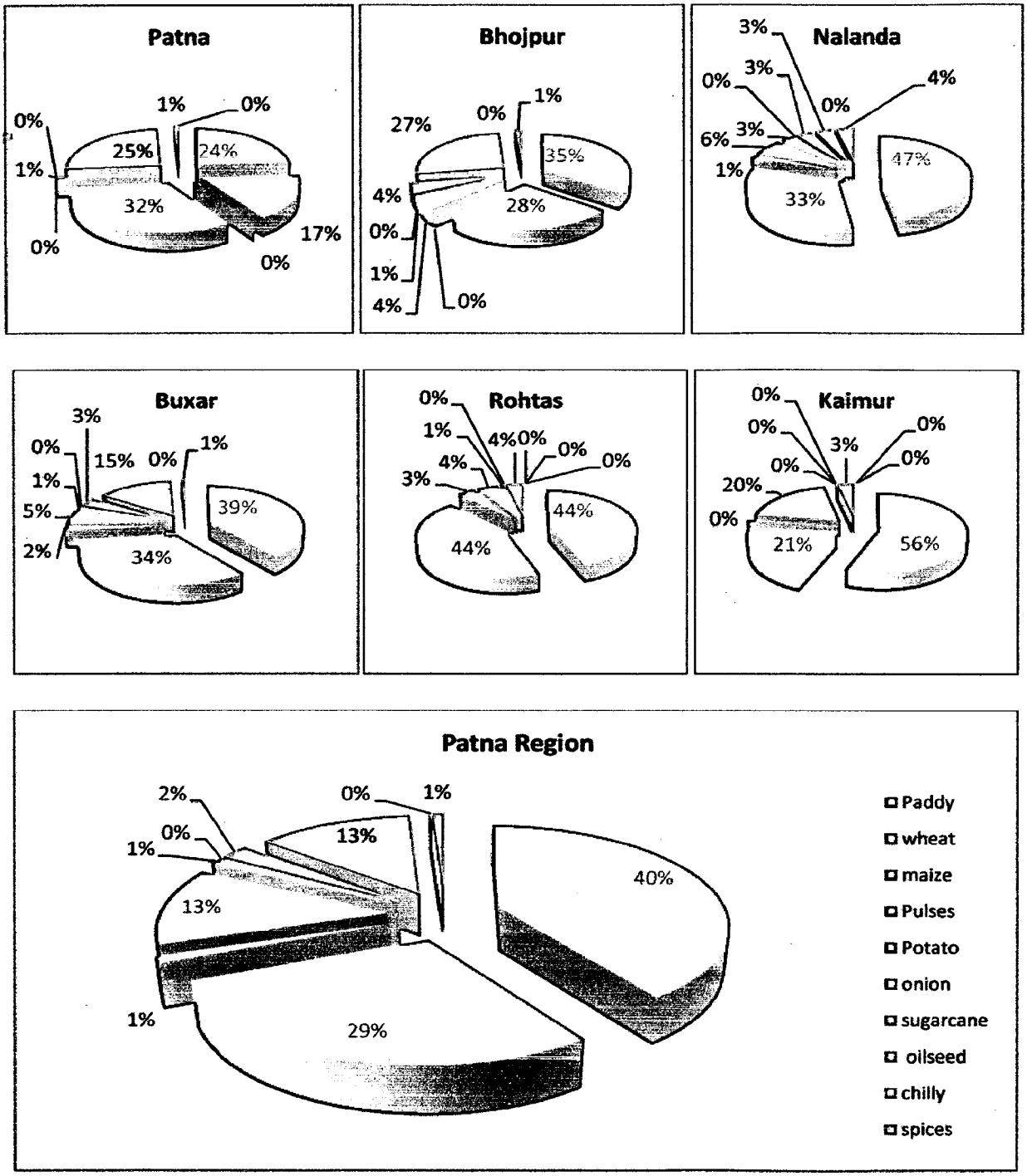


Figure 5.1.16 Charts showing pattern of area sown under different crops

- Most of area sown under wheat and paddy crop

Table 5.1.16: Production of different crops in 100 household's sample: in Kgs/year

District	Paddy	wheat	maize	Pulses	Potato	onion	sugarcane	oilseed	chilly	spices	no of house holds surveyed
Patna	41100	27700	0	45500	2400	6000	0	10200	500	300	25
Nalanda	58000	47300	1700	6200	15400	0	4200	2700	0	3600	15
Bhojpur	61500	62000	0	2300	5000	100	75500	1400	0	1500	15
Buxar	77100	77200	2400	3900	7200	0	14100	800	0	900	15
Rohtas	109400	109400	5500	5300	3500	0	4500	0	0	0	15
Kaimur	142500	53000	1600	18600	0	0	0	3400	0	0	15
Total	489600	376600	11200	81800	33500	6100	98300	18500	500	6300	100

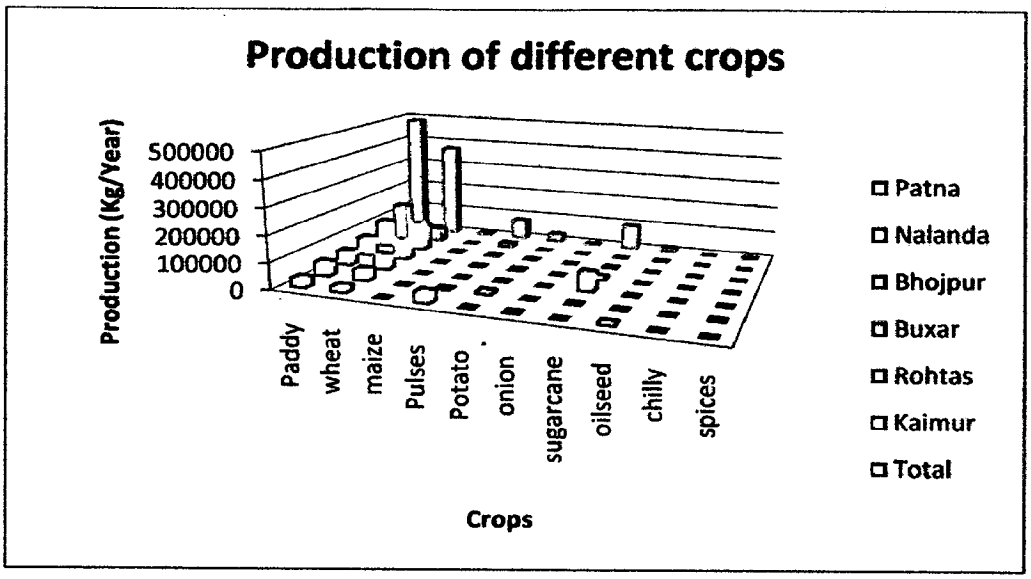


Figure 5.1.17 Chart showing production of different crops

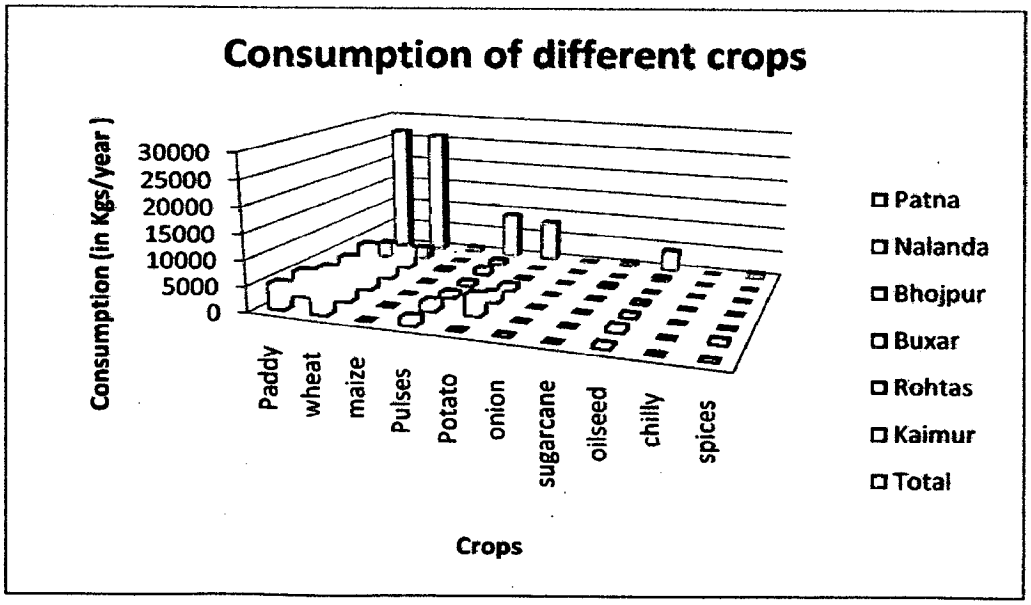


Figure 5.1.18 Chart showing consumption of different crops

Table 5.1.17: Consumption of different crops in 100 household's sample: in Kgs/year

District	Paddy	wheat	maize	Pulses	Potato	onion	sugarcane	oilseed	chilly	spices	no of house holds surveyed
Patna	5520	4990	0	1820	100	250	0	870	60	150	25
Nalanda	5540	5210	210	2200	4440	0	115	1290	0	807	15
Bhojpur	4110	4470	0	1430	2250	40	55	880	0	89	15
Buxar	4130	4340	100	1110	1400	0	190	550	0	44	15
Rohtas	4700	4700	700	1570	200	0	700	0	0	0	15
Kaimur	2830	2430	100	1200	0	0	0	780	0	0	15
Total	26830	26140	1110	9330	8390	290	1060	4370	60	1090	100

Table 5.1.18: Yield of different crops in 100 household's sample: in Kgs/Ha

District	Paddy	wheat	maize	Pulses	Potato	onion	sugarcane	oilseed	chilly	spices	No. of house holds surveyed
Patna	2220	2140	-	1820	9840	12300	-	530	1020	1230	25
Nalanda	2000	2370	2450	1640	9950	-	2150	1300	-	1640	15
Bhojpur	2550	3220	-	790	7320	8200	25800	80	-	1640	15
Buxar	3160	3660	2460	1180	9840	-	7000	90	-	1800	15
Rohtas	4040	4080	2650	2070	9570	-	2050	-	-	-	15
Kaimur	4100	4100	6560	1530	-	-	-	1600	-	-	15
Average	3010	3300	3530	1505	9304	10250	9250	720	1020	1580	100

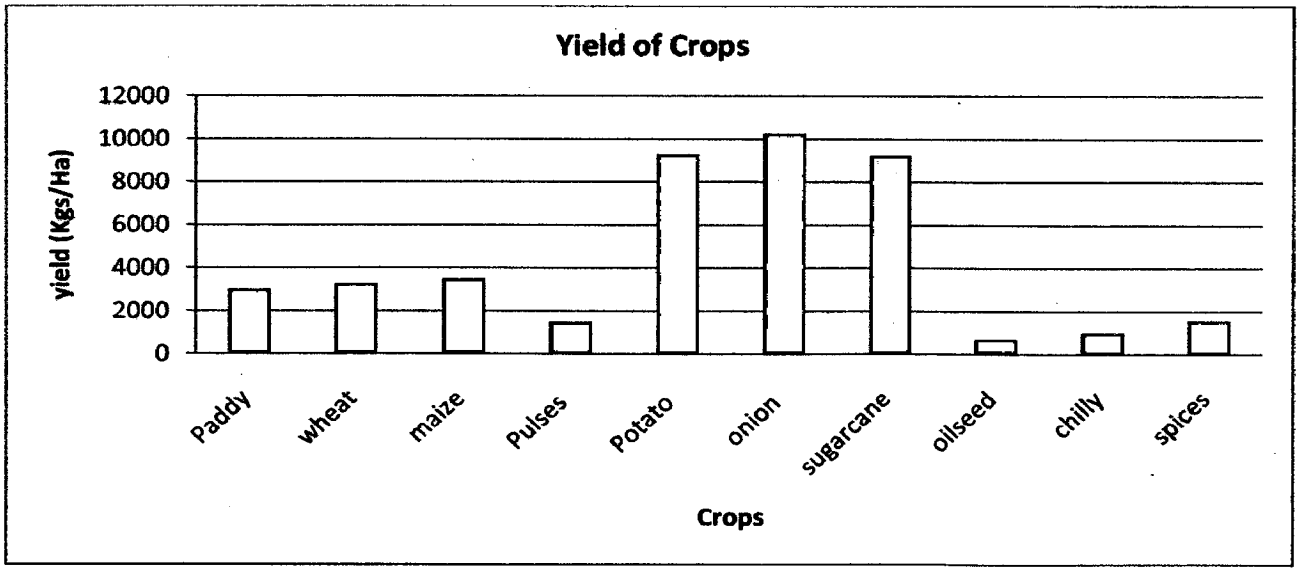


Figure 5.1.19 Chart showing per Ha yield of different crops

- Production and Consumption of Paddy, wheat, pulses, potato and sugarcane is high.
- Yield of potato, onion and sugarcane is high as compared to other crops.

Table 5.1.19: Production of agricultural by-products (in kg/year)

District	Paddy,wheat,maize etc.-Straw, Husk, Bran, Fodder.	Sugarcane Bagasse	Sugarcane Molasses	(Gram, Dhaniya, Sarso)-green leaves-Saag	Maize-Edible corn oil	Maize-Corn silk	Maize-Corncobs	Maize-Corn kernels	others	No. of house holds surveyed
Patna	40400	0	0	5215	0	0	0	0	0	25
Nalanda	63700	2100	1000	3150	110	110	1100	135	0	15
Bhojpur	72200	37900	18240	1915	0	0	0	0	0	15
Buxar	92300	7560	3770	1560	160	160	1600	200	0	15
Rohtas	137600	2240	1110	1050	370	370	3700	460	0	15
Kaimur	117000	0	0	4010	110	110	1100	130	0	15
Total	523200	49800	24120	16900	750	750	7500	925	0	100

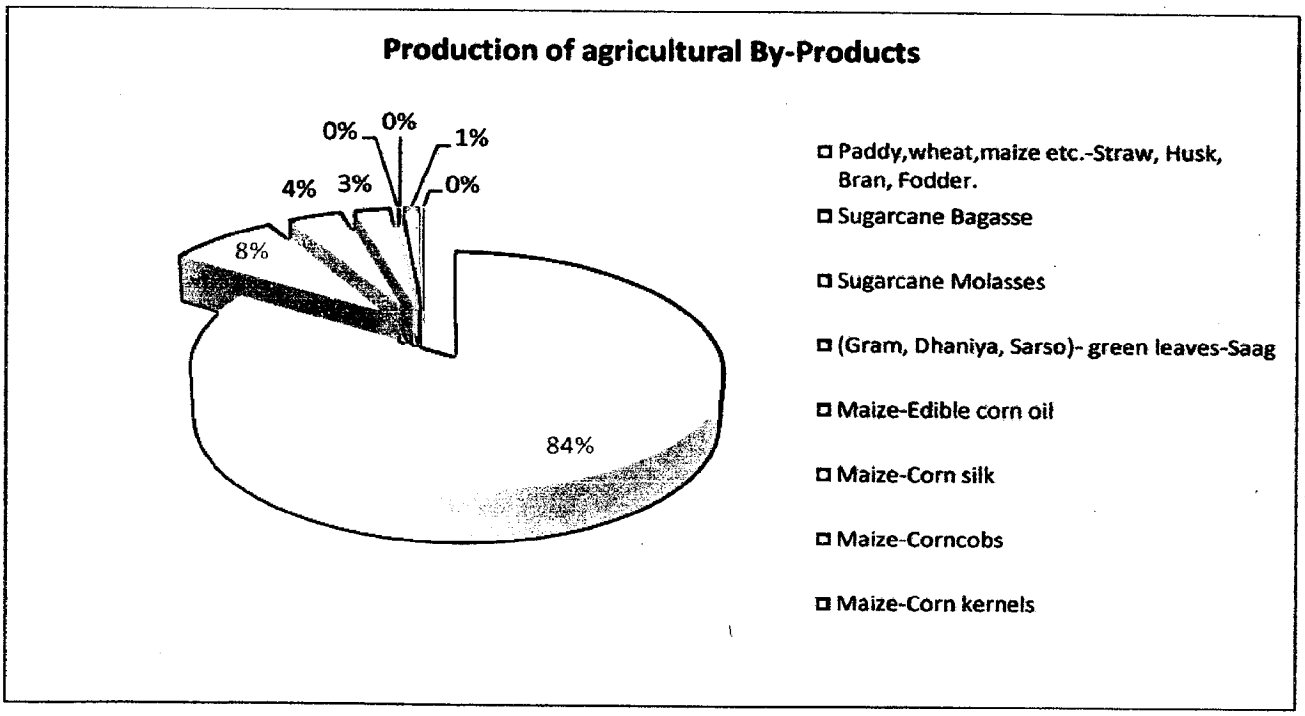


Figure 5.1.20 Chart showing agricultural By-products

- Production of husk, bran, straw is higher as paddy and wheat production is high.
- Bagasses and molasses are second major by-products in the household surveyed.

Table 5.1.20: Production of different fruits/vegitables (in Kg) per year

District	banana (dozen)	mango	lichi	guava	jack fruit	plum	lemon	Bamboo (in no.)	Todi (lt. per day)	vegetables (per day)	papaya	No. of house holds surveyed
Patna	0	800	0	1100	500	500	500	0	0	316	50	25
Nalanda	4000	5210	300	1900	0	100	700	450	160	78	40	15
Bhojpur	170	4700	0	1680	100	0	25	0	0	120	0	15
Buxar	170	4700	0	1580	0	0	25	0	0	160	0	15
Rohtas	80	20200	0	0	0	0	0	0	0	210	0	15
Kaimur	12	10300	0	500	0	0	0	0	0	220	0	15
Total	4432	45910	300	6760	600	600	1250	450	160	1104	90	100

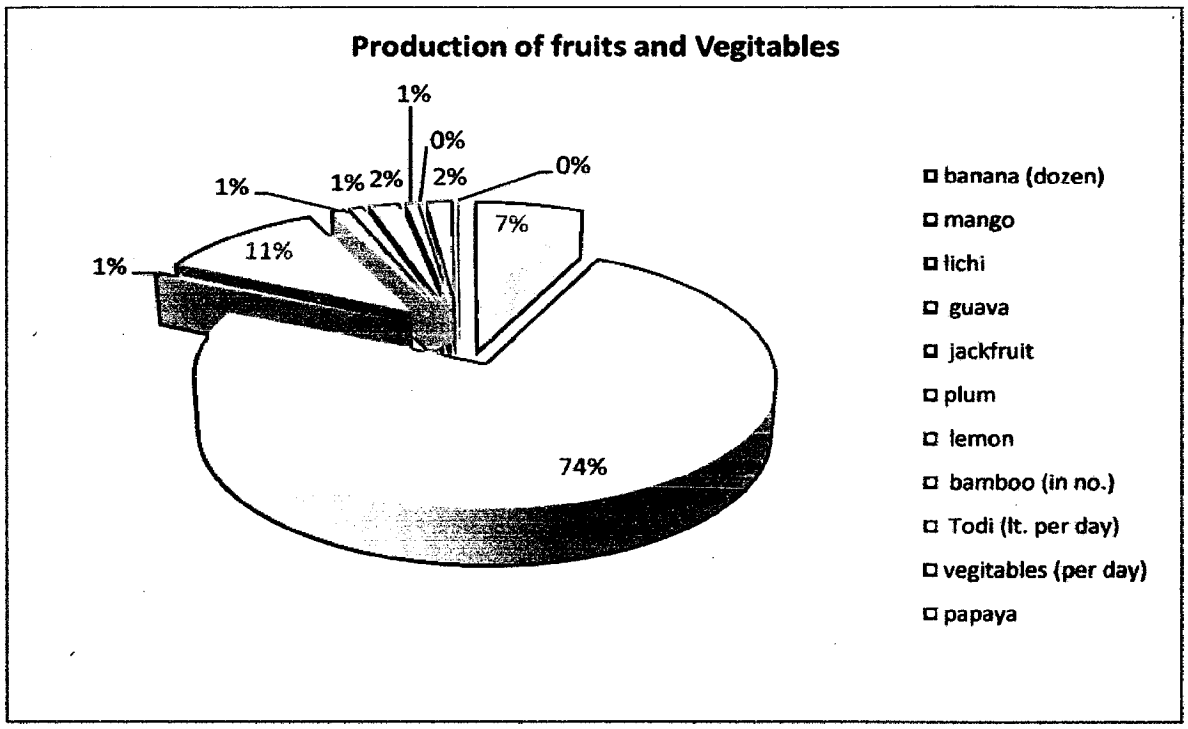


Figure 5.1.21 Chart showing production of fruits and vegetables

- Mango production is highest in the households surveyed.
- Guava and banana are also produced.
- Most of the household produces vegetables for their own consumption in the lawns.
- Some households cultivate bamboo in their fields.
- Todi is also produced in good amount.

