



Socio-economic Conceptual Frame Work-WP2

**"Sustainable Settlements in Periurban Areas,"
(Acronym: periurban)**

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ABBREVIATION

Agri.	- Agricultural
CECRI	- Central Electro Chemical Research Institute
CES	- Consulting Engineering Services
CFTRI	- Central Food Technology and Research Institute
CMA	- Chennai Metropolitan Area
CMC	- Chennai Municipal Corporation
CMDA	- Chennai Metropolitan Development Authority
CMWSSB	- Chennai Metropolitan Water Supply and Sewerage Board
CT	- Census Towns
DCR	- Development Control Regulations
DTCP	- Directorate of Town and Country Planning
EMU	- Electro Motive Unit
etc	- etcetera
Ha/H	- Hectare
HHI	- House Hold Industry
HS	- High School
HUDCO	- Housing and Urban Development Corporation
IGNOU	- Indira Gandhi National Open University
IRMA	- Institute of Rural Management Anand
IT	- Information Technology
Lpcd	- Litres per capita per day
LPG	- Liquefied Petroleum Gas
m	- Metre
M	- Municipality
M.Corp	- Municipal Corporation
Max	- Maximum
Min	- Minimum
MMA	- Madras Metropolitan Area
MMDA	- Madras Metropolitan Development Authority
MNC	- Multi National Company
MS	- Middle School
NEERI	- National Environmental Engineering Research Institute
NGO	- Non Governmental Organisation
NH	- National Highway
NIC	- National Informatics Centre
NLM	- National Literary Mission
Non-agri	- Non-agricultural
PCA	- Primary Census Abstract
PG	- Postgraduate
PS	- Primary School
PU	- Peri Urban

PUI	- Peri Urban Interface
R	- Rural
Rs	- Rupees
SD	- Sustainable Development
SH	- State Highway
SHG	- Self Help Group
SL.NO	- Serial Number
Sq.Ft	- Square Feet
Sq.Km	- Square Kilometer
TCPO	- Town and Country Planning Organisation
TERI	- The Energy Resources Institute
TN	- Tamilnadu
TP	- Town Panchayat
TWAD	- Tamilnadu Watersupply And Drainage board
U	- Urban
UA	- Urban Agglomeration
UG	- Undergraduate
USA	- United States of America
VP	- Village Panchayat
WP2	- Work Package 2

1 INTRODUCTION

1.1 Introduction

Peri-urban areas refer to the settlements beyond, about or around cities. These areas accommodate the spillover developments of the core cities. *Peri-urban* areas are in some form of transition from strictly rural to urban. These areas often form immediate urban rural interface and may eventually evolve into being fully urban. The majority of them are on the fringe of established areas. But they may also be clusters of residential developments within rural landscape. They have significant ecological, bio-diversity, land and cultural heritage values. These areas may be within the planning areas but outside the administrative boundaries of the cities. The *Peri-urban* settlements and the core cities have very strong interactions, inter-dependence and inter-relationships. However, they do not have level play fields. The *Peri-urban* settlements are always at the receiving ends. They are the source of sweet drinking water. In turn, the cities let out highly polluted effluents and sewage into them. The *Peri-urban* areas supply all the essential daily requirements such as milk, vegetables, flowers etc. to the cities. However, cities use them as dumping grounds for solid wastes. The *Peri-urban* areas record staggering growth rate of population during inter-decennial periods. The land value is relatively cheaper. Therefore, middle and lower middle class families' conscious about cost, settle in these areas. This also helps them to get away from the cramped, congested and polluted city environment. Added to these factors are less rigorous development control regulations and almost invisible enforcement machinery. These situations lead to urban sprawl, unauthorized and squatter settlements, deviated and violated structures. These types of developments threaten the environment, quality of life, destroys open spaces, increase volume of traffic, air pollution and noise pollution. On the whole, it wreaks havoc with the natural environment and resources. However, growth is inevitable. The process of urbanization is not restricted to cities and involves more than the social and physical dimension of housing, infrastructure and urban services. There has always been a growing dependency of cities on the surrounding hinterland for a wide range of resources, including water energy, building materials and services of goods. Often the large extent of surrounding rural areas and open spaces are utilized by the city dwellers for leisure and recreation. Academic institutions find the surroundings hinterlands cheaper for establishing residential type of schools and colleges. Cities in turn, provide the goods, services and the market place for rural and agriculture produce.

The process of urbanization constantly threatens the delicate balance that prevails in the process of dependency. The suburban developments through urban sprawl in developed countries continue to consume large extent of rural land often threatening or destroying natural ecosystems and watersheds. In the face of increasing threat to fertile agricultural land and

food production many countries in the developed world started to go in for *Peri-urban* agriculture as the import of food items proved expensive.

In the developing world, the rural urban interface is also affected by urban sprawl. This is primarily caused by rapid population growth and proliferation of low-income settlements. The direct and indirect consequences of *Peri-urban* development are exhibited in several ways. The direct consequences include loss of often fertile and productive land, the depletion of water resources owing to urban and industries demand and pollution caused by unsafe disposal of solid waste and sewage as well as by uncontrolled industrial emissions. The indirect consequences include the social costs and risks associated with settlements in flood plains and low lying areas. The cost of providing infrastructure and services to the extended areas in the form of schools, hospital, utilities, roads and transport is often astronomical.

Universally, the problem of competing jurisdiction that exists in the *Peri-urban* areas often results in inequality in the provision of, land use allocation, energy supply transport and water management. 'The phenomenon of urban sprawl and formation of *Peri-urban* area is attributable to the competing efforts to attract developments on cheaper land and taxes at the cost of city development. Besides the environmental consequences in terms of land use and energy consumption, it creates an impact on the social cohesiveness and cultural vitality of cities. Urbanization therefore in the more sustainable form requires a more coherent approach to urban-rural interface or the *Peri-urban* Interface (PUI).

1.2 Peri-urban sustainability

In recent years, Sustainable Development (S.D) has come into wide use to signify environmentally stable economy. S.D is an encompassing principle of earlier concept of development that emphasize the need to meet the present requirements without in any way compromising the future generation's capacity to meets its needs. S.D strikes a balance between economic viability and environmental stability. An example of a S.D. need is promotion and protection of environment without disturbing the economic development. Development in every sphere of human activity is an unending and continuous process. Therefore, development must not meet a dead end. S.D. enables enhancement and efficient, equitable use of existing resources. Intuitively, sustainability seems to stress the need to view environmental protection and continuing economic growth as mutually compatible and not necessarily conflicting objectives. Therefore, sustainability implies compatibility with natural resource base limitations.

In the increasingly urbanized world promotion of sustainable urbanization in the *Peri-urban* area have several challenges. Sustainable development hitherto has been addressed as the balance between social environmental and economic goals. There is however little understanding of the trade off found in simultaneous pursuit of these goals. The pertinent issue has been the abstract appreciation of the sustainable development in relation

to the political dimensions. In reality, the cities are not sustainable in themselves as the urban dwellers and economic activities inevitably depend on environmental resources and services from outside the built up area which is often the *Peri-urban* areas around the cities.

To adequately define the means and process of sustainable development of *Peri-urban* area a more encompassing vision of the concept is called for (Fig.1.10). While the environmental economic and social goals still apply the physical sustainability, the political and institutional process promoting competition or cooperation between different agents need greater emphasis in promoting *Peri-urban* sustainability. Thus the concept could encompass, social economic, ecological, physical and political dimensions.

Economic sustainability relates to the capacity of a practice to put local / regional resources to productive use for the long-term benefit of the community, without damaging or depleting the natural resource base on which it depends and without increasing the city's ecological footprint. This implies taking into consideration the full impact of the production cycle.

Social sustainability refers to the fairness, inclusiveness and cultural adequacy of an intervention to promote equal rights over the natural, physical and economic capital that support the livelihoods of local communities, with particular emphasis on the poor and traditionally marginalized groups.

Cultural adequacy means the extent to which a practice respects cultural heritage and cultural diversity.

Ecological sustainability pertains to the impact of urban production and consumption on the integrity and health of the city-region and global carrying capacity. This demands the long-term consideration between the state dynamics of environmental resources and services, and the demands exerted over them.

Physical sustainability concerns the capacity of an intervention to enhance the livability of buildings and urban infrastructures for all city dwellers, without damaging or disrupting the urban region environment. It also includes a concern for the efficiency of the built environment in supporting the local economy.

Political sustainability is concerned with the quality of governance systems guiding the relationship and actions of different actors among the previous four dimensions. It implies the democratization and participation of local civil society in all areas of decision-making.

The major objective of the WP2 background paper is to bring in to focus, the socio-economic characteristics and the environmental impacts prevailing in a Peri-urban settlement or area in Indian context.

However the pertinent questions here are, what is this peri-urban area? How is it defined? What are the direct and indirect changes that are taking place over space and time in these areas? Though there are several definitions, the simplest is the one put forward by Mr. Wehrwein (Ref 4) that " The area of transition between well recognized urban land uses and the area devoted to agriculture". It is again very difficult to clearly demarcate urban land uses, as

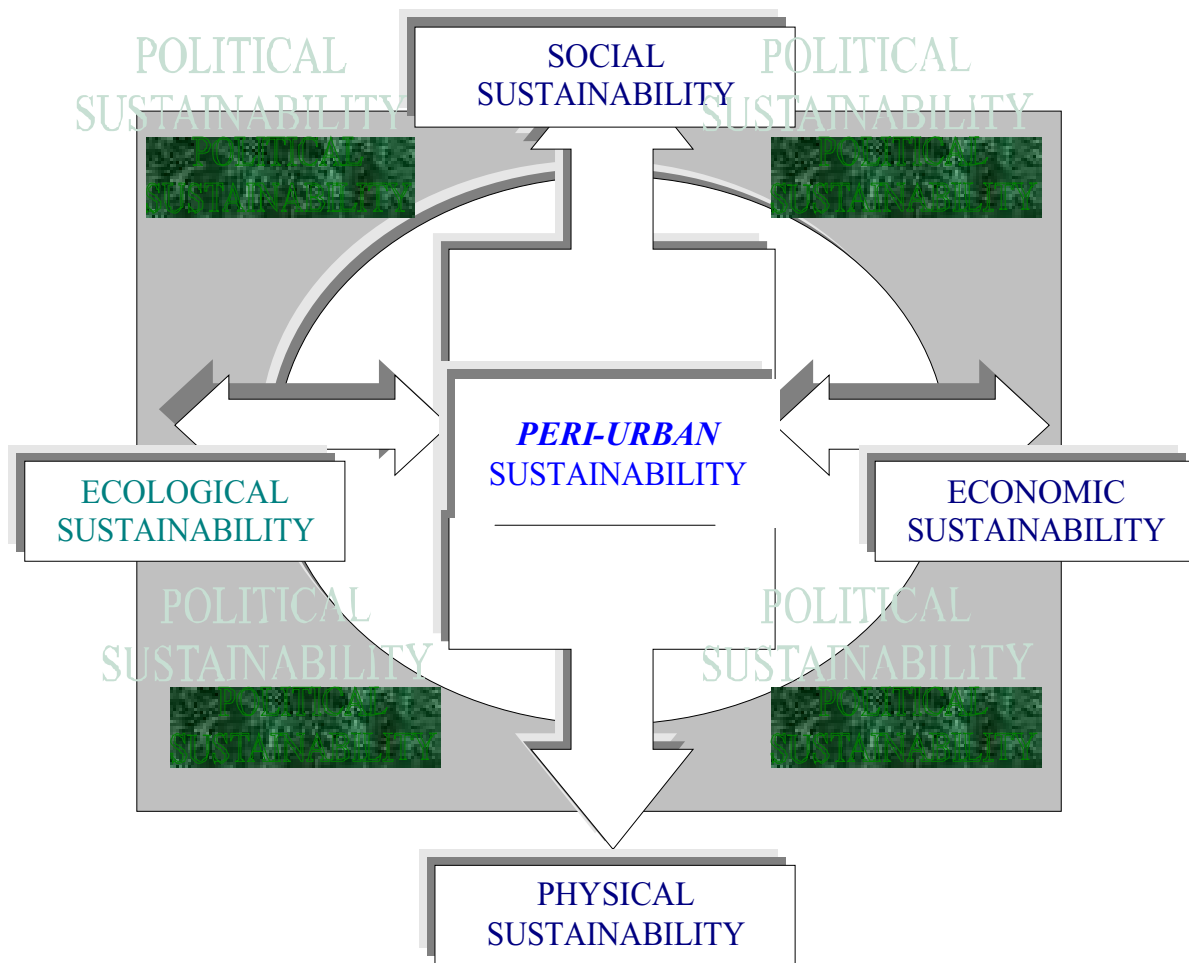


Figure.1.10 Peri-Urban Sustainability - The Concept

they are diverse. If peri-urban is an intermittent stage in the conversion of rural area into an urban area, then which stage in the process is really Peri-urban? These are some of the crucial factors, which need clarification and understanding in Indian conditions if the ultimate objective is to find out a system for achieving sustainable development in peri-urban areas.

The WP2 background paper presents seven chapters. The chapters 1 introduces the concept of peri-urban, the problems and prospects prevailing in the peri-urban areas, the socio-economic trends and the environmental impact that are witnessed in these areas and the need for understanding and defining the process of peri-urban formation in Indian conditions.

The chapter 2 is the crucial chapter, which explains the study orientation in tune with the objectives of the study and the issues involved. The study methodology is formulated to identify the process of formation of peri-urban areas. It includes, the driving forces, the potentials offered by the peri-urban area, the environmental impacts taking place and the interaction between the peri-urban and urban areas. Peri-urban indicators are framed based on the urban growth trends in major cities, the urban rural transformation that is generally taking place in and around Metropolitan

regions, through networking and available information. The indicators are based on socio-economic characteristics, agricultural activities and infrastructure levels prevailing in different settlements. The indicators are tested for Chennai Metropolitan area through case studies.

The Chapter 3 deals with the literature review to identify the studies that have been conducted, the study results and the extent of coverage etc. to help understand the process of peri-urban formation and the resulting changes in the socio-economic characteristics and the environment in Indian conditions.

The Chapter 4 deals with Chennai Metropolitan Area, the process of peri-urban formation, the development pattern and trends, the problems and prospects prevailing in different areas in the metropolitan region.

The chapter 5 essentially deals with several case studies relating to socio-economic characteristics prevailing in different areas in the Metropolitan region namely urban, urbanizing and rural areas.

The case studies provide for extensive data analysis to identify the peri-urban settlements in the metropolitan region in tune with the peri-urban indicators suggested in chapter - 2. The case studies also reveal the extent of environmental degradation that has taken place due to the formation of peri-urban areas, the levels of exploitation of natural resources and the pollution levels.

The chapter 6 deals with the project networking and the details of deliberations held in the workshop conducted to discuss about the findings of the study on socio-economic characteristics in peri-urban areas.

The chapter 7 deals with the study findings and conclusions.

2 STUDY OBJECTIVES AND THE CONCEPTUAL BOUNDARY

2.1 Objectives of the Study

The basic aim of the WP2 background paper is to appreciate the socio economic characteristics with particular reference to environmental impact in peri-urban areas. In order to fulfill the aim of the study the following objectives are set,

- i) To understand and appreciate the process of urbanization and peri-urban formation in Indian conditions.
- ii) To formulate indicators which could identify peri-urban areas through available literature.
- iii) To appreciate the Socio-economic Characteristics and the environmental impact in the peri-urban areas of CMA.
- iv) To test the suggested indicators, a comparative analysis is undertaken through case studies in CMA to establish peri-urban settlements.

2.2 Study Methodology

The study has been designed to probe into the existing literature on “Socio economic characteristics in *Peri-urban* area with particular reference to its impact on the Environment”.

Though there have been several isolated studies emanating from Urban and Regional planners, Social scientists, geographers and NGO on the problems and prospects of urban, *Peri-urban* and rural areas, there is very little information on the relationship between socioeconomic characteristics and the environmental change that are taking place during the formation of *Peri-urban* areas. The concept of sustainable development itself has taken roots very recently in Indian conditions and it requires great deal of studies and research to understand the process of *Peri-urban* formation, the socio-economic changes that are taking place overtime and space and in the process, the extent of exploitation of natural resources that take place in the *Peri-urban* area. There are several pertinent issues, which need greater understanding and clarification to designate a particular settlement as most urbanized, urbanizing or peri-urban and rural over time and space particularly in the region around metropolitan areas. While there cannot be strict regimentation on the spatial limit to identity the periurban areas, there is an absolute necessity to identify the relevant indicators, which are characteristics of a peri-urban area.

The pertinent issues therefore are, if a settlement is said to be peri-urban, an intermediate stage in the process of urbanization which converts rural areas in to urban area over a period of time, then which is the stage at which the settlement is said to be in the state of peri-urban? What are the indicators? What are the factors, which influence the indicators, need clear understanding. In short, understanding clearly, the dynamics of the peri-urban formation is crucial to define a settlement as peri-urban or otherwise.

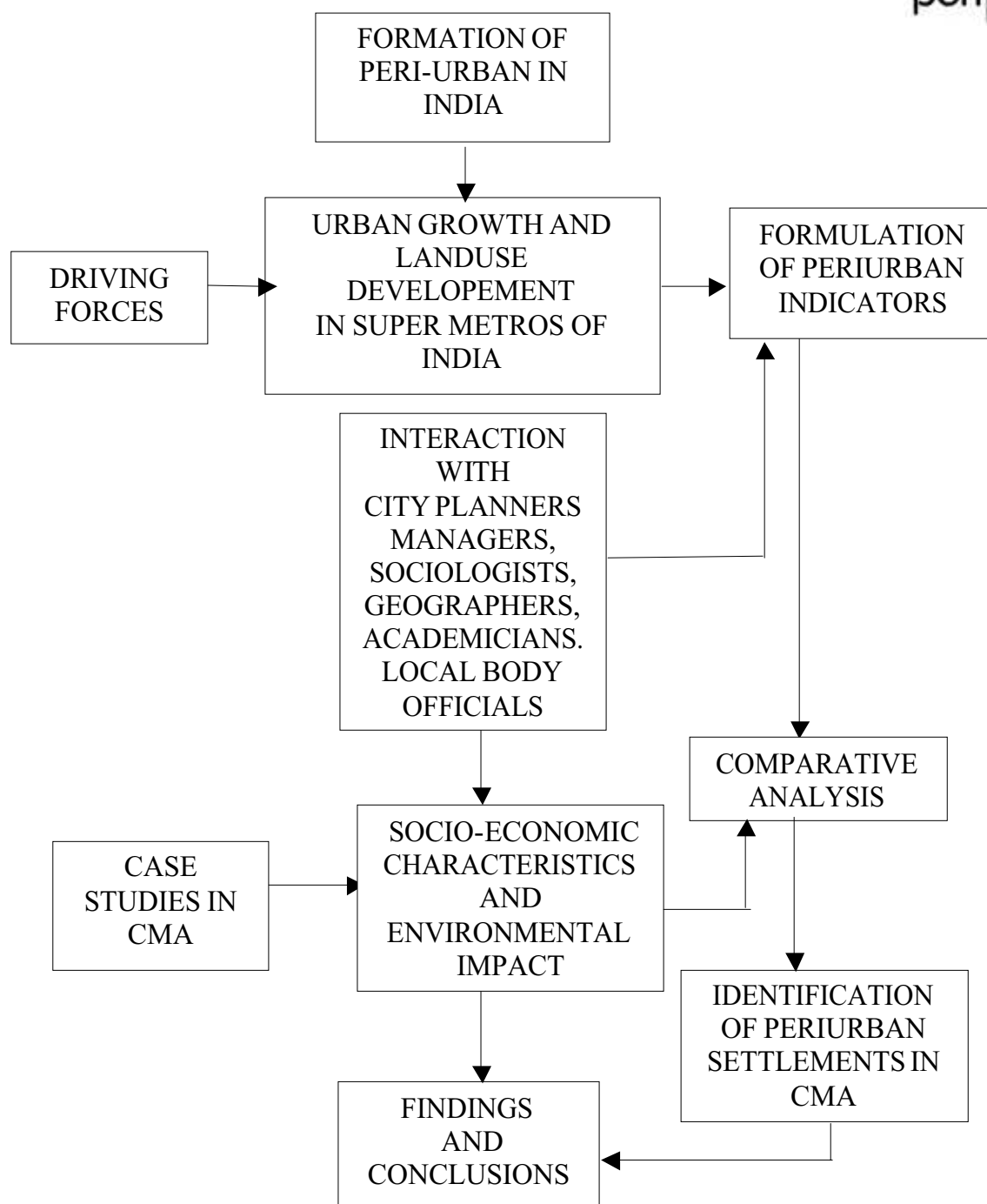


Figure.2.10 Study Methodology

Beyond the question of whether a peri-urban formation is desirable or not, it is desirable to understand the process, the forces which influence the peri-urban formation, the environmental impact that is created and the socio-economic transformation that is taking place. A study of this dimension calls for probing in to the very process of urbanization in India, the growth of metropolitan regions and the developmental trends. Irrespective of the regions in India, there have been several common and strong influencing factors responsible for the growth of metropolitan cities in India. A cursory analysis of the growth trends around major metropolitan cities could very well address, the process of formation of peri-urban areas. The study methodology is as shown in the Fig 2.10.above.

2.3 Metropolitan Management in India - The common denominators

Rapid urbanization experienced in a short period in India and other developing countries has thrown a formidable challenge to urban planners and managers. The urban population was merely three *percent* till the beginning of the 20th century. But today, the position has greatly changed and the task of managing urban areas has become more tedious. The rapid growth witnessed through in-migration (assessed to be around 30 *percent* of the population) and the inability of the city governments to provide affordable services have been the major reasons for indiscriminate expansion of the urban areas around the core. The National Commission on urbanization (Ref 30) expressing its concern about the process of urbanization in major cities said “. heroic engines of growth on the one hand but on the other where some of the worst human and environmental degradation in the world can be witnessed”. While the major cities namely the “Super Metro Cities” have been facing several challenges, the dimensions and severity of the problems are similar in all the cities. The pattern of urban growth, expansion, land utilization environmental degradation because of excessive exploitation of natural resources etc are similar in all the cities. Thus the driving forces which induce large scale conversion of rural in to urban area passing through a state of “peri-urban” must almost be same excepting some of the social issues which are unique to the individual cities because of inherited cultural ties.

2.4 Metropolitan Region structures

The have been witnessing tremendous growth. The Table 2.10 indicates the population and the growth in the Super Metros from 1961.

Super Metros (Years)	Population in Millions				
	1961	1971	1981	1991	2001
Kolkatta	5.74	7.031	9.166	11.19	13.216
Mumbai	4.152	5.971	8.228	9.925	16.368
Delhi	2.359	3.647	5.714	9.217	12.791
Chennai	1.945	3.170	4.277	3.841	6.424
Bangalore	1.2	1.654	2.914	3.302	5.686
Hyderabad	1.249	1.796	2.528	3.058	5.533
Ahmedabad	1.206	1.742	2.515	2.954	4.519

Table 2.10 Population of Super Metros in India (1961-2001)

Source: Census of India

2.5 Super Metros

The Fig.2.11 (annexure I) shows the location of Super Metros in India and Fig.2.12 (annexure I) looks at the seven Super Metros at the same comparable scale. It indicates their basic growth structure communicating

from a nucleus, which is called the core of the city around which all new developments have taken place. The core is the most congested part of the city. It is medieval in the case of Delhi, Ahmedabad, Hyderabad and Bangalore too, to certain extent. It is colonial in the case of Chennai, Kolkata and Mumbai. Mumbai, Chennai, Kolkata are the port metros while Mumbai has been experiencing a linear development, Kolkata also faced similar growth but with the Hubli river as a major determinant. In the case of Chennai the growth has been semi radial with the rivers as minor determinant. In Delhi, being the inland Metro, the growth has been radial. Here too the Yamuna river has become a major determinant. Hyderabad and Ahmedabad have been experiencing growth with the rivers as moderate determinant. Bangalore blessed with a blend of wetlands and high grounds experiences a radial growth with the river at a far off distance.

The study of Super Metros and the developmental trend fig. 2.12 and 2.13,2.14 (annexure I) indicate that the location choice for establishing the transportation infrastructure and the work nodes is along established transportation corridors. Location of residential developments are also primarily along transportation corridors. However, the development trends and the land value trends around the core of the city indicate that it is not always the availability of a transportation corridor that has influenced developments for a *Peri-urban* condition, there may be several other reasons for the location choice by the residents. It also shows that in all the Super Metros, developments have not been taking place in certain direction / pockets inspite of a major transportation corridor. In most of the Super Metros it is found that the developmental trend has been faster and the population density higher along a particular direction when served by both rail and road corridors. With the available information it may be concluded that the location choice of residents depends not only on the transportation accessibility but also on the environmental consideration coupled with affordability (Ref 23) besides physical constraints like poor soil conditions, marshy lands and mountainous terrain, rivers, lakes and quarries.

2.6 Occupational structure in Super Metros

The occupational structure prevailing in the Super Metros Table: 2.11(indicate that while the primary sector occupation has been dwindling in all the Super Metros, the growth of organized sector employment is not commensurate with the demand. There has been a marginal decrease in the manufacturing sector in most of the Super Metros, but the growth of service sector seem to be significant in some of the Super Metros (Ref 29). The situation for Chennai is not very different from other metros.

2.7 Urban Land Use and Density Patterns

The study of Urban land use and density patterns in India published by the Town and Country Planning Organization (TCPO) in 1979 after studying 407 Master Plans, has indicated that 36.5 per cent of land in metros (1.00 million plus) is shown for agriculture or undevelopable use; for cities

	OCCUPATION STRUCTURE IN PERCENTAGE											
	Primary Sector %		Manufac Turing %		Construc tion %		Trade & Commerce		Transportati on %		Other services %	
	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981
Super Metros												
Calcutta UA	1.5	2	39	42	2.2	2.8	23	22	11.3	10.2	23	21
Bombay MC	1.5	1	42	41.5	3	3.5	23	22	10.5	10	20	22
Delhi UA	1.5	1.5	24	29	5.5	6.5	21.5	22.5	9.5	9	38	31.5
Madras UA	2	3	29.5	32	6.5	5	22	23	17	11	23	26
Bangalore UA	5	4	37.5	36.5	5.5	6.5	15.5	16.5	5.5	6.5	31	30
Hyderabad UA	3	2	24	25	4	5	18	19	11	12.5	40	36.5
Ahmedabad	1	1	46.5	38.5	5.5	7	17	19.5	6	8	24	26
Average (Unweighted)		2		35		5.2		20.8		9.5		27.5

Table: 2.11 Occupational Structure of Super Metros in India 1971 & 1981

Source: Madras 2011 - Policy Imperatives an agenda for action, MMDA, 1991

(0.1 million to 1.0 million) it is 48.0 per cent; and for all classes of urban areas it is 53.0 per cent.

Also from the Town and Country Planning Organization (TCPO) study, broad land use allocations at the development plan level (excluding agriculture or undevelopable land outside the urbanisable fence), is as per Table 2.12 (This in most cases is for plan periods ending in 1991).

The crucial employment generating broad land uses are commercial (wholesale and retail trade, warehousing and service uses) and industrial (heavy, medium and small scale). At the super-metro level, wholesale trade and warehousing are today more easily relocated at metro-region peripheries near transport nodes and in areas where land for expansion is more easily available on favourable terms. This leads to developments, which may be identifiable as peri-urban areas.

2.8 Urban land use and the Transportation Network

Major work centres relating to industries business and trade are often located on lands, which are fairly cheap and highly accessible (Ref 25). The major attraction is the availability of transportation corridors road / rail. If both are available the development is faster as movement of men and materials is fundamental to growth. The Fig. 2.13 & 2.14(annexure I) shows the location of work nodes in the super metro system. Growth of work centers has induced growth of residential colonies and other activities around the centers. Thus transportation corridors and the activity centres are observed to be responsible for generating conditions suitable for formation of peri-urban areas.

The land value is primarily governed by the transportation corridor and the potential it offers, for a better living environment. The Fig. 2.15 & 2.16 (annexure I) shows the range of land value in the Super Metros. It is clear that the land value is higher along the transportation corridor, depending upon the nearness to the city centre. Higher land values even along major

BROAD LAND USE IN PERCENTAGE					
Sl. No.	Land use Category	In Metros (Population 1 million plus)	In Cities (Population 0.10 to 1.00 million)	All Class of Urban Areas	Remarks
1	Residential	33.8	38.6	33.7	Some plans have a projection upto 2001
2	Commercial	2.7	2.7	2.7	
3	Industrial	9.7	9.2	8.4	
4	Public and Semi-public use	7.9	8.7	7.3	
5	Parks and Play Grounds	8.6	8.2	7.6	
6	Roads	9.5	10.2	9.2	
7	Others	27.8	22.4	31.1	Inclusive of land for transportation other than Defence lands and other specified areas etc.
	Total	100.0	100.0	100.0	

Table: 2.12 Project Development Plan Broad Land Uses - 1991 (Within the identified urban fence)

Source: Master Plan for Madras Metropolitan Area, 1994.

transportation corridor is highly prevalent in the urbanized areas closer to the city and reduce as the distance increases.

The transportation structure of the Super Metros has been greatly responsible for the type of intense developments along the corridors because of easy access and location of urban uses. The Fig. 2.17 & 2.18 (annexure I) shows the transportation structures prevailing in the Super Metros. Introduction of new roads in the form of 'missing links', 'ring roads' by passes etc have greatly influenced development of new urban area gradually converting the rural areas thus leading to peri-urban formation.

The increase in land value immediately after the implementation of a new road project induces faster commercial activities closer to corridors and

intense development later away from the corridor leading to formation of new urban areas.

2.9 Natural Resources and Employment opportunities.

Peri-urban and rural lands, river and water bodies are under enormous pressure for supply of building materials. Though only 7 *percent* of the work force practice, in construction related activities, majorities of these are engaged in the activities relating to supply of building materials. One of the major items is brick, which is extensively manufactured in areas away from the city as the industry is a traditional one, which does not call for highly skilled labour.

Brick manufacturing industry on one side depletes the topsoil and renders the land unfit for agriculture. At the same time facilitates water re-charging for the area through the pits created.

Similar phenomenon takes place in the case of stone quarries too. But squandering of sand from the riverbed makes the river dry and bald resulting in quick flow of water causing flash floods and waste.

Inadequate planning and management of water supply system exerts pressure on the areas outside the cities for ground water exploitation forcing the agricultural activities to stop rendering land less labourers jobless

2.10 Peri-urban - Concept of formation

Urban centers face huge shortfall in urban infrastructure. The fast deteriorating environment often pushes the developments to the periphery of the cities, creating a rural-urban interface. Master plans prepared for all the cities in India encompass a larger extent of area beyond the city limit. The underlying principal for such inclusion is the strong influence exercised by the city over this area and the dependence and interaction induce urban - rural interface up to a certain distance from city center beyond which it is fully rural in character. Thus the Master Plans cover, urban, rural and peri-urban which are neither rural nor urban (Fig.2.19) areas in its fold. The extension of urban character or the urbanization trend beyond city limit is accelerated not only by urban pressure or driving forces but also the availability of transportation corridors facilitating easy access. During the process of urbanization in the area beyond city, the peri-urban area is assumed to exist, before it reaches rural areas.

The process continues and the rural areas get converted into urban area passing through the peri-urban stage. However this pattern does not seem to take place uniformly all around cities (Ref 28). High growth rate, faster developments are experienced along major transportation corridors, particularly where the corridor comprises of both road and rail. Comparative study of seven major cities (Delhi, Bombay, Calcutta, Chennai, Ahmedabad, Bangalore, Hyderabad) shows that urban extensions have taken place along major transportation corridors served by both road and rail. The areas abutting these corridors depending upon the proximity to the city center have all the urban characters or lost all the rural characters. The dependency on

the city is more for job education etc. The Fig 2.19 illustrates the Concept of formation of *Peri-urban* areas.

Today's *Peri-urban* area is likely to become urban area of tomorrow, again when transportation network is augmented and the inflow and outflow of resources is facilitated. There is tremendous interaction that takes place between city and *Peri-urban* area, and *Peri-urban* and rural areas, but the magnitude and character differ. Here, the peri-urban area is assumed to be falling between urban and rural area or it is the rural fringe as shown in the diagram

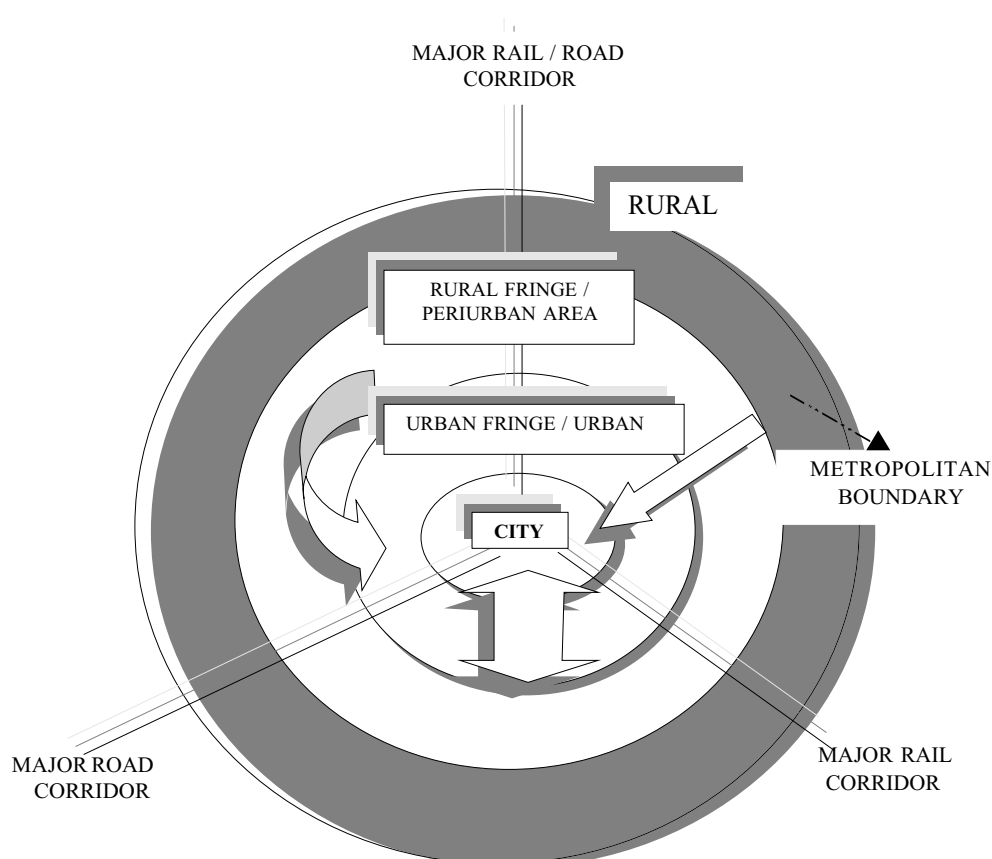


Figure. 2.19 Formation of Peri-urban areas

2.11 Factors influencing peri-urban formation

2.11.1 The Driving Forces

Formation of *Peri-urban* settlements is influenced by several socio-economic factors, which ultimately impinge on the natural resources prevailing around major cities. The 'driving forces' are,

- Population growth in cities
- Migration
- Increased land value in the city
- Increasing congestion and deterioration of living environment in the city
- Higher transportation accessibility
- Availability of health and education facilities outside the city

- Desire to own a house at affordable prices
- Availability of communication facilities outside the city
- Community and friends influence

2.11.2 Potentials of Peri-urban area for development

The pressure on the rural fringe or *Peri-urban* areas is more for several urban activities in view of the potentials that the *Peri-urban* areas offer.

- Industries often find *Peri-urban* areas highly suitable in terms of cheaper land, water and unskilled labour.
- Educational institutions of varying types prefer the *Peri-urban* areas obviously because of cheaper land and water
- The recent trend is formation of 'Farm houses' – a typical pass time for the urban rich at the cost of conventional agricultural activities
- Corporate houses acquire extensive land in the *Peri-urban* areas for the purpose of creation of recreation centers, which attract huge crowd particularly during weekends.
- Horticulture activity is extensively practiced producing, vegetables and flowers for the urban market in most of the *Peri-urban* and the adjoining rural settlements.

2.11.3 Interaction between the urban and rural fringe or Peri-

Urban areas

- The *Peri-urban* areas are the predominant location of residence for majority of labour force required by the business community, construction industry and trade and commerce.
- It is the middle-income group of people residing in the *Peri-urban* area commute every day to the urban centers, for jobs in service and other industries
- It is the *Peri-urban* area, which supply fresh vegetables greens and flowers of certain varieties to the urban market.
- It is the *Peri-urban* area, which receive treated and untreated sewage from the urban centers and supply mainly fodder to cattle in and around the city.
- It is the *Peri-urban* area, which supplies groundwater to the city during dry seasons.

On the contrary urban areas are the major suppliers of consumer products to the *Peri-urban* area. The industries and the educational institutions receive professionals from urban centers through owned / hired vehicles. It is the urban centers, which have specialized hospitals to cater to the medical needs of *Peri-urban* and rural areas. Similarly specialized higher education centers are primarily located only in the urban centers.

2.11.4 Socio-economic and environmental Impact arising out of Peri-urban formation

The impacts arising out of the formation of *Peri-urban* areas; are visible in the extensive exploitation of the natural resources. The impact is felt in the form of,

- Change in land use pattern
- Increasing reduction in the extent of fertile agricultural lands
- Extensive accretion on water bodies and water courses, increasing flooding during rainy season and draught during dry season
- Depletion of ground water due to over exploitation to satisfy the domestic and commercial needs
- Depletion of agricultural production
- Increasing land and water pollution due to garbage and sewage disposal
- Change in employment structure.

Though the above characteristics are common to all the major urban centers of India, there is hardly any study undertaken to establish clearly these aspects. Many of the conclusions are drawn indirectly through available data / information through observation, learning from professionals who deal with the specific subjects.

2.12 Formulation of Peri-urban Indicators

Study of Socio-economic characteristics and the environmental impact calls for identification of a Peri-urban settlement or area first. To establish that a particular settlement is Peri-urban in character, there must be acceptable indicators. The indicators are again dynamic in character as the periurban is an intermediate state in the process of urbanization or conversion of rural area in to an urban area. Thus the indicators themselves should have a range which when interpreted at maximum and minimum levels must indicate urban and rural characteristics. The intermediate value indicates a Peri-urban status. This is true if only one indicator is considered. When multiple indicators are possible to establish the status of a settlement either individually or in combination, there is a need to visualize a scenario where in if more than 75 percent of the indicators are found satisfied by a settlement it is said to be urban and at the lower level if only 25 percent is satisfied it can be classified as rural. In between 25 and 75 percent can be considered to represent a Peri-urban status.

2.13 Classification of Indicators

There can be several indicators employed to determine the status of a settlement, however the indicators can be broadly grouped under three major categories, namely 1. Socio-economic indicators (Table 2.13) 2. Agricultural indicators (Table 2.14) and 3. Infrastructure indicators (Table 2.15).

The value fixed for each and every indicator is based on the census of India records, the literature review on Super Metros in India and the developmental trends taking place in the extended areas of cities. The values are subject to change as the settlement moves from rural to urban status. However, a set of indicators and the value at any point of time is likely to represent the status of the settlement, at that point of time so that future actions needed towards sustainability can be assessed. The validity or the sustainability of the indicators can be tested on comparing the physical, socio-economic and environmental conditions prevailing in different settlements in a metropolitan region. Although peri-urban formation need not be space specific it will be desirable to study the settlements within the metropolitan influence zone obviously for want of data and information availability.

SL.NO.	INDICATORS	CRITERIA	CHARACTER		
			URBAN	PERI-URBAN	RURAL
1	POPULATION (Total)	>= 5000	★	★	
		< 5000			★
2	POPULATION DENSITY	>= 400 Persons/ Sq.km	★		
		< 400 Persons/ Sq.km		★	★
3	LITERACY (% to the total population)	>= 75percent	★	★	
		< 75percent			★
4	WORK FORCE MALE (% to the total workforce)	>= 50percent	★	★	
		< 50percent			★
5	WORK FORCE FEMALE (% to the total workforce)	>= 25percent	★		
		< 25percent		★	★
6	DEPENDENTS (% to the total population)	>= 60percent		★	★
7	NON- AGRICULTURE WORKERS (% to the total workers)	>= 75percent	★	★	
		< 75percent		★	★

8	AGRICULTURE WORFORCE (% to the total workforce)	< 5percent	★	★	
		>= 5percent		★	★
9	MANUFACTURING and HOUSEHOLD INDUSTRY (% to the non- agriculture workforce)	>= 2percent	★	★	
		< 2 percent		★	★
10	OTHER SERVICES (% to the total agriculture workforce)	>=95percent	★	★	
		< 95percent		★	★
11	CULTIVATORS (% to the total agriculture workforce)	>= 50percent		★	★
		< 50 percent	★	★	
12	AGRICULTURE LABOURERS (% to the total agriculture workforce)	>= 50 percent		★	★
		< 50 percent	★	★	

Table 2.13 Socio-economic Indicators

Agricultural activities play a crucial role in determining the character of a settlement. The following are the indicators considered.