Table 5.1.21: Consumption of agricultural by-products (in kg/year)

District	Paddy, wheat, maize etc.- Straw, Husk, Bran, Fodder.	Sugarcane Bagasse	Sugarcane Molasses	(Gram, Dhaniya, Sarso)- green leaves- Saag	Maize- Edible corn oil	Maize- Corn silk	Maize- Corncobs	Maize -Corn kernels	others	no of house holds surveyed
Patna	8700	0	0	160	0	0	0	0	0	25
Nalanda	11100	94	6	270	0	0	30	0	0	15
Bhojpur	14200	50	10	250	0	0	0	0	0	15
Buxar	13300	156	7	160	0	0	35	0	0	15
Rohtas	10500	560	7	200	0	0	100	0	0	15
Kaimur	7600	0	0	190	0	0	15	0	0	15
Total	65400	860	30	1230	0	0	180	0	0	100

Table 5.1.22: Consumption of different fruits/vegitables (in Kg) per year

District	banana (dozen)	mango	lichi	guava	jack fruit	plum	lemon	Bamboo (in no.)	Todi (lt. per day)	vegitables (per day)	papaya	no of households surveyed
Patna	0	30	0	30	10	10	10	0	0	26	10	25
Nalanda	40	910	0	600	0	0	20	0	0	18.5	0	15
Bhojpur	50	320	0	200	10	0	10	0	0	30	0	15
Buxar	50	1410	0	190	0	0	10	0	0	25	0	15
Rohtas	80	2300	0	0	0	0	0	0	0	30	0	15
Kaimur	12	800	0	200	0	0	0	0	0	30	0	15
Total	232	5770	0	1220	20	10	50	0	0	159.5	10	100

Table 5.1.23: production of Horticulture byproducts (in kg/year)

District	leaves	wood	Fibre	medicinal wood	medicinal leaves	twigs used as Datun	no of households surveyed
Patna	265	25	0	0	0	25	25
Nalanda	1150	170	110	0	0	170	15
Bhojpur	660	70	0	0	0	70	15
Buxar	620	70	0	0	0	70	15
Rohtas	670	65	0	0	0	65	15
Kaimur	1070	90	0	0	0	90	15
Total	4435	490	110	0	0	490	100

Table 5.1.24: consumption of Horticulture byproducts (in kg/year)							
District	leaves	wood	Fibre	medicinal wood	medicinal leaves	twigs used as Datun	no of house holds surveyed
Patna	25	25	0	0	0	25	25
Nalanda	65	100	0	0	0	55	15
Bhojpur	25	30	0	0	0	25	15
Buxar	20	20	0	0	0	20	15
Rohtas	25	25	0	0	0	25	15
Kaimur	20	25	0	0	0	20	15
Total	180	225	0	0	0	170	100

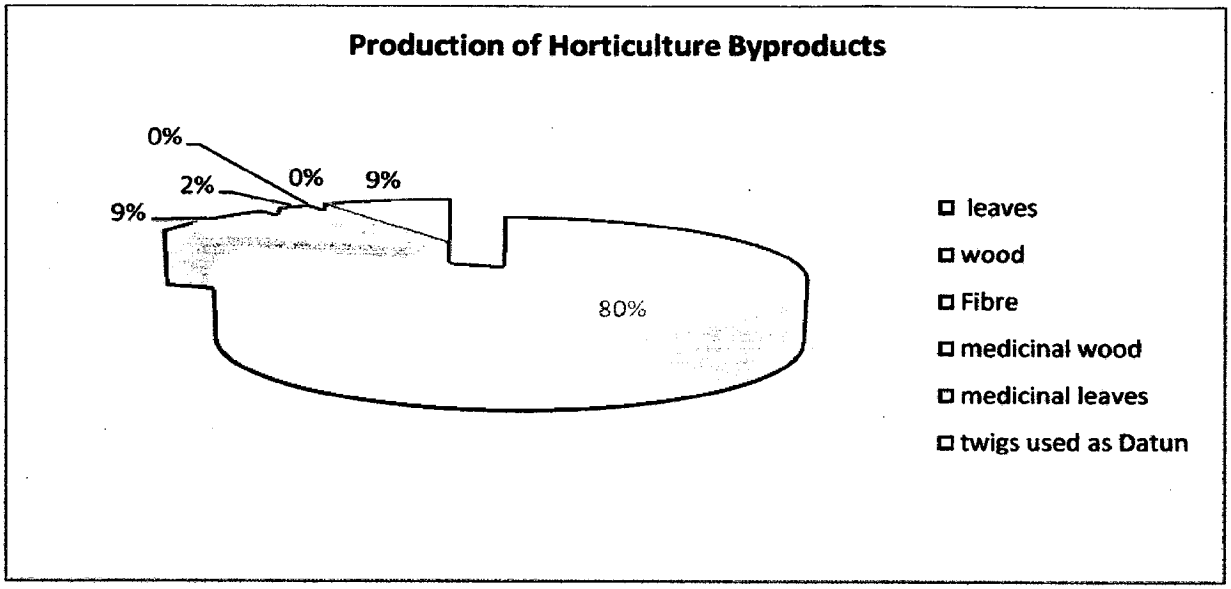


Figure 5.1.22 Chart showing production of horticulture by-products

- Major by-products are leaves and wood used for energy generation, fodder and rituals.
- Twigs are used as Datun.

Table 5.1.25: Sources of irrigation: no of household						
Income Group	Canal	pond	river	tubewell	rainfed in kharif season	Total
0-10000	15	0	4	5	20	33
10000-20000	12	0	5	18	26	31
20000-30000	11	0	1	12	17	19
30000-40000	7	0	0	3	8	9
40000+	4	0	1	2	6	8
Grand Total	49	0	11	40	77	100

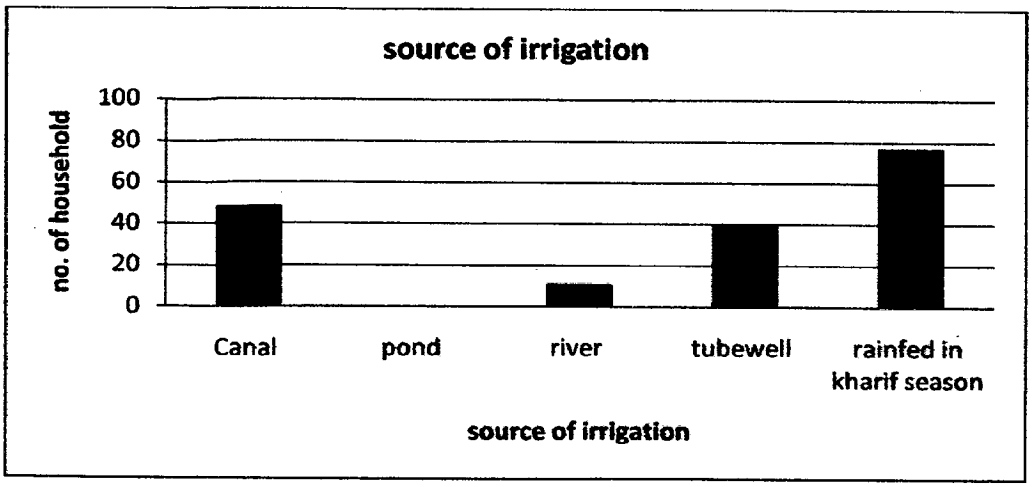


Figure 5.1.23 Chart showing sources of irrigation

- Canal is the major source of irrigation as less than two-third (63.64 percent) agricultural household are dependent on it.
- More than half (51.95 percent household uses tube well for irrigation.

  More than one-tenth of the household use river water for irrigation.

Table 5.1.26: Input in agriculture (In Rs.)(yearly)

District	Fertiliser	Organic manure	Sowing, ploughing reaping & harvesting	Labour	Seeds	Pesticides	Irrigation	rent of tractor	Vet. Services	Total	No of house holds surveyed
Patna	55500	0	3930	26000	136300	55500	55500	4500	0	337230	25
Nalanda	43400	0	3140	39500	109600	43400	43400	0	100	282540	15
Bhojpur	39250	0	2770	20100	94900	39250	39250	0	0	235520	15
Buxar	37900	0	2800	25200	95850	37900	37900	0	0	237550	15
Rohtas	43500	0	3195	30250	133400	43500	43500	1000	0	298345	15
Kaimur	41200	0	2950	28400	102500	41200	41200	0	200	257650	15
Total	260750	0	18785	169450	672550	260750	260750	5500	300	1648835	100

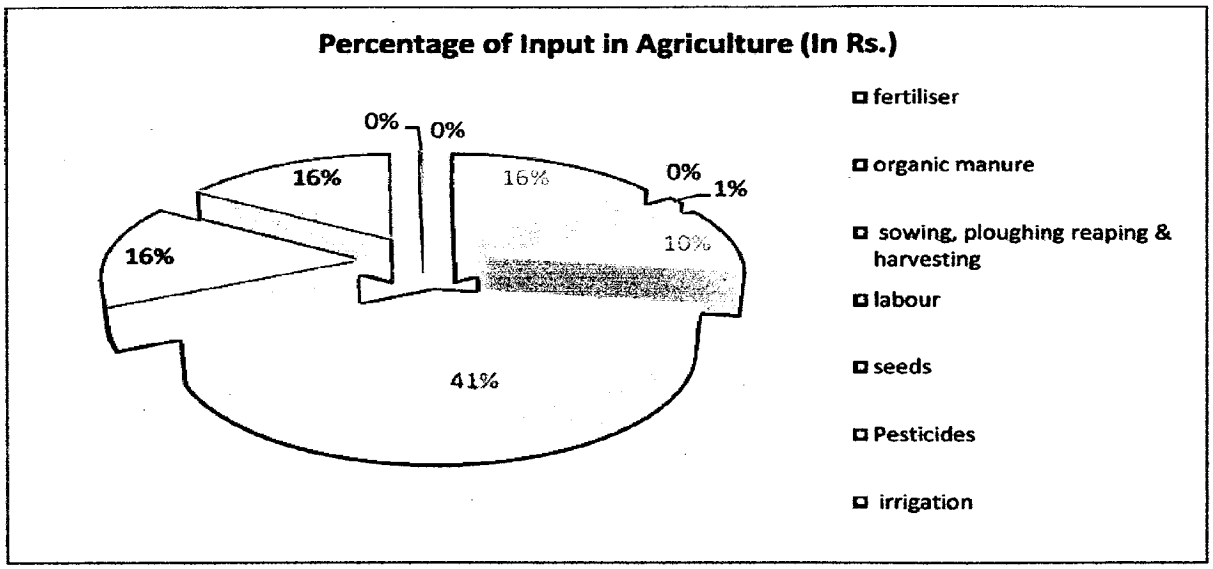


Figure 5.1.24 Chart showing percentage of input in agriculture (in Rs.)

Table 5.1.27: No. of cattles

Income Group	cow	buffalo	Bull/ox/ mule/horse	sheep/goat	poultry	birds	fish
0-10000	22	23	0	0	1	20	0
10000-20000	25	25	2	0	2	70	2000
20000-30000	15	9	2	0	0	0	130
30000-40000	4	2	4	0	0	0	1400
40000+	14	12	0	0	0	0	5000
Grand Total	**80**	**71**	**8**	**0**	**3**	**90**	**8530**

Table 5.1.28: Input in livestock in Rs.: no. of household					
Income Group	**0-500**	**500-1000**	**1000-1500**	**>1500**	**Total**
0-10000	26	7	0	0	33
10000-20000	24	5	1	1	31
20000-30000	19	0	0	0	19
30000-40000	6	1	2	0	9
40000+	6	0	1	1	8
Grand Total	**81**	**13**	**4**	**2**	**100**

Table 5.1.29: Output from livestock (per day) in 100 household surveyed				
District	**milk (in lt.)**	**dung (Kg)**	**meat (Kg)**	**egg (Dozen)**
Patna	257	240	0	0
Nalanda	71	90	8	2
Bhojpur	76	95	80	0
Buxar	75	80	40	0
Rohtas	70	70	5	5
Kaimur	133	150	55	0
Total	**682**	**725**	**188**	**7**

Table 5.1.30: Consumption livestock (per day) in 100 household surveyed				
District	**milk (in lt.)**	**dung (Kg)**	**meat (Kg)**	**egg (Dozen)**
Patna	51	55	0	0
Nalanda	49	65	0.5	1
Bhojpur	48	55	4	0
Buxar	31	40	1	0
Rohtas	33	40	1	1
Kaimur	51	45	3	0
Total	**263**	**300**	**9.5**	**2**

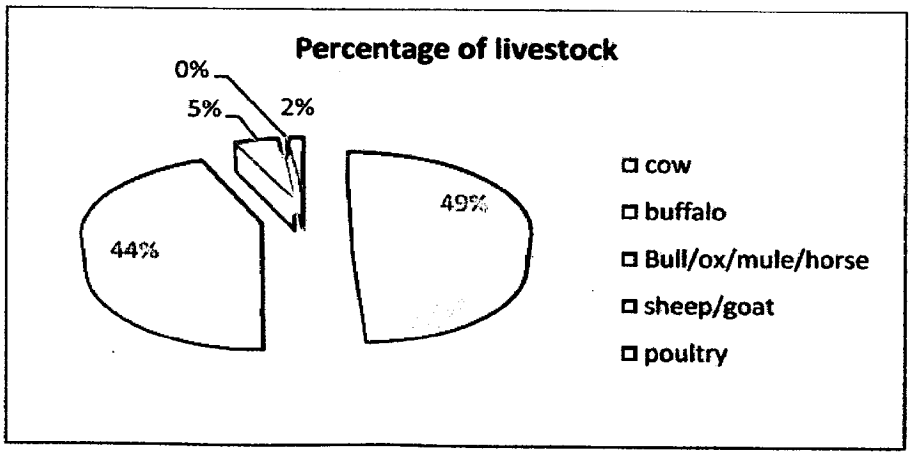


Figure 5.1.25 Chart showing percentage of livestock

Table 5.1.31: credit/deposit in 100 household surveyed			
District	**Deposit (Rs.)**	**Credit (Rs)**	**credit-dposit Ratio**
Patna	10217000	2275000	22.27%
Nalanda	31,60,000	25,20,000	79.75%
Bhojpur	2270000	1901000	83.74%
Buxar	6592000	672000	10.19%
Rohtas	9710000	1460000	15.04%
Kaimur	6550000	1552000	23.69%
Total	38499000	10380000	26.96%

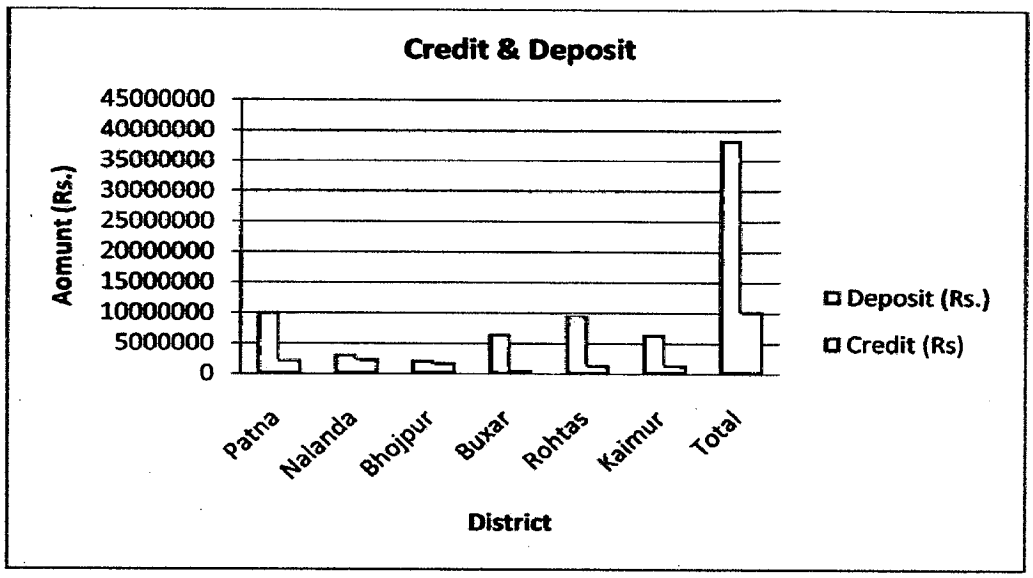


Figure 5.1.26 Chart showing credit and Deposit (in Rs.)

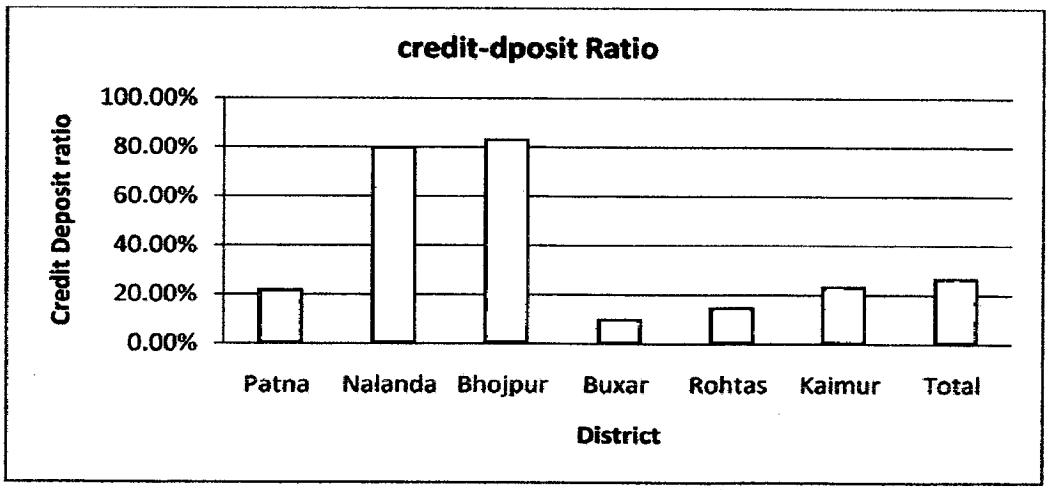


Figure 5.1.27 Chart showing credit-deposit ratio

- Deposit in banks were much more than credits.
- C-D ratio is low (26.96 percent)
- C-D ratio in Nalanda and Bhojpur districts were found relatively higher.

Chapter 6. SYSTEM APPROACH

Region is considered as a system and it has different subsystems, which are physical, social, economic, ecology, environment, infrastructure and institution (Figure 6.0.1). All these subsystems of the system are inter-connected and interdependent to each other. System approach (Forrester. J.W., 196,1969; Chadwick,G., 1971; Batty, M,,1974; Mohapatra,1994; Ogata Katsuhiko,2004) establishes the strong relationship between different subsystem in a given system, and all the subsystems function as an integral whole in a system. All the subsystems of the system are interlinked and interdependent on each other and function as a whole with dynamic characteristics. If one of the subsystems of this system is defunct or partly functions or make advance functions, it's effect can be seen in the entire system. For example, if the social subsystem takes lead role (population growth occurs exorbitantly), then the other subsystems will also be affected.

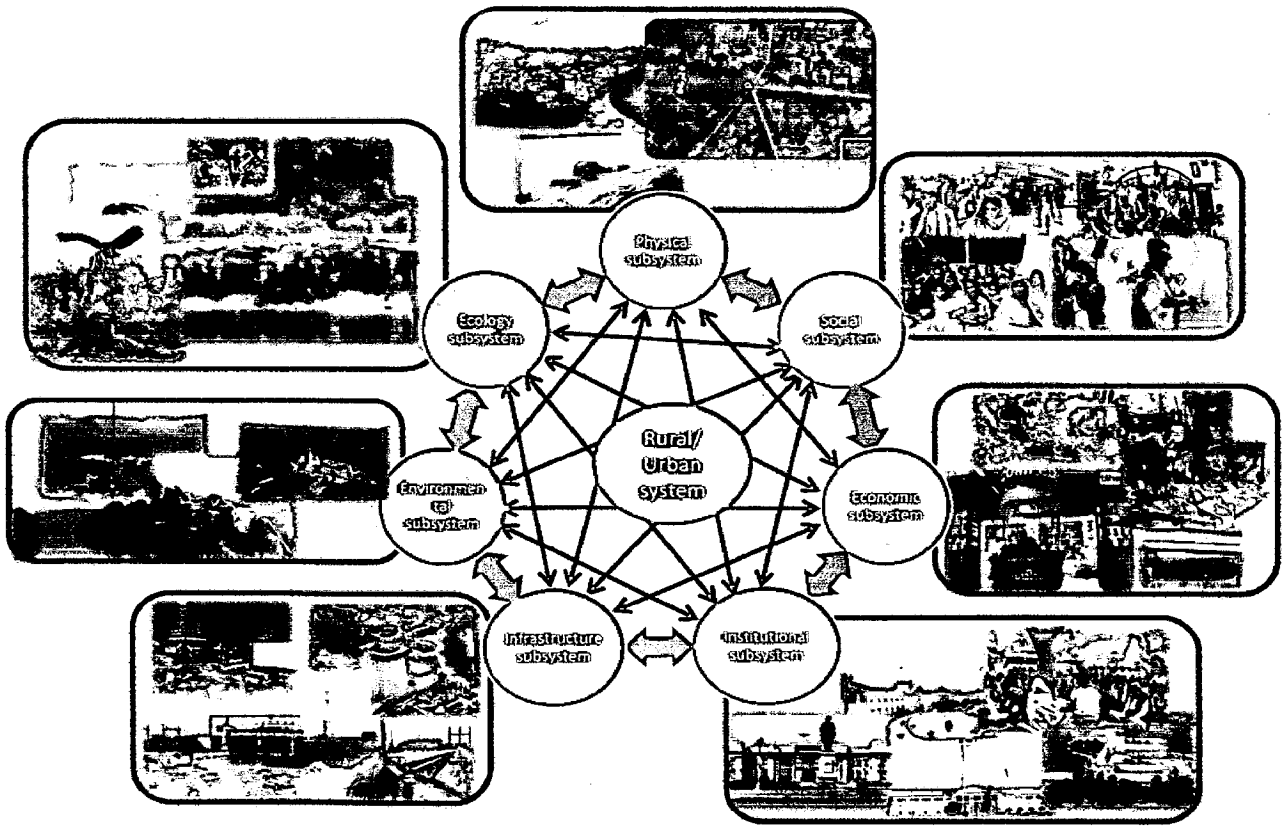


Figure 6.0.1 Rural/Urban System of Patna region

System approach has been considered while analyzing the system of Patna region. The findings of analysis show that the effect of change in one subsystem can be seen on all the other subsystems and significantly, on the entire regional system of Patna region. At present

there are negligible rural industries in Patna region, which is the major cause of under developed economy. The region is facing socio economic backwardness since long time. The introduction of rural industries, part of **infrastructure subsystem**, will improve the **economic subsystem** by income and wealth generation due to increased production. Due to increase in production and distribution the supply chain will improve automatically and will cause a good number of employment generation at each and every stage of production, distribution and supply. Due to increase in amount and varieties of goods supply, and increased income of people the demand will increase automatically, which will further, cause in increase of production of final products as well as the raw agricultural goods. This will generate the dynamic wheel of vibrant economy (Figure 6.0.2) .

Improvement in agriculture will take place to increase the production by implementation of new technologies and improved HVY crops, fertilizers and pesticides etc. Improvement in agriculture is sign of change in **Physical subsystem** of the regional system. Further, Improvement in economic subsystem will cause improvement in living standards of the people and the BPL people will be able to get rid of poverty and the ill effects of poverty, such as starvation, crime, health problems, illiteracy, unawareness, unhygienic environment, pollution etc. Wealth creation will lead to more socially-secure rural communities, and people will be better able to feed themselves, educate themselves and plan for a secure future from the additional employment and incomes that will result from the investments that the industries will bring. This means the improvement in the **social subsystem** will take place. Improved social subsystem will need improved **infrastructure and institutional subsystem** and the improvement can be implemented using the wealth generated due to improved economy of the region.

We know, the rural industries do not produces any chemical or unhygienic by-products and are very eco-friendly, so rural industrial development will never effect the **environment and ecological subsystem** adversely. There will also gains for the environment with improved management and use of natural resources. So, finally it can be said that the rural industrial development in the Patna region will affect all the subsystems of the regional system positively and hence will bring overall development of the whole system and a channel of development in the region's rural system will take place due to rural industrialization.

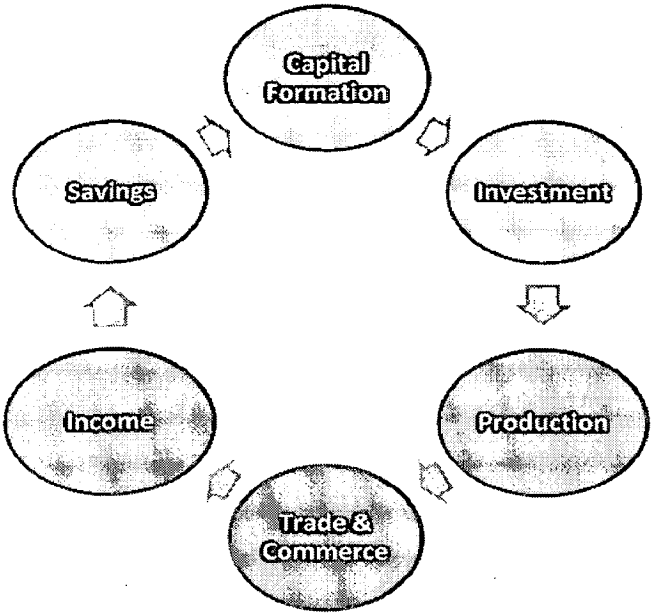


Figure 6.0.2 Dynamic wheel of Economy

An increase in the agricultural productivity releases labour for manufacturing employment and thus contributes towards modernization and growth of the manufacturing sector. A higher income raises the demand for manufacturing products. Further, aggregate savings increase and finance industrialization. Industrialization will lead to urbanization. Hence, rural industrialization is an effective way to achieve a balanced and sustainable development of the rural and the urban system, and the agricultural and the manufacturing, sectors of a nation's economy.

Chapter 7. POPULATION PROJECTION

Population Projection has been done to determine the demand for future. According to the future demand the planning for the rural Industrial location has been done.

District	Population (1991)	Population (2001)	Projected Population (2031)			
			Arithmetic method (1)	Geometric method (2)	Exponential method (3)	Average of 1,2 & 3
	P_m	P_0	$P_n = P_0 + n(P_0 - P_m)/m$	$P_n = P_0 (1+r)^n$ $1+r = (P_0/P_m)^{1/m}$	$P_n = P_0 e^{rn}$	(1+2+3)/3
Patna	36,18,211	47,09,851	79,84,771	103,88,360	103,88,360	95,87,164
Nalanda	19,96,257	23,68,327	34,84,537	39,54,734	39,54,734	37,98,002
Bhojpur	17,92,771	22,33,415	35,55,347	43,18,205	43,18,205	40,63,919
Buxar	10,87,676	14,03,462	23,50,820	30,15,116	30,15,116	27,93,684
Rohtas	19,17,416	24,48,762	40,42,800	51,00,788	51,00,788	47,48,125
Kaimur	9,83,269	12,84,575	21,88,493	28,64,315	28,64,315	26,39,041
TOTAL	1,13,95,600	1,44,48,392	2,36,06,768	2,96,41,518	2,96,41,518	2,76,29,935

Arithmetic method:-

$P_n = P_0 + n(P_0 - P_m)/ m$

$\Rightarrow P_{2031} = P_{2001} + 30(P_{2001} - P_{1991})/ 10$

Geometric Method:-

$P_n = P_0 (1+r)^n$

$1+r = (P_0/ P_m)^{1/m}$

$\Rightarrow (1+r) = (P_{2001}/ P_{1991})^{1/10}$

& $P_{2031} = P_{2001} (P_{2001}/ P_{1991})^3$

Exponential method:-

$P_n = P_0 e^{rn}$

$\Rightarrow P_{2001} = P_{1991} \times e^{10r}$

& $P_{2031} = P_{2001} \times e^{30r}$

$\Rightarrow P_{2031} = P_{2001} \times (e^{10r})^3$

$\Rightarrow P_{2031} = P_{2001} (P_{2001}/ P_{1991})^3$

Population Projection by Curve fitting method:

District	Population (1961)	Population (1961)	Population (1971)	Population (1971)	Population (1981)	Population (1991)	Population (2001)
Patna	18,66,599	29,49,746	22,50,835	35,56,945 Patna	30,19,201	36,18,211	47,09,851
Nalanda	10,82,172		13,04,934		1,639,905	19,96,257	23,68,327
Bhojpur	10,14,466	32,18,017	12,41,763	3,939,034 Shahabad	14,90,746	17,92,771	22,33,415
Buxar	6,15,460		7,53,357		9,16,864	10,87,676	14,03,462
Rohtas	10,49,728		12,84,927		15,74,621	19,17,416	24,48,762
Kaimur	5,38,363		6,58,987		7,91,682	9,83,269	12,84,575
TOTAL	61,66,788	61,67,763	74,94,803	74,95,979	94,33,019	1,13,95,600	1,44,48,392

Source: census of India

$Y = a + bx + cx^2$ ----------(a)

$\sum y = an + b\sum x + c\sum x^2$----------(b)

$\sum xy = a\sum x + b\sum x^2 + c\sum x^3$----------(c)

$\sum x^2y = a\sum x^2 + b\sum x^3 + c\sum x^4$----------(d)

Table 7.0.1: Population data of five decades for Patna Region(1961-2001)							
year	Time (years)	Population ($\times 10^5$)					
	x	y	x^2	x^3	x^4	xy	x^2y
1961	0	61.67	0	0	0	0	0
1971	10	74.95	100	1000	10000	749.5	7495
1981	20	94.33	400	8000	160000	1886.6	37732
1991	30	113.95	900	27000	810000	3418.5	102555
2001	40	144.48	1600	64000	2560000	5779.2	231168
Total	100	489.38	3000	100000	3540000	11833.8	378950

Substituting these values in given equations (b),(c) & (d) we get,

489.38=5a+100b+3000c----------(i)

11833.8=100a+3000b+100000c---------(ii)

378950=3000a+100000b+3540000c----------(iii)

Solving these equations we get,

a=61.91, b=1.05, c=0.025

Now, substituting these values in eqn. (a)

We get the parabola,

$y=61.91+1.05x+0.025x^2$

Projected population for 2031, x=70 years

So, population y (10^5)=61.91 + 1.05x70 + 0.025x70^2 = 257.91

=> P_{2031}=257.91x10^5

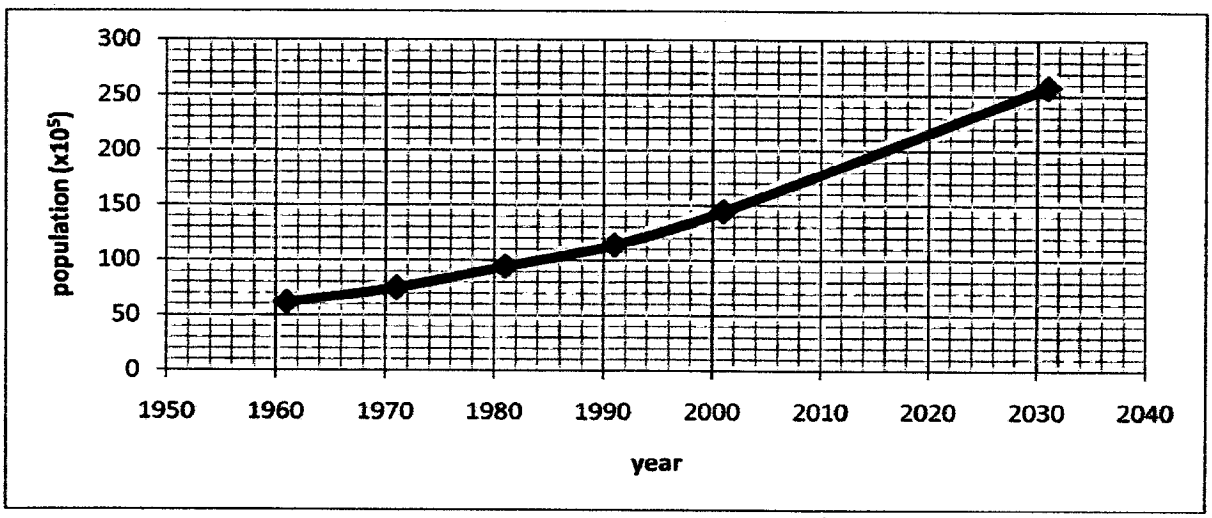


Figure 7.0.1 Graph showing population projection of Patna region

According to this method we get the population less than we get from the above methods. So, we will take the projected population as calculated from the above methods.

Table 7.0.2: Population of Patna region

District	Population (1961)	Population (1971)	Population (1981)	Population (1991)	Population (2001)	Projected Population (2031)
Patna	18,66,599	22,50,835	30,19,201	36,18,211	47,09,851	95,87,164
Nalanda	10,82,172	13,04,934	16,39,905	19,96,257	23,68,327	37,98,002
Bhojpur	10,14,466	12,41,763	14,90,746	17,92,771	22,33,415	40,63,919
Buxar	6,15,460	7,53,357	9,16,864	10,87,676	14,03,462	27,93,684
Rohtas	10,49,728	12,84,927	15,74,621	19,17,416	24,48,762	47,48,125
Kaimur	5,38,363	6,58,987	7,91,682	9,83,269	12,84,575	26,39,041
TOTAL	61,66,788	74,94,803	94,33,019	1,13,95,600	1,44,48,392	2,76,29,935

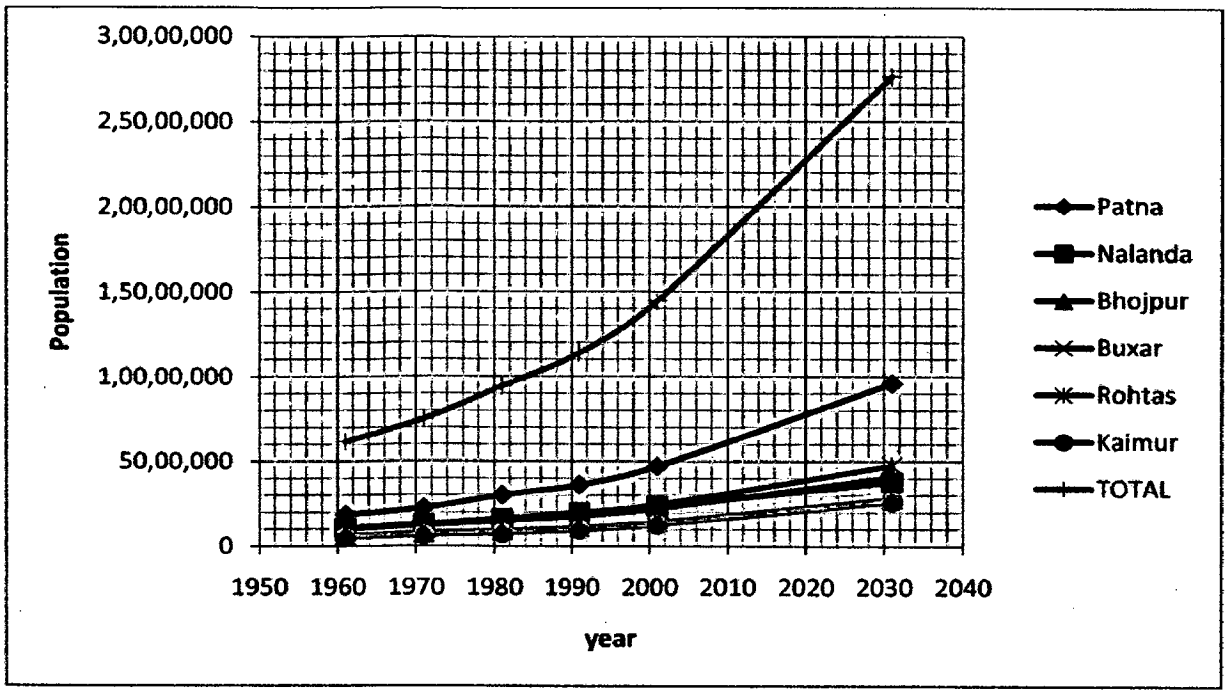


Figure 7.0.2 Graph showing population projection of different districts of Patna region

These projections shows that that the population of the region will be slightly less than double in 30 years of time span.

Chapter 8. INPUT-OUTPUT ANALYSIS

In economics, an **input-output model** uses a matrix representation of a region's economy to predict the effect of changes in one industry on others and by consumers, government, and foreign suppliers on the economy. Wassily Leontief (1905-1999) is credited with the development of this method of determining interdependence among the various sectors of the economy. The word 'inter-dependence' or 'interaction' is used to convey the idea that each industry employs the output of other industries as input while its output is used by other industries as an input.

- The Input-Output Analysis was evolved by Leontief as a method of determining inter-dependence among the various sectors of economy.
- The word 'inter-dependence' or 'interaction' is used to convey the idea that each industry employs the output of other industries as input while its output is used by other industries or sectors as an input.
- Consider the production of the ith sector. We may isolate the quantity of that production that goes

(1) to final demand, Y_i,

(2) to total output, X_i, and

(3) flows x_{ij} from that sector to other sectors.

Thus,

$$x_{i1}+x_{i2}+x_{i3}+\ldots\ldots\ldots x_{ij} + Y_i = X_i$$

- The Concept of Technical Co-efficients:

The unit of industry i used as input for the production of one unit of output of industry j are known as technical coefficient (α_{ij}).

Thus,

$$\alpha_{ij} = \frac{x_{ij}}{X_j}$$

- There is a relation between the demands of all sectors and the output of each sectors as follows,

$$X_i = \sum_{j=1}^{n} \alpha_{ij} Y_j \ , \qquad \text{where } (i=1,2,\ldots\ldots\ldots, n)$$

8.1 Wheat & Paddy

Table 8.1.1: Input-Output table: Wheat & Paddy (In Kg)

Wheat & Paddy: Input-Output Table

Economic Activity			Input to Agriculture			Input to Manufacturing					Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand	Total Output
			Wheat	Rice/ paddy	Straw/Husk/Bran	Flour (Ata, Meda)	Beaten Rice (Chuda)	Packed food (Bread, rice, poha, litti, halwa, puri, puwa, idli, dosa etc)	Snacks (bread, biscuit, rolls etc.)	Fodder								
			x_{i1}	x_{i2}	x_{i3}	x_{i4}	x_{i5}	x_{i6}	x_{i7}	x_{i8}	x_{i9}	x_{i10}	x_{i11}	x_{i12}	x_{i13}	x_{i14}	Y_i	X_i
Agriculture	Wheat	x_1	56934000	0	401967800	880991000	0	0	91000	9000	8900000	9000	50000	50000	5000	993200	0	1350000000
	Rice/paddy	x_2	0	65515500	685634000	722400	5779350	5779350	50000	9000	4244400	5000	40000	40000	4000	1498000	504000000	1273321000
	Straw/Husk/Bran	x_3	800000	800000	0	0	0	70000	20000	986000000	3625000	10000	5000000	500000	50000	80700000	10026800	1087601800
Manufacturing	Flour (Ata, Meda)	x_4	0	0	0	0	0	5779350	25000000	1000	2204200	50000	0	500000	50000	8128850	840000000	881713400
	Beaten Rice (Chuda)	x_5	0	0	0	0	0	1257000	1257000	10000	11500	5000	0	60000	10000	58850	3110000	5779350
	Packed food	x_6	0	0	0	0	0	0	0	10000	10260	10000	0	10000	10000	2824440	10011000	12885700
	Snacks	x_7	0	0	0	0	0	0	0	5000	26410	20000	0	10000	50000	5101090	21205500	26418000
	Fodder	x_8	0	0	0	0	0	0	0	0	3625000	10000	0	10000	1000	2372000	980000000	986018000
Transport		x_9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
services		x_{10}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy		x_{11}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labour		x_{12}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes		x_{13}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Import		x_{14}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit: In Kgs., base year 2001

Table 8.1.2: Input-Output table: Wheat & Paddy (In Rs.)

Wheat & Paddy: Input-Output Table																			
Economic Activity			Input to Agriculture			Input to Manufacturing					Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand/ Supply	Total Output
			Wheat	Rice/ paddy	Straw/Husk/Bran	Flour (Ata, Meda)	Beaten Rice (Chuda)	Packed food (Bread, rice, poha, litti, halwa, puri, puwa, idli, dosa etc)	Snacks (bread, biscuit, rolls etc.)	Fodder								
			x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{110}	x_{111}	x_{112}	x_{113}	x_{114}	Y_i	X_i
Agriculture	Wheat	x_1	68320800	0	10049195	1057189200	0	0	1092000	108000	1068000	108000	600000	600000	600000	11018400	0	1147687830
	Rice/paddy	x_2	0	1310310000	16140850	14448000	11358700	11358700	1000000	180000	8488800	100000	800000	800000	800000	29960000	1008000000	1191514850
	Straw/Husk/Bran	x_3	200000	200000	0	0	0	17500	5000	2465000	906250	2500	1250000	125000	12500	20175000	25067000	27190045
Manufacturing	Flour (Ata, Meda)	x_4	0	0	0	0	0	1329250	3750000	0	5069660	1150000	0	1150000	1150000	18696355	1932000000	2027940820
	Beaten Rice (Chuda)	x_5	0	0	0	0	0	7542000	0	600000	600000	300000	0	3600000	600000	3531000	1866000000	3467610000
	Packed food	x_6	0	0	0	0	0	0	0	1500000	1539000	1500000	0	1500000	1500000	42366600	1501650000	1932855000
	Snacks	x_7	0	0	0	0	0	0	0	1900000	5282000	4000000	0	2000000	1000000	10202180	424110000	528360000
	Fodder	x_8	0	0	0	0	0	0	0	0	7250000	200000	0	200000	20000	1744000	1960000000	1972036000
Transport		x_9	5000000	5000000	250000	5000000	500000	500000	300000	500000	5000000	500000	500000	50000	500000	50000000	261944500	279224500
services		x_{10}	5000000	5000000	250000	5000000	500000	500000	300000	500000	5000000	500000	500000	50000	500000	50000	99118000	127918000
Energy		x_{11}	5000000	5000000	250000	5000000	500000	500000	300000	500000	1200000	50000	500000	50000	500000	50000	59010000	79060000
Labour		x_{12}	5000000	50000000	250000	5000000	500000	500000	300000	500000	500000	500000	500000	300000	50000	50000	142970000	257270000
Taxes		x_{13}	5000000	5000000	250000	5000000	500000	500000	300000	500000	5000000	50000	500000	50000	0	50000	216545000	239805000
Import		x_{14}	5000000	5000000	250000	5000000	500000	500000	300000	500000	15000000	300000	500000	300000	500000	50000	663345000	700075000
Total			69090800	131801000	26205043	1058934000	11588700	32424955	6328170	25021100	27922183	12790379	0000000	2366500	2395930	17063809	3826891050	5452830130
Unit: In Rs., base year 2001																		

Data taken into consideration while doing above calculations are as follows:

- **Population (2001): 14448392**
- Area for wheat: 455473 Ha, Area for Paddy: 655155 Ha
- Seed req. (wheat): 125 kg/ha, seed req. (rice): 100 kg/ha.
- Per capita availability of rice-73.8 kg, wheat-67 kg.
- The conversion ratio (i.e. recovery % of various final product and byproduct for every 100 kg feed of raw paddy) for these improved rice mills are can be as follows:

1. Percent of milled rice : 62-68%
2. Percent of rice bran : 4-5%
3. Percent of rice husk : 25%
4. Percent of germ wastages : 2%-8%

- Price: wheat flour-23 Rs /kg,wheat-18 Rs /kg, rice-28 Rs/kg, husk,bran-0.25 Rs /kg, beaten rice-60 Rs /kg, packed food-150 Rs/kg, snacks-200 Rs/kg, fodder-2 Rs/kg
- Tax: agricultural income is tax free, 5 % avg. for industrial sectors
- Transportation cost:100 Rs/quintal
- services (space, electricity, irrigation, fertiliser, pesticides, IT etc) :1000 Rs/ha/year

SOURCE: Agriculture Department, GOB, Statistics & Evaluation Dept., GOBwww.en.wikipedia.org/wiki/**Wheat**

Now we know, input-output coefficients,

$$\alpha_{ij} = x_{ij} / X_j$$

Using above equation the coefficients are calculated and are shown in table below.