SL.NO.	INDICATORS	CRITERIA	CHARACTER		
			URBAN	PERI- URBAN	RURAL
1	AGRICULTURAL LANDUSE (% to the total extent of land)	< 10percent	★	★	
		> 10percent			★
2	CROPS PADDY	> 100 tonnes			★
3	HORTICULTURE			★	★
4	COTTAGE & SSI			★	★
5	DAIRY FARMS				★
6	POULTRY FARMS / MEAT			★	★

Table 2.14 Agricultural Indicators

2.14 Conceptual Frame work of the study

Urban pressures exerted by several driving forces induce formation of peri-urban areas. The formation of peri-urban area, which is considered to be in a state of flux, undergoes rapid transformation. The transformation is observed to be indicated by several indicators relating to Socio-economic, agricultural and infrastructural changes that take place during the transition from rural to urban. Tremendous pressure is exerted on the natural resources relating to water, water resources, agriculture land, forestland, and water bodies. Gradual changes take place in the socio-economic fabric of the settlements due to the formation of peri-urban condition. The combined effect of changes occurring in the socio-economic characteristics and the pressure exerted on the natural resources induce environmental change often resulting in unsustainable level of pollution. The Fig.2.20 (annexure 1) illustrate the conceptual framework of the study.

SL. NO	INDICATORS	CRITERIA	CHARACTER		
			URBAN	PERI-URBAN	RURAL
1	DISTANCE FROM THE CITY CENTRE	< 25 km	★		
		> 25 km		★	★
2	DISTANCE FROM MAJOR RAIL CORRIDOR	< 2 km	★		
		> 2 km		★	★
3	AVAILABILITY OF BUS AND RAILTRANSPORT		★	★	
4	DISTANCE TO HIGHER EDUCATION	< 5 KM	★		
		> 5 KM		★	★
5	PRIMARY HEALTH CENTRE	< 2 KM	★	★	
		> 2 KM			★
6	SHOPPING FACILITY	< 2 KM	★	★	
		> 2 KM			★
7	PRESENCE OF MNC			★	★
8	WATER SUPPLY	Piped supply	★	★	★
		House connection	★	★	
9	LATRINES WITH SEPTIC TANK		★	★	
10	DRAINAGE	Street	★	★	

Table 2.15 **Infrastructure Indicators**

3 LITERATURE REVIEW

3.1 Peri-urban - Definitions

(a) The process of urbanization over a period of time has brought in a host of spatial problems. The gradual conversion of the rural areas around the urban center induced development of a rural urban fringe/peri-urban, which does not conform to many urban planning standards (Ref 1). This phenomenon is neither unique to Indian conditions nor an unaccepted / unacceptable condition in western countries. Mr. Wehrwein a social scientist, and a land economist of USA, for the first time defined the rural urban fringe as “the area of transition between well recognized urban land uses and the area devoted to agriculture”. Though universally valid it does not lend itself to a meaningful exercise in the delimitation of the rural urban fringes/peri-urban around cities.

(b) The other definition attempted by Mr. Blizzard and Anderson, seems to be specific that is “the rural urban fringes is that area of mixed urban and rural land uses between the points where full city services cease to be available and the point where agricultural land use predominates”. This definition too has its limitation, as with in the city boundary itself availability of city services is neither equal in terms of quantity (Ref 2) and quality nor maintained to desired standards. Further, the emphasis has been on the land use. Again, while land use is an important factor, the human factor cannot be brushed aside particularly in Indian conditions because the rural people have a distinct culture. Therefore there appears to be a need for arriving at a practical definition for the rural urban fringe/peri-urban to suit to the Indian conditions.

(c) The smallest human settlement namely the village surrounds all the metropolitan cities. These villages have clearly defined boundaries called revenue boundaries. It is common to witness urban characteristics along with rural features in most of the villages, which is construed as a peri-urban area. The urban characteristics gradually disappear and the villages became distinctly rural beyond a certain distance from the city center (Ref 3). This distance depends on the degree of transportation accessibility available with the city centre. The faster the transport communication, the longer the distance up to which the urban characteristics extend. However defining the urban land use is indeed difficult as they are diverse.

(d) In accordance with the simplest definition “the rural urban fringe or peri-urban is an area of mixed rural and urban populations and land uses, which begins at the point where agricultural land uses appear and extends up to the point where the urban land uses disappear or the dependency on the city for employment becomes insignificant”. This simple definition encompasses several important features. First of all, agricultural land uses are considered as distinct rural feature. Irrespective of whether agricultural activities are going on or not, the revenue record will show the use as agriculture land wet or dry. More often if it is a wet agricultural land, the

probability of the land being used for agriculture is high unless the water resources are completely dried up (Ref.5). If it is dry agricultural land with meager water resources, it is generally used for non-agricultural activity, as most often the land value is also cheap. Therefore the degree of agricultural activity in terms of land utilization and the produce will indicate whether a particular settlement (village) is either urban or rural or peri-urban.

(e) Secondly, the type of crops grown, the presence of vegetable gardens, flower gardens and dairies producing milk for the city indicate strong linkages with the city inducing the growth of activities, which are urban in character.(Ref 6). The employment structure in the settlement (village) is a major indicator of the nature of the settlement either urban or rural. If a few adult, men and women commute to the city for work purposes everyday then it indicates the urban character.

(f) The most striking feature of the Indian rural urban fringe or peri-urban is the presence of both rural and urban people in the revenue villages around the city (Ref 8). The census data does not directly exhibit the dichotomy. However it can be inferred from it through the literacy rate and the occupational characteristics of the village population. The new residential colonies arising out of establishment of an activity namely institutions, education centers etc may be located at the periphery of the villages, mostly having very little interaction with the village excepting availing people for domestic help, farming etc.

(g) As per Census of India (Ref 7) definition if more than 75 percent of the men work force is engaged in non-agricultural activity in a village having more than 5000 population then the settlement is said to be urban in character. At the same time, villages though falling within metropolitan region may not have any distinct urban land use as well as the influence of city in farming and animal husbandry. Daily commuting to the city for work may not be present.

(h) Structure Plan, which is a policy document on Urban Development for Chennai Metropolitan Area (Ref.3), identifies three distinct areas within the Chennai Metropolitan area namely (i) Rural areas (ii) Rural Fringe and (iii) Urban Fringe based on services and utilities. Similar definitions have also been adopted by several Master plans and Development plans.

The rural area is with very low demands for services and utilities, the urban fringe having densely urbanized area is with full urban services and the rural fringe is having partial coverage of services and utilities. On cursory observation one may conclude that the 'rural fringe' fits in to the definition of " Peri-urban area". However, it calls for detailed investigation.

The urban growth pattern, the Metropolitan management and the common denominators prevailing in the Super Metros of India (Ref 29) have indicated that 'peri-urban' conditions prevail within the administrative boundary of a Metropolitan Development agency and it is designated as 'rural fringe'. Irrespective of definitions, settlements having urban character mixed with rural functions is common in the Metropolitan regions of India.

(i) The study by Rakodi 1999 (Ref. 9) on poverty and the Peri-urban Interface has brought out several important aspects, which could form the basis for future studies.

The conclusions of the study are,

- There is very little available information that looks specifically at poverty in Peri-urban areas.
- A process of increased differentiation or polarisation between capitalist and subsistence producers is often referred in Peri-urban areas.
- Those who cannot take advantage of the opportunities presented by urban markets include the already land poor, those who have insufficient capital to purchase land and/or intensify production, and those who are excluded from credit and extension systems. Often, women find it more difficult than men to access all these resources.
- Urban pressures on common pool resources such as forests, rivers and wetlands, may lead to environmental degradation and reduced access by the poor to products they were previously able to gather.
- Residents in villages within the zone of Peri-urban influence are presented with alternative economic opportunities for self-employment.
- There is very little information available on process of social change in Peri-urban villages.
- There is likely to be increasing competition for resources (such as water, building materials, energy) between local communities within the Peri-urban area and the city. Analyses of the relative access to infrastructure of rich and poor households are scarce.

The experience from Hubli-Dharwad study on the 'Sustainable livelihood' (Ref.10) concept indicates the following.

The poor are more likely to be casual workers, and may move from working in agricultural work to more urban-based work, such as construction, road building, selling fruit and vegetables. There may, however, be more opportunities for more casual agricultural work if agricultural intensification takes place. Such opportunities would be balanced by increasing mechanization.

Women may have greater opportunities for undertaking paid agricultural work, as more men take up urban employment. Wages may, however, remain low. Although there may be benefits in terms of increasing household income with women taking on more paid employment, there may also be adverse impacts on their work burden, childcare and health.

People respond differently to opportunities and threats posed by urbanization. This could result in increasing polarisation between income groups.

Diversifying income sources away from agriculture could lead to a decrease in agricultural productivity, which could have a long-term impact on the food security of poor households.

The sustainable livelihood framework that was initially designed to generate more understanding of rural household has become a generic frame for use in Peri-urban areas too.

3.2 Urbanization and exploitation of natural resources

The natural resources, which are often subject to extreme exploitation, are the agriculture land and the water bodies surrounding the metropolitan areas. Information on the total extent of land converted from agricultural use to other uses may be available. But the micro level data is hard to compile from available records.

However there have been several studies and publications on the extent of depletion of water bodies and its impacts both on urban development and ground water level.

3.2.1 Conversion of Tanks

Lakes were critical for Indian cities. They prevented floods and recharged ground water and were symbols of identity, asset value and engineering skills of a settlement. Today, these lakes are either the target by various governmental agencies for developments, lucrative real estate for builders, the last resort for slum dwellers or garbage dumps. The subsequent problems of flooding and water shortage have made the planning authorities and the people rethink and adopt strategies to rebuild their city's water wealth. (Ref-11, 12)

3.2.2 Impacts - Conversion of Tanks

Depletion of lakes and natural water bodies that maintain a delicate ecological balance, subsequently leads to water scarcity and problems of seasonal floods and severe environmental degradation as the drainage pattern (lakes - an integral component) of any area is highly sensitive to any human intervention - either in the form of town planning schemes / unauthorized real estate activities or encroachments with vested interests. (Ref.13, 14)

3.2.3 Legislative Mechanism

The judiciary and the civil society have to step in because the executive has failed miserably in protecting lakes. But in the end, the courts have to rely on the executive to implement its orders, and they function under the law of the land, which are also not clear with regard to urban water bodies. What is lacking is a structured framework that lays down the government's responsibility clearly. (Ref.15, 16)

3.2.4 Technological Interventions

Alarmingly exploding population has started causing the unscrupulous exploitation of water resources and as a result the water table has started

falling down drastically in many parts of the world. Hence it is high time, either to minimize the aquifer withdrawal or increase the ground water resources. Minimizing the aquifer withdrawal is not possible as population is steadily increasing. But on the contrary, increase in the ground water resources is possible through artificial recharge techniques by utilizing the rainwater. (Ref.17)

4 CHENNAI METROPOLITAN AREA

4.1 Developmental trends

4.1.1 Introduction

The observation made in the study of “Super Metros” threw light on several aspects of urban growth, the direction, opportunities for development and transportation infrastructure facility and the possible location in the metropolitan region for the formation of a peri-urban area. However, the identification of a peri-urban area itself became crucial for the study in Indian context and therefore with a set of indicators formulated based on the observations of Super Metros study, Chennai Metropolitan area has been identified for detailed investigation. In accordance with the objectives of the study, identification of peri-urban areas, the socioeconomic characteristics, the environmental impact and testing of indicators have been attempted with the available secondary source of data and information as well as primary sources through case studies.

(I) Urban growth in Chennai Metropolitan Area

Chennai is the fourth largest city in India, located on the eastern seaboard of the sub-continent with a harbor that caters for a fifth of the country's imports and exports. It is well located in relation to rail routes to the rest of India and has a firm but relatively static base of large-scale formal industry and commerce including insurance, shipping and banking. It is a relatively uncongested city by Indian standards and is expanding outwards rather than upwards because of the ready availability of land (Ref 18).

Nevertheless the Chennai Metropolitan Area is experiencing acute problems of rapid urban growth. Its population is increasing rapidly, it's economy is not expanding at an equivalent rate, and there is a growing pressure on the limited utility services that exist. It is becoming more difficult to find work except in the informal sector and real income is declining. The problems of shelter is becoming increasingly severe and in general the population of Chennai is experiencing deterioration in the quality of its urban environment.

Various stages of growth of CMA are shown in the fig. 4.10. In 1943 the urban settlements were well within the perimeter of the present city. Between 1943-1963 the settlement process has crossed the city boundary and developments extended along the major corridors, beyond the city limits. The City area increased from 48.60 sq.km to 130.00 sq.km during this period. Between 1963 and 1980 rapid development took place along the three railway corridors ie. to a distance of 25 kms in the Southern and Western corridors to a distance of 15 kms in the northern corridor. The City limits increased from 130.80 sq.kms to 172.50 sq.kms in 1978. During 1980-85 development took place along the corridors besides filling in the wedges between the corridors. From 1985-88 further developments occurred along both the rail and road

corridors. The urban agglomeration (including the city) at the end of the 1988 was 352.50 sq.kms. Due to this type of “radial development”, land between the corridors nearer to the city centre was often left without development.

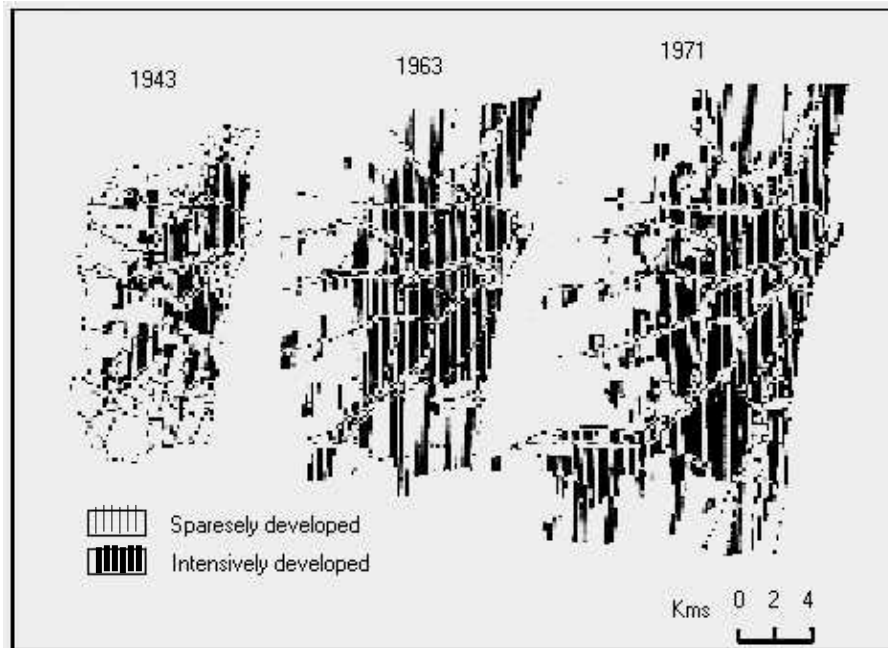


Fig. 4.10 Stages of Growth - Madras since 1943

The land use patterns in the rest of the Chennai Metropolitan Area have undergone significant changes Fig.4.11a, 4.11b, and 4.11c.

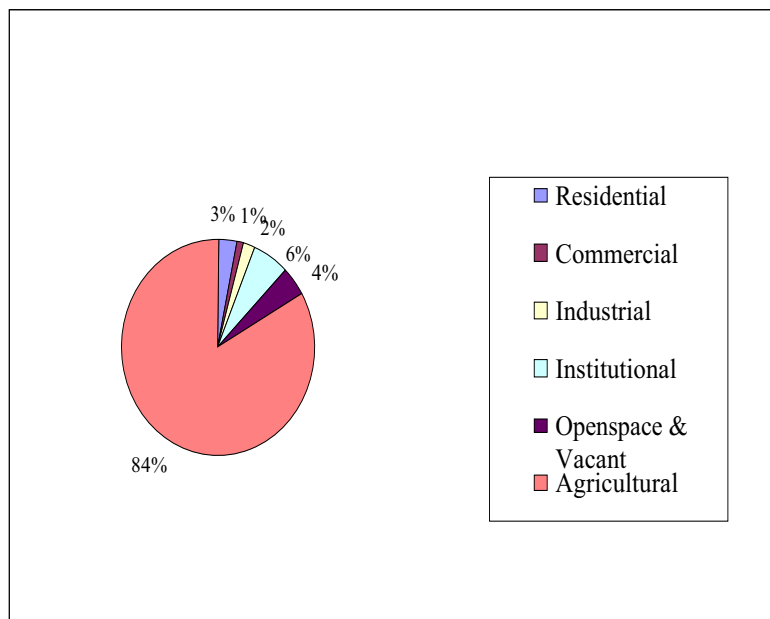
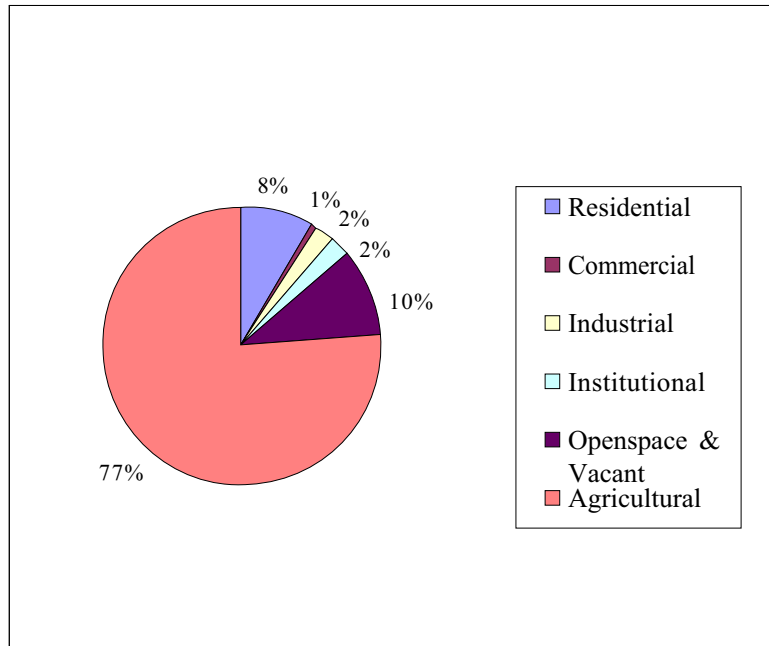


Fig 4.11a Land use 1964



4.11b Land use 1974

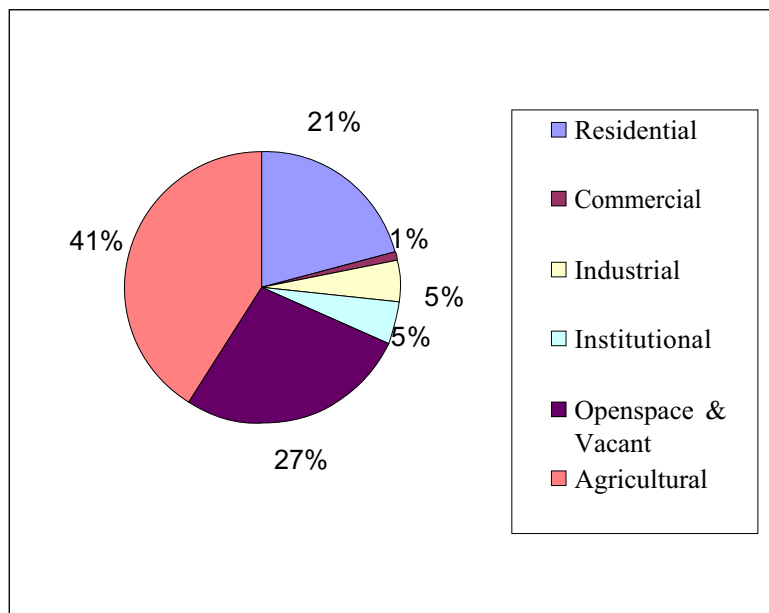


Fig. 4.11c Land use 1991

The most important is the proliferation of residential developments along the fringe areas of city, especially the south and southwest of Chennai. Table 4.10 spells out the land use changes that have been taking place over the period 1974-1991.