Table 8.1.3: Matrix of Input-Output co-efficients: Wheat & Paddy

Wheat & Paddy: Matrix of Input-Output co-efficients																	
Economic Activity			Input to Agriculture			Input to Manufacturing					Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export
			Wheat	Rice/ paddy	Straw/Husk /Bran	Flour (Ata, Meda)	Beaten Rice (Chuda)	Packed food (Bread, rice, poha, litti, halwa puri, puwa, idli, dosa etc)	Snacks (bread, biscuit, rolls etc.)	Fodder						
			α_{i1}	α_{i2}	α_{i3}	α_{i4}	α_{i5}	α_{i6}	α_{i7}	α_{i8}	α_{i9}	α_{i10}	α_{i11}	α_{i12}	α_{i13}	α_{i14}
Agriculture	Wheat	α_{1j}	0.05953	0.00000	0.36959	0.52131	0.00000	0.00000	0.00021	0.00005	0.38249	0.00844	0.07589	0.02332	0.00250	0.01702
	Rice/paddy	α_{2j}	0.00000	0.10997	0.59363	0.00071	0.33333	0.05980	0.00019	0.00009	0.30401	0.00782	0.10119	0.03110	0.00333	0.04280
	Straw/Husk/Bran	α_{3j}	0.00002	0.00002	0.00000	0.00000	0.00000	0.00001	0.00000	0.12500	0.00325	0.00020	0.15811	0.00486	0.00052	0.02882
Manufacturing	Flour (Ata, Meda)	α_{4j}	0.00000	0.00000	0.00000	0.00000	0.00000	0.06877	0.10883	0.00001	0.18156	0.08990	0.00000	0.44700	0.04794	0.26706
	Beaten Rice (Chuda)	α_{5j}	0.00000	0.00000	0.00000	0.00000	0.00000	0.03902	0.01427	0.00030	0.00247	0.02345	0.00000	0.13993	0.02501	0.00504
	Packed food	α_{6j}	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00076	0.00551	0.11726	0.00000	0.05830	0.06253	0.60517
	Snacks	α_{7j}	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00051	0.01892	0.31270	0.00000	0.07774	0.41685	1.45730
	Fodder	α_{8j}	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02596	0.00156	0.00000	0.00078	0.00008	0.00678
Transport		α_{9j}	0.00004	0.00004	0.00009	0.00002	0.00014	0.00003	0.00001	0.00003	0.01791	0.03909	0.00632	0.00019	0.20842	0.00714
services		α_{10j}	0.00004	0.00004	0.00009	0.00002	0.00014	0.00003	0.00001	0.00003	0.00179	0.00391	0.00632	0.00019	0.02084	0.00007
Energy		α_{11j}	0.00004	0.00004	0.00009	0.00002	0.00014	0.00003	0.00001	0.00003	0.00043	0.00039	0.00632	0.00019	0.00208	0.00007
Labour		α_{12j}	0.00044	0.00042	0.00009	0.00002	0.00014	0.00003	0.00001	0.00003	0.00018	0.00391	0.00632	0.01943	0.00021	0.00007
Taxes		α_{13j}	0.00004	0.00004	0.00009	0.00002	0.00014	0.00003	0.00001	0.00003	0.00179	0.00039	0.00632	0.00019	0.00000	0.00007
Import		α_{14j}	0.00004	0.00004	0.00009	0.00002	0.00014	0.00003	0.00001	0.00003	0.05372	0.39088	0.63243	0.19435	0.20842	0.00001
base year 2001																

Calculations:

- Demand of wheat (farm output) in 2031, is P2031x1 kg per capita/yr=1x2,76,29,935=27629935 kg/yr=331559220 Rs
- Demand of Paddy in 2031, is P2031x100 kg per capita/yr=100x2,76,29,935=2762993500 kg/yr=55259870000 Rs.
- Demand of Straw/Husk/Bran in 2031, is P2031x40 kg per capita/yr=40x2,76,29,935=1105197400 kg/yr=276299350 Rs.
- Demand of Flour in 2031, is P2031x70 kg per capita/yr=70x2,76,29,935=1934095450 kg/yr=44484195350 Rs
- Demand of beaten rice in 2031, is P2031x10 kg per capita/yr=10x2,76,29,935=276299350 kg/yr=16578000000 Rs
- Demand of packed food in 2031, is P2031x100 kg per capita/yr=100x2,76,29,935=2762993500 kg/yr=414449025000 Rs
- Demand of snacks in 2031, is P2031x100 kg per capita/yr=100x2,76,29,935=2762993500 kg/yr= 552598700000 Rs
- Demand of fodder in 2031, is P2031x2 kg per capita/yr=2x2,76,29,935=55259870 kg/yr=110519740 Rs

Table 8.1.4: Final Demand in 2031

Economic Activity		Yi
Agriculture	Wheat	331559220
	Rice/paddy	55259870000
	Straw/Husk/Bran	276299350
Manufacturing	Flour (Ata, Meda)	44484195350
	Beaten Rice (Chuda)	16578000000
	Packed food	414449025000
	Snacks	552598700000
	Fodder	110519740
Transport	(10% increase)	288138950
services	(10% increase)	10902980
Energy	(10% increase)	6491100
Labour	(10% increase)	15726700
Taxes	(10% increase)	23819950
Import	(10% increase)	729679500.00
Total		1085162927840
Unit: In Rs., base year 2001		

We Know,

$$X_i = \sum_{j=1}^{n} \alpha_{ij} Y_j \quad , \qquad \text{where } (i=1,2,\ldots\ldots, n)$$

Using the above equation, the required output of products in 2031 have been calculated.

Table 8.1.5: Required Output in 2031

Name of Items	Formula	Output in Rs./Year (Base Year 2001)	Output in Kg/Year
Wheat	$X_1 = \sum_{j=1}^{14} \alpha_{1j} Y_j$	23549843720	1962486977
Rice/paddy	$X_2 = \sum_{j=1}^{14} \alpha_{2j} Y_j$	36807917394	1840395870
Straw/Husk/Bran	$X_3 = \sum_{j=1}^{14} \alpha_{3j} Y_j$	42103977	168415908
Flour (Ata, Meda)	$X_4 = \sum_{j=1}^{14} \alpha_{4j} Y_j$	88896390207	3865060444
Beaten Rice (Chuda)	$X_5 = \sum_{j=1}^{14} \alpha_{5j} Y_j$	24067270480	401121175
Packed food	$X_6 = \sum_{j=1}^{14} \alpha_{6j} Y_j$	446938870	2979593
Snacks	$X_7 = \sum_{j=1}^{14} \alpha_{7j} Y_j$	1083428530	5417143
Fodder	$X_8 = \sum_{j=1}^{14} \alpha_{8j} Y_j$	12457333	6228667
Total		174906350511	8252105777

X_9, X_{10}, X_{11}, X_{12}, X_{13} & X_{14} represents the output of transport, services, energy, labour, taxes and imports respectively.

8.2 Sugarcane

Table 8.2.1: Input-Output table: Sugarcane (In Kg)

Sugarcane: Input-Output Table																	
Economic Activity			Input to Agriculture	Input to Manufacturing						Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand	Total Output
				Sugar	Juice/Syrup	Rock Candy	Molasses	Bagasse (paper, cardboard, utensils, gunny bags etc.	Filter Press cake or press mud								
			X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	Y_i	X_i
Agriculture		X_1	7815000	36260000	6544000	3272000	540000	845100	400000	100000	52100	127450	127450	127450	220450	8900000	65440000
Manufacturing	Sugar	X_2	0	0	20000	20000	0	0	0	360000	62000	0	40000	80000	52100	2000000	2636000
	Juice/Syrup	X_3	0	0	40000	0	0	0	0	317300	30000	0	40000	40000	2500000	1702000	4760200
	Rock Candy	X_4	0	0	0	0	0	0	0	1800	1000	0	1000	500	200000	122000	327200
	Molasses	X_5	0	0	0	0	2700	0	0	27300	10000	15000	15000	10000	4600	464200	519000
	Bagasse (paper, cardboard, utensils, gunny bags etc.	X_6	0	0	0	0	0	30000	0	30000	10000	12000	8000	8000	000000	945080	1943080
	Filter Press cake or press mud	X_7	0	0	0	0	0	0	7500	51550	25000	0	25000	25000	300000	532150	966200
Transport		X_8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
services		X_9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy		X_{10}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labour		X_{11}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes		X_{12}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Import		X_{13}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unit: In Kgs., base year 2001																	

Table 8.2.2: Input-Output table: Sugarcane (In Rs.)

Sugarcane: Input-Output Table																			
Economic Activity			Input to Agriculture	Input to Manufacturing						Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand/ Supply	Total Output
				Sugar	Juice/Syrup	Rock Candy	Molasses	Bagasse (paper, cardboard, utensils, gunny bags etc	Filter Press cake or press mud								
			X_{1i}	X_{2i}	X_{3i}	X_{4i}	X_{5i}	X_{6i}	X_{7i}	X_{8i}	X_{9i}	X_{10i}	X_{11i}	X_{12i}	X_{13i}	Y_i	X_i
Agriculture		X_{1i}	2344500	10008000	10632000	0816000	1647000	2535300	1200000	300000	156300	382350	382350	382350	661350	26700000	196320000
Manufacturing	Sugar	X_{2i}	0	0	800000	800000	0	0	0	1443600	2486000	0	1600000	2200000	2124000	120000000	145440000
	Juice/Syrup	X_{3i}	0	0	400000	0	0	0	0	3173000	300000	0	400000	400000	2500000	17029000	17602000
	Rock Candy	X_{4i}	0	0	0	0	0	0	0	324000	180000	0	180000	90000	3600000	22122000	38806000
	Molasses	X_{5i}	0	0	0	0	10800	0	0	110000	40000	60000	60000	40000	18400	1856800	2106000
	Bagasse (paper, cardboard, utensils, gunny bags etc	X_{6i}	0	0	0	0	0	150000	0	150000	50000	60000	40000	40000	4300000	4725400	9715400
	Filter Press cake or press mud	X_{7i}	0	0	0	0	0	0	15000	103100	50000	0	30000	30000	600000	1064300	1932400
Transport		X_{8i}	320000	15000	15000	15000	1500	15000	1500	320000	50000	1220000	30000	40000	40000	1064600	2184900
services		X_{9i}	120000	15000	15000	15000	1500	15000	1500	15000	120000	12000	15000	25000	22000	324600	363800
Energy		X_{10i}	120000	500000	50000	50000	13000	50000	1500	120000	120000	200000	50000	40000	42350	1982350	3341200
Labour		X_{11i}	110000	10000	10000	10000	1500	10000	1500	10000	500	500	0	0	20000	2712350	2806350
Taxes		X_{12i}	1000000	25000	25000	25000	1500	25000	1500	250000	25000	150000	15000	15000	20000	4202350	5780350
Import		X_{13i}	120000	25000	25000	50000	1500	25000	1500	150000	25000	15000	15000	15000	0	20485000	20953000
Total			2523500	10067000	2007*2000	10*81000	1680300	2825300	1224000	1946*100	3506800	2190850	285*350	4337350	6604810	224667950	320360100
Unit: In Rs., base year 2001																	

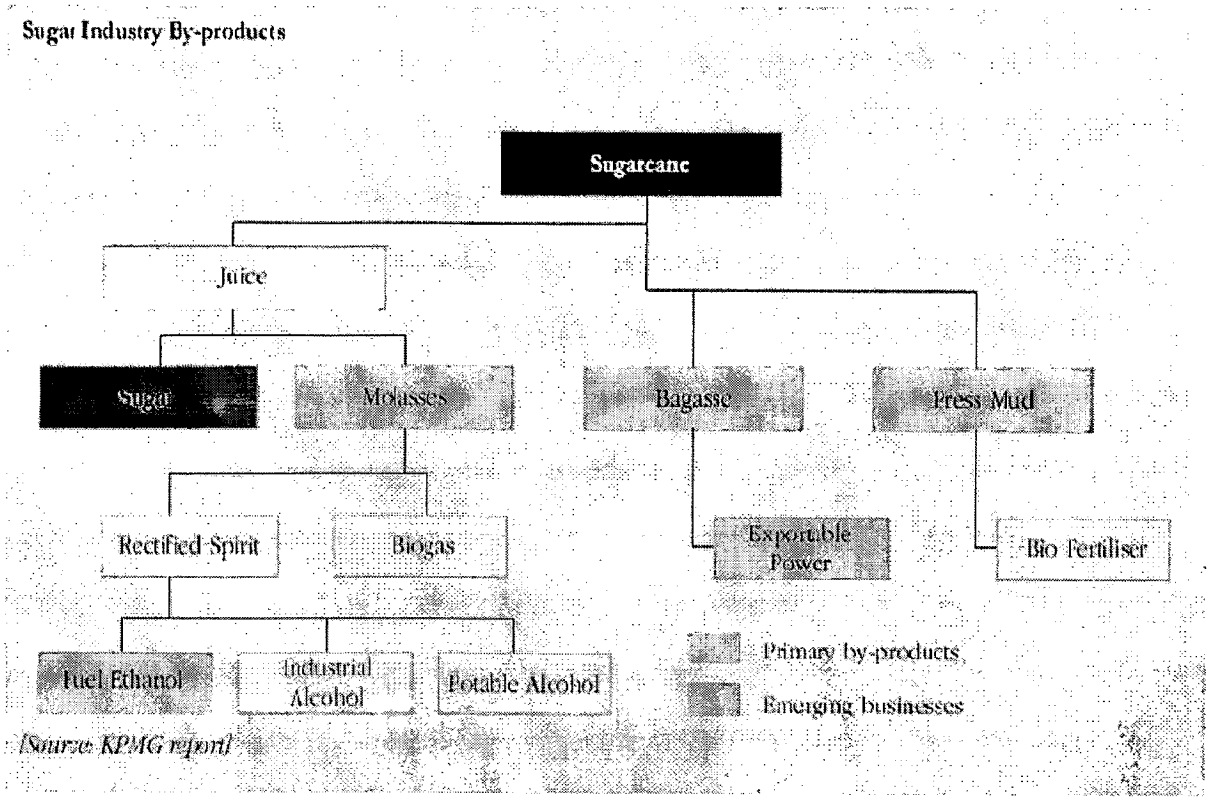


Figure 8.2.1 Products and by-products of Sugar industry

Data taken into consideration while doing above calculations are as follow :

Population (2001): 14448392

Area for sugarcane: 1563 Ha

Seed required: 5 ton/ha

- Approximately 10 percent of each sugar cane can be processed into commercial sugar. Sugar cane consists of 70 percent water, 14 percent fibre, 13.3 percent saccharose (about 10 to 15 percent sucrose) and 2.7 percent soluble impurities.
- consumption of sugarcane: 2 kg/person/yr
- Price: Sugar- 39-40 Rs/kg, sugarcane-2-3 Rs/kg, juice 10-15 Rs/kg, bagasses-0.8rs/kg materials made by it 5 Rs/kg,molasses-3-4 Rs/kg, press mud-1 Rs/kg mat-2 Rs/kg, rock candy-180 Rs/kg
- Tax: agricultural income is tax free, 15 % avg. for industrial sectors
- Transportation cost:100 Rs/quintal

- services (space, electricity, irrigation, IT etc) :100 Rs/ha/year

SOURCE: Agriculture Department, GOB, Statistics & Evaluation Dept., GOB
www.en.wikipedia.org/wiki/Sugarcane

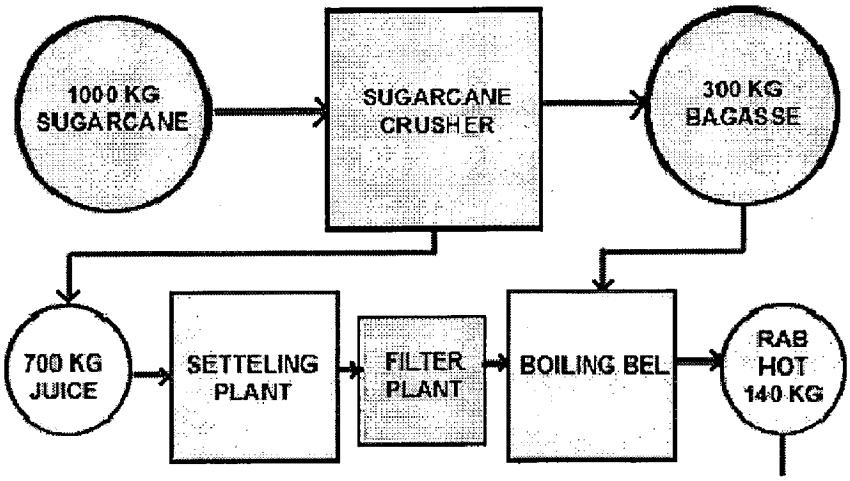


Figure 8.2.2 Sugarcane processing

Now we know, input-output coefficients,

$$\alpha_{ij} = x_{ij} / X_j$$

Using above equation the coefficients are calculated and are shown in table below.

Table 8.2.3: Matrix of Input-Output co-efficients: Sugarcane

Sugarcane: Matrix of Input-Output co-efficients															
Economic Activity			Input to Agriculture	Input to Manufacturing						Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export
				Sugar	Juice/Syrup'	Rock Candy	Molasses	Bagasse (paper, cardboard, utensils, gunny bags etc.	Filter Press cake or press mud						
			α_{1j}	α_{2j}	α_{3j}	α_{4j}	α_{5j}	α_{6j}	α_{7j}	α_{8j}	α_{9j}	α_{10j}	α_{11j}	α_{12j}	α_{13j}
Agriculture		α_{1j}	0.1194	0.7500	0.4124	0.1667	0.7500	0.2610	0.6210	0.0137	0.0430	0.1144	0.1320	0.0661	0.0316
Manufacturing	Sugar	α_{2j}	0.0000	0.0000	0.0168	0.0136	0.0000	0.0000	0.0000	0.6607	0.6816	0.0000	0.5524	0.5536	0.1014
	Juice/Syrup	α_{3j}	0.0000	0.0000	0.0084	0.0000	0.0000	0.0000	0.0000	0.1452	0.0825	0.0000	0.1381	0.0692	1.1931
	Rock Candy	α_{4j}	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0148	0.0495	0.0000	0.0621	0.0156	1.7181
	Molasses	α_{5j}	0.0000	0.0000	0.0000	0.0000	0.0049	0.0000	0.0000	0.0050	0.0110	0.0180	0.0207	0.0069	0.0009
	Bagasse (paper, cardboard, utensils, gunny bags etc.	α_{6j}	0.0000	0.0000	0.0000	0.0000	0.0000	0.0154	0.0000	0.0069	0.0137	0.0180	0.0138	0.0069	0.2148
	Filter Press cake or press mud	α_{7j}	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0078	0.0042	0.0137	0.0000	0.0172	0.0086	0.0286
Transport		α_{8j}	0.0016	0.0001	0.0003	0.0003	0.0007	0.0015	0.0008	0.0146	0.0137	0.3951	0.0172	0.0069	0.0019
services		α_{9j}	0.0006	0.0001	0.0002	0.0002	0.0007	0.0015	0.0008	0.0007	0.0330	0.0036	0.0052	0.0043	0.0010
Energy		α_{10j}	0.0006	0.0034	0.0011	0.0008	0.0068	0.0051	0.0008	0.0055	0.0330	0.0590	0.0172	0.0069	0.0020
Labour		α_{11j}	0.0006	0.0001	0.0002	0.0002	0.0007	0.0010	0.0008	0.0005	0.0001	0.0001	0.0000	0.0000	0.0010
Taxes		α_{12j}	0.0051	0.0002	0.0005	0.0004	0.0007	0.0026	0.0008	0.0114	0.0069	0.0449	0.0052	0.0026	0.0010
Import		α_{13j}	0.0006	0.0002	0.0005	0.0008	0.0007	0.0026	0.0008	0.0069	0.0069	0.0045	0.0052	0.0026	0.0000
Total			0.1285	0.7541	0.4406	0.1831	0.7652	0.2908	0.6334	0.8907	0.9886	0.6584	0.9863	0.7504	3.2954
Unit: In Rs., base year 2001															

Calculations:

- Demand of Agricultural product in 2031, is P2031x2 kg per capita/yr=2x2,76,29,935=55259870 kg/yr=165779610 Rs
- Demand of sugar in 2031, is P2031x70 kg per capita/yr=70x2,76,29,935=1934095450 kg/yr=77363818000 Rs.
- Demand of juice/jelly in 2031, is P2031x30 kg per capita/yr=30x2,76,29,935=828898050 kg/yr=8288980500 Rs
- Demand of rock candy in 2031, is P2031x10 kg per capita/yr=10x2,76,29,935=276299350 kg/yr=49733883000 Rs
- Demand of molasses in 2031, is P2031x5 kg per capita/yr=5x2,76,29,935=138149675 kg/yr=552598700 Rs
- Demand of bagasses in 2031, is P2031x5 kg per capita/yr=5x2,76,29,935=138149675 kg/yr= 690748375 Rs
- Demand of press mud in 2031, is P2031x2 kg per capita/yr=2x2,76,29,935=55259870 kg/yr=110519740 Rs

Table 8.2.4: Final Demand in 2031

Economic Activity		Yi
Agriculture		165779610
Manufacturing	Sugar	77363818000
	Juice/Syrup	8288980500
	Rock Candy	49733883000
	Molasses	552598700
	Bagasse (paper, cardboard, utensils, gunny bags etc.	690748375
	Filter Press cake or press mud	110519740
Transport	(10% increase)	21610710
services	(10% increase)	3570930
Energy	(10% increase)	2180585
Labour	(10% increase)	2983585
Taxes	(10% increase)	4622585
Import	(10% increase)	22533500
Total		153376011210
Unit: In Rs., base year 2001		

We Know,

$$X_i = \sum_{j=1}^{n} \alpha_{ij} Y_j \ , \qquad \text{where } (i=1,2,\ldots\ldots, n)$$

Using the above equation, the required output of products in 2031 have been calculated

Table 8.2.5: Required Output in 2031

Name of Items	Formula	Output in Rs./Year (Base Year 2001)	Output in Kg/Year
Sugarcane	$X_1 = \sum_{j=1}^{13} \alpha_{1j} Y_j$	70415626861	23471875620
Sugar	$X_2 = \sum_{j=1}^{13} \alpha_{2j} Y_j$	838057314	22951433
Juice/Syrup	$X_3 = \sum_{j=1}^{13} \alpha_{3j} Y_j$	100702895	10070289
Rock Candy	$X_4 = \sum_{j=1}^{13} \alpha_{4j} Y_j$	39470033	219278
Molasses	$X_5 = \sum_{j=1}^{13} \alpha_{5j} Y_j$	3018499	754625
Bagasse (paper, cardboard, utensils, gunny bags etc.	$X_6 = \sum_{j=1}^{13} \alpha_{6j} Y_j$	15813971	3162794
Filter Press cake or press mud	$X_7 = \sum_{j=1}^{13} \alpha_{7j} Y_j$	1745694	872847

X_8, X_9, X_{10}, X_{11}, X_{12} & X_{13} represents the output of transport, services, energy, labour, taxes and imports respectively.

8.3 Mango

Table 8.3.1: Input-Output table: Mango (In Kg)

Mango: Input-Output Table																	
Economic Activity			Input to Horticulture	Input to Manufacturing						Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand	Total Output
				Mango Fruit	Juice/Syrup	Jam/Jelly	Pickle/Aamras/Aamchur/candy	twigs used as Datun	leave/wood (for religious & medicinal purposes)								
			x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	Y_i	X_i
Horticulture		x_1	73000	56600000	0	0	0	5000000	5000000	500000	4417	333	4417	167	33	33	67182400
Manufacturing	Mango fruit	x_2	0	0	6000000	400000	16400000	0	0	37500	3313	0	3313	125	8750000	25030750	56625000
	Juice/Syrup	x_3	0	0	860000	0	0	0	0	62500	1250	0	1250	63	350000	55349937	6100000
	Jam/Jelly	x_4	0	0	0	44667	0	0	0	33333	667	0	667	33	136667	230633	446667
	Pickle/Aamras/Aamchur/candy	x_5	0	0	444	0	2413778	0	0	222222	5556	0	5556	111	3333333	11014556	16995556
	twigs used as Datun	x_6	0	0	0	0	0	150	0	2000000	1000	0	1000	0	299800	2698050	5000000
	leave/wood (for religious & medicinal purposes)	x_7	0	0	0	0	0	0	150	2000000	10000	0	1000	100	298890	2689860	5000000
Transport		x_8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
services		x_9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy		x_{10}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labour		x_{11}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes		x_{12}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Import		x_{13}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unit: In Kgs., base year 2001																	

Table 8.3.2: Input-Output table: Mango (In Rs.)