Land Use	1974*		1991**	
	Hect.	Percent	Hect.	Percent
Residential	8460	8.2	20747.77	20.89
Commercial	100	0.1	428.64	0.45
Industrial	2860	2.8	4704.69	4.75
Institutional	2540	2.4	5062.32	5.08
Open Space	10720	10.3	12982.92	13.07
Agricultural	79120	76.2	40991.21	41.25
Total	103790	100	99337.97	100

Table 4.10 Land use in Chennai Metropolitan Area (excluding City) 1974-1991

* Source: Structure Plan (Vol. I) For Chennai Metropolitan Area, 1981

** Source: Architecture + Design, Oct. 1994

The available secondary information and the information gathered from interviews and interactions indicate that Chennai Metropolitan area has been witnessing tremendous population growth. The table 4.11 indicates the population growth in CMA.

Year	Population in Million	
	City	Rest of CMA
1901	0.553	0.255
1911	0.575	0.255
1921	0.592	0.284
1931	0.734	0.322
1941	0.881	0.369
1951	1.414	0.485
1961	1.815	0.543
1971	2.573	0.846
1981	2.732	1.353
1991	3.842	1.966
2001	4.216	2.209

Table 4.11: Growth of population in Chennai City and CMA

Source: Madras Master Plan -2011,CMDA

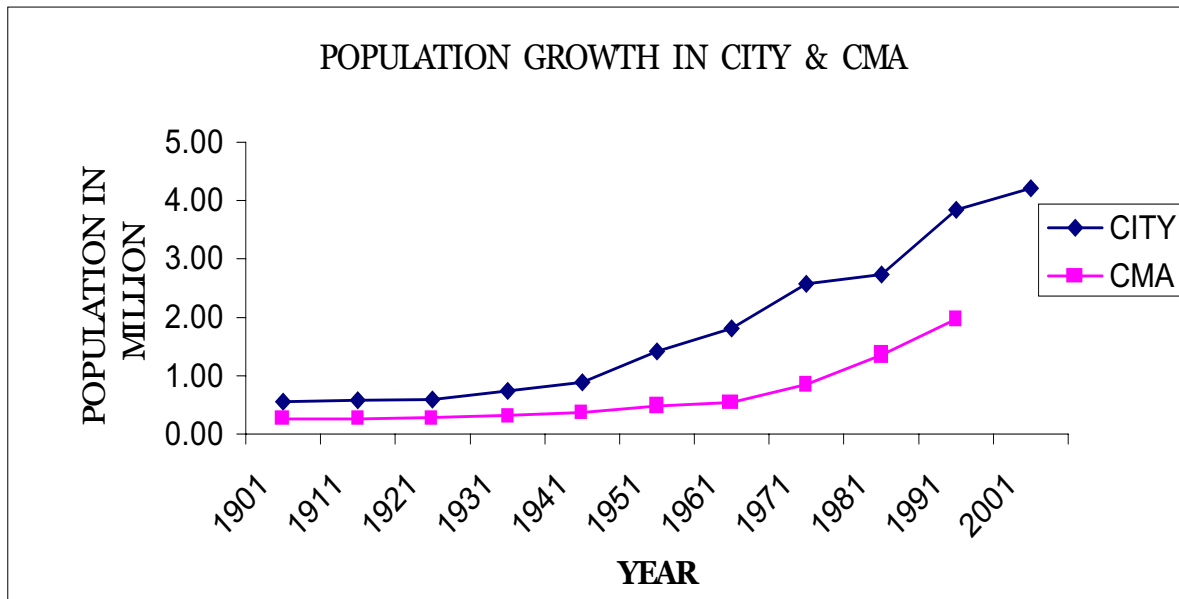


Fig 4.12 Population growth in City and CMA

4.1.2 CMA - Classification based on Services and Utilities

The Chennai Metropolitan Area shows a range of development from rural, with very low demands for services and utilities, to densely urbanized areas with full urban services. The gradual growth in the demand for services and utilities in a urbanizing area is traced here, in order to enable a better understanding of some of the problems the CMA, faces, and of the way in which the concerned agencies in the CMA have responded to the demand forced upon them. At each stage in the process of urbanization.

- (a) Water Supply
- (b) Sewerage
- (c) Storm water
- (d) Refuse disposal

are discussed in that order, which is also the order of priority of needs in most areas.

I (a) Rural areas

The following characteristics of rural development result in a low demand for urban utilities and services.

- Rural people have direct access to a source of water for domestic use, either a well or a surface source (a tank or a stream).
- Rural people have access to fuel sources (wood or dung).
- In rural areas, organic waste, both animal and human and household refuse can be recycled and assimilated in natural systems.
- Wastewater in rural areas presents few problems and is assimilated in natural systems. Stagnation of storm water can however be a problem even in rural areas when surface drainage is impacted.

(b) Water Supply

In rural areas of the CMA water comes from two major sources – tanks and wells. 90-95 percent of the villages in the CMA have protected water systems for domestic uses, and the policy is to provide protected water for all villages in the near future. Some villages without a protected source rely on water in tanks, for both domestic and irrigation purposes. In many cases the water in the tanks is exhausted by the end of the dry season. Most villages have a secondary source of water in shallow wells, usually located in the ayacut of the tank. These are indirectly dependent on the tank water, via seepage for recharging the ground water. Some villages rely only on well water. Protected water supplies will rely on local ground water and consequently it is important that rural or urban developments do not threaten either the quantity or quality of drainage water.

(c) Sewerage

Piped sewerage systems do not exist in rural areas – nor is there any need for them. Night soil and animal wastes are commonly used to maintain soil fertility and are valuable as such to villages. As nearly all water is fetched by hand, there is very little wastewater. Sewage is composted in dry latrine pits and sullage is allowed to infiltrate the ground. Although there is not a need for rural sewerage systems, there is a need for more attention to be given to infiltration systems for sullage and storm water to prevent stagnation problems due to slow infiltration and impeded drainage in many rural villages.

(d) Storm water drainage

The extent of paved surface or roofs in rural areas is so small that any increase in run-off during storms is insignificant and water (except where it is collected for immediate use) infiltrates the ground or runs off overland. Only in cases where this run-off is causing erosion (usually only in steeply sloping areas or following deforestation – hence no problem in CMA) is there a problem in rural areas.

(e) Refuse disposal

There is a minimum of household refuse in rural areas, largely because most food is home grown and so packed produce is minimal. Organic waste is fed to livestock, composted and returned to the soil or burned. Any glass or metal, which is not reused, can be disposed of without nuisance. In spite of this, refuse in rural villages is a problem, though principally a cosmetic one. Perhaps because of the very small quantities of refuse, much of it is dumped on the street and some encouragement is required to promote a more disciplined approach to refuse disposal in villages.

II The Rural Fringe

There are many incentives for urban uses to locate in rural areas on the fringe of major cities. (Here the rural areas, which are experiencing, the early

advances of urbanization are referred to as the 'rural fringe'). Cheap land is probably the greatest incentive. There are disincentives, also, notably the lack of services. But, as has been pointed out lack of water / sewerage / refuse collection etc are not problems in rural setting and are no discouragement. However, the daily commuter trip to work will often be via public transport and, therefore, a strong locational factor attracting rural fringe development is proximity or ease of access to a major transport route.

Accessibility to electricity supply and to a lesser extent telephone are also likely to be important locational criteria for newcomers to the rural fringe. However as rural electrification and the provision of telephone connections in rural area has become a high priority, the lack of these services is unlikely to be a negative locational criterion for much longer.

A few scattered houses in rural areas are not likely to cause much problem. Industrial uses locating in rural fringe areas, cause concern particularly in respect of water demands (and possible adverse impacts on rural uses), industrial pollutants (particularly water pollutants) and their effect in triggering other urban uses and hence service demands.

Agricultural industries are quite often found in rural fringe areas. These may be intensive agricultural enterprises (dairy units, feed lots, laying chickens, broiler chickens etc) they may be processing agricultural products (slaughter houses, tanneries, packing facilities, mills etc) or they may be commodity or distributing facilities (feed mills, warehouses, etc). Though most of these are likely to be small enterprises, their impact on the environment (particularly their polluting capacity) and their demand for services may be disproportionate. Effluents from tanneries and other similar industries have created a serious problem by way of polluting groundwater.

Small rural industries encouraged by the Small Industries Development Corporation do not demand any increase in the level of services in rural areas except perhaps the provision of electricity and piped water, (which can be provided under pressure by an overhead tank supplied by a small pump). The objective of setting up such industries is of course to provide employment for the existing rural population.

III (a) The Urban Fringe

Areas, which are experiencing considerable pressure from urban development are referred to have as the 'urban fringe'. It is in this area that a large part of the resources need to be concentrated; for it is here that many subsequent urban problems have their origin. It is surprising how a few scattered urban uses in an otherwise undeveloped area can effectively 'freeze' the pattern of development and make all subsequent service infrastructures follow this pattern.

In the urban fringe, residential development is no longer limited to a few individual homes, but includes large speculative developments. The overall density of the area may still be quite low but locally densities will be high enough to create problems.

(b) Water supply

The first of these problems is water. Urban fringe residents may well be middle class, urban-based families who characteristically have a high demand for water (particularly for indoor bathing and for water closets as opposed to dry-pits). Thus the increase in demand is disproportionate to the increase in population. At the same time, disposal of sewage from individual homes presents few problems until densities reach the point where effluents pollute supply wells. This problem tends to arise suddenly because the increase in water demand and the increase in sewage generation occur simultaneously.

The increase in demand for water may also seriously reduce the water available for irrigation and exceed the safe yield of wells, which tap small and low yield aquifers, often relying on the tank and ayacut irrigation for recharge. Draining the tanks for development may reduce the recharge and the safe yield of wells. However new development is often located on the ayacut of tanks, hence displacing some of the demand for irrigation water.

(c) Sewerage

There are two important changes, which will occur. First middle-class residents on small lots will not have any opportunity to utilize sewage for agricultural purposes. The natural assimilative capacity of their small area of vegetation and soil is rather limited. Secondly there will be more sewage and it will usually be water borne. However there is normally separation of sullage and sewage. Unless the soil is well drained and a septic tank has adequate capacity and a dispersion trench there may be problems with individual disposal systems on small lots. (Say of less than 2 grounds) if there is a well on the same lot the same problem will apply to very much larger plots.

The point is often reached in the urban fringe where pockets of development are dense enough to create pollution problems, and yet these pockets are so dispersed that to serve the areas with sewerage is prohibitively expensive when treatment is on a area wide basis.

(d) Storm water drainage

As the area of roofs and paving increases so does the amount of run-off during storms. A small increase in run-off can cause serious erosion and change the behaviour of river channels. The resulting increase in flood frequency is an impact of development, which will be felt in downstream areas in the city itself. While increased run-off is creating flood problems, these are being further aggravated by the development of tanks and damage to tank bunds. It is not certain how effective tanks are in reducing flooding but they do act as retention ponds, which lengthen the time of concentration and reduce flood peaks.

(e) Refuse disposal

Unlike farm families that generate very small quantities of household refuse; suburban families purchase most of their food and other goods. Some of this is packaged and through there is considerable reuse of packages there is a need to dispose of a larger quantity of refuse to landfill in low lying waterlogged areas is unsatisfactory especially where refuse is largely organic and therefore will be subject to settlement.

Conclusion

The range of developments from rural to urban taking place during the process of urbanization around Chennai Metropolitan area is classified as ‘rural’, ‘rural fringe’ and ‘urban fringe’. Compared to the definition for peri-urban area with the range of developments taking place around CMA, the ‘rural fringe’ almost represents the peri-urban status and the ‘urban fringe’ represents ‘urban status’. Therefore, for the purpose of analysis and discussion in this study, the “rural fringe” is represented as equivalent to ‘peri-urban’ and the “urban fringe” is represented as equivalent to ‘urban’.

4.1.3 Factors influencing the formation of “peri-urban” areas in

CMA

(i) Driving Forces

Several urban pressures bring about the formation of a ‘rural fringe’ or peri-urban area. The severity of urban pressures culminates into quicker transition from rural to urban.

(ii) Increasing land cost

Spiraling land cost within the city has created huge demand for land outside city. There is a vast difference in the land value between the center of the city and the periphery. In the case of Chennai, the difference in land value in the three directions are as follows,

The land prices along the three corridors and the adjacent Peri-urban areas is as shown in the following table, and Fig.4.13(annexure 1)

Sl.no.	Name of the corridor	Land Cost per Sq.ft.					
		Urban		Peri-urban		Rural	
		Min.Rs.	Max.Rs.	Min.Rs.	Max.Rs.	Min.Rs.	Max.Rs.
1.	North	207	495	93	234	9	21
		Thiruvotriyur		Manali		Sirugavoor	
2.	West	83	373	87	345	76	127
		Nerkundram		Poonamallee		Thirumazhisai	
3.	South	266	1043	160	693	75	210
		Alandur		Tambaram		Gowrivakkam	

Table 4.12 Land value in CMA

Source: Registration of Land Records, Tamil Nadu 2003

- The minimum and maximum price indicated for a particular location implies that the maximum price prevails adjacent to or abutting transportation corridor and the minimum price prevails at the periphery of the settlement.
- The prices along the three corridors indicate that even at the rural areas around the southern corridor the land price is more as the land is in high demand.
- The non-affordability characteristics of a vast majority (namely the middle income group, mostly employed in service sector, business sector, trade and commerce) and the potential exhibited by the peripheral area have driven this segment of population to seek land outside the city for residential purposes.
- Availability of housing loans at affordable interest rates has also influenced tremendous growth in the periphery thus leading to the formation of Peri-urban areas. The Government of India to promote housing activity and stock, extended tax benefits and the financial institutions (Banks) have reduced the interest rate from 14 to 8.5 percent. Thus, there has been a tremendous boost offered to the housing industry.

(iii) Rental value

The rental value prevailing in the city for a reasonable accommodation of 500 to 800 sq.ft. is 3 to 4 times more in the city than in the Rural fringe or Peri-urban settlements. This is a major attraction for those who cannot afford to pay a high rent in the city.

(iv) Congestion

High density developments (24512 Persons) and the high order traffic congestion prevailing on the city streets force the city residents to spend more time for travelling thereby subjecting themselves to pollution. Often Peri-urban areas served by both bus and rail corridors have better accessibility and less travel time though the distance of travel is more. The rural areas are often free from high level of pollution and enjoys less population density 2220 persons / sq.km.

(v) Desire to own house

The Indian culture, firmly believes in residing at one's own place. The selection of the place of residence depends on the affordability characteristics. The Peri-urban areas thus provide enormous scope for new settlements at affordable cost.

(vi) Inadequate water supply

Chennai in particular has been suffering for want of good water supply source. The present sources are inadequate and do not ensure supply throughout the year, as it is monsoon dependent. The groundwater quality at most of the locations in the city is either hard or not fit for drinking and cooking purposes, or totally inadequate to meet the demand, thus driving the city dwellers to seek better residential location.

II) Opportunities provided by Peri-urban areas

A detailed study of the physical factors responsible for promoting large-scale developments along the southwest direction has revealed the following,

(i) Land Slope

Chennai Metropolitan area is fairly flat. A major portion of the CMA is subject to flooding. The map prepared for establishing the land slope indicated those areas with a slope less than 5percent is considered to be most suitable for development purposes. Accordingly a major portion of the land in the southwest direction falls in the less than 5percent slope category (Fig.4.14 annexure 1). This enables the developers to promote large-scale developments in this direction.

(ii) Accessibility

The higher the accessibility the higher would be the economic attractiveness of the area for promotion of developments. The (Fig.4.15 annexure 1) explains the accessibility prevailing in CMA. It is explained as buffer zone 1 and 2 and outside buffer.

It is seen that the southwest area of CMA has the highest accessibility through major roads (National Highways, state highways etc) and Railways. Higher accessibility is conducive for promotion of developments. The yearly Sub-urban Railway, Commercial Details for the year 2002-2003 for the three corridors has shown the following.(Table 4.14)

The commercial detail is for the section of the Sub-urban Railway system from the city boundary to the nearest Municipality located along the corridors. It is clearly seen that the western corridor carries the highest

Type	Residential / Commercial		
	Buffer 1 (m)	Buffer 2 (m)	Outside buffer (m)
National Highway (NH) and State Highways (SH) and Major roads	< 1000	1000-1500	> 1500
Other roads	< 500	500-1000	> 1000
Railways	< 1000	1000-2000	> 2000

Table 4.13 Details of buffer distances for roads and railways

Source: Dissertation Report, Institute of Remote Sensing (2001)

volume of traffic. However, on the southern corridor, metro bus service also has a competitive service. Thus the corridors most sought after for development purposes are the southern and the western corridors. More than 35 percent of the 1577 bus services operated within CMA per day are in the southern corridor followed by 25 percent in the west 33 percent in the city and only 7 percent in the North.

Sl.no.	Name of the Corridor	No. of tickets sold per year in millions	Earnings per year in Rs.millions.
1.	North	4.5	30
2.	West	15	136
3.	South	8	46

Table4.14 Yearly Railway Commercial Details (2002-2003)

Source: Southern Railway

(iii) Soil type

Type of soil is also considered to be one of the major factors in locating developments, as often the soil type determines the cost of foundation, the availability of ground water and the potential to develop gardens. The (Fig.4.16 annexure 1) shows the prevalent soil types in CMA. The sandy soil is found to be highly suitable for construction purposes, which is predominant in the southwest part of CMA.

(iv) Land use

The land use of the area intended for development is a crucial factor for selection. Often the land value is based on the current use of the land. The rural settlements and villages with level ground is found to be highly suitable for development purposes as found in the south west part of the CMA.

(v) Ground water level

Availability of ground water is the primary consideration of the migrants to the peripheral areas for settlement. Availability of good potable water at a shallow depth is often preferred by the residents. The (Fig.4.17) shows the availability of ground water at different depth in CMA. The southwest portion of the CMA has good water availability at shallow depths.

(vi) Ground water quality

The (Fig.4.18 annexure 1) shows the quality of water prevailing underground. The electrical conductivity expressed in Microns/centimeter is the measure of the water quality. Accordingly the quality of water available in the southwestern part of CMA is fairly of good quality.

(vii) Conclusion

The study has shown in clear terms, that the rural fringe or Peri-urban formation or the process of urbanization does not take place around the city uniformly. Besides economic affordability, migrants intending to settle outside the city for obvious reasons of congestion and lack of desirable level of environmental standards in the city, consider not only economy, accessibility but also the living environment for the selection of an appropriate housing location. Therefore natural resources namely, water, land, soil condition, water table etc are subject to high pressure for exploitation.

5 CASE STUDIES

The Peri-urban study is based on the premises that the Peri-urban area is formed because of certain 'driving forces' along the periphery and also because of certain potentials that the periphery offers for development as an attraction. Irrespective of whether the formation of Peri-urban area is forced or natural, the area undergoes several changes in the Socio-economic fabric of the area and the physical environment (Fig.5.1.10 Annexure-I). To ascertain such changes as well as to test the driving forces, and the indicators formulated in chapter 2. several case studies have been undertaken.

5.1 Case Study 1

(a) Socio-economic characteristics in 52 settlements of CMA

From the study of Super metros (7 Major cities in India) and the development pattern, it is found that the direction where both rail and road corridors exist undergoes tremendous growth leading to Peri-urban formation. In order to test this finding in Chennai Metropolitan area, detailed investigation of the developmental trends along major transport corridors was undertaken by analysing several physical, socio-economic characteristics prevailing in 52 settlements for which data is available for the last two decades.

The process of formation of Peri-urban areas depends on several opportunities the settlements provide in terms of economy, transport and communication, water, living environment etc. The fig 5.1.11 (Annexure I) indicates the settlement distribution with in CMA.

The civic status of the settlements is as follows,

1. Municipalities	- 08
2. Town Panchayats	- 26
3. Census Towns	- 17
4. Contonment Boards	- 01

	52

The rest of the settlements are all either villages or village panchayats.

(b) Transportation corridors and Peri-urban growth

The Fig 5.1.11 (Annexure I) clearly shows that over a period of time smaller settlements have grown up to the status of Municipality only along major transportation corridors. On the North, along the Thiruvottiyur high road and the Kolkatta Railway line, the Kathivakkam Municipality and Thiruvottiyur Municipality are located. On the North west along the Northern-Trunk road (NH 5), Madhavaram Municipality is located. This Highway does not have a parallel railway line running close by. On the west, along the Bangalore Railway line two Municipalities namely Avadi and Ambattur exists. Besides the Railway line there is a major road which has been upgraded as a National Highway(NH 205).

Whereas on the south, there is a railway line and a major highway

running parallel to each other. This corridor has three major Municipalities, Alandur, Pallavaram and Tambaram. A cluster of Town Panchayats and Census Towns have come up along these two corridors clearly establishing the fact that there has been pronounced development taking place along this corridor.

The Pertinent question is, why developments are more along this corridor when compared to other corridors in spite of the presence of transportation corridors in other directions too? The answer is that though greater accessibility is considered to be the prime reason for fast development, good accessibility alone is not sufficient to induce greater developments.

For example on the Northern side as well as on the north western side, besides the Municipalities there are hardly any Town Panchayat or census towns, only villages exist. The prime reason being presence of petro-chemical industries which emit pollutants throughout the year. Non-availability of good drinking water, intrusion of saline water into the wells and non-availability of adequate education and health facilities are other major reasons.

The southern half of the CMA is fully crowded with Town Panchayats, Census towns and Villages, having dense developments. The area falling adjacent to the transportation corridor within 2 kms is the highly developed area. In particular, on the southern side, well-developed Rail and Road Transport facilities provide higher level of accessibility.

Availability of good drinking water and nearness to major health and educational facilities add to the attraction. More than 60 percent of the technical education institutions (60 around the CMA) is located on the southern half of CMA because of high accessibility and availability of land at affordable cost. More than 35 percent of the 1577 bus services operated within CMA per day are in the southern corridor followed by 25 percent in the west 33 percent in the city and only 7 percent in the North.

Similarly among the four metro Railway corridors, the southern corridor carries the highest volume of passengers everyday. The North South-eastern corridor has two major parallel roads along the seashore. One is the East Coast Expressway and other is designated as IT corridor, with large number of IT related industries and institutions. There was unprecedented demand for housing development along the seashore in view of the availability of good underground water. This is evident from the growth of smaller settlements to the level of census towns (5) and panchayat union (3). However the pressure has been reduced because of coastal zone development regulation and restriction imposed on the extraction of ground water.

The southern corridor is the most visible and highly used by the people of Tamil Nadu as Chennai is located at the Northern most corner of the Tamil Nadu State. Potential for development along the North is highly restricted as the neighbouring state boundary is closer to the city.

The objective of conducting the study is to find out the socio-economic characteristics prevailing in selected settlements (which are truly representative) so as to identify the Peri-urban settlements. In all, 52

settlements have been selected to represent Municipalities Town Panchayats census Towns and rural areas. The massive data collected from various sources has been subjected to cross analysis to establish the characteristics of Peri- urban area.

(c) Population growth and density variations

The Table 5.1.10 (Annexure I) lists all the settlements up to the level of Census Towns excepting villages falling in the study area. There are eight Municipalities and a Municipal corporation in the city of Chennai. All the Municipalities are located outside the Chennai city either along the boundary or along major transportation corridors. While the Chennai Municipal Corporation has shown a decadal growth rate of 11.1 percent, the Municipalities have shown a growth rate of 1.5 to 5 times that of Chennai city. The tremendous growth is attributed to the opportunities provided by these Municipalities in terms of economy and environment. compared to the Chennai Municipal Corporation. Many Town Panchayats which have lesser population than Municipalities have shown 10 to 20 times increase in population. Several Town Panchayats in general have witnessed higher growth. In particular three Town Panchayats namely Perungudi which has a large base of IT related industries and residential colonies has shown a decadal growth of 142 percent, where as Pallikaranai which has many educational institutions and a major Metro train terminus located at the nearby settlement along the Chennai City boundary showed 187.7 percent and Maduravoyal has witnessed the highest growth rate of 196.5 percent due its closeness to the whole sale market created in recent times. It is also interesting to note that the decadal growth rate has been negative (-86.4percent) in the case of Pammal which has large number of leather and chemical industries causing pollution to the ground water and in the case of Nandambakkam (-13.9percent) due to pollution. The settlements have all shown increase in population due to migration of people predominantly from the city rather than from rural areas in the metropolitan region. Excepting a marginal percentage of the population settled in these settlements all are middle income and lower income group people only.

(d) Population Density

Population density prevailing in the study area (CMA) and it's decadal variation are the indicators of the level of development taking place in a settlement.

The Table 5.1.11 (Annexure I) indicates the population density in 1991 and 2001 and the decadal variation. While all the settlements have witnessed densification, a few Municipalities, Town Panchayats and census towns have shown tremendous degree of densification.

Sl.no.	Population Density ranges Persons/Sq.km.	No.of settlements			
		1991	%	2001	%
1.	0-1000	2	4	1	2
2.	1001-3000	22	42	13	25
3.	3001-6000	16	31	17	33
4.	6001-9000	10	19	9	17
5.	9001-12000	2	4	9	17
6.	12001-15000			3	6
Total		52	100	52	100

Table:5.1.12 Population Density Variation in 52 settlements of CMA (1991-2001)

Source: Census of India 1991 - 2001

Some of the Census Towns (CT) has registered more than 150 percent increase in density over a period of 10 years. The Table 5.1.12 indicates the number of settlements falling in different density ranges during 1991 and 2001. the sharp decrease in the percentage share of settlements falling in the density range 1001-3000 from 42% to 25% has resulted in increased share in the higher density ranges. More than 70 percent of the settlements fall in the population density range of 3001 and above.

The higher the population density the higher is the level of urbanization resulting in rapid conversion of rural areas in to urban areas passing through the Peri-urban stage.

It may be seen that in majority of the settlements, the decadal increase in density has been less than 5 percent. Whereas it is 15 to 20 percent in the case of very few settlements. The local bodies which have faced tremendous population densification are finding it difficult to create and maintain adequate infrastructure facilities.

(e) Conclusion

The pattern of densification that has been taking place over a decade from 1991 till 2001 (Ref fig 5.1.12 & 5.1.13 annexure I) clearly establishes a scenario, which fits in to the general hypothesis that as the income and consequent affordability reduce, new settlements take place away from the city. The first choice being the second order settlement namely the Municipalities, then to Town Panchayats and then to village Panchayats. Here the Town Panchayats have undergone greater densification indicating the fact that it is the middle income and lower income people who are responsible for the kind of development. While access to a good transportation corridor is the first preference in selecting a residential site, other considerations namely, good ground water, basic education health and shopping facilities, also carry adequate importance. The settlements which have undergone tremendous densification seemed to have fulfilled individual family's requirement at least to some extent if not 100 percent.

These settlements gradually got urbanized over a period of time and tend to induce growth of Peri-urban settlements around them. Thus Peri-urban areas are created over a period by gradual urbanization process starting from the city boundary. While the city boundary itself could be redrawn according to the urbanization trend, perhaps this might induce faster urbanization along the boundary as was witnessed in the case of Pallikaranai which is located immediately next to Velachery and closer to city boundary got merged with Chennai City in the year 1995. This is clearly visible in the Table 5.1.10 (annexure I) wherein the population of Pallikaranai in 1991 was only 7822 and increased to 22503 in the year 2001 registering a three fold increase so also the population density.

(f) Literacy Rate

Tamil Nadu State has a high literacy rate in India when compared to several other states. Literacy and the level of education more often are responsible for success of socio-economic programme. The Table 5.1.13 (annexure I) indicates the literacy rate prevailing in the settlements falling in CMA during 1991 and 2001. While all the settlements have registered an increased level of literacy from 1991, two of the settlements (Ambattur Municipality and Perungudi) have registered negative growth. Both the settlements have large-scale industries and illiterate mass, which has moved in because of employment opportunities.

The Chennai City has registered only 80.14 percent literacy due to many slum areas with illiterate mass. In case of Municipalities, the increase in literacy rate is significant 5 to 6 percent (Table: 5.1.14).

Sl.no.	Literacy Rate Range (%)	Number of settlements			
		1991	%	2001	%
1.	0-60	7	13	-	-
2.	61-70	9	17	2	4
3.	71-80	14	27	7	13
4.	81-90	21	41	33	64
5.	91-100	1	2	10	19
Total		52	100	52	100

Table:5.1.14 Decadal variation of Literacy rate in 52 settlements of CMA
Source Census of India 1991 - 2001.

Alandur Municipality has registered a literacy rate of 93.34 where as Meenambakkam having a population of less than 10,000 has registered a literacy rate of 93.2, whereas another Town Panchayat having population 30,000 has registered a rate of 93.43.

Similarly a census town which is only a village panchayat has registered a rate of literacy rate of 95.94 in 2001 raising it from 90.87 in 1991.

The highest achievement is made by the Valasaravakkam town panchayat. It has registered 96.6 percent in 2001 a great improvement from 89.91 percent in 1991.

(g) Conclusion

Majority of the settlements in CMA study area fall in the range of 81 to 90 percent literacy which is higher than National average.

Given the importance to the education by the state and federal governments there has been tremendous improvement in literacy rate and almost all the settlements are having higher levels of literacy.(Refer fig.5.1.14 & 5.1.15)

(h) Workers Participation rate and the dependents ratio

Workers participation rate indicates the health of the community. Chennai city has registered Table 5.1.15 (annexure I) 34.19 percent as the workers participation rate in the year 2001. Workers participation also depends on the employment opportunities available to suit to the education levels of the population in a particular area. Concentration of skilled workforce may be found in the urbanized, Peri- urban and rural settlements within the Metropolitan area depending upon the employment opportunity available. For example, Perungudi has registered not only higher growth in population, density, literacy but also workers participation rate due to establishment of large number of IT related industries.

All the settlements in the study area have a workers participation in the range of 30 to 40 percent with a decadal growth of 3 to 4 percent (Table 5.1.16). Only a few settlements have registered a participation level of more than 40 percent. The share of settlements having a participation rate of 31 to 35 percent has shown a significant increase. Participation rate may not be the appropriate indicator of the higher living standard in a particular area. For example, the settlements like Tirusulam and Sikkarayapuram have registered a participation rate of 42.67 and 49.2 respectively, but the work fore is predominantly labour force engaged in stone quarry and stone crushing factories. The literacy rate (64.59 and 69.85 respectively) confirms the above. (Ref. Fig.5.1.16 & 5.1.17)

Sl.no.	Workers Participation range (%)	Number of settlements			
		1991	%	2001	%
1.	0-25	1	2	-	-
2.	26-30	23	44	4	8
3.	31-35	23	44	3	63
4.	36-40	5	10	13	25
5.	>40	-	-	2	4
Total		52	100	52	100

Table:5.1.16 Workers participation rate and the share of settlements in CMA

Source: Census of India 1991 - 2001

The share of dependent population seemed to have decreased considerably in many of the settlements. (Table 5.1.17). Dependents share in the range of more than 71 percent has come down 35 percent to 8 percent,

where as of 61-65 percent and 66-70 percent.

Sl.no.	Range of Dependents Share (%)	No. of settlements			
		1991	%	2001	%
1.	<=60	4	7	-	-
2.	61-65	2	4	14	27
3.	66-70	28	54	34	65
4.	>=71	18	35	4	8
Total		52	100	52	100

Table:5.1.17 Dependents ratio in 52 settlements of CMA

Source: Census of India 1991 - 2001.

(i) Conclusion

The higher level of dependents share is also an indication of high order unemployment.

j) Employment status

Urbanization and population pressure have been responsible for conversion of agriculture lands for urban use and agricultural laborers in to informal sector workers. The Table 5.1.18 (Annexure I) shows the total workers and the share of agricultural workers and non agricultural workers. While there has been a significant increase in the total workers from 1991 to 2001, there has been a steady decrease in the share of agricultural workers, with a proportional increase in the non-agricultural workers.

The shares of agricultural laborers vary from 0.04 percent (Alandur) to a maximum of 18percent in Thirumazhisai. It may be seen that none of the settlement (excepting village panchayats) in any of the category has agricultural laborers to an extent of 25 percent to qualify for a rural status. Thus all the settlements come under urban classification. But in reality, agricultural activity is also going on with laborers brought in from nearby districts obviously for two major reasons, one availability of agricultural laborers in the local areas is becoming scarce and even if it is available the cost is higher. It makes economic sense to bring in labor from outside only during important stages of cultivation which requires large scale labor input. With increasing mechanization and introduction of scientific farming the labor input has come down significantly. The labor input for horticulture and cultivation of vegetables and cash crop is also less.

(k) Conclusion

- As per the Census of India classification all the settlements qualify for urban status, as the share of non-agriculture labour is more than 75percent. However marginal level of agriculture activity is also prevalent in many settlements.

(l) Classification of Agricultural workers

The Census of India identifies workers engaged in Agricultural and Non agricultural sectors. The Table 5.1.19 (Annexure I) Shows the share of cultivators and labourers engaged in agricultural activity. Cultivators are the ones who either own the land or taken the land on lease for agricultural activity / farming. The agricultural labourers are the ones who do not own the land but work in the field.

The Table 5.1.20 explains the share of cultivators and laborers living in the settlements and the number of settlements having the cultivators / laborers at different proportion.

Sl.no.	% range of cultivators and labourers	No. of settlements falling in the range of cultivators				No. of settlements falling in the range of Labourers			
		1991	%	2001	%	1991	%	2001	%
1	0-25	13	25	15	29	12	25	14	27
2	26-50	15	29	21	41	11	20	9	18
3	51-75	13	25	8	15	19	36	19	36
4	76-100	11	21	8	15	10	19	10	19
Total		52	100	52	100	52	100	52	100

Table: 5.1.20 Classification of Agriculture workers in 52 settlements - Decadal Variation (1991-2001)

Source: Census of India 1991 - 2001.

The share of cultivators has shown significant reduction in 2001 compared to 1991, where as the share of agriculture labourers has not undergone major changes between 1991 and 2001.

m) Male and female Participation in Agriculture workforce

The Table:5.1.21 shows the settlements falling in different percentage range of male participants in agriculture as cultivators who not only own the land but also work in the agricultural labourers. A steady decline in the share of cultivators is notified over the years as most of them are small land owners who sold the land for other developments. Similar trend is noticed Table 5.1.22 share of Agriculture labourers over a period of 10 years from 1991 to 2001.

(n) Conclusion

While statistical evidence is hard to come, it is experienced that cultivators hire the labourers continuously so that there is always job for the agricultural labourers. However both the cultivators and the agricultural labourers are a diminishing lot.

	Range of Male participants %	Cultivators			
		1991		2001	
		Male	Percentage	Male	Percentage
1	0 - 60	2	4	7	13
2	61 - 70	2	4	0	0
3	71 - 80	4	8	6	12
4	81 - 90	15	29	13	25
5	91 - 100	29	56	26	50
Total		52	100	52	100

Table:5.1.21 Male Cultivators in the workforce of 52 settlements of CMA

Source: Census of India 1991-2001

Sl.no.	Range of Male participants %	Agricultural Labourers			
		1991		2001	
		Male	Percentage	Male	Percentage
1	0 - 60	6	12	16	31
2	61 - 70	4	8	8	15
3	71 - 80	8	15	11	21
4	81 - 90	18	35	7	13
5	91 - 100	16	31	10	19
Total		52	100	52	100

Table: 5.1.22 Male Agricultural Labourers in the workforce of 52 settlements of CMA

Source: Census of India 1991-2001.

Sl.no.	Range of Female participants %	Cultivators			
		1991		2001	
		Female	Percentage	Female	Percentage
1	0--10	33	63	30	58
2	11--20	13	25	13	25
3	21--30	5	10	6	12
4	31--40	1	2	0	0
5	41--100	0	0	3	6
Total		52	100	52	100

Table: 5.1.23 Female Cultivators in the workforce of 52 settlements of CMA

Source: Census of India 1991 - 2001.

(o) Non-agricultural workforce

Table 5.1.25 (annexure I) show the workforce engaged in Non-agricultural sector namely: Manufacturing (Household) and other services in 1991 and 2001 respectively. The share of workforce in the manufacturing sector in 1991 was not more than 1 percent of the total workforce excepting in a few settlements. The six settlements which had registered a share of 10 to 45 percent in manufacturing industry in 1991 have shown sharp decline over the

Sl.no.	Range of Female participants %	Agricultural Labourers			
		1991		2001	
		Female	Percentage	Female	Percentage
1	0 – 10	19	37	17	33
2	11 – 20	18	35	8	15
3	21 – 30	9	17	13	25
4	31 – 40	2	4	5	10
5	41 – 100	4	8	9	17
Total		52	100	52	100

Table:5.1.24 Female Agricultural labourers in the workforce of 52 settlements of CMA

Source: Census of India 1991 - 2001.

decade. There appears to be a gradual improvement in the share of workers in manufacturing sector in 2001. Though the increase has been in the range of 2 to 3 percent in majority of the settlements some settlements have registered 7 to 8 percent and even 21 percent. However there has not been any significant increase in the share of manufacturing sector. All other services include 97 to 99 percent of the Non-agricultural sector workforce.

Tables 5.1.23 & 5.1.24 show similar decline trend in the case of female cultivators and agriculture labourers.

The Table: 5.1.26 & 5.1.27 shows the male workforce engaged in Manufacturing and Household industry and other services in 52 settlements of CMA. It is observed that though there has been growth in the share of male workforce both the manufacturing and other service sectors, the increase is more pronounced in other service sectors.

Sl.no.	Range of Male participants %	Manufacturing & HHI			
		1991		2001	
		Male	Percentage	Male	Percentage
1	0 - 60	17	32.7	25	48.1
2	61 - 70	12	23.1	18	34.6
3	71 - 80	11	21.2	5	9.6
4	81 - 90	7	13.5	4	7.7
5	91 - 100	5	9.6	0	0.0
Total		52	100.0	52	100.0

Table: 5.1.26 Male workforce in Manufacturing and Household Industry in 52 settlements of CMA. Source: Census of India 1991-2001.

Sl.no.	Range of Male participants %	Other Services			
		1991		2001	
		Male	Percentage	Male	Percentage
1	0 - 60	8	15.4	0	0.0
2	61 - 70	1	1.9	2	3.8
3	71 - 80	4	7.7	11	21.2
4	81 - 90	33	63.5	39	75.0
5	91 - 100	6	11.5	0	0.0
Total		52	100.0	52	100.0

Table: 5.1.27 Male workforce in Other Services 52 settlements of CMA

Source: Census of India 1991-2001

Sl.no.	Range of Female participants %	Manufacturing & HHI			
		1991		2001	
		Female	Percentage	Female	Percentage
1	0-15	12	23	1	2
2	16-30	14	27	9	17
3	31-45	16	31	28	54
4	46-60	6	12	8	15
5	61-100	4	8	6	12
Total		52	100	52	100

Table: 5.1.28 Female workforce in Manufacturing and Household Industry

52 settlements of CMA

Source: Census of India 1991-2001

Sl.no.	Range of Female participants %	Other Services			
		1991		2001	
		Female	Percentage	Female	Percentage
1	0 – 10	9	17	0	0
2	11 – 20	38	73	44	85
3	21 – 30	1	2	6	12
4	31 – 40	2	4	2	4
5	41 – 100	2	4	0	0
Total		52	100	52	100

Table:5.1.29 Female workforce in Other Services in 52 settlements of CMA

Source: Census of India 1991-2001

Similarly the level of female participation has also been significant in both manufacturing and other service sectors (Table: 5.1.28 & 5.1.29).

(p) Conclusion

People engaged in manufacturing industries are mostly skilled who often commute from urbanized area thus locating the industries along transport corridor becomes crucial.

The share of Male and Female participation in the other service sectors which have been witnessing higher growth.

(q) Income level of the people in CMA settlements

Income levels prevailing in the settlements of different sizes indicate the economic status of the people as well as the local bodies. More often information on Income levels is not accurate. National Informatics Center has collected information about income levels in different settlement sizes as given in the Table 5.1.30. The minimum is Rs.2265 per month. It may be noted that in almost all the settlements, the percentage share of people falling in the higher income group gradually reduces.

All the settlements have all the ranges of income, but the percentage share of people living in settlement having various income levels differ. The higher the income level the lower the percentage of people in that category.

Income levels Rs. / month	No. of settlements falling in various income percentages of people			
	0-20%	21-40%	41-60%	61-80%
Upto 2265	6	9	17	1
2265 to 3500	12	22	3	--
3500 to 4800	18	13	2	1
Above 4800	21	4	3	1

Table 5.1.30 b Income levels and the distribution of settlements

Source: National Informatics Centre

(r) Conclusion

Income level determines the affordability for housing, transport and other facilities. It is the affordability that essentially determines the location of housing for a vast majority of the people. It is found that the section of population earning more than Rs.4800 per month at 1995 prices is far less living in the far off settlements. Thus affordability becomes a crucial factor in deciding the housing location.

(s) Land use and Land holding

The extent of land under agricultural use and non-agricultural use determines the activity pattern in the settlement. It is often found that Revenue records may be showing several pieces of land as under agricultural use, but the actual use may be different. Pressures and compulsions which are the prime reasons for the exodus of the urbanites to seek cheaper land to put up housing results in indiscriminate conversion of agricultural land for development of non-agricultural uses.(Table.5.1.31 annexure I)

Sl.no.	% Share of Agriculture (in ha.)	No. of settlements falling in the range	
		Nos.	Percentage
1.	0-10	28	54
2.	11-20	8	15
3.	21-30	6	12
4.	31-40	4	7
5.	>41	6	12
Total		52	100

Table: 5.1.32 Share of Agriculture Land use in 52 settlement of CMA.