Mango: Input-Output Table

Economic Activity			Input to Horticulture	Input to Manufacturing						Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand/ Supply	Total Output
				Mango Fruit	Juice/Syrup	Jam/Jelly	Pickle/Aamras/Aamchur/candy	twigs used as Datun	leave/wood (for religious & medicinal purposes)								
			X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	Y_i	X_i
Horticulture		X_{1j}	2920000	2264000000	0	0	0	49994000	49994000	15000000	132500	10000	132500	5000	1000	13000	2382202000
Manufacturing	Mango frut	X_{2j}	0	0	240000000	16000000	636000000	0	0	1500000	132500	0	132500	5000	350000000	1001230000	2265000000
	Juice/Syrup	X_{3j}	0	0	68800000	0	0	0	0	5000000	100000	0	100000	5000	28000000	385995000	488000000
	Jam/Jelly	X_{4j}	0	0	0	6700000	0	0	0	5000000	100000	0	100000	5000	20500000	34595000	67000000
	Pickle/Aamras/ Aamchur/candy	X_{5j}	0	0	20000	0	108620000	0	0	10000000	250000	0	250000	5000	150000000	495655000	764800000
	twigs used as Datun	X_{6j}	0	0	0	0	0	1500	0	20000000	10000	0	10000	0	2998000	26980500	50000000
	leave/wood (for religious & medicinal purposes)	X_{7j}	0	0	0	0	0	0	1500	20000000	100000	0	10000	1000	2988900	26898600	50000000
Transport		X_{8j}	500000	50000	50000	50000	50000	500	500	1000000	500000	10000000	5000000	5000000	5000000	64299000	91500000
services		X_{9j}	50000	5000	5000	5000	5000	500	500	5000	0	5000	1000	5000	105000	2108000	2300000
Energy		X_{10j}	50000	5000	50000	50000	5000	500	500	13000000	100000	100000	50000	500000	500000	589000	15000000
Labour		X_{11j}	50000	5000	5000	5000	5000	500	500	50000	50000	50000	0	1000	1000000	4778000	6000000
Taxes		X_{12j}	5000000	50000	50000	50000	50000	500	500	100000	10000	50000	10000	0	100000	529000	6000000
Import		X_{13j}	50000	50000	50000	50000	50000	500	500	50000	5000	5000	5000	50000	0	634000	1000000
Total			8620000	2264165000	309030000	22910000	764785000	49998500	49998500	90705000	1490000	10220000	5801000	5582000	361192900	2044304100	6188802000

Unit: In Rs., base year 2001

Data taken into consideration while doing above calculations are as follows:

Population (2001): 14448392

- Area for Mango: 2625 Ha,
- Yield 12000kg/Ha
- **Mango consists of- Pro:** 0.5%, **Fat:** 0.3%, **Water:** 82%, **Fiber:** 1.8%
- Demand of Mango: 5 kg/capita/year, pickle-2 kg/capita/year, juice-5kg/capita/year, jam-1 kg/capita/year,twigs-1kg/capita, medicinal/ritual leaves -0.50 kg/capita/year.
- Price: Mango-40rs/kg, pickle- 45 rs/kg, juice-80 rs/kg, jam-150 rs/kg, twigs-10 rs/kg, leaves-10 rs/kg
- Tax: agricultural income is tax free, 5 % avg for industrial sectors
- Transportation cost:100 rs/quintal
- services (space, electricity, irrigation, IT etc) :100 rs/ha/year

SOURCE: Agriculture Department, GOB, Statistics & Evaluation Dept., GOB
www.en.wikipedia.org/wiki/**Mango**

Table 8.3.3: Prices of Mangoes

Mango type	price
gulab khas	200-250rs/kg
maldah	45-50 rs/kg
Dussheri	35 rs/kg
ruban	180-200 rs/kg
min price	18 rs/kg
amrapali	36 rs/kg
sukul mango(pickle)	12 rs/kg
Average	30 rs/kg

Now we know, input-output coefficients,

$$\alpha_{ij} = x_{ij} / X_j$$

Using above equation the coefficients are calculated and are shown in table below.

Table 8.3.4: Matrix of Input-Output co-efficients: Mango

Mango: Matrix of Input-Output co-efficients																
Economic Activity			Input to Horticulture	Input to Manufacturing						Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export
				Mango Fruit	Juice/Syrup	Jam/Jelly	Pickle/Aamras/Aamchur/candy	twigs used as Datun	leave/wood (for religious & medicinal purposes)						
			x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}
Horticulture		x_{1j}	0.00123	0.99956	0.00000	0.00000	0.00000	0.99988	0.99988	0.16393	0.05761	0.00667	0.02208	0.00083	0.00100
Manufacturing	Mango fruit	x_{2j}	0.00000	0.00000	0.49180	0.23881	0.85774	0.00000	0.00000	0.01639	0.05761	0.00000	0.02208	0.00083	350.00000
	Juice/Syrup	x_{3j}	0.00000	0.00000	0.14098	0.00000	0.00000	0.00000	0.00000	0.05464	0.04348	0.00000	0.01667	0.00083	28.00000
	Jam/Jelly	x_{4j}	0.00000	0.00000	0.00000	0.10000	0.00000	0.00000	0.00000	0.05464	0.04348	0.00000	0.01667	0.00083	20.50000
	Pickle/Aamras/Aamchur/candy	x_{5j}	0.00000	0.00000	0.00004	0.00000	0.14202	0.00000	0.00000	0.10929	0.10870	0.00000	0.04167	0.00083	150.00000
	twigs used as Datun	x_{6j}	0.00000	0.00000	0.00000	0.00000	0.00000	0.00003	0.00000	0.21858	0.00435	0.00000	0.00167	0.00000	2.99800
	leave/wood (for religious & medicinal purposes)	x_{7j}	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00003	0.21858	0.04348	0.00000	0.00167	0.00017	2.98800
Transport		x_{8j}	0.00021	0.00002	0.00010	0.00007	0.00007	0.00001	0.00001	0.01093	0.21739	0.66667	0.83333	0.83333	5.00000
services		x_{9j}	0.00002	0.00000	0.00001	0.00007	0.00001	0.00001	0.00001	0.00003	0.00000	0.00033	0.00017	0.00083	0.10500
Energy		x_{10j}	0.00002	0.00000	0.00010	0.00007	0.00001	0.00001	0.00001	0.14208	0.04348	0.00667	0.00833	0.08333	0.50000
Labour		x_{11j}	0.00002	0.00000	0.00001	0.00007	0.00001	0.00001	0.00001	0.00055	0.02174	0.00333	0.00000	0.00017	1.00000
Taxes		x_{12j}	0.00210	0.00002	0.00010	0.00007	0.00007	0.00001	0.00001	0.00109	0.00435	0.00333	0.00167	0.00000	0.10000
Import		x_{13j}	0.00002	0.00002	0.00010	0.00007	0.00007	0.00001	0.00001	0.00055	0.00217	0.00033	0.00083	0.00833	0.00000
Total			0.00362	0.99963	0.63326	0.34194	0.99998	0.99997	0.99997	0.99131	0.64783	0.68133	0.96683	0.93033	561.19290
base year 2001															

Calculations:

- Demand of MANGO in 2031, is P2031x5 kg per capita/yr=5x2,76,29,935= 138149675kg/yr= 5525987000Rs
- Demand of JUICE/SYRUP in 2031, is P2031x5 kg per capita/yr=5x2,76,29,935=138149675 kg/yr=11051974000 Rs.
- Demand of JAM/JELLY in 2031, is P2031x1 kg per capita/yr=1x2,76,29,935=27629935 kg/yr=4144490250 Rs
- Demand of PICKLE/CANDY in 2031, is P2031x2 kg per capita/yr=2x2,76,29,935=55259870 kg/yr=2486694150 Rs
- Demand of TWIG in 2031, is P2031x1 kg per capita/yr=1x2,76,29,935=27629935 kg/yr=276299350 Rs
- Demand of MEDICINAL LEAVES/WOOD in 2031, is P2031x0.5 kg per capita/yr=0.5x2,76,29,935=13814967 kg/yr= 138149670 Rs

Table 8.3.5: Final demand in 2031

Economic Activity		Yi
Horticulture		10000
Manufacturing	Mango fruit	5525987000
	Juice/Syrup	11051974000
	Jam/Jelly	4144490250
	Pickle/Aamras/Aamchur/candy	2486694150
	twigs used as Datun	276299350
	leave/wood (for religious & medicinal purposes)	138149670
Transport	(10% increase)	70728900
services	(10% increase)	2318800
Energy	(10% increase)	647900
Labour	(10% increase)	5255800
Taxes	(10% increase)	581900
Import	(10% increase)	697400
Total		23703835120

We Know,

$$X_i = \sum_{j=1}^{n} \propto_{ij} Y_j \ , \qquad \text{where } (i=1,2,\ldots\ldots, n)$$

Using the above equation, the required output of products in 2031 have been calculated.

Table 8.3.6: Required Output in 2031

Name of Items	Formula	Output in Rs./Year (Base Year 2001)	Output in Kg/Year
Mango fruit	$X_2 = \sum_{j=1}^{13} \propto_{2j} Y_j$	8803564185	220089105
Juice/Syrup	$X_3 = \sum_{j=1}^{13} \propto_{3j} Y_j$	1581728220	19771600
Jam/Jelly	$X_4 = \sum_{j=1}^{13} \propto_{4j} Y_j$	432799600	2885330
Pickle/Aamras/Aamchur/candy	$X_5 = \sum_{j=1}^{13} \propto_{5j} Y_j$	466434800	10365200
twigs used as Datun	$X_6 = \sum_{j=1}^{13} \propto_{6j} Y_j$	17577800	1757780
leave/wood (for religious & medicinal purposes)	$X_7 = \sum_{j=1}^{13} \propto_{7j} Y_j$	17658146	1765810
Total		11319762751	256634825

X_1, X_8, X_9, X_{10}, X_{11}, X_{12} & X_{13} represents the output of horticulture, transport, services, energy, labour, taxes and imports respectively.

Problems identified during the analysis:

1) price of mango(varieties) varies from 12 rs/kg to 200 rs/kg
2) export is much more than import
3) lesser interdependency between different sectors

8.4 Dairy

Table 8.4.1: Input-Output table: Dairy (In Kg)

Dairy: Input-Output Table																					
Economic Activity			Agriculture /Cattle	Input to Manufacturing											Input to Transports	Input to Service	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand	Total Output
			Fodder	Milk	Milk Powder	cheese, Paneer	Butter/ cream	Ghee	Khoya & Peda (Indian sweets)	Curd	lassi	milkshake	Ice cream								
			X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	Y	X
Agriculture/ Cattle	Fodder	x1	90000000	0	0	0	0	0	0	0	0	0	0	4745000	35000	3000	7500	10000	49500	50000	94900000
Manufacturing	Milk	x2	195000	392000000	1800000	1200000	500000	1945000	2250000	1670000	1100000	273000	670000	96000	7480	336	28280	3200000	3295900	816355000	1259250000
	Milk Powder	x3	0	0	0	0	0	0	0	0	0	0	20000	400	350	34	630	8000	2320	168261	200000
	cheese, Paneer	x4	0	0	0	0	0	0	88235	0	0	0	0	1800	524	49	926	24800	7192	496474	620000
	Butter/cream	x5	0	10000	0	0	0	10000	2000	0	0	0	1000	250	445	42	787	4000	1160	70316	100000
	Ghee	x6	0	0	0	0	0	0	1667	0	0	0	0	730	377	35	656	14000	4060	328482	350000
	Khoya & Peda (Indian sweets)	x7	0	0	0	0	0	0	0	0	0	0	0	1760	593	56	1049	21200	6148	499193	530000
	Curd	x8	0	0	0	0	50000	20000	1000	150000	50000	0	0	15000	1780	168	3148	60000	17400	1131504	1500000
	Lassi	x9	0	0	0	0	0	0	0	0	0	0	0	10000	1780	168	3148	40000	11600	933304	1000000
	milkshake	x10	0	0	0	0	0	0	0	0	0	0	0	3300	1978	187	3498	12000	3480	275558	300000
	Ice cream	x11	0	0	0	0	0	0	0	0	0	0	0	500	445	42	787	8000	2320	187906	200000
Transport		x12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
services		x13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy		x14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labour		x15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes		x16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Import		x17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit: In Kgs., base year 2001

Table 8.4.2: Input-Output table: Dairy (In Rs.)

Dairy: Input-Output Table

Economic Activity			Agriculture/ Cattle	Input to Manufacturing										Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export	Final Demand	Total Output
			Fodder	Milk	Milk Powder	cheese, Paneer	Butter/ cream	Ghee	Khoya & Peda (Indian sweets)	Curd	Lassi	milkshake	Ice cream								
			X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	Y_1	X
Agriculture/ Cattle	Fodder	X_1	180000000	0	0	0	0	0	0	0	0	0	0	9190000	70000	6000	15000	20000	90000	100000	184800000
Manufacturing	Milk	X_2	1575000	9800000000	45000000	105000000	12500000	18625000	56250000	11750000	27500000	6525000	10750000	2100000	157000	8400	207000	30000000	82397500	2014357500	11151230000
	Milk Powder	X_3	0	0	0	0	0	0	0	0	0	0	5000000	100000	80000	8400	157100	2000000	580000	12063200	20000000
	cheese, Paneer	X_4	0	0	0	0	0	0	15000000	0	0	0	0	305600	80000	8400	157100	4516000	1222540	84100560	105100000
	Butter/ cream	X_5	0	2000000	0	0	0	2000000	100000	0	0	0	200000	50000	80000	8400	157100	800000	232000	11063200	20000000
	Ghee	X_6	0	0	0	0	0	0	100000	0	0	0	0	175200	80000	8400	157100	3700000	971100	78519000	84000000
	Khoya & Peda (Indian sweets)	X_7	0	0	0	0	0	0	0	0	0	0	0	564000	80000	8400	157100	3180000	922200	74870000	79500000
	Curd	X_8	0	0	0	0	2500000	1000000	50000	7500000	2500000	0	0	750000	80000	8400	157100	3000000	870000	96575200	75000000
	Lassi	X_9	0	0	0	0	0	0	0	0	0	0	0	500000	80000	8400	157100	2000000	580000	10065200	10000000
	milkshake	X_{10}	0	0	0	0	0	0	0	0	0	0	0	148500	80000	8400	157100	510000	176600	12100100	13100000
	Ice cream	X_{11}	0	0	0	0	0	0	0	0	0	0	0	100000	80000	8400	157100	1600000	164000	3778200	10000000
Transport		X_{12}	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	5000	10000	9000	15000	1500000	150000	12114700	14581700
Services		X_{13}	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	0	50000	50000	1500000	150000	135250000	138600000
Energy		X_{14}	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	15000	1833105000	1835575000
Labour		X_{15}	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	0	50000	50000	5000	50000	15000	211092500	214812500
Taxes		X_{16}	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	15000	1518263000	1519080000
Import		X_{17}	250000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	150000	150000	15000	429213000	430150000
Total			185375000	9802300000	45100000	105300000	15100000	31025000	73155000	10350000	10100000	7125000	22250000	11188700	1268000	345000	2158600	104016000	83015841	23504732160	36841183200

Unit: In Rs., base year 2001

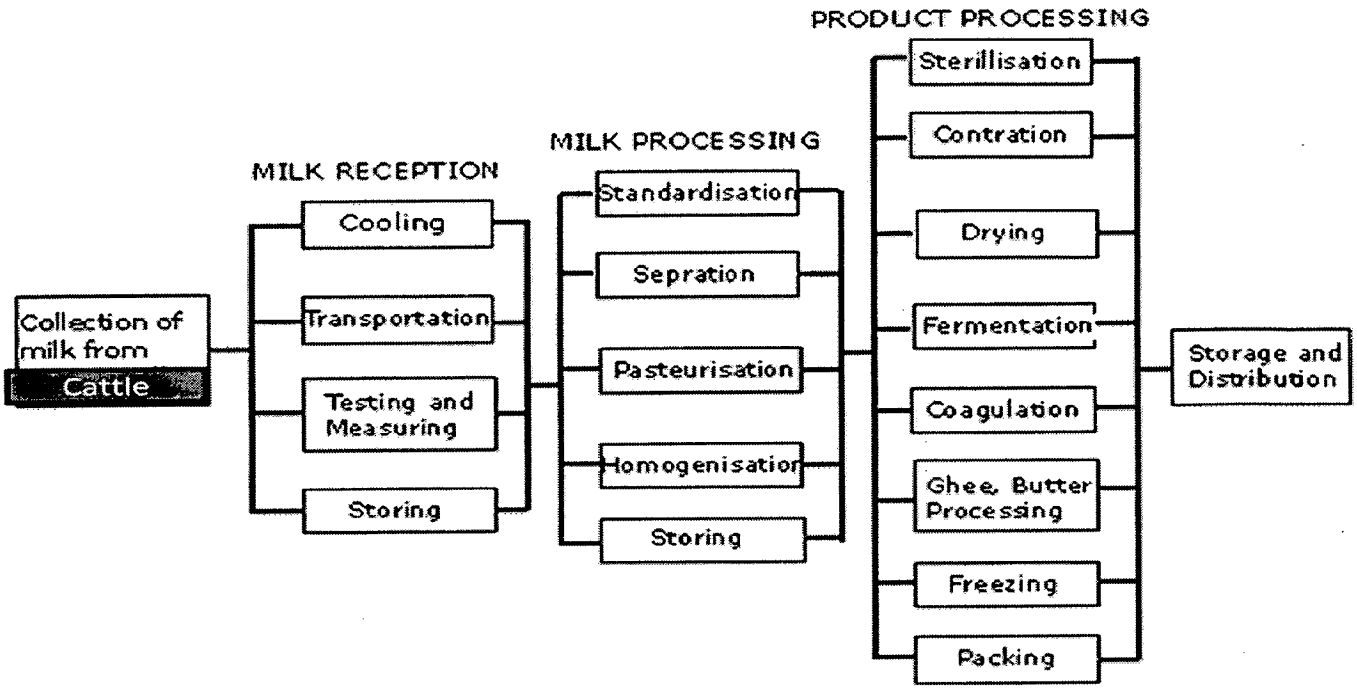


Figure 8.4.1 Dairy Industry

Data taken into consideration while doing above calculations are as follows:

Population (2001): 14448392

- Approximately 20 percent of milk can be processed into cream.
- 90 percent of milk can be processed into curd.
- Milk contains 80-90% water.
- 10 percent of milk can be processed into milk powder,
- 20 percent of milk can be processed in khoya,
- 20 percent of milk can be processed in butter and
- 18 percent of milk can be processed in ghee.
- 10 percent of milk can be processed into cheese/paneer
- No. of cattles (cow+buffao) (2001)=15000000 ,
- Consumption of Fodder per day per TLU(tropical livestock unit)=6 kg/day

- Price: Milk- 20-25 rs/kg, milk powder-250 rs/kg, cheese/paneer-150-170 rs/kg,butter/cream-200 rs/kg,ghee-200-240 rs/kg,khoya/peda/sweets-150 rs/kg, curd/lassi-50rs/kg, milkshake-40-45 rs/kg, icecream-200 rs/kg, fodder-2 rs/kg
- Tax: agricultural income is tax free, 5 % avg for dairy sectors
- Transportation cost:100 rs/quintal
- services (space, vetinary, electricity, IT etc) : 458600000 Rs/year

Sources: livestock census 2003, COMFED, GOB
Report on milk market agency survey, 2007

Table 8.4.3: Annual consumption in Patna region

Milk Products	Units	2009-10
Ghee	MTs	250
Table Butter	MTs	20
Ice-cream	MTs	110
Lassi	MTs	800
Misti Dahi	MTs	200
Peda	MTs	180
Paneer	MTs	420
Sudha Spl.	MTs	200
Plain Curd	MTs	800
Kalakand	MTs	40
Rasogulla	MTs	150
Gulabjamun	MTs	100
milk	MTs	1259250
cheese	MTs	200
milk consumption		150 gm/ day/capita
fodder consumption	MTs	91250

Now we know, input-output coefficients,

$$\alpha_{ij} = x_{ij} / X_j$$

Using above equation the coefficients are calculated and are shown in table below.