Source: National Informatics Centre

It may be seen from Table: 5.1.32 that maximum share of agricultural land is in the order of little more than 40 percent of the total land in only 6 settlements. The rest 46 settlements have less than 40 percent land in agricultural use. The predominant share (28 settlements) is up to 10 percent of the total land.

Similarly land holding in majority of the cases (90 percent of the settlements) is less than 1 ha only. The economic opportunity offered by the Real Estate Development is more often lucrative to the cultivators / owners for the following reasons;

- Lack of availability of labour
- Cost of labour
- Increase cost of agricultural inputs
- Non availability of financial assistance.
- Dependence on power for irrigation
- Pressure from the developments in the surrounding area
- Immediate financial returns

Thus small land holdings is vulnerable for conversion.

(t) Conclusion

Weak local bodies and ineffective administrative control mechanism have rendered the conversion of land for non agricultural use easy. It became rampant causing great environmental damage.

The issue at this stage is whether to halt such conversion? Or streamline such conversions so that it conforms to environmental standards?

(u) Agricultural Produce

It is interesting to find that in spite of irresistible pressure for conversion of land for non-agricultural use some agricultural activities are taking place if not to the same degree that prevailed in the olden days. The Table 5.1.33 (annexure I) shows the crop details cultivated in many settlements even though the land holdings are small. The predominant crop that is being cultivated is paddy. It is to be noted here that Chennai Metropolitan area had a very good network of small and medium lakes for

storage and use for agricultural activities. Unfortunately most of the lakes which were once the source for irrigation have all been encroached upon for other uses. The major sufferer is the agriculture besides, environmental degradation, flooding, depletion of ground water and water pollution. Most of the settlements where the paddy was grown once had surface water irrigation facility and today the irrigation is by lift irrigation from deep bore wells. Thus, the number of crops grown per year (earlier three) has come down to only one crop per year. Besides other reasons of non-availability of adequate ground water is the major reason for the dismal state.

In very few settlements paddy, cash crops vegetables and flowers are grown, in most of the other settlements it is only paddy and cash crops. All the marketable agricultural produce come to city market for consumption. The southern railway which runs EMU trains in three directions (North, West and South) has special coaches attached to the metro trains to facilitate farmers to bring agricultural produce to the city markets. At important stations on all the three railway lines, there are special markets to avail fresh vegetables flowers and farm products. Road Transport is also used by the farmers whose settlements are little away from the major rail corridor.

(v) Livestock

Most of the settlements have cattle's to supply milk. The entire quantity of milk produced Table 5.1.34 (annexure I) is either locally consumed or sent to the nearest bigger settlement for consumption. However poultry farms supply birds and eggs to the city. Local interaction reveals that cattle farming, sheep / goat rearing and poultry are not carried out on an extensive scale. It is mostly looked after by women folk who are not engaged otherwise in organized sector activities.

5.1.1 Identification of Peri-urban Settlements

To test the validity or the reasonableness of the indicators suggested in Chapter - 2, a comparison with the information obtained for the 52 settlements has been made. The Table 5.1.35 (annexure I) shows the socio-economic indicators for the 52 settlements and the status of the settlement. If more than 75% of the indicators indicate urban the settlement is classified as 'urban'. If between 25% and 75% of the indicators show urban it is classified as peri-urban. If less than 25% of the indicators show urban it is classified as rural. Similar exercise has been carried out for the Agriculture Indicators (Table: 5.1.36(annexure I)) and the Infrastructure Indicators (Table: 5.1.37(annexure I))

The Table: 5.1.38 (annexure I) shows the consolidated statement of the status of 52 settlements in CMA. As per the Census of India definition all the 52 settlements are classified as Urban. However, on comparison with the Socio-economic(12), Agriculture(6) and infrastructure(10) indicators, settlements exhibited either urban or periurban status and none of the settlements showed rural status.

The Table: 5.1.39 shows Civic Status and assigned status of 52

settlements in CMA.

Sl.no.	Civic Status	No. of Settlements	Assigned Status		
			Urban	Periurban	Rural
1.	Municipality	8	7	1	-
2.	Town Panchayat	27	13	14	-
3.	Census Town	17	8	9	-
TOTAL		52	28	24	-

Table: 5.1.39 Civic status and assigned status in 52 settlements of CMA

Source: Census of India 2001

If a settlement is found having the same status (Urban/Peri-urban/Rural) in any two category of indicators, then it is said to be having that status. It is observed from the Table (5.1.39) that there are 24 settlements falling in the category of peri-urban area out of 52 settlements. One settlement namely Madhavaram which is classified as urban by Census of India and having a status of Municipality is indicated as peri-urban. Similarly 14 town panchayats and 9 census towns are identified as periurban against the classification by census of India. While the socio-economic and agriculture indicators have played a major role in identifying Peri-urban status of settlements, the transportation accessibility indicators under the infrastructure indicators have also played a crucial role.

The Fig:5.1.18 (annexure I) shows the location of peri-urban areas among the 52 settlements.

5.2 Case Study 2

5.2.1 Socio-economic Characteristics in 80 Rural settlements in CMA

In order to further understand and test whether the peri-urban areas identified under case study I truly represent the peri-urban character or not a further selection of 80 settlements was made for analysis and comparison with results of case study I. The fig 5.2.10 (annexure I) shows the location of settlements. According to census of India these settlements are classified as rural within the metropolitan region. The latest census data (2001) is yet to be made available and therefore, the data collected by National Informatics Centre in 1995 is made use of for all the eighty settlements. Some of the data is not available for a few settlements and therefore analysis is made only for the settlements for which data are available. It is also important to note that these eighty settlements continue to remain as rural as per census of India, since for all the settlements identified as urban within CMA, the latest census (2001) provides data.

(a) Comparative Analysis**(i) Literacy Rate**

Often the literacy rate prevailing in the settlement is the measure of economic well being of the settlement as gainful employment is decided by the literacy level. Further any developmental program depends on the literacy level of the people of the settlements.

Sl.no.	Literacy rate range %	Number of settlements	%
1.	0-20	12	16
2.	21-30	6	8
3.	31-40	22	29
4.	41-50	16	21
5.	51-60	14	18
6.	61-70	6	8
Total		76	100

Table: 5.2.11 Range of Literacy rate and settlement distribution

Source: National Informatics centre.

A comparative analysis of the literacy level prevailing in the Peri-urban / urban and the rural settlements located adjacent to the urban and peri-urban settlements shows that in the former case almost all the settlements have shown a literacy level of more than 80 percent, whereas in the later, almost all the settlements have registered less than 60 percent. Predominance is seen in the 30-40percent range (Table 5.2.11). This clearly indicates that inspite of the locational advantage within the metropolitan region the literacy level is lower and the settlements are yet to achieve the status of Peri-urban. (Refer table 5.2.10, annexure I)

ii) Workers Participation Rate and dependents share:

Workers participation rate is found to be less in the rural settlements compared to the Peri-urban/urban settlements. Majority of the settlements (about 50percent) (Table:5.2.12) fall below the level of 30 percent participation.

Another 30 percent of the settlements fall in the category of 30-50% participation. Since the literacy level is also low in many of the settlements, the participation is mainly in the agriculture oriented activities. The Table 5.2.14 indicates the share of male and female in the workforce. While the workers participation rate itself is found low, the share of male workers is more pronounced is 65 percent of the settlements to an extent of 54-75 percent participation range, and the share of female workers to an extent of 26-50 percent is pronounced in 65 percent of the settlements. To an extent of 54-75 percent participation range, and the share of female workers to an extent of 26-50 percent is pronounced in 65% of the settlements. The male workers participation is found to be more. The Table 5.2.15 shows the dependents

share. The highest share (76%-100%) is shown by 35 percent of the settlements followed by 42 percent of settlements

Sl.no.	Range of workers participation rate %	Number of settlements	%
1.	0-30	34	49
2.	31-50	21	30
3.	51-70	8	11
4.	>71	7	10
Total		70	100

Table:5.2.13 Range of workers Participation rate and settlement distribution

Source: National Informatics Centre

in (51-75%) range. It is therefore seen that the dependents share is highly pronounced in rural settlements, unemployment is also a reason for higher share of dependents.

Sl.no.	Range of Workforce-Male/Female participation%	Participation Rate			
		Male		Female	
		Number of settlements	%	Number of settlements	%
1.	0-25	0	0	24	32
2.	26-50	6	8	49	64
3.	51-75	49	65	3	4
4.	>75	20	27	0	0
Total		75	100	76	100

Table:5.2.14 Workforce-Male and Female Participation in 80 settlements of CMA

Source: National Informatics Centre

Sl.no.	Range of Dependents share rate %	Number of settlements	%
1.	0-25	5	7
2.	26-50	12	16
3.	51-75	31	42
4.	76-100	26	35
Total		74	100

Table: 5.2.15 Range of Dependents Share

Source: National Informatics Centre

Sl. no.	Range of Agriculture and Non-agriculture workforce %	Number of settlements Agriculture workforce	%	Number of settlements Non-Agriculture workforce	%
1.	0-25	7	9	44	55
2.	26-50	7	9	22	27
3.	51-75	22	27	7	9
4.	76-100	44	55	7	9
Total		80	100	80	100

Table:5.2.16 Share-range of Agriculture and Non-agriculture workforce and the settlement distribution in CMA

Source: National Informatics Centre

The Table:5.2.16 shows the share of agriculture and non-agriculture workforce is found to be more than 50 percent in 82 of the settlements and only 18 percent of the settlements are in the non-agriculture sector. This establishes predominance of agriculture activities in the settlements.

iii) Agriculture Work Force

The Table 5.2.17(annexure I) shows the workforce details for the agriculture sector. The Table:5.2.18 shows the number of settlements having various ranges of agricultural workforce share.

Sl.no.	Range of Agriculture Workforce %	Number of settlements	%
1.	0-25	3	4
2.	26-50	5	7
3.	51-75	22	29
4.	76-100	45	60
Total		75	100

Table:5.2.18 Range of Agriculture workforce and distribution of settlements

Source: National Informatics Centre

The Table: 5.2.18 indicates the number of settlements falling in different ranges of Agriculture workforce. The share of settlements having more than 50% of the workforce engaged in agriculture is 89 percent. In which 60 percent of the settlements are having agriculture workforce in the range of (75-100) percent.

This is quite contrary to the findings made from the study of Peri-urban/urbanized settlements in CMA (case study I) where the share of agricultural labourers has not exceeded 18 percent in any of the settlements.

It can safely be concluded that these settlements clearly fall in the category of rural area, which are likely to be taken over by the forces of urbanization gradually. (Table 5.2.17- annexure I)

The share of Agriculture cultivators is comparatively less (Table: 5.2.19) than the share of labourers. Forty-five percent of the settlements have shown the share of cultivators in the range of 0-20 only following 27 percent in the range of 21-40 percent. Whereas, the share of labourers in the range of 76-100 is found in 51 percent of the settlements. Since cultivators are also the owners of land, the share is less compared to labourers. Landless labourers and jobless agriculture labourers are more prevalent in the rural areas of CMA.

Sl.no.	Range of Cultivators share %	Number of settlements	%
1.	0-20	34	45
2.	21-40	20	27
3.	41-60	11	15
4.	61-80	10	13
5.	>81	-	-
Total		74	100

Table:5.2.19 Range of Agriculture Cultivators share and settlement distribution

Source: National Informatics Centre

Sl.no.	Range of Agriculture-Labour Share %	Number of settlements	%
1.	0-25	2	3
2.	26-50	15	20
3.	51-75	20	26
4.	76-100	39	51
Total		76	100

Table: 5.2.20 Range of Agriculture labourers share and settlement distribution

Source: National Informatics Centre

(iv) Non Agricultural Employment Status

The non-agriculture sector constitutes Manufacturing and Household Industry and other services. The status is as shown in Table:5.2.21(annexure I) and Table 5.2.22

While the share of Non-agriculture workforce itself is not exceeding 25 percent in majority of the settlements, the range of workforce engaged in Manufacturing and Household industry is 0-20 percent. Which is less significant. Again 93 percent of the settlements have shown a share of percent workforce in other services. The share of people engaged in service sector is more pronounced compared to manufacturing sector. In real terms, the number of persons employed in both sectors, is less significant.

Sl.no.	Range of Workforce in Manufacturing and HHI %	Number of settlements	%
1.	0-20	65	91.5
2.	21-40	5	7.0
3.	41-60	0	0
4.	61-80	1	1.5
5.	>81	0	0
Total		71	100

Table: 5.2.22 Range of workforce in Manufacturing and Household Industry and the distribution of settlements

Source: National Informatics Centre

Sl.no.	Range of Workforce in Other services %	Number of settlements	%
1.	0-20	0	0
2.	21-40	0	0
3.	41-60	0	0
4.	61-80	5	7
5.	>81	66	93
Total		71	100

Table:5.2.23 Range of workforce in Other services and the distribution of services

Source: National Informatics Centre

(v) Income Level

The income levels prevailing in the settlements indicate the economic health of the people living in the settlement.

The predominant income level seems to be Rs.2265 per month in more than 50 percent of the settlements. As the income range increases (fig.5.2.12), the number of settlements falling in the income range decreases. The income scenario when compared to the Peri-urban/urbanized area is certainly less as the settlements are villages. The number of settlements falling in the income range of more than Rs.3500 is more. (Table 5.2.24 Annexure I).

(vi) Land Use

All the settlements have a significant share of agricultural land. About 41 percent of the settlements have more than 50 percent of the land classified as agricultural land. While 25 percent of the settlements have agricultural land share in the range of 26 to 50 percent, 31 percent of the settlements have less than 25 percent share of agricultural land. This clearly establishes the predominance of agricultural activities. (Table 5.2.25 annexure I).

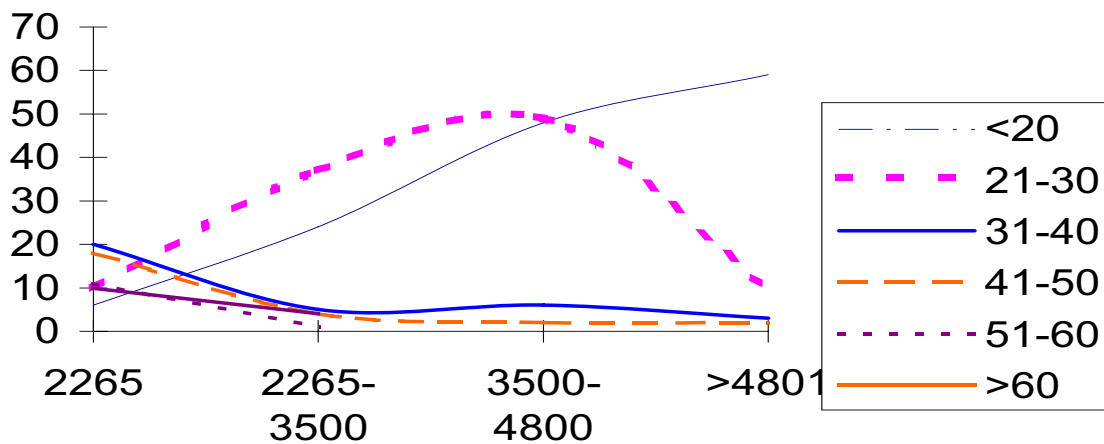


Fig.5.2.12 Income Category

Sl.no.	Range of Agriculture Land Share %	Number of settlements	%
1.	0-25	23	31
2.	26-50	21	28
3.	51-75	13	17
4.	76-100	18	24
Total		75	100

Table:5.2.26 Range of Agriculture land share and the distribution of settlements

Source: National Informatics Centre

(vii) Agricultural Produce

Villages having significant share of agricultural land and labourers produce varieties of agricultural produce. However, the predominant produce. (Table 5.2.27 annexure I) is paddy coupled with vegetables and flowers. Almost all the villages produce paddy in varying quantities depending upon the availability of water. The nearest market for these produce is the major municipalities, town panchayats and then the Chennai city.

(viii) Cottage and Food Industry

Pottery, fireworks, bidi (country cigarette) and hosiery manufacturing are the common cottage industries found in 15 percent of the villages. The women participation is the highest and it provides not only employment during lean seasons of agricultural activities but also a good source of income. More than half of the settlements contribute poultry and dairy products to the city population. (Table 5.2.28 annexure I)

5.2.2 Conclusion

The exclusive analysis of the Socio-economic characteristics prevailing in the rural areas and the comparison with the Periurban areas indicate that though the rural areas are adjacent to Periurban, the socio-economic characteristics and the activity pattern etc. differ marginally from periurban. The Table 5.2.29 (annexure I) shows the rural settlements and a few peri-urban settlements identified on comparison with the peri-urban indicators formulated in chapter-2.

The Table 5.2.29 shows the settlement status where in only one settlement is urban, 8 are periurban settlements and the rest (71) are rural settlement. The settlements are predominantly rural (Fig.5.2.11) in status.

Though these settlements are classified as rural as per Census of India definition, there are a few urban and peri-urban settlements identified as per the indicators formulated for the study.

5.3 Case Study 3

5.3.1 Comparative Study of three settlements in CMA

(a) Introduction

The process of urbanization has resulted in varying degree of infrastructure development in different settlements of CMA. To appreciate the level of infrastructure vis-à-vis the socio-economic characteristics, three settlements of urban, Peri-urban and rural character have been selected based on the outcome of the case study 1 and studied. The case study results are as described subsequently.

(b) Characteristics of three settlements - a pilot study report

In order to compare the Socio-economic and service facilities prevailing in three types of settlements falling in the category of urban, peri-urban and rural, a pilot study has been undertaken referring to the Socio-economic survey conducted by CES consultancy Pvt.Ltd. in selected settlements of CMA. Tambaram is one of the settlements falling in urban category and is about 27km from the city centre. Tambaram is well served by both road and rail along the Southern corridors. A settlement falling in the Peri-urban area, called Poonamallee is also about 28km from the city centre. Poonamallee is on a major National Highway on the West. The settlement falling in a rural area is called Sirugavoor which is also about 25 km from the city centre served by bus service along Northern corridor (Grand North Trunk Road). The fig.5.3.10 (Annexure I) shows the location of the three settlements.

(i) Type of housing

The type of housing is an indicator of the general income and living standards of people of a settlement. Housing environment also speak about the level of infrastructure facilities available in the settlement. The Table

5.3.10 shows the type of housing prevailing in the three selected settlements. A sample of 200 households has been surveyed.

Housing condition	Name of the settlement and nature of the area					
	Tambaram (Urban)		Poonamallee (Peri-urban)		Sirugavoor (Rural)	
	Houses	Percent	Houses	Percent	Houses	Percent
Pucca	31	15.5	39	19.5	1	0.5
Semi-pucca	120	60	150	75	77	38.5
Kutcha	49	24.5	11	5.5	122	61.0
Total	200	100	200	100	200	100

Table 5.3.10 Type of housing in the three settlements

Source: Socio-Economic Survey Report, CES Consultancy, India Pvt.Ltd. May 1994.

The Table 5.3.10 shows the type of housing stock that prevails in the three settlements. Pucca housing is a full-fledged cement concrete housing is found to be rare (0.5percent) in a rural settlement, whereas it is found more (19.5percent) in Peri-urban area even when compared to the urban area (15.5percent). Peri-urban area being the most attractive location for housing in view of several advantages has been witnessing construction of more pucca houses.

The percentage share of semi pucca housing in the Peri-urban area is observed to be more than the urbanized area similar to pucca housing indicating, the gradual improvement of kutcha houses in to semi pucca houses. Semi pucca houses are less in the rural area.

The kutcha housing is more prevalent in the rural settlement and in the urban area settlement, whereas it is less in the Peri-urban area. In the case of rural area it is the agricultural labourers who are economically weaker, own these houses, whereas in the case of urbanized area it is the slum dwellers who are employed in unorganized sector occupy these houses.

(ii) Type of streets

A comparative study of the type of streets prevailing in the three settlements is revealed in the Table 5.3.11

Type of street	Name of the settlement		
	Tambaram (Urban) (percent)	Poonamallee (Peri-urban) (percent)	Sirugavoor (Rural) (percent)
Kutcha	---	---	---
Gravel	---	--	100
Water bound	---	20	---
Asphalted	100	80	---

Table 5.3.11 Type of streets

Source: Socio-Economic Survey Report, CES Consultancy, India Pvt.Ltd.

The urbanized area has the advantage of having 100 percent asphalted road, where as the rural area has only a gravel road. Peri-urban area has the

combination of both the gravel as well as asphalted road depending upon the land use and development character prevailing in the area and also the local government financial position. Thus the urban and rural characteristics are well established in the Peri-urban area.