Table 8.4.4: Matrix of Input-Output co-efficients: Dairy

Dairy: Matrix of Input-Output co-efficients

Economic Activity			Agriculture/ Cattle	Input to Manufacturing										Input to Transport	Input to Services	Input to Energy	Input to Labour	Input to Taxes	Input to Export
			Fodder	Milk	Milk Powder	cheese, Paneer	Butter/ cream	Ghee	Khoya & Peda (Indian sweets)	Curd	lassi	milkshake	Ice cream						
			u_1	u_2	u_3	u_4	u_5	u_6	u_7	u_8	u_9	u_{10}	u_{11}	u_{12}	u_{13}	u_{14}	u_{15}	u_{16}	u_{17}
Agriculture/ Cattle	Fodder	u_1	0.048367	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.650720	0.000153	0.000003	0.000048	0.000013	0.000230
Manufacturing	Milk	u_2	0.025685	0.311296	0.900000	0.996203	0.625000	0.578864	0.707547	0.556667	0.550000	0.505556	0.418750	0.164567	0.000408	0.000004	0.002246	0.051644	1.014270
	Milk Powder	u_3	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.125000	0.006857	0.000191	0.000001	0.000500	0.001291	0.001347
	cheese, Paneer	u_4	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.188679	0.000000	0.000000	0.000000	0.000000	0.020982	0.000194	0.000001	0.000500	0.002722	0.002840
	Butter/cream	u_5	0.000000	0.000064	0.000000	0.000000	0.000000	0.023810	0.005031	0.000000	0.000000	0.000000	0.005000	0.003428	0.000191	0.000001	0.000500	0.000516	0.000539
	Ghee	u_6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005031	0.000000	0.000000	0.000000	0.000000	0.012013	0.000191	0.000001	0.000500	0.002169	0.002264
	Khoya & Peda (Indian sweets)	u_7	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.018102	0.000191	0.000001	0.000500	0.002053	0.002142
	Curd	u_8	0.000000	0.000000	0.000000	0.000000	0.125000	0.011905	0.000629	0.100000	0.050000	0.000000	0.000000	0.031427	0.000191	0.000001	0.000500	0.001937	0.002021
	Lassi	u_9	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.034285	0.000191	0.000001	0.000500	0.001291	0.001347
	milkshake	u_{10}	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010183	0.000191	0.000001	0.000500	0.000349	0.000364
	Ice cream	u_{11}	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006857	0.000191	0.000001	0.000500	0.001033	0.001078
Transport		u_{12}	0.000263	0.000002	0.001000	0.000474	0.002500	0.000595	0.000629	0.000667	0.001000	0.003704	0.001250	0.000343	0.000022	0.000005	0.000048	0.000968	0.000348
services		u_{13}	0.000263	0.000002	0.001000	0.000474	0.002500	0.000595	0.000629	0.000667	0.001000	0.003704	0.001250	0.003428	0.000000	0.000026	0.000159	0.000968	0.000348
Energy		u_{14}	0.000263	0.000002	0.001000	0.000474	0.002500	0.000595	0.000063	0.000667	0.001000	0.003704	0.001250	0.003428	0.000100	0.000026	0.000159	0.000032	0.000035
Labour		u_{15}	0.000263	0.000002	0.001000	0.000474	0.002500	0.000595	0.000629	0.000667	0.001000	0.003704	0.001250	0.000000	0.000100	0.000026	0.000016	0.000032	0.000035
Taxes		u_{16}	0.000263	0.000002	0.001000	0.000474	0.002500	0.000595	0.000629	0.000667	0.001000	0.003704	0.001250	0.003428	0.000109	0.000026	0.000159	0.000032	0.000033
Import		u_{17}	0.001317	0.000002	0.001000	0.000474	0.002500	0.000595	0.000629	0.000667	0.001000	0.003704	0.001250	0.003428	0.000100	0.000026	0.000176	0.000097	0.000035

Unit: In Rs., base year 2001

- 250 gram per capita consumption per day is the recommendation of the Medical Council of India,

Calculations:

- Demand of fodder in 2031, is Total production- (Population of livestock in 2031)x(consumption of fodder in kg/day/TLU)x365=65736500000-30000000x6x365 kg/yr=36500000 kg/yr=73000000 Rs
- Demand of milk in 2031, is P2031x100 kg per capita/yr=100x2,76,29,935=2762993500 kg/yr=69075000000 Rs.
- Demand of milk powder in 2031, is P2031x1 kg per capita/yr=1x2,76,29,935= 27629935 kg/yr= 6907500000 Rs.
- Demand of cheese/paneer in 2031, is P2031x2 kg per capita/yr=2x2,76,29,935=55259870 kg/yr= 9394178000 Rs.
- Demand of cream/butter in 2031, is P2031x2 kg per capita/yr=2x2,76,29,935=55259870 kg/yr= 11052000000 Rs.
- Demand of ghee in 2031, is P2031x2 kg per capita/yr=2x2,76,29,935=55259870 kg/yr= 13262000000 Rs.
- Demand of khoya peda(sweets) in 2031, is P2031x3 kg per capita/yr=3x2,76,29,935=82889805 kg/yr= 12433000000 Rs.
- Demand of curd in 2031, is P2031x10 kg per capita/yr=10x2,76,29,935=276299350 kg/yr= 13815000000 Rs.
- Demand of lassi in 2031, is P2031x10 kg per capita/yr=10x2,76,29,935=276299350 kg/yr= 13815000000 Rs.
- Demand of milk shake in 2031, is P2031x10 kg per capita/yr=10x2,76,29,935=276299350 kg/yr= 12433000000 Rs.
- Demand of ice cream in 2031, is P2031x1.5 kg per capita/yr=1.5x2,76,29,935=41444902 kg/yr= 8288980500 Rs.

Table 8.4.5: Final Demand in 2031

Economic Activity		Yi
Agriculture/ Cattle		73000000
Manufacturing	Milk	69075000000
	Milk Powder	6907500000
	cheese, Paneer	9394178000
	Butter/cream	11052000000
	Ghee	13262000000
	Khoya & Peda (Indian sweets)	12433000000
	Curd	13815000000
	Lassi	13815000000
	milkshake	12433000000
	Ice cream	8288980500
Transport	(10% increase)	13579170
services	(10% increase)	501875000
Energy	(10% increase)	207615500
Labour	(10% increase)	345501750
Taxes	(10% increase)	1703091500
Import	(10% increase)	472158500
Total		173792479920
Unit: In Rs., base year 2001		

We Know,

$$X_i = \sum_{j=1}^{n} \alpha_{ij} Y_j \ , \qquad \text{where } (i=1,2,\ldots\ldots, n)$$

Using the above equation, the required output of products in 2031 have been calculated.

Table 8.4.6: Required Output in 2031

Name of Items	Formula	Output in Rs./Year (Base Year 2001) Xi	Output in Kg/Year
Fodder	$X_1 = \sum_{j=1}^{17} \alpha_{1j} Y_j$	78291403	39145702
Milk	$X_2 = \sum_{j=1}^{17} \alpha_{2j} Y_j$	86501537651	3460061506
Milk Powder	$X_3 = \sum_{j=1}^{17} \alpha_{3j} Y_j$	1039321782	4157287
cheese, Paneer	$X_4 = \sum_{j=1}^{17} \alpha_{4j} Y_j$	2352381313	13837537
Butter/cream	$X_5 = \sum_{j=1}^{17} \alpha_{5j} Y_j$	425602747	2128014
Ghee	$X_6 = \sum_{j=1}^{17} \alpha_{6j} Y_j$	67753043	282304
Khoya & Peda (Indian sweets)	$X_7 = \sum_{j=1}^{17} \alpha_{7j} Y_j$	5024598	33497
Curd	$X_8 = \sum_{j=1}^{17} \alpha_{8j} Y_j$	3624672417	72493448
Lassi	$X_9 = \sum_{j=1}^{17} \alpha_{9j} Y_j$	3571667	71433
milkshake	$X_{10} = \sum_{j=1}^{17} \alpha_{10j} Y_j$	1174798	26107
Ice cream	$X_{11} = \sum_{j=1}^{17} \alpha_{11j} Y_j$	2632211	13161
Total		94101963630	3592249997

X_{12}, X_{13}, X_{14}, X_{15}, X_{16} & X_{17} represents the output of transport, services, energy, labour, taxes and imports respectively.

Chapter 9. RESULTS

Products	Projected Output (2031) (Kg/Year)	Land Area under different crops (2005-06) (Ha)	Land Area under different crops (2031) (Ha)	Yield (required) (Kg/Ha)	Yield in Patna Region (2005-06) (Kg/Ha)	Max. yield achieved till 2007 (Kg/Ha)	Result Output (2031) (Kg/Year)
Wheat	1962486977	**455473**	**455473**	**4309**	2059	4507 (Punjab)	**1962486977**
Paddy	1840395870	**655155**	**655155**	**2809**	1943	4022 (Punjab)	**1840395870**
Sugarcane	23471875620	**1563**	**1563**	15017195	**41868**	101620 (Tamilnaidu)	**158832060**
Mango	220089105	**2625**	**7875**	83843	**21590**	25600 (TN)	**220089105**

Note: figures shown in red colour are not feasible.

Source: Directorate of Economics & Statistics, Bihar, Patna.
An Executive Summary, MEETING OF CORE GROUP (consist of Central Ministers and State Chief Ministers, constituted on 15th March, 2010) **ON PRICES OF ESSENTIAL COMMODITIES, BACKGROUND PAPER.**

Products	Projected Output (2031) Kg	$x_{ij} = a_{ij} * x_j =$	required input of wheat crop (Kg/Yr)	$x_{ij} = a_{ij} * x_j =$	required input of paddy crop (Kg/Yr)	Land area required (Ha)
Wheat	1962486977	X11	116825043	x21	0	455439
Paddy/Rice	1840395870	x12	0	x22	202388507	655178
Straw/ Husk/ Bran	168415908	x13	62244998	x23	99976882	50037
Flour (Ata, Meda)	3865060444	x14	2014901085	x24	2753650	468583
Beaten Rice (Chuda)	401121175	x15	0	x25	133707058	47600
Packed food	2979593	x16	0	x26	178183	63
Snacks	5417143	x17	1120	x27	1025	0.62
Fodder (wheat/ paddy)	6228667	x18	341	x28	569	0.28

Products	Output (2005-06) kg	Projected Output (2031) kg	$x_{ij} = \alpha_{ij} * x_j =$	required input of SUGARCANE (Kg/Yr)	Land area required (Ha)
Sugarcane	65440000	158832060	-	-	1563
Sugar	3636000	8825082	x12	6618812	65
Juice/Syrup	4760200	11553673	x13	4764962	47
Rock Candy	327200	794160	x14	132360	1
Molasses	549000	1332500	x15	999375	10
Bagasse (paper, cardboard, utensils, gunny bags etc.	1943080	4716128	x16	1230706	12
Filter Press cake or press mud	966200	2345103	x17	1456284	14

Products	Projected Output (2031) kg	$x_{ij} = \alpha_{ij} * x_j =$	required input of MANGO (Kg/Yr)	Land area required (Ha)
Mango fruit	220089105	x22	0	10194
Juice/Syrup	19771600	x23	9723738	450
Jam/Jelly	2885330	x24	689034	32
Pickle/Aamras/Aamchur/candy	10365200	x25	8890653	412
twigs used as Datun	1757780	x26	0	925
leave/wood (for religious & medicinal purposes)	1765810	x27	0	925

Products	Projected Output (2031)	$x_{ij} = \alpha_{ij} * x_j =$	required input of Milk (Kg/Yr)
Milk	3460061506	x21	1005455
Milk Powder	4157287	x22	1077104713
cheese, Paneer	13837537	x23	3741558
Butter/cream	2128014	x24	13785023
Ghee	282304	x25	1330009
Khoya & Peda (Indian sweets)	33497	x26	163417
Curd	72493448	x27	23701
Lassi	71433	x28	40354686
milkshake	26107	X29	39288
Ice cream	13161	X30	13198
Fodder	39145702	x31	5511

Chapter 10. FINDINGS

10.1 Potential in Rural Industries:

10.1.1 Potential in agro based projects are:

1. Processing of major and minor crops (wheat, Paddy, pulses, sugarcane and maize)
2. Processing of fruits and vegetables (vegetables, potato, mango and litchi)
3. Processing of crop and agro industrial residue (straw, husk, bagasses, press mud, bran, corn shuck, corncobs and fodder)
4. Poultry and animal husbandry
5. Dairy and milk processing

10.1.2 Potential in other small scale and cottage industries:

1. Match stick, carpentry, pottery, stone cutting and crushing, handmade paper, soft toys, Bindi, beauty products, handloom etc
2. Bamboo products: furniture, baskets, musical instrument (bansuri), vessels, decorative objects
3. Art and handicraft materials (eg. Madhubani Painting, bronze metal work)

Figure 10.1.1 Madhubani Painting

Figure 10.1.2 Bamboo products and pots

10.2 SWOT

10.2.1 Strength

- **Agricultural Land Availability**
- **Human Resource**
- **Agro-climatic Conditions**
- **Water resources**
- **Location and Connectivity**
- **Traditional Strengths in Industry**
- **Vast Domestic & global Market**

10.2.2 Weakness

- **Small size of land holding**
- **Lack of infrastructure facility in terms of electricity, sanitation.**
- **Weak supply Chain**
- **Lack of Marketing**
- **Less use of technology in Agriculture**
- **Industrial Infancy**
- **Lack of Industrial Training**
- The **lack of processing and inadequate storage** of fruits and vegetables result in **huge wastages.**

10.2.3 Opportunities

- **Scope of increase in crop yield**
- **Fertile Land**
- **Availability of rare varieties which are in demand**
- **Ensured Irrigation due to canals**

- **Least prone to flood Hazards**
- **Commercialization of milk products**
- **Increase in R/D**

10.2.4 Threats

- **Volatile Law & Order Scenario**
- **Poor Credit/Deposit Ratio**
- **Lack of collective strength**
- **Poor Investment Climate / migration**
- **Lack of IT/Awareness in the rural system**
- **Uncontrolled price of agricultural products (Need of Minimum Support Price)**
- **Unemployment**

10.3 Prediction of IMPACT OF AGRO-INDUSTRIES ON THE REGION

- The impact of an **agro-industrialization** in support of the region will be positive.
- There will be a *'win-win'* situation for the **people, communities and government**.
- There will be gain of **intellectual and financial wealth** in the organization of many small-scale producers to supply the **agro-processors** for the industries.
- Wealth creation will lead to more **socially-secure rural communities**, and people will be better able to **feed themselves, educate themselves** and plan for a secure future from the additional **employment and incomes** that will result from the investments that the industries will bring.
- There will also gains for the **environment with improved management** and use of **natural resources.**
- People become less **exploitive and more responsible** where there will long-term issues of **socio-economic security**.

It will improve the **socio-economic condition** and give a way to come across the **regional imbalance and inequality** prevailing since long time

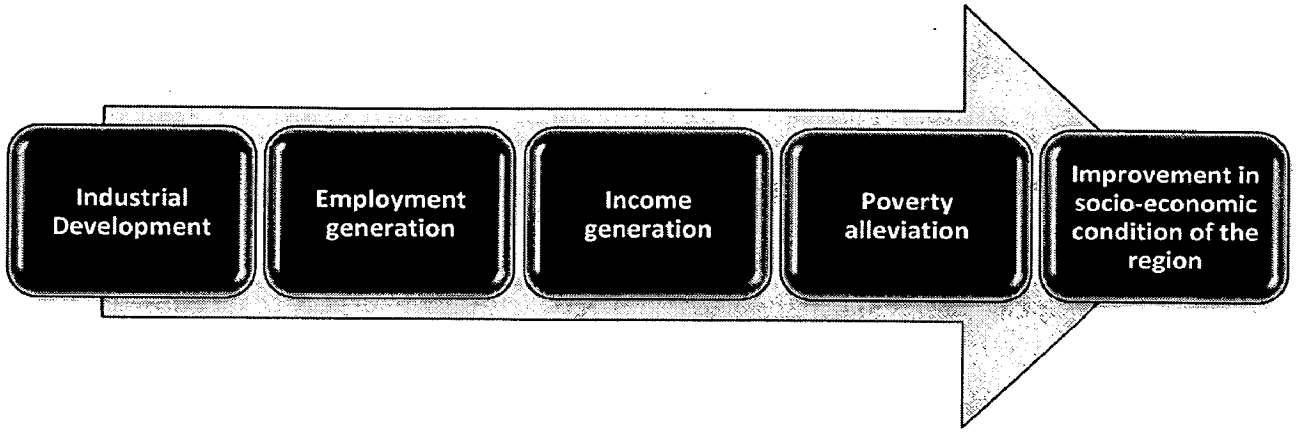


Figure 10.3.1 Process of socio-economic development due to industrial development

Chapter 11. RECOMMENDATIONS

11.1 Priorities should be:

- **General agricultural development.**
- **Development of sectors in support of agriculture.**

11.2 Proposed measures to be taken in support of general agro-industrial development include:

- Improved **use and service delivery** of important **agricultural inputs.**
- Investment in agricultural **research and development (R&D).**
- **Restoring, protecting and developing arable land** and making it more productive.
- Promoting **agriculture mechanization.**
- Re-directing **agricultural education and training needs** to respond to the changing requirements of the agriculture sector.
- Promoting the development of **indigenous technologies.**
- Measures **to protect the environment and to conserve natural resources.**
- An understanding of the use of **appropriate post-harvest practices** (including the introduction or expansion of **commercial agro-industries**).
- Development of **adequate physical and institutional infrastructure.**
- Improvement in **information system** and **supply chain** with use of technologies.

11.3 Strategic Interventions:

- Actual and potential yield gap should be minimized
- Area under fruit crops like mango and litchi should be extended.
- Production of green vegetables, spices, potato, and onion should be increased.
- Experience of Sudha Dairy should be multiplied.
- Near stagnation of poultry development should be given a boost.

- Storage and transportation facility should be improved by providing facilities at proper location.
- Stores for food grains need to be equipped with adequate facilities for materials handling, fumigation and aeration.
- Credit support by financial institution should be ensured by helping the banking system in recovery of loans.
- Law and order should be improved to increase the investment climate. Improvement in supply chain has been suggested.
- Areas having surplus of resources (agricultural resource, human resource and bovine resource) have been identified and clubbed for the establishment of industries at optimum location to get maximum profit. These identified areas are shown in the map.
- In support of these industries market areas should also be identified.

11.4 Post Harvest Infrastructure

Recommendation to strengthen the post harvest infrastructure to meet the present level of production as well as the anticipated increase in production volumes, like:

1. ***Collection Centres:*** The collection centre will consists of mechanical sorting, grading and packing line.
2. ***Multi Product Processing Unit***
3. ***Cold Storage (for perishable food products)***
4. ***Rural Mandi***
5. ***Marketing and Storage Facilities***

Inadequate post-harvest facilities lead to waste

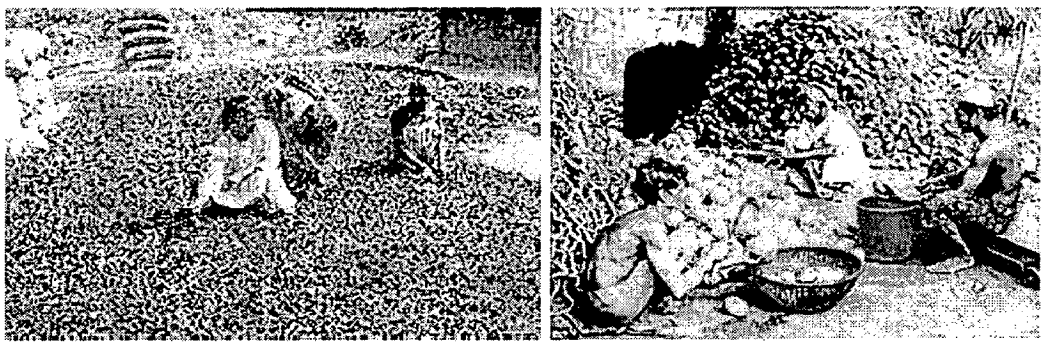
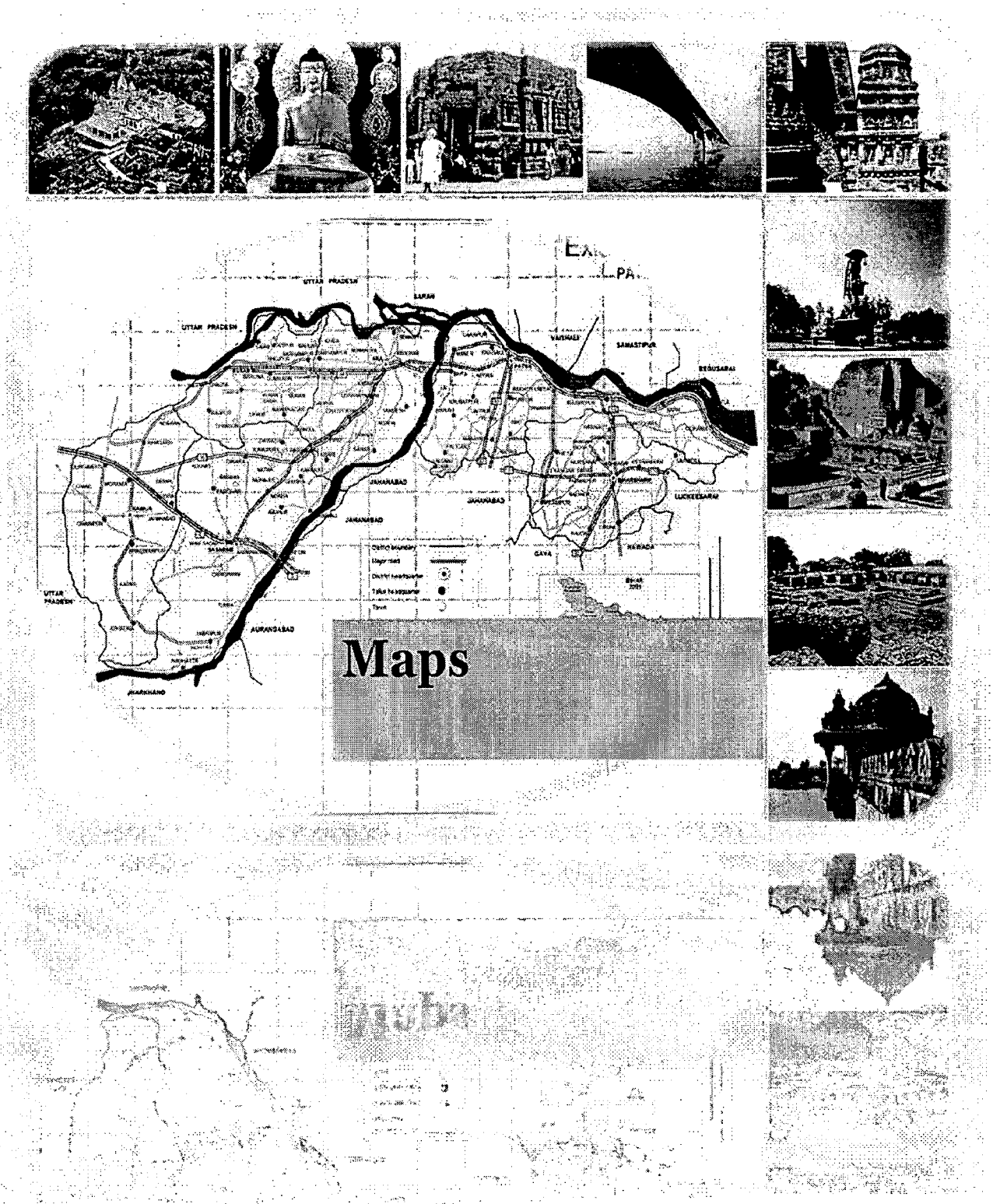


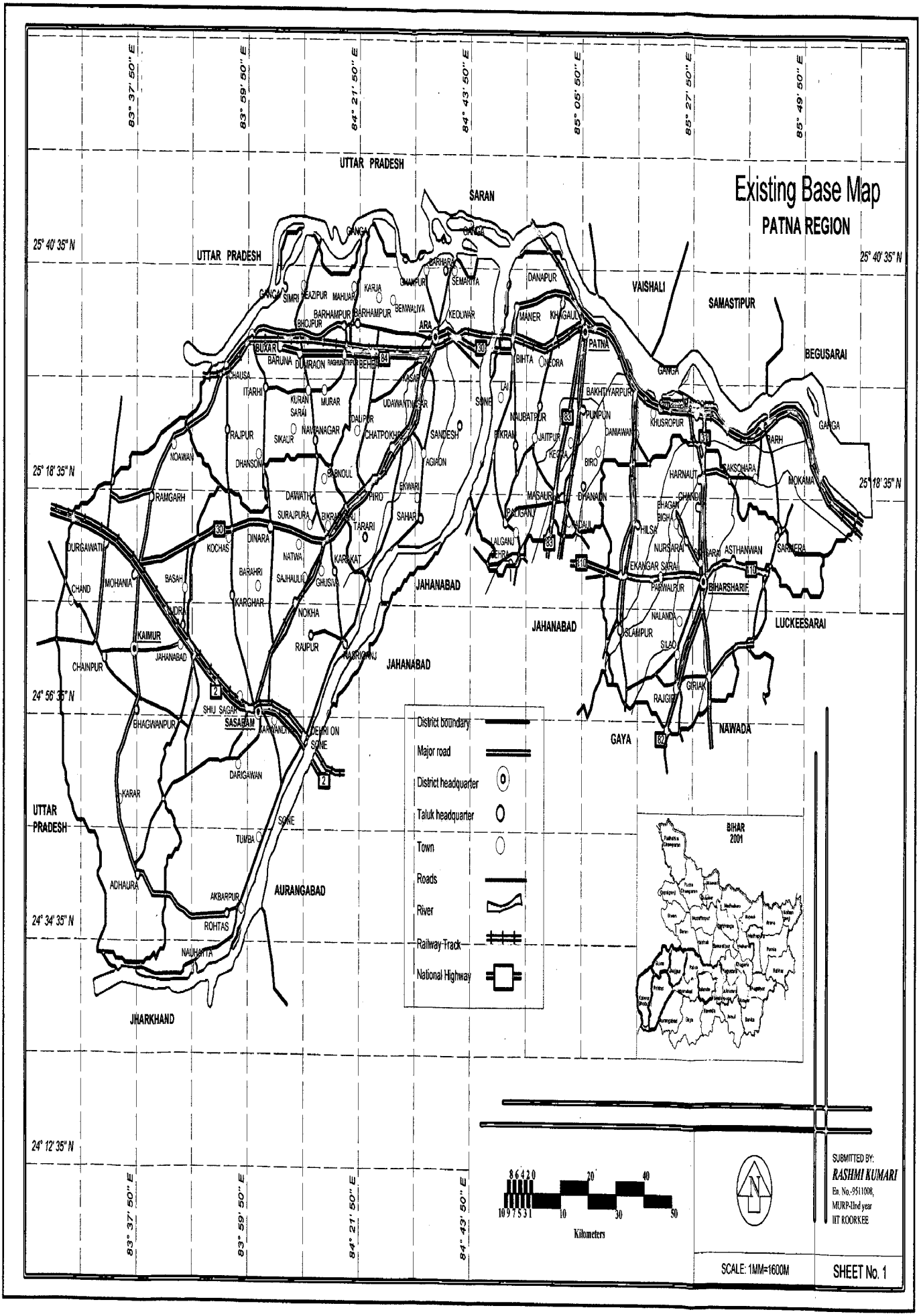
Figure 11.4.1 Agro-processing

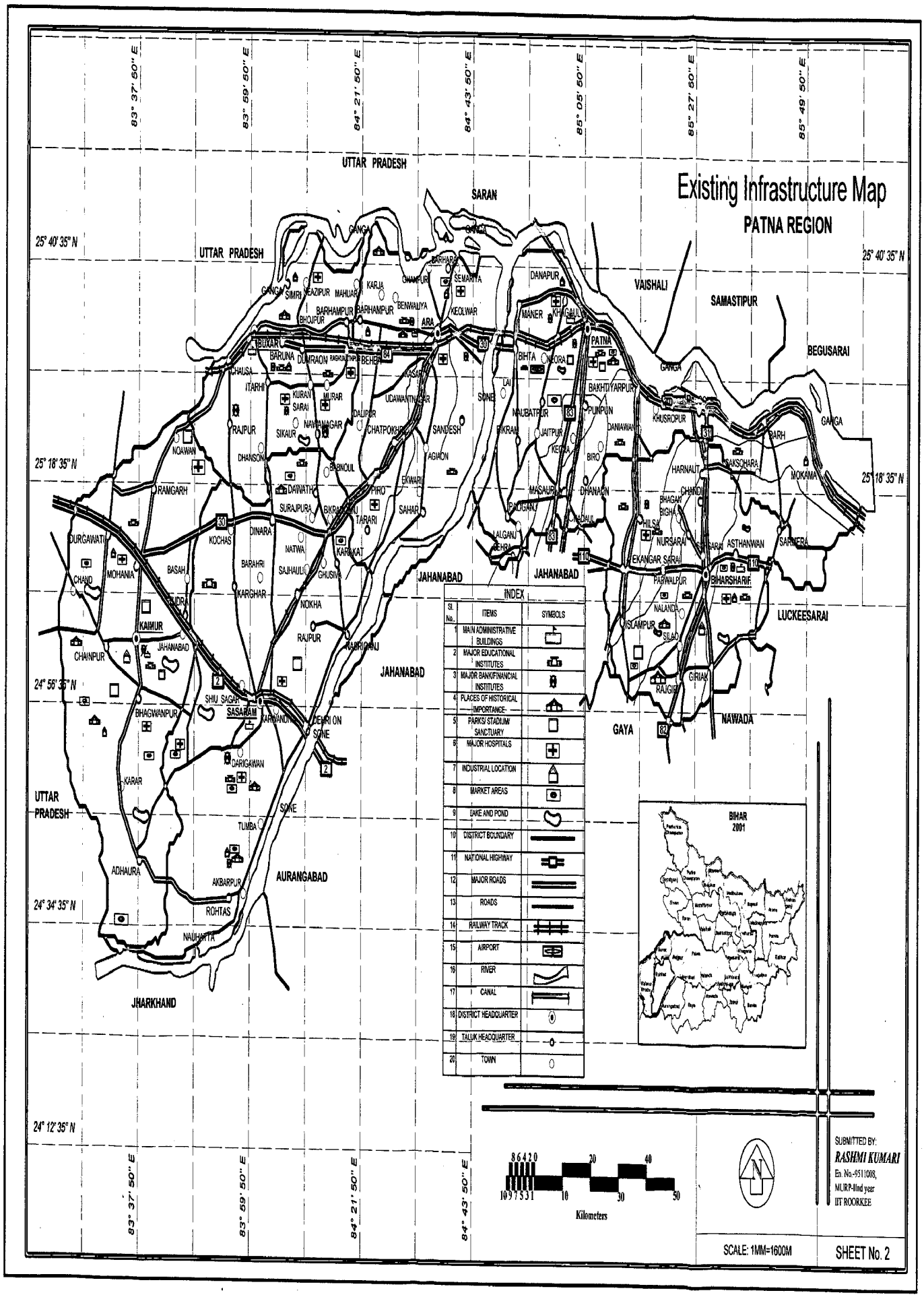
11.5 The main focus of the agro processing industries should be on:

1. Meeting the present as well as projected future **domestic market need** of the region;
2. **Export & marketing** farm fresh **produce, processed foods, dairy, meats;**
3. Promoting **safe, hygienic, sustainable, organic farm practices**; and international standards for hygiene and health;
4. Practice of **contract farming** and establishment of **AEZ's;**
5. Distribution of **agricultural inputs**; and
6. **Strong farmer relationships, disintermediation and 'demand led production'.**

Chapter 12. MAPS




Existing Base Map
PATNA REGION
UTTAR PRADESH
SARAN
VAISHALI
SAMASTIPUR
BEGUSARAI
JAHANABAD
GAYA
NAWADA
LUCKEESARAI
JHARKHAND
AURANGABAD
KAIMUR
BIHARSHARIF
SASARAM
ARA
PATNA
BUXAR
DEHRI ON SONE
83° 37' 50" E
83° 59' 50" E
84° 21' 50" E
84° 43' 50" E
85° 05' 50" E
85° 27' 50" E
85° 49' 50" E
25° 40' 35" N
25° 18' 35" N
24° 56' 35" N
24° 34' 35" N
24° 12' 35" N
District boundary
Major road
District headquarter
Taluk headquarter
Town
Roads
River
Railway Track
National Highway
BIHAR
2001
Kilometers
SCALE: 1MM=1600M
SHEET No. 1
SUBMITTED BY:
RASHMI KUMARI
En. No.-9511008,
MURP-IInd year
IIT ROORKEE


Existing Infrastructure Map
PATNA REGION
83° 37' 50" E
83° 59' 50" E
84° 21' 50" E
84° 43' 50" E
85° 05' 50" E
85° 27' 50" E
85° 49' 50" E
25° 40' 35" N
25° 18' 35" N
24° 56' 35" N
24° 34' 35" N
24° 12' 35" N
UTTAR PRADESH
JHARKHAND
SARAN
VAISHALI
SAMASTIPUR
BEGUSARAI
LUCKEESARAI
NAWADA
GAYA
JAHANABAD
AURANGABAD
BUXAR
ARA
PATNA
BARH
BIHARSHARIF
SASARAM
DEHRI ON SONE
KAIMUR
GANGA
SONE
INDEX
Sl. No.
ITEMS
SYMBOLS
1 MAIN ADMINISTRATIVE BUILDINGS
2 MAJOR EDUCATIONAL INSTITUTES
3 MAJOR BANK/FINANCIAL INSTITUTES
4 PLACES OF HISTORICAL IMPORTANCE
5 PARKS/ STADIUM/ SANCTUARY
6 MAJOR HOSPITALS
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8 MARKET AREAS
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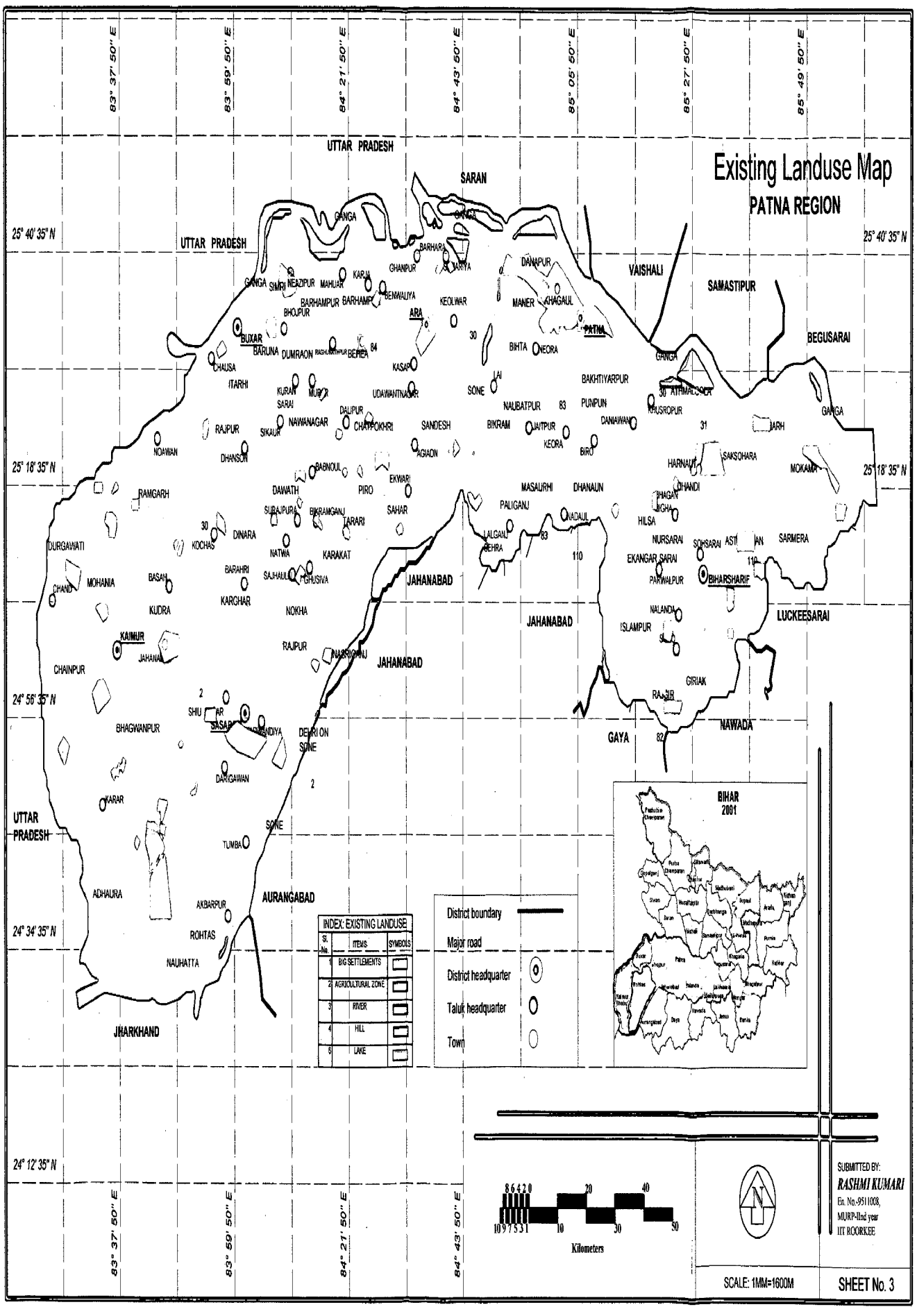
12 MAJOR ROADS
13 ROADS
14 RAILWAY TRACK
15 AIRPORT
16 RIVER
17 CANAL
18 DISTRICT HEADQUARTER
19 TALUK HEADQUARTER
20 TOWN
BIHAR 2001
86420
1097531
20
40
10
30
50
Kilometers
SUBMITTED BY:
RASHMI KUMARI
En. No.-9511008,
MURP-IInd year
IIT ROORKEE
SCALE: 1MM=1600M
SHEET No. 2

Existing Landuse Map
PATNA REGION



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RASHMI KUMARI
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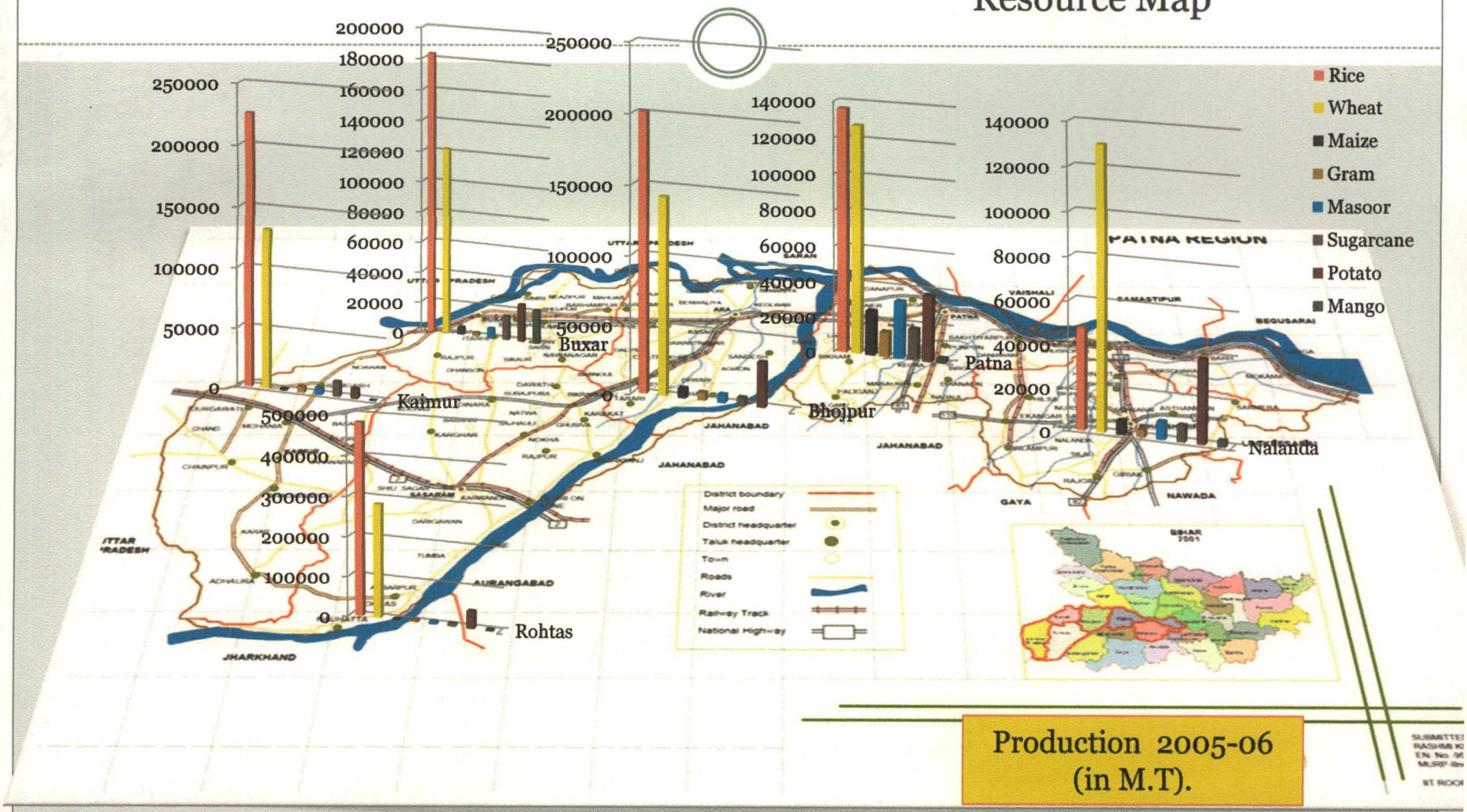
MURP-IInd year
IIT ROORKEE

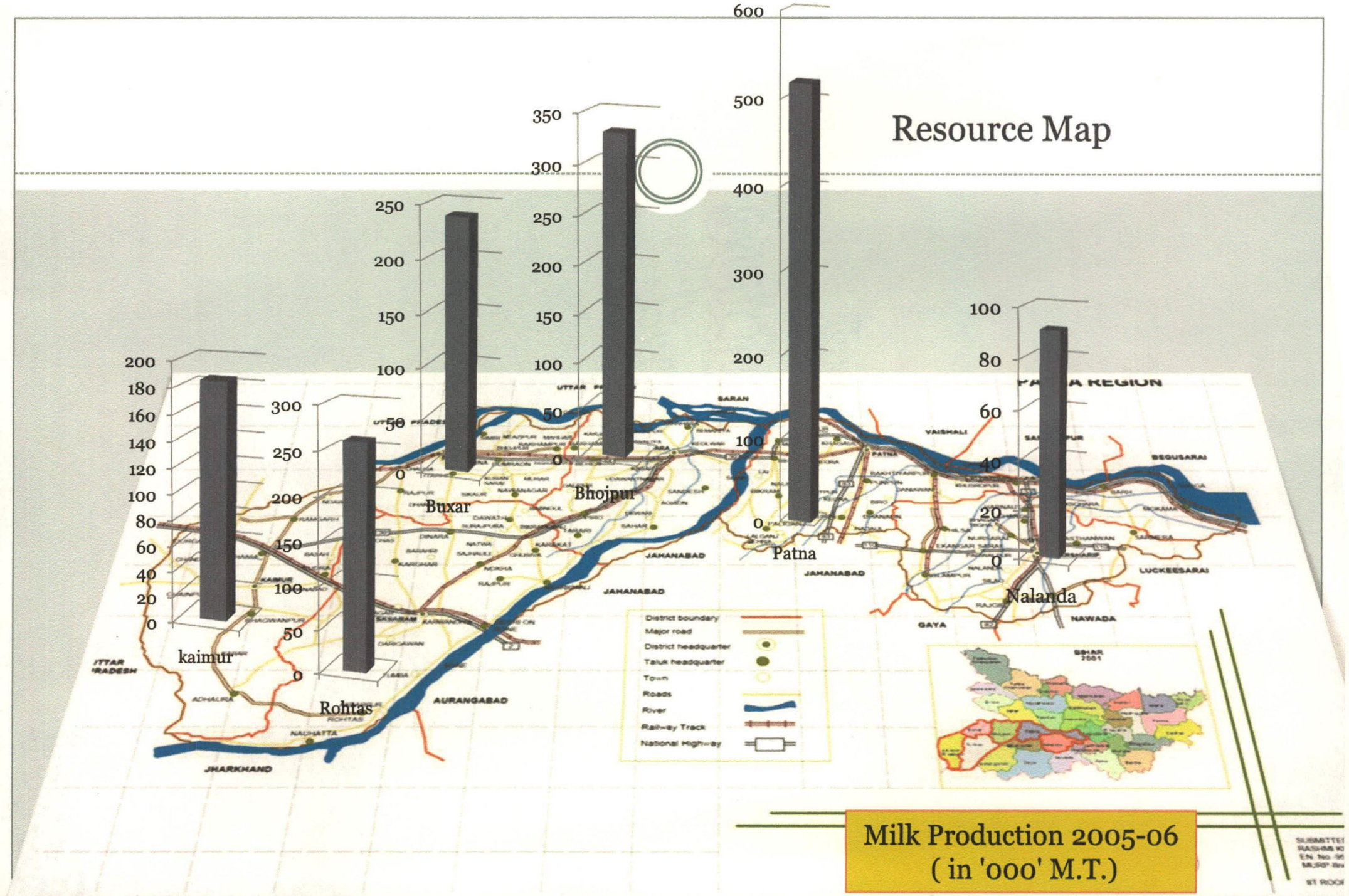
Resource Map



Production 2005-06
(in M.T).