(iii) Education status

Tamil Nadu in general and Chennai Metropolitan Area in particular are found to be having highly literate population. The pilot study results indicate the education status prevailing in the three settlements as shown in the Table 5.3.12

Education Status	Name of the settlement					
	Tambaram (Urban)		Poonamallee (Peri-urban)		Sirugavoor (rural)	
		percent		percent		percent
Illiterate	29	5	39	9	40	9
Literate	38	10	52	12	81	20
Up to Hs	223	59	284	65	269	62
Up to Hr. Sec	37	9	35	8	19	5
Graduate	31	8	23	5	17	4
Post graduate	10	3	5	1	---	---
Professional	8	2	---	---	---	---
Technical	4	1	---	---	---	---
Total	438	100		100		100

Table 5.3.12 Education Status

Source: Socio-Economic Survey Report, CES Consultancy, India Pvt.Ltd.

It is generally believed that opportunities for education are more in urban area compared to Peri-urban and rural area. However, the pilot study results have shown different scenario. While the illiteracy level is found to be in the range of 8 to 10 percent in all three areas, the literacy level seemed to be more in the rural area because of aggressive education policies like the 'Arivoli Iyakkam' and elder's education scheme etc. These evening programs seemed to be appealing to the rural segment in view of the work and leisure regime prevailing in the rural area where as the situation is different (lack of time due to informal sector employment) in both urban and Peri-urban area. The education scenario up to the level of High School and higher Secondary level seemed to be almost at the same range (60-65 percent) in all the three settlements. Clearly urbanized area has the potential for people having post graduate education, professional education and technical education.

(iv) Employment

Employment structure prevailing in the three settlements reveals the type of settlement. It is very clear from Table 5.3.13 that the Peri-urban settlement, which is undergoing fast urbanization, has a large share of business and service people followed by Urban area. Though the people

belonging to these two sectors live in the Peri-urban area, they will be commuting to the city for their daily work. The professional employment is pronounced where in the urban area. The labour force is also more in the urban area, obviously from the slum areas.

The rural settlement enjoys a large share of farmers, farm workers and labourers and professionals are virtually absent.

Employment sector	Name of the settlement		
	Tambaram (Urban) percent	Poonamallee (Peri-urban) percent	Sirugavoor (rural) percent
Service	26	42	6
Business	35	40	6
Professional	9	2	---
Farmer	1	6	17
Labourer	17	7	44
Farm worker	10	3	27
Total	100	100	100

Table 5.3.13 Employment structure

Source: Socio-Economic Survey Report, CES Consultancy, India Pvt.Ltd.

(v) Water supply

Source and type of supply

In Chennai Metropolitan area water supply system has several sources and types. The Chennai city receives water from surface sources (lakes). Treated water is supplied through pipe lines and stand post, during normal years of rainfall. However during dry reasons, deep bore well water is subject to marginal treatment and supplied. Similarly settlements along the periphery of the city also receive piped supply from deep bore wells rarely treated. The source is either deep bore well or dug well.

In the case of the settlements selected for the study purposes a total of 300 households were selected for interview and the study analysis reveal the following as shown in the Table 5.3.14.

It is observed that Tambaram which is an urban area receives house pipe supply to an extent of 63 percent and 37 percent is only through stand posts located in streets. Poonamallee which is classified as a Peri-urban area receives water supply by house connections only to an extent of 47 percent and the rest through stand posts (Street taps). In the case of Sirugavoor which is a village house connection is only to an extent of 29 percent and the rest through stand posts. House connection is the indication of the affordability level of the residents as the water is priced and collected, where as in the case of stand posts a nominal tax is collected along with the property tax. The better the affordability of the residents and the financial health of the local body determine the extent of water supply coverage in the settlement.

Poonamallee gets more supply through public supply system both by

house connection as well as stand posts. Tambaram gets less through public supply system and supplemented by private deep bore well water as well as dug well water.

Sl.No.	Name of the settlement		Public water supply	Private Bore well supply	Private Dug well	Total
1	Tambaram (Urban)	House pipe	15	38	10	63
		Stand post	32	3	2	37
						100
2	Poonamallee (Peri-urban)	House pipe	42	2	3	47
		Stand post	40	13		53
						100
3	Sirugavoor (Rural)	House pipe	--	29	---	29
		Stand post	---	71	---	71
						100

Table 5.3.14 Source and type of water supply

Source: Socio-Economic Survey Report, CES Consultancy, India Pvt.Ltd.

The Sirugavoor entirely depends on the deep bore water. In the absence of any surface source all the three settlements are supported by ground water. Water to the public supply system is mostly drawn from riverbeds from a far off places under various schemes.

(vi) Toilet facility

Sewerage system is totally absent outside the City area. Even within the city several pockets do not have the facility of a sewer connection. In all the three settlements which are lying outside the city sewer system is totally absent. However, Toilet or the Latrine with septic tank is the most commonly used system in the CMA. On interview of 100 households in each category of settlement it is ascertained that 74 percent in Tambaram and 81 percent in Poonamallee use Latrines with septic tank. In sirugavoor all the interviewed said that there is no such Latrines in the settlement. In the case of Tambaram (26percent) and Poonamallee (19percent) do not have any of these latrines. These people may be slum dwellers in Tambaram as it is an urbanized area, and poor agricultural labourers in the case of Poonamallee as it is a Peri-urban area. For the slum dwells and the agricultural labourers public toilets are the only option.

Poonamallee (Peri-urban area) has better sanitary facilities when compared to Tambaram urbanized area) because of development of new housing stock. In terms of sanitary facility Poonamallee people are better off than in Tambaram. In the case of Sirugavoor, it is yet to get the attention of the local body.

(vii) Disposal of waste water

Often wastewater from households is let off improperly to the detriment of health of the residents themselves. Several type of wastewater disposal is followed in the CMA. The type that is followed is as given in the Table 5.3.15.

Disposal type	Tambaram (Urban)	Poonamallee (Periurban)	Sirugavoor (Rural)
a. Connected to sewer	-	-	
b. Connected to drains	65percent	64percent	
c. Use it for kitchen garden	1percent	16percent	
d. Collection in cesspool and disposal	-	1percent	
e. To allow it to stagnate near the house	32percent	18percent	
f. Let it into the street	2percent	1percent	

Table 5.3.15 Type of wastewater disposal in the study area

Source: Socio-Economic Survey Report, CES Consultancy, India Pvt.Ltd. May 1994.

It is observed that while the extent of connection to the drains (mostly open drains) along the sides of streets stands at the same level (65percent) in Tambaram and Poonamallee, Usage for gardening purposes is observed to be more in the Peri-urban settlement (Poonamallee) when compared to Tambaram as well as Sirugavoor. While collection in pools and disposal does not seem to be in practice in both the settlements Tambaram and Poonamallee, allowing it to stagnate or run through the street seems to be more in the case of Tambaram than in Poonamallee. Sirugavoor settlement does not seem to face the problem as Latrines are totally absent and other activities like, bathing, washing etc are normally carried out near the wells in the agriculture fields.

(viii) Solid waste disposal

Solid waste disposal has been a major problem for the city as more often peripheral areas are resorted to for land filling. Land filling often pollutes the ground water and the water becomes unusable even for agricultural purposes. The system of solid waste collection in the three settlements is as shown in the Table 5.3.16

Collection of solid waste in bins at home and disposing it of when local body trucks come for collection is almost nonexistent in Poonamallee (4percent) than in Tambaram. However throwing the solid waste into the bins placed in the street seems to be common in both Tambaram and Poonamallee, though little more pronounced in Poonamallee. But disposing it on to the street and open space seems to be practiced in the Peri-urban settlement (Poonamallee) than in the urbanized Tambaram. In the case of Sirugavoor the entire solid waste is disposed off in the open area as open area is more abundant in villages and Peri-urban areas.

While Tambaram and Poonamallee both have a system of garbage

collection introduced by the local body, the practice of daily collection seems

Sl.No.	Type of disposal percent			
	Collection in bins at home	Collection in bins in the street	Throwing into the street	Throwing into the open area
Tambaram (Urban)	30	53	17	--
Poonamallee (Peri-urban)	4	62	24	8
Sirugavoor(Rural)	--	--	--	100

Table 5.3.16 Solid waste disposal

Source: Socio-Economic Survey Report, CES Consultancy, India Pvt.Ltd.

to be absent. The practice is to collect once in two days or once in a week. Sirugavoor does not seem to have a system of collection at all. Residents of the three settlements when asked to prioritize their most important civic needs. While the Tambaram residents prioritized, water supply, improvement to housing stock sewer system, electricity etc, the Peri-urban area has placed importance on the road network.

(c) Conclusions

Pucca housing stock is observed to be more in Periurban area which is experiencing rapid growth. As the periurban area is undergoing conversion from rural to urban the semipucca housing stock is also found to be higher. The rural area accommodating maximum share of kutcha housing.

The urban area enjoys the asphalt roads, where as the periurban area is served by both Asphalt as well as water bound Macadam roads. The rural roads remain as mud roads.

The Peri-urban area and the rural area enjoy higher literacy rate, however education level beyond higher secondary level is certainly more in the urban area.

The periurban area has a larger share of people employed in service and business sectors, when compared to urban area, where as the urban area have a higher share of professionals. The rural area is having a significant share of labourers and farm workers.

All the settlements in the CMA excepting Chennai city do not get treated water but water from deep borewells is supplied through pipes. Here, again the urban area has a major share of individual house connections and the rest is street stand posts. The opposite is true in the case of periurban area. For the rural; areas, street stand posts is the only source of piped supply, otherwise they mostly depend on open wells, lakes etc.

- Chennai city enjoys sewerage system where as the rest of CMA does not have the facility. It is only the latrines that is prevalent in urban and periurban area and the rural area does not even have this facility.
- Open drains are common both in urban and periurban area both for waste water disposal as well as for storm water. The rural area does not have even open drains facility.

- While some kind of a system of solid waste collection is in place in both urban and periurban area, the disposal is only through landfills (not scientifically carried out) or burning. Rural area does seem to have neither large scale waste generation nor disposal problems.

5.4 Case Study 4

5.4.1 Interaction with locals of 11 settlements

(I) Introduction

The case study 4 is a major effort undertaken to interact with the locals to understand several socio-economic characteristics relating to employment mode of transport energy consumption etc. Here 220 persons of varying educational and socio-economic background have been contacted and their views ascertained.

(II) Peri-urban area - Characteristics

The Table 5.4.10 (annexure I) shows the basic details of the 11 settlements (Fig.5.4.10 annexure I) 11 settlements. These settlements are all located at the periphery of the Chennai Metropolitan Area along major transport corridors.

The settlements (11) have been selected based on the civic status (Town Panchayat, Panchayat Union and Village Panchayat) as well as assigned status through the indicators suggested in chapter 2. having population in the range of 15000 - 20000, 5000 - 10000 and < 5000. The distance of these settlements is 0-5km from major transport corridors (road / rail or both) along the three major directions. The status of the settlements is found to remain the same even on application of revised set of indicators (12) instead of 26 indicators.

(a) The population distribution among the settlements vary from 1100 to 9000 persons and correspondingly the basic factors also indicate variance. The density, obviously is more (3000 persons / sq.km) in all the settlements having a population of more than 15000 and it is very less in smaller settlements in the range of 243 to 857 persons / sq.km. The densification of population is more in settlements nearer to the major rail and road corridors. As the distance from the transport corridor increases, the density drastically reduces as transport accessibility is limited. The literacy rate is observed to be higher in settlements having higher population in general. But settlement having comparatively less population also has shown higher literacy rate (Nandambakkam 90 percent - periurban settlement)

(b) Literacy level is observed to be less than 50 percent in many of the villages (Rural). This may be due to the poor economy prevailing in the rural areas. (Table 5.4.11 annexure I)

(c) The workers classification indicates almost similar trends in all settlements 30 to 50 percent of the population is found to be the work force. But the work force engaged in agricultural activity (both cultivators and labourers) are the highest in the rural segment where the population is less

than 5000. Whereas, the share of agriculture labour force in higher order settlement (peri-urban) does not exceed 9 percent and zero in most of the settlements. While higher order settlements (peri-urban) show a share of 1 to 5 percent in manufacturing sector and the rest in all other service sector similar to trade and commerce, transport, construction etc., in the case of rural segment the share of manufacturing sector workers is almost zero. This clearly established the case that where there is opportunity for employment, the population densification and consequent Peri-urban formation takes place. Similarly it is observed that the dependent population is in the range of 80 to 90 percent in settlements having higher population (more than 10000) where as in the settlements having population less than 5000, the dependents ratio is in the range of 50 to 80 percent. This may be due to engagement of people in as casual labourers in several of the non agricultural sector activities. Similarly the agricultural land use is found to be less than 25 percent in higher order settlement (peri-urban) where as in the rural segment it is more than 60 percent. (Table 5.4.12 annexure I)

The settlements which are at different stages of urbanization and falling in the Peri-urban category at present and settlements which are likely to become Peri-urban in the near future tend to exhibit several characteristics in terms of employment, travel characteristics etc.

Twenty people in each settlement having different educational and social back round were interviewed to find some of the socio economic characteristics not found in census records. The analysis of the data collected according to the size of the settlement is as given below. The assigned status as urban, peri-urban and rural is also mentioned for all the 11 settlements as per the case study I & II.

(d) The Table 5.4.11(annexure I) shows the education status of the people interacted with in the 11 settlements. Here 93 percent is found to have acquired education through formal educational institutions and the rest (7percent through informal education system. Upto undergraduate level of education there appears to be not much of variation in all the settlements and a few settlements (peri-urban) seem to have the benefits of post graduates too. Peri-urban settlements in particular have registered higher share of undergraduates. Through none of the settlements have achieved 100 percent literacy, the education / literacy level is found to be more than 90 percent which is significant from the point of view of educating the people on environmental issues relating to sustainable development. By and large the level of education is understood to be the key to get gainful employment.

(e) The Table 5.4.12 (annexure I) shows the employment structure of those interacted with. While unemployment and self employment occupy a major share in all the settlements irrespective of the size, people employed in industry is found to be in the order of 10 to 20 percent in only seven settlements out of the eleven. The share from higher order settlements (urban & peri-urban) is comparatively less than the lower order settlements. Peri-urban areas have shown higher levels of self-employment. The employment is mostly in the unskilled area. Jobs are predominantly the ones provided by the Government establishments. The employment shown as industry is unskilled

jobs on daily wages. Predominance of the people engaged in Government sector is found more in the settlements along the west and southern corridors, obviously in view of the higher degree of transport accessibility provided by both road and railway.

(f) The Table 5.4.13 (annexure I) shows the place of employment, in all the settlements a vast majority of the people in peri-urban areas are found to be locally employed. In the case of Vandaloor (it is a peri-urban settlement) only 57% of the persons interacted are found to be working locally and a significant share (22%) is also found to be working outside the settlement as Vandaloor is well connected by road and rail.

A small segment of the people interacted expressed that they go out of the settlement for jobs. Invariably it may be in the nearest bigger settlement, which is not far off from the native settlement. Another small segment of the people interacted with expressed that there is no fixed destination for work and wherever the job is available surrounding the native settlement they preferred to avail it.

(g) Since a vast majority is locally employed the maximum distance they travel for work is 5km (Table 5.4.14 annexure I). A small percentage of people do seem to travel beyond 5km for work. The opportunity is basically dependent on the availability of industry nearby. For a Peri-urban dweller it makes economic sense to avail jobs outside the settlements only when the wages are attractive after deducting for transport cost. The longer the distance the dependence on private mode or public transport is more which again is preferred based on cost.

(h) This is very well exhibited in the Table 5.4.15 (annexure I), which explains the mode of transport for work. Predominant mode of transport is observed to be walk and bicycle. However usage of bus and train are restricted in settlements where people seek employment outside the settlement as well as within the settlement depending upon the distance factor.

Tamil Nadu State in general and CMA in particular have the highest connectivity to the bus service. Almost all the rural areas are connected with bus routes with a frequency of buses every one-hour. Thus people in the settlements have better access for mobility.

(i) The household energy scenario is exhibited in the Table 5.4.16(annexure I) usage of LPG is wide spread in all settlements. However, people having less economic affordability use wood and kerosene. Availability of wood is common in all settlements as the type of wood (casuarina) normally used for cooking purposes is commercially grown and sold in the market. Economically weaker section people are often supplied with kerosene through civil supply outlet. However, during rainy season and at times of short supply many rural people use cowdung as an alternative, which is the cheapest source of fuel for cooking purposes.

Availability of electrical energy is common for the purpose of lighting and for the operation of other electrical gadgets. Electricity is not preferred for cooking, as it is not only expensive but also not suitable to the cooking practice followed in Indian kitchens.

(j) The Table 5.4.17 (annexure I) shows the presence of industries in the 11 settlements. Majority of the settlements have agriculture based depots and agriculture service centres. These settlements also produce Milk, Eggs and Meat in sufficient quantity everyday not only to cater to the local needs but also to the markets in the nearby bigger settlements.

(k) The Table 5.4.18 (annexure I) indicates the general income trend of the people living in the 11 settlements. It is seen that the higher order settlements exhibit higher proportion of people earning higher levels of income. The predominant income level falls in the category of upto Rs.2265/- month. The income level has a strong correlation with the size of the settlement and activity.

(l) In the Table 5.4.19 (annexure I), the land use disposition prevailing in the 11 settlements is as shown. The higher the settlement size, the less is the extent of land under agricultural use. In recent times, several of the educational institutions have bought large extent of land for institutional purposes thus rendering agricultural labourers jobless.

(m) The land holdings are predominantly in the range of less than a hectare (Table 5.4.20 annexure I). Urban pressure has been more on smaller land holdings so that development and sale of land for other purposes is easy. Landowners are often offered lucrative price for small parcels of land if located closer to transportation corridors.

5.5 Case Study 5

In the evolution of Peri-urban area, the population growth in the urban area is the primary force, which generates pressure on its formation. Once the pressure is generated, it is but natural that the most conducive location / direction is resorted to by the population to locate residence and new activities depending upon the cost and affordability. Thus Peri-urban areas re-organise itself as settlements, which have the blend of both urban activity and rural functions. The regeneration of these areas arises when the environmental impact is severely felt beyond sustainable levels. The natural resources land, water and air are not only exploited but also contaminated to various degrees by the Peri-urban development

5.5.1 Exploitation and Pollution of Natural Resources in Peri-Urban Areas

(I) Land

Land, the primary natural resource is often subject to, misuse, disuse and abuse too. Potential agricultural land, which has been offering food produce, is exploited extensively for non-agricultural use, particularly for residential purposes in the Peri-urban areas. Chennai Metropolitan area is a typical example.

The agricultural land share and water bodies have steadily declined from 1974; where as all the other uses have shown an increase

particularly the commercial, residential and industrial uses. (Fig 5.5.10 annexure I)

Sl.No.	Land category	Area (sq.km)			Percentage variation	
		1974	1986	1997	1974-1986	1974-1997
1	Residential	147	186	303	26	106
2	Commercial	22	35	68	59	209
3	Industrial	22	33	47	50	113
4	Waste land	60	47	82	33	37
5	Water bodies	104	102	89	-10.2	-14
6	Agriculture	813	715	379	-12	-29

Table.5.5.10 Land use changes in CMA from 1974 to 1997

Source: Dessertation Report - Institute of Remote Sensing, 2001.

(II) Land pollution

The fig.5.5.11 shows the location of sewage treatment and disposal points as well as solid waste dumping sites.

The city sewage is treated at five different locations as shown. The total handling capacity of these treatment plants is 751 MLD out which only about 100 MLD is used by industries after tertiary treatment for cooling purposes and the rest is let off in to natural watercourses.

Similarly the solid waste dumping grounds at Perungudi and Kodungaiyur handle about 3000 tons / day. The dumping of solid waste is taking place on public land or watercourses. Thus land and water are both polluted. Quarries create artificial ponds, which are misused and polluted causing diseases to animals and human beings. The brick kilns not only erode topsoil, but also renders good agricultural land fallow. The quarries are either in the peri-urban areas or closer to the peri-urban areas.

(III) Conversion of Tanks

(a) Process of Conversion

With rapid urban growth and extension of the city limits, the agricultural lands at the periphery are eaten away and along with it; the tanks which were earlier irrigating the lands also face threat of conversion. The catchment area gets the first priority to be identified for other purposes (residential in most cases), keeping in view of the settlement process, the density of developments nearby and the availability of enhanced infrastructure (proximity to the transportation corridors). The catchment area with its natural drainage pattern further enhances the site and its characteristic properties, making these tank lands highly suitable for large scale developments, where the density of built - up structures and paved surfaces reduce the flow of the surface run - off into the natural depressions nearby - "tanks". The tank lands (ayacut) dries up gradually to follow the

development trend and become largely vulnerable to squatter, temporary settlements which makes its appearance near to the tank - water spread area, risking the flooding and inundation problems during the monsoons. These temporary slums slowly pave the way for lucrative real estate activities and the mushrooming of unauthorized developments that pollute the water spread area becomes a common phenomenon. This further gives a momentum for encroaching on to the shallow portions of the tank, which have no physical demarcation (a bund / retaining wall), defining the boundary of the water body. (Refer Fig. 5.5.12 annexure I)

(b) Chronology of conversion (From 1940 -1995)

There were nearly 279 tanks in C.M.A. in 1940, when the city was in the early stages of urban growth and development, with an area of 77.21 sq.kms and a population of 0.865 millions. The conversion was predominantly within the city for planned developments by the governmental organizations. The conversion was on the western, southern corridors closer to the transportation lines and at the peripheral limits of the city. During 1980 -'95, the conversion process was markedly seen near the urban nodes of Ambattur, Avadi, Tambaram and at Manali and Alandur. (Refer fig. 5.5.13 annexure I)

(c) Rate of conversion

The tanks that have got converted for several purposes can be accounted to around 177 tanks (1940 - 2001). The conversion rate has gradually increased in 1940 - 1960 (Refer Fig. 5.5.14) and then a slow and gradual increase can be noted from 2.45 to 2.6 tanks per year. The rate of conversion of the tanks in C.M.A. is 3.6 per year (as on 1995 - 2001), which shows a sharp increase in comparison to the rate of conversion of 2.6 tanks per year in 1980 - 1990. which are also facing the urban pressures. Though the number of converted tanks has gradually decreased numerically from 69 tanks (1940 - 60) to about 22 tanks, the rate of conversion is on an increasing note, which poses a serious threat to the existing 102 tanks.

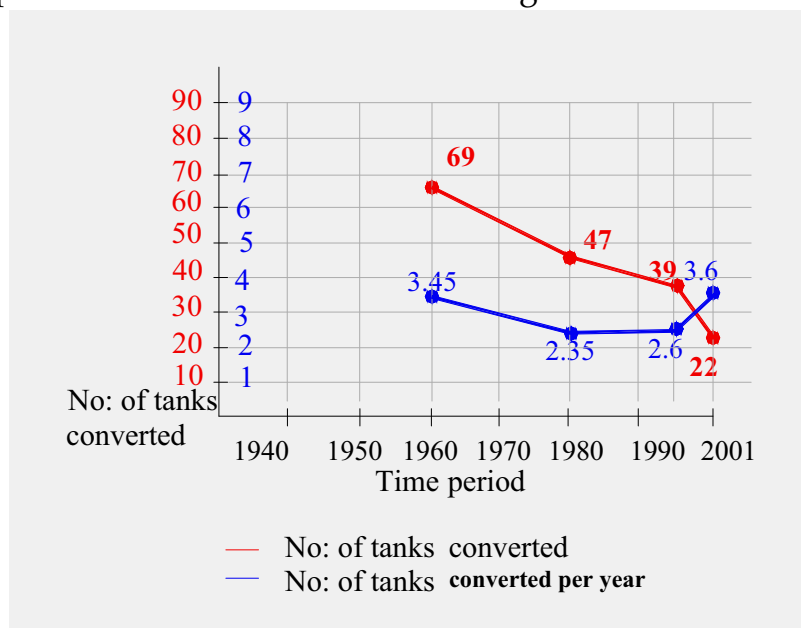


Fig.No: 5.5.14 Tanks and their conversion rate

(d) Factors influenced conversion

The various urban development projects (Sites and services, industrial estate establishments), demarcating of urbanisable zoning regulations on the master plan, introduction of enhanced infrastructure (transportation corridors) were some of the factors that governed the conversion process of tanks in C.M.A.

(i) Factor: 1 - Urban Growth

The growth in spatial terms - extension of the city limits (Refer fig. 5.5.13) and the increase in the population contribute to the urban growth of a city. There has been a steady increase in the population and the area of the city from 1901 to 1980, (from 68.17 sq. kms to 174 sq. kms) after which the city expanded in the form of urban outgrowths. (Refer Table no: 5.5.11) There has been a gradual decrease in the no: of tanks with a corresponding increase in the area and population of the city and its agglomerations.

YEARS	1961	1971	1981	1991	2001
Extent (Area in sq.kms) City	128.83	128.83	170	170	174
Population (in millions) City	1.73	2.59	3.28	3.8	4.21
CMA (excluding city)	2.33	3.48	4.63	5.3	6.42
Urban Agglomeration	1.94	3.16	4.2	5.36	
Growth Rate (Decadal) City	49.47	26.64	15.89	20.28	
No. of tanks that existed	210		163		102

Table no: 5.5.11 Tanks and urban growth factor

Source: Dissertation report 2003, School of Architecture and Planning.

The newly developed urban nodes were situated closer to the city on its periphery and nearer the transportation corridors. Correspondingly the land values increased due to these interventions and there was a mounting pressure on the tank lands near the developed areas (Velachery, Ambattur, Porur, Manali), to be taken up for development in various forms. (Refer Table 5.5.11)

Area	Land value per ground or 2400 Sq.ft.			
	Not legally sub - divided (in thousands)		Legally sub - divided and serviced (in thousands)	
	in 1975	in 1995	in 1975	In 1995
Manali	1.5	75	3	125
Ambattur	3	50	6	100-200
Avadi	3	150	3	100-200
Tambaram	3.5	75	5	200-300
Porur	3	100	5	250-300

Table No: 5.5.12 Land Values in C.M.A.

Source: Master Plan for M.M.A. - 2011

(ii) Factor: 2 - Urban Developments

Urban developments in the form of planned (from the Govt.) and unplanned (encroachments) developments have also influenced the conversion of tanks. Nearly half the area of the major tanks has been taken up for the residential projects (planned encroachments), (Refer Table no: 5.5.13), where the water retaining and storage function of the tank has said to be technically retained. The tanks were identified for such developments in view of the constraints placed by the World Bank on the availability of 50percent as Government lands and also to avoid alienation and cumbersome land acquisition procedures. Nearly 10percent of the total no: of tanks in C.M.A. have been utilised for the above scheme.

Name of the tank	Area taken for project	Percent area of tank covered
Velachery	125.45 acres	51.7percent
Ambattur	146 acres	40percent
Chitlapakkam	50 acres	19.5percent
Avadi	126 acres	15percent

Table No: 5.5.13 Sites And Services Scheme on Tanks

Source: Dessertation report 2003, School of Architecture and planning

These planned encroachments gradually led to the mushrooming of unauthorized developments on the tank lands and in several cases (Porur, Velachery, Ambattur, Chitlapakkam), the tank itself are being encroached. Nearly 22 tanks (20percent) have been encroached up to 50percent (Adambakkam, Porur, Velachery, Avadi) and 18 tanks have succumbed to the early stages of encroachments (Pulidhivakkam, Korattur). The offset of 1- 2 kms on either side of these transportation corridors helps to locate the tanks that could have a higher probability of getting encroached. (Refer fig. 5.5.15)

(iii) Factor: 3 - Transportation corridors

Tanks on the railway corridor were converted much faster during 1940 - 80, while the tanks nearer to the major roads are facing rapid conversions and encroachments in the recent years. The tanks converted on the railway corridor are 22 in comparison to the 17 tanks converted on the major road corridor.

The introduction of the by pass route from Irumbuliyur to Maduravoyal, the outer ring road project in conjunction with several other urban development projects introduced earlier (in various stages of completion) and varying parameters already discussed has also had a marked influence on the conversion of tanks from 1995 - 2001.

(iv) Factor: 4 - Spatial Distribution

Conversion of tanks along spatial rings at varying distances from the centre of the city, greatly follows the "distance - decay "theory (Refer fig.

5.5.15). The conversion has been gradual starting from the city to its periphery and extended parts. Tanks at a distance of 14 - 18 kms are currently facing conversion due to the gradually increasing rate of settlements, density of developments, cheaper land cost and also the progress in the occupancy rate

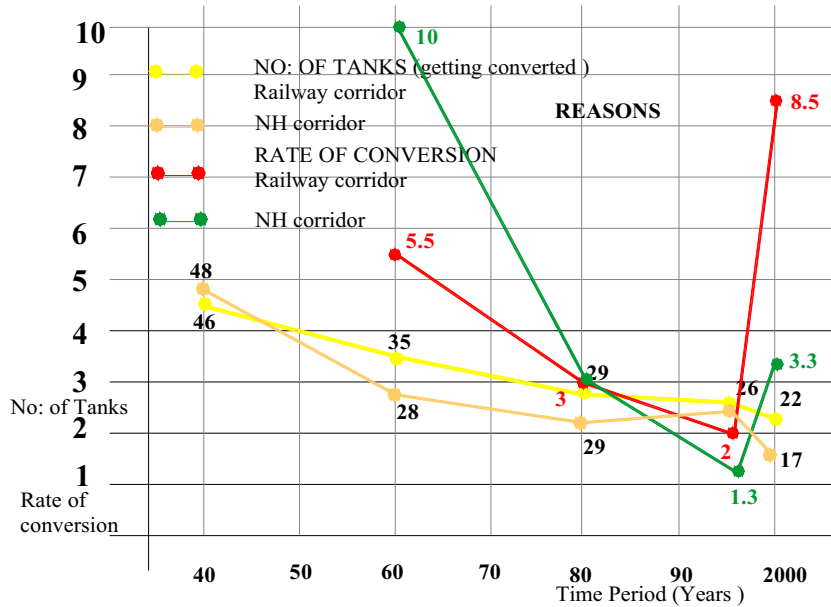


Figure no: 5.5.15 Conversion of tanks vs. transportation corridors

at the sites and services schemes (e.g.: Avadi and Ambattur schemes). The spatial rings also aid in identifying the tanks vulnerable for conversion in future.

(e) Need for conversion

The majority of tanks that were converted (80percent) during 1940 - 2001 were for residential purposes, which also include the tanks totally, encroached. Several of the tanks converted during 1970 - 1980 were for industrial purposes, while the tanks were used for public / institutional functions largely during the early 1960 - '70. (Refer Fig: 5.5.16)

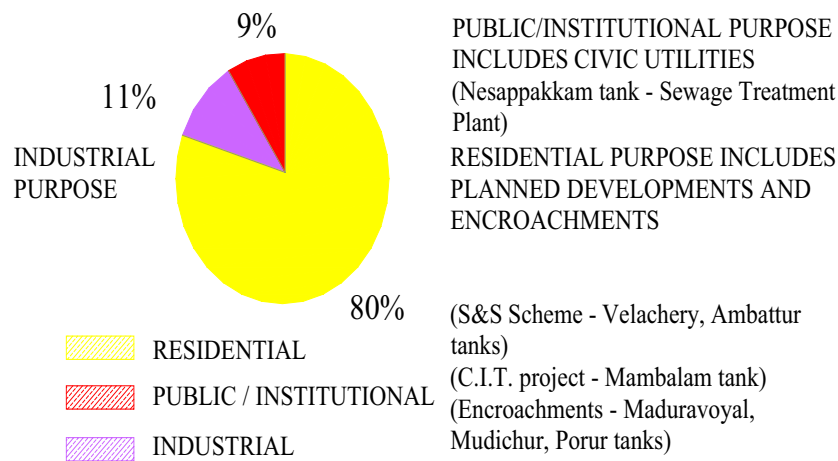


Fig. no: 5.5.16 Purpose of conversion

(f) Vulnerable tanks

Conclusion can be derived that the tanks closer to the transportation corridors and the already developed areas and the urban nodes still face the threat of conversion. (Fig 5.5.17 annexure I) indicates the vulnerable tanks as the tanks at the periurban areas of the metropolitan area are the most vulnerable due to the decline in agricultural activities and the slow increase in the land values. The availability of larger parcels of vacant tank lands near the above mentioned periurban areas makes it vulnerable in due course of time as majority of the catchment areas are being developed, except near the major tanks of RedHills, Cholavaram and Chembarambakkam quoted and demarcated as non - urbanisable zone in the second master plan. The tanks along with their command areas should be treated as vulnerable land that faces the onslaught of urban development pressures.

The tanks on the southern corridor (Tambaram taluk) are in various stages of conversion. Many of these tanks are still largely undisturbed (Vengaivasal, Vengapakkam, Ottiyambakkam), but the proliferation of urban developments and the settlement process could play a major role in the emergence of unauthorized developments nearer to these areas.

The tank lands nearer to the already mentioned major tanks though classified as non- urbanisable, would attract illegal and temporary settlements because of the unused and vacant nature of these potential water recharging zones.

(g) Impacts on the urban environment

Depletion of lakes and natural water bodies that maintain a delicate ecological balance, subsequently leads to water scarcity and problems of seasonal floods and severe environmental degradation as the drainage pattern (lakes - an integral component) of any area is highly sensitive to any human intervention. The repercussive effects of neglect of the traditional irrigation systems (tanks) and its widespread impacts on the water supply, drainage, micro - climate and the urban environment, has to be considered to establish the significance of these eco - assets : tanks.

(i) Quality of Ground Water

The quality of ground water finds is an important component in selecting a parcel of land for development, even when there is a supply of water from the external sources. The rapid conversion of tanks and its impacts on the quality of the ground water table has been studied to substantiate the significant role of tanks in the urban environment. The data on the levels of chlorides, iron, carbonates, sulphates, pH, total dissolved solids and fluoride content, all of which form the basic parameters, which define the quality of ground water, were collected. Based on the levels of concentration of the above constituents in comparison to the suggested standards, the quality of

the ground water in the settlements have been broadly classified as (i) very good, (ii) good, (iii) fair and (iv) poor. (Refer fig. 5.5.18 annexure I)

The quality of water in the settlements on the basis of the above-mentioned classification is indicated in the map. It reveals that the quality of water is very good only in a very few settlements in C.M.A. throughout the year. The misuse and neglect of tanks in the study area affects the quality and the quantity of ground water, which could be felt at the neighbouring environs, and the samples selected pertain to the areas where there has been rampant pollution of the water bodies and other forms of uncontrolled illegal developments.

(ii) Ground Water Table

The depth at which water is available below the ground level is termed as the water table level. In the study area of C.M.A., the water table varies widely from around 5 feet to over 40 feet depth. The settlements are classified accordingly as those having water table levels, (i) below 15 feet, (ii) between 16 and 25 feet and (iii) more than 25 feet. (Refer fig. 5.5.19 annexure I) The settlements along the coast in northern C.M.A., Thiruvottiyur, Kathivakkam, Ennore, Sadayankuppam and Nandiyambakkam have water tables at less than 15 feet depth. Similarly, Perungudi, Neelangerai, Kottivakkam, Injambakkam and Vandalur in southern C.M.A. have water tables at less than 15 feet depth. Around 50percent of the settlements have water table at medium depths from 16 - 25 feet. The settlements immediately after the city boundary and those next to them having water table at less than 25 feet fall under this category. Around 40percent of the settlements have water table levels at more than 25 feet depths. Major settlements like Tambaram, Alandur, Pallavaram, and Avadi fall into the third category.

(iii) Sites and Services Scheme on the tank

Special mention has to be made about the technological innovations in the functional modifications done to the tank to suit residential development. (Refer Fig. no: 5.5.20) The remaining portion of the tank was deepened so as to simultaneously fill and raise the portion that was to be developed (Cut and Fill method). The original water retaining capacity was restored and a retaining wall demarcated the boundary of the scheme.

Fig. 5.5.20 Concept

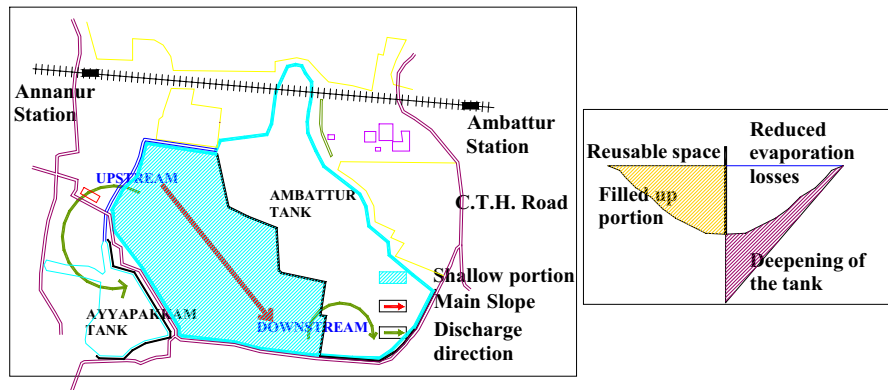


Fig.5.5.20 Tank and its Environs - Issues and problems

The scheme saw a spurt in the development of unauthorized layouts (75 houses on 5- 10 acres) near the tank and the absence of a physical demarcation gave impetus to the encroachments on the shallow portions of the tank. This has consequently led to the pollution of the tank, now being used as a garbage dump yard. Several temporary settlements near the surplus channel have got rapidly converted to built structures posing problems to the functioning of the surplus channel during monsoons.

(iv) Ground water Exploitation

Extraction and supply of ground water to the thirsty city has become a major economic activity where in large number of tankers are involved, employment generated, revenue generated to the farmers. Predominant ground water sources (Fig.5.5.21 annexure I) are Poonamallee, Thiruverkadu and Thirumazhisai, all are classified as peri-urban areas. According to the assessment by the CMWSSB (Chennai Metropolitan Water Supply and Sewerage Board) about 4500-5000 tanker trips are performed everyday to the city. A tanker full of water (12000 litres) is priced between Rs 575 to Rs 675. During all the lean monsoon years the private tanker suppliers did brisk business taking advantage of acute water scarcity position in the city.

(h) Tank - dump yard Tank lands - Encroachments



Dumping of garbage



Conversion as residential areas

i) Encroachments on Tanks - “Porur and Velachery water bodies”



Encroachments



Sand Mining

(ii) Profile

Porur, a Town Panchayat covers an area of 5 sq. kms. The State highway - Mt. Poonamalee road cuts through the settlement while the National Highway - By pass road cuts over the major tank.

(iii) Porur tank NH over the Porur tank



(iv) Demographic Characteristics

Porur Town Panchayat has a population of nearly 28,782 (as in 2001 census), and has been considered as well developed and a rapidly growing area owing to the availability of basic infrastructure, potable ground water and enhanced transportation networks

IV Conclusion

Study of the environmental impact induced due to developments in peri-urban areas has indicated that more often consumption of agricultural land, land occupied by the water bodies and watercourses for developmental purposes have been at the initiative of the authorities themselves. During the formation of Peri-urban areas, the tanks and the land belonging to the water bodies are the worst affected. While availability of good ground water is one of the prerequisite for locating housing, the very housing activity encourages encroachment on lands belonging to water bodies. In the process, the water body is lost as well as the ground water recharging source is also lost. Thus several peri-urban areas which enjoyed copious ground water faces saline water intrusion because of over exploitation as well as depletion of water sources. The details of water resources and the Peri-urban settlement locations are shown in Fig.5.5.22 (annexure I) The weak links between various authorities and local bodies make it convenient for the encroachers and developers to escape without notice causing heavy damage to the environment.

Case study - Pallikaranai and Thiruninravur

5.6 Case Study 6

5.6.1 Urban growth and changes in CMA

Introduction

During the Process of urbanization the periurban stage is introduced. At the stage the settlement under go various socio-economic changes and changes in the natural resource base. Though macro level analysis of data available for 143 settlements (Case Study I - 52 settlements, has been carried out, understanding of the changes that are taking at micro level becomes crucial to appreciate the dynamics of transition. Here two case studies carried out by CMDA on Pallikaranai and Thiruninravur are presented.

I(a) Pallikaranai

Pallikaranai which was a village in the Southern corridor now almost at the verge of getting converted into urban area from Peri-urban characteristics as the Pallikaranai settlement is immediately after the city boundary is comprised of Scheduled caste, Naicker, Gramani and other castes. The prominent sections are the Scheduled caste and the Naicker community. It has good agricultural land with good irrigation facilities. In the last three years due to the selling of agricultural land for residential purpose, the total area under cultivation has decreased. The nature of this village is being changed due to conversion of agricultural land to residential uses. Most of the landowners of this village sold their land and started to do non-agricultural activities or started small businesses

Two engineering companies have provided employment to this village and neighboring villages also. Approximately 500 workers are employed in both the companies and 90 percent of them are from the local villages. In the early years i.e. three years back paddy was cultivated two times a year with other crops like gingelly, ragi etc. Totally three crops