SHEET No. 4

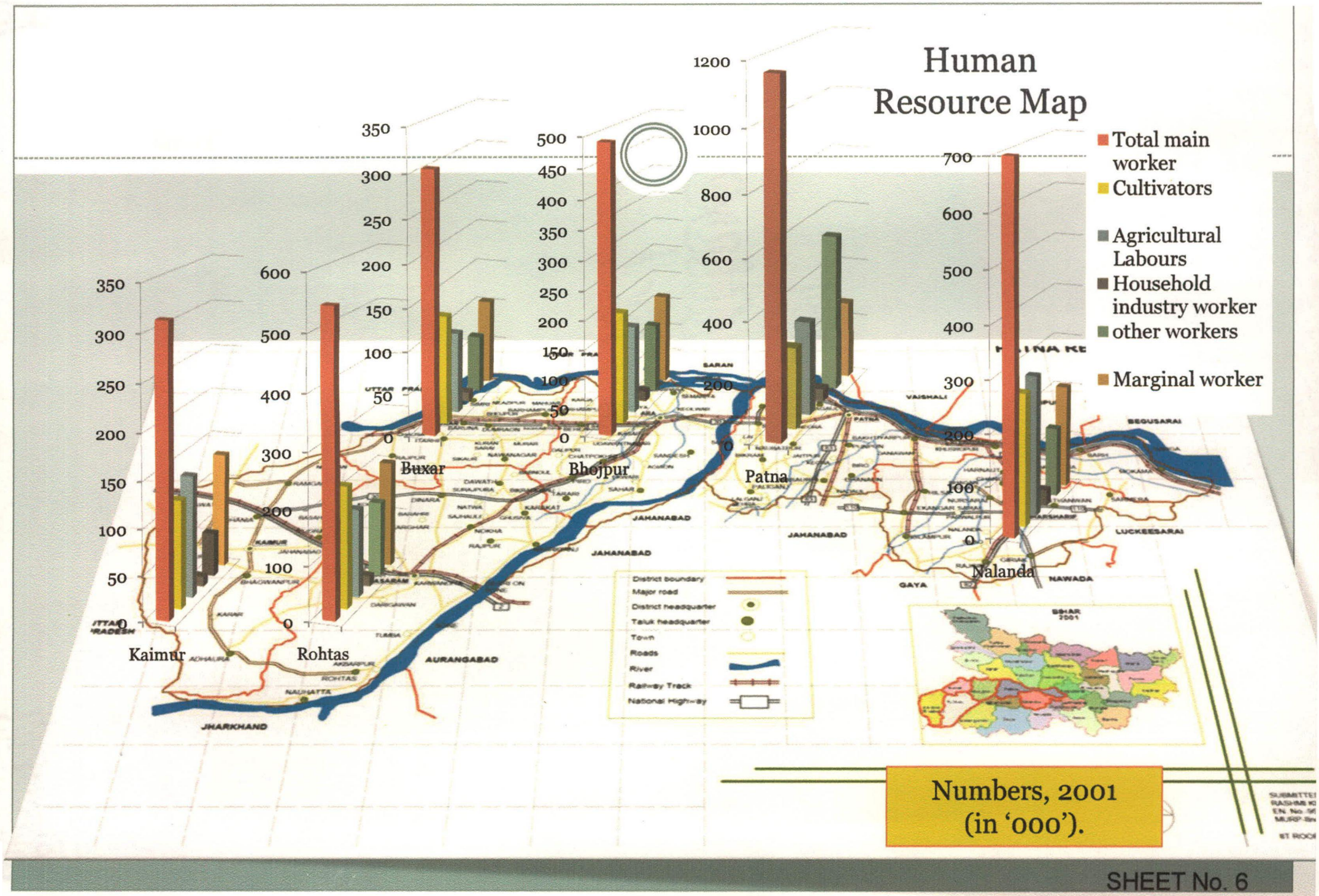
Resource Map



Milk Production 2005-06
(in '000' M.T.)

SHEET No. 5

Human Resource Map



Numbers, 2001 (in '000').

Table: Details of proposed Agro based industrial centers

district	No. of centers	Area covered under each center (Ha)	Area covered under each center for different crops: (In Ha)			
			Wheat	paddy	sugarcane	mango
Patna	7	45700	8570	12147	60	17
Nalanda	4	58200	20586	25708	46	32
Bhojpur	5	49500	10991	17040	25	252
Buxar	4	40600	15549	19586	93	252
Rohtas	8	48800	16283	24456	22	14
Kaimur	7	48900	9390	15443	41	0
Total	35	291700	81369	114380	287	567

Note: Area distribution among crops has done according to current cropping pattern.

District	Milk Production area under each center '000' M.T.
Patna	148
Nalanda	46
Bhojpur	132
Buxar	120
Rohtas	64
kaimur	52

Products	Output per '000' MT of milk (in kg)
Milk Powder	1202
cheese, Paneer	3999
Butter/cream	615
Ghee	82
Khoya & Peda (Indian sweets)	10
Curd	20951
Lassi	21
milkshake	8
Ice cream	4

Products	Per Ha. Output (In M.T.)
Mango fruit	22
Juice/Syrup	44
Jam/Jelly	90
Pickle/Aamras/Aamchur/candy	25
twigs used as Datun	2
leave/wood (for religious & medicinal purposes)	2
Sugarcane	102
Sugar	136
Juice/Syrup	246
Rock Candy	794
Molasses	133
Bagasse (paper, cardboard, utensils, gunny bags etc.	393
Filter Press cake or press mud	168
Wheat	4
Paddy/Rice	3
Straw/ Husk/ Bran	3
Flour (Ata, Meda)	8
Beaten Rice (Chuda)	8
Packed food	47
Snacks	8737
Fodder (wheat/ paddy)	22245

Proposed Agro-Industrial Centers
PATNA REGION

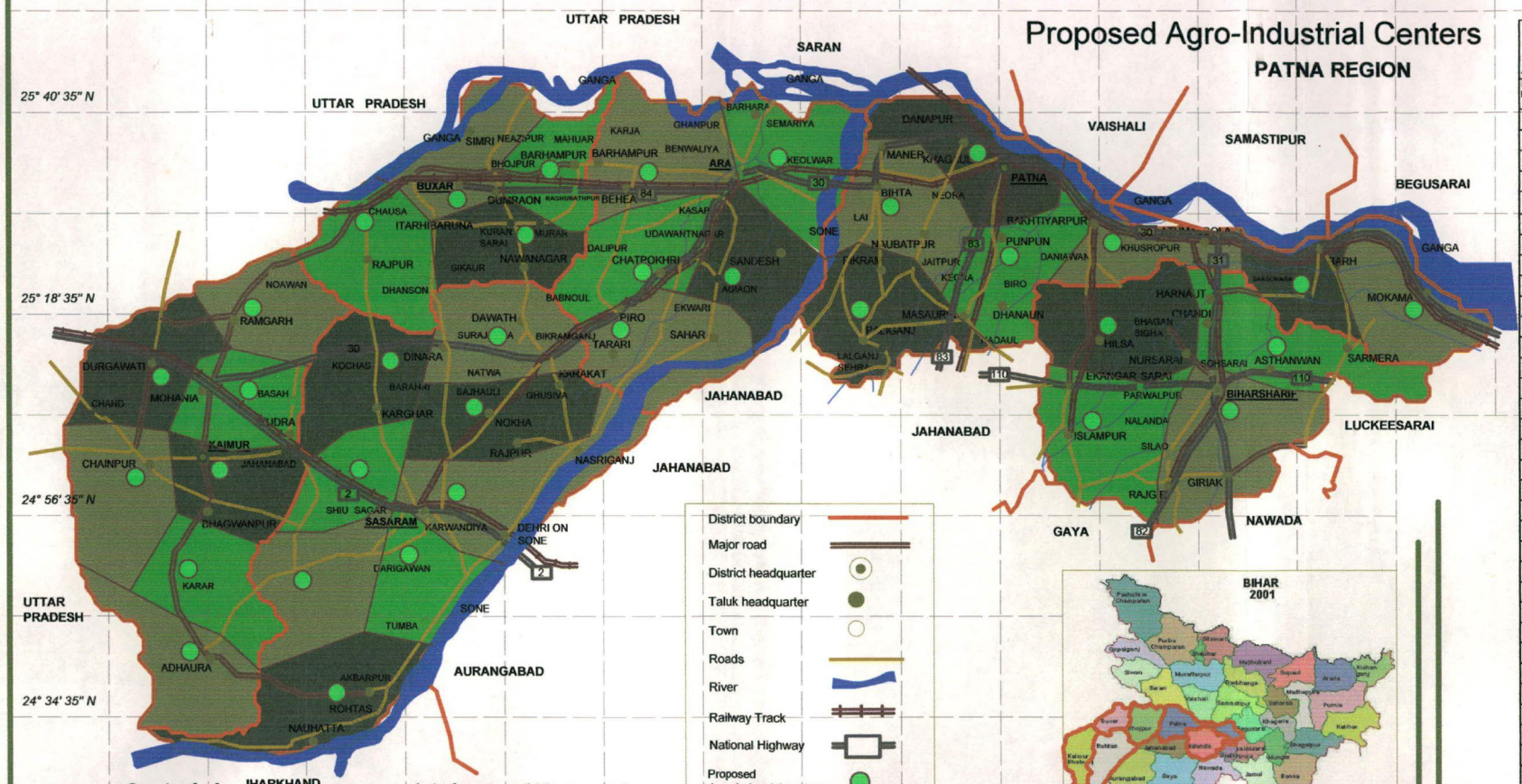


Table: List of places identified for establishment of Agro-based Industries

Sl. No	Name of Place	District
1	MOKAMA	PATNA
2	SAKSOHRA	PATNA
3	KHUSROPUR	PATNA
4	PUNPUN	PATNA
5	KHAGAUL	PATNA
6	BIHTA	PATNA
7	PALIGANJ	PATNA
8	ASTHANWAN	NALANDA
9	BIHAR SHARIF	NALANDA
10	ISLAMPUR	NALANDA
11	HILSA	NALANDA
12	KEOLWAR	BHOJPUR
13	BEHEA	BHOJPUR
14	CHATPOKHRI	BHOJPUR
15	PIRO	BHOJPUR
16	AGIAON	BHOJPUR
17	CHAUSA	BUXAR
18	KURAN SARAI	BUXAR
19	BUXAR	BUXAR
20	BRAHMPUR	BUXAR
21	AKBARPUR	ROHTAS
22	DARIGAWAN	ROHTAS
23	SHIW SAGAR	ROHTAS
24	CHAPRI	ROHTAS
25	KARWANDIYA	ROHTAS
26	NOKHA	ROHTAS
27	KOCHAS	ROHTAS
28	DAWATH	ROHTAS
29	ADHAURA	KAIMUR
30	KARAR	KAIMUR
31	CHAINPUR	KAIMUR
32	KAIMUR	KAIMUR
33	MOHANIA	KAIMUR
34	DURGAWATI	KAIMUR
35	RAMGARH	KAIMUR

Steps involved:

1. *Data collection: Primary and Secondary data*
2. *Analysis of data*
3. *Input-Output analysis*
4. *Demand Projection for the year 2031*
5. *Calculation of output required for projected demand*
6. *Output feasibility according to yield capacity*
7. *Finalizing the future output of commodities*
8. *Land area required for particular amount of resource availability which is required to produce particular amount of manufacturing good's output*
9. *Location for concentration of rural industries has been suggested in the proposal, on the basis of resource availability, transportation facility, labour availability & demand (market) availability.*
10. *Area boundaries has been defined which will provide resources for different industrial concentration in the present sheet (SHEET No. 8)*
11. *According to growth pole theory the concentrated industrial location will work as poles, and secondary growth poles will be generated in the region by influence of these poles automatically.*
12. *Thus, the industrialization will take place and will give a boost to the sustainable development of all the subsystems of the entire regional system.*

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MURP-IInd year
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SCALE: 1MM=1600M

SHEET No. 8

Chapter 13. CONCLUSION

- The Indian economy is poised to achieve a double-digit growth rate. Against this, the Bihar state is being talked about as a sleeping giant of Indian agriculture based economy (agro-industries) among the other states of India. Though the study area has enormous amount of potential for the development of industries, the study area is totally neglected, the available resources are not utilized properly. As a consequence, the study area became backward in terms of socio-economic condition. In this present investigation, at the outreach, an attempt has been made to have thorough understanding about the socio-economic condition of the system. Subsequently the available resources were quantified towards imparting industries in the system, and the recommendations have made.

- **Rural industries** have major role to shape the Indian economy. Scarcity of physical capital, unemployment and under employment, regional imbalances and disparities, inequalities in distribution of income and wealth, un-utilization and/or under utilization of rural resources, etc., together responsible for under developed economy in the region in particular, and the state in general.

- The resources of untapped regions like Patna region should be judiciously utilized by strengthening industries in the rural system.

- The study concluded with plausible recommendations for imparting industrialization in the study area. It is anticipated that, if the proposed planning model is implemented successfully in the study area, it will ensure sustainable development in the system, definitely.

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APPENDIX I

HOUSEHOLD SURVEY SCHEDULE

Surveyed by:.....

Name of the study area:
Name of the village/town/city:
Name of the district:

1. **Name of the family head:**
2. **Caste:**.....
3. **Address:**.....
4. **Religion:**.....

Sl no.	Name of persons	Relation with family head	Age (yrs)	Married (yes/no)	Maximum education attained	Monthly income	Primary occupation	Secondary occupation
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

5. **Monthly expenditure**:

a. Food		g. Housing rent	
b. Clothes		h. Energy	
c. Education		i. Transportation	
d. Recreation		j. Labour/Servant wages	
e. Health		k. Loan Repayment	
f. Household Appliances/Furnitu Electronic Goods		l. Any Other	

Total Monthly Expenditure:

6. **Energy expenditure (In Rs.):**

a. Fuel wood		f. LPG	
b. Charcoal		g. Electricity	
c. Kerosene		h. Bio-gas	
d. Diesel		i. Cow-dung cakes	
e. Petrol		j. crop residue	

7. Household appliances:

Refrigerator....., TV....., AC....., Stove....., Cooler....., Mixer/grinder....., Geyser....., Computer....., Washing Machine....., Pressure cooker....., Phone(Landline)....., Mobile ....., Other.....

8. Housing:

- Type of house: Pucca / Semi pucca / kutcha, Detached/ Semi-detached/ Row housing.
- Latrine.....
- Bath.....
- Toilet.....
- Age of the house (yrs): .....
- Physical condition: good / livable / dilapidated Ownership: rented / owned / other
- Nos of rooms:..... nos of floors..... Finance : bank / self / ancestral / other

9. Water supply:

Sources:.....Storage..... availability..... .....duration of water supply (in hours).....
quality of water.....charges.....

10. Drainage / sewerage:

- Availability of : septic tank / sewer line / no facility
- Drains: open / covered / no drains
- Problems: overflow/ clogging / bad odour / no problems
- Over flow in rainy seasons: yes / no
- Charges:

11. Waste disposal:

- Method of collection at house: storage container / dust bin / polythene bags / throwing out
- Frequency of collection: everyday / alternate day / 3 days / 5 days / weekly / none
- Agency of collection:
- Charged / non charged

12. Power/ energy supply:

Source.....duration of power cuts.....metered / non metered.....
monthly tariff.....transformer.....substation availability.....
Voltage fluctuation.....

13. Transport facilities:

- Condition of road: kachha / pucca maintenance of the road: good / bad / worse
- Modes of transport: cycle.....2-wheeler.....4-wheeler.....public transport.....
- Distance travelled for various trips to avail certain facilities:
  educational.....health.....occupational.....recreational.....administrative works.....market.....
- Expenditure (per day) on various trips to avail certain facilities:

educational.....health.....occupational.....recreational.....administrative works.....market.....

- Nearby large villages / urban settlements:
- Connectivity to surrounding villages and urban settlements:.....
- nearest railway station:.....Distance travelled to reach the railway station:.....
- nearest bus station:.....Distance travelled to reach the bus station:.....

14. <u>Educational facilities</u>:

- Total no. of educational institutes.....
- Level and number of institutes: primary:..... / secondary:..... / higher secondary:..... other:.....
- level of education: satisfactory / unsatisfactory
- Vocational/industrial training institutes if any.....

15. <u>Medical Facilities</u> :

No. of Primary health care centre.....distance.....level of service: satisfactory / unsatisfactory
No. of govt. Hospital.....distance.....level of service: satisfactory / unsatisfactory
No. of nursing home .....distance.....level of service: satisfactory / unsatisfactory
No. of medical shops.....distance.....

16. <u>Community/Recreation facilities</u>:

Religious Places..... Open Grounds for Fairs..... Cinema Hall/Theatre..... Gymnasium..... Botanical Garden..... Parks..... Playgrounds..... Stadium..... Club..... Historical Places..... Libraries.....

17. <u>Migration pattern</u>:

1) Type of migration:
   (a) In migration/ Out migration
   (b) rural to urban/urban to rural/rural to rural/urban to urban
   (c) Inter regional migration/Intra regional migration
2) Reasons of migration: occupation/education/better infrastructure/others
3) Period of migration:

18. Agriculture:

- **Total land ownership**

  Fellow land:..... **Cultivable land:.....**

- **Net income from cultivation (in Rs.)**
- **Cropping Pattern:**

Sl. No.	Name of the crop	Kharif Crop			Rabi Crop			Summer Crop		
		Area (Ha.)	Production (Kgs)	Consumption (Kgs)	Area (Ha.)	Production (Kgs)	Consumption (Kgs)	Area (Ha.)	Production (Kgs)	Consumption (Kgs)
1	Wheat									
2	Maize									
3	Paddy									
4	Barley									
5	Pulses (Gram, masoor, Khesari, Moong, Urad, Tur, Arhar, peas etc.)									
6	Potato									
7	Onion									
8	Sugarcane									
9	Makhana									
10	Oil seeds									
11	Cotton									
12	Jute									
13	Mesta									
14	Sesame									
15	Chilly									
16	Tobacco									
17	Spices									
18	Any Other (ragi, millet, bajra, jwar etc.)									

- **Horticulture:**

Sl. No.	Name of the crop	No. of Trees	Total (Area in ha.)	Output (Unit)	Consumption (Unit)	Surplus (Unit)
1.	Banana					
2.	Mango					
3.	Lichi					
4.	Guava					
5.	Grapes					
6.	Jackfruit					
7.	Plum					
8.	Makhana					
9.	Amla					
10	Lemon					

11	Pineapple					
12	Coconut					
13.	Neem					
14	Vegetables					
15.	Any Other					

Sources of irrigation:

Sl. No.	Source	Kharif Crop (Area in ha.)	Rabi Crop (Area in ha.)	Summer Crop (Area in ha.)	Total (Area in ha.)
1	Canal				
2	Pond				
3	River				
4	Tube well				
5	Rainfed				

Farm output from cultivations in kilograms

Sl. No.	Output	Kharif Crop(qt. in kg)		Rabi Crop(qt. in kg)		Summer Crop(qt. in		Total Crop(qt. in kg)	
		Major Prdct.	By Product	Major Prdct	By Product	Major Prdct	By Product	Major Prdct	By Product
1	Total output								
2	Consumed								
3	Surplus								

Input in Agriculture (In Rs.)

Fertilizers	ploughing	Seeds	Labour cost	Electricity	Energy	Irrigation

Livestock

Sl. No.	Name of Animal	Nos.	Milk(Ltrs)			Dung(unit)			Input (Livestock)
			Total output	Consumed	Surplus	Total output	Consumed	Surplus	
1	Cow								
2	Buffalo								
3	Bull/ Ox/Mule/ Horse								
4	Sheep/Goat								
5	Any Other								

Sl. No.	Name of Animal	No:	Meat (Kg)			Egg (Nos.)			Wool(Kg)			Input (Livestock
			Total outpu	Consume	Surplu:	Total outpu	Consume	Surplu:	Total output	Consume	Surplu	
1	Sheep/ Goat											
2	Poultry											
3	Birds											
4	Fish											
5	Any Oth											

19. Financial Institutions:

Sr. No	Name of Bank	Type (nationalized Co-operative/ Private/RRBs)	Deposit (Rs.)	Credit (Rs.)
1	SBI			
2	BOB			
3	Allahabad Bank			
4	Canara Bank			
5	Others (UBI, PNB, BOI, BOM, DENA BANK INDIAN BANK etc.)			

Any other private money lending agencies/ Individuals:

20. Rural Industries :

S. No.	Type of Industry	Raw material utilized	Net Input (raw material)	Net Ouput (Product)	Bye-produc or pollutan (name/ quantity)	Investment Per annum (in Rs.)	Income Per annun (in Rs.)	Saving per annun (in Rs.)
	Agro Based							
1	Food processing, packaging and storage							
2	Cotton							
3	Medicinal plants							
	Oil Extracting							
1	Ground nut							
2	Mustard							
3	Turpentine oil							
4	Neem oil							
5	Coconut oil							
	Food Processing							
1	Mango juice							
2	Lemon juice							
3	other fruit juice							
4	Papad							
6	Chips							
7	Pickle							
8	Bread /Biscuit							
9	Packed food							
10	Jam/jelly/sauce							
11	Rice/Flour mill							
12	Sugar mill							
13	Molasses							
14	Wine/syrup							
	Livestock based							
1	Dairy							
2	Woolens							

3	Carpets							
4	Blankets							
5	Leather							
6	Honey							
7	Silk							
	Other SSI							
1	Khadi							
2	Pottery							
3	Carpentry/ Blacksmith							
4	Match/ Agarbatt							
5	Card board							
6	Plywood							
7	Saw mill							
8	Wooden works							
9	Hand made pape							
10	Cane-bamboo/ baskets							
11	candles							
12	Tie n Dye							
13	Handloom							
14	Handcraft							
15	Bio gas							
	Demand based							
1	Gen. Engg.							
2	Agri. Implements							
3	Cycle rick parts							
4	Soap & Shampo							
5	Beauty Products							
6	Stone crusher							
7	Stone Polishing							
8	Brick kilns							
9	Building materia							
10	Electronics							
11	Canning & fruits							

- Any other agro-industries.....
- Any other industry based on the products or by-products of live-stock/agrarian products.....
- Scale of industries:.....
- Distance of Industries from Market.....expenditure in transportation.....
- Distance of Industries from Raw material..... expenditure in transportation.....

21. Social welfare schemes undertaken by the GOI or any other authority:

Names of the schemes:.....,.....,.....,.....

Sources of funding:.....

The benefitted population:.....

22. Remarks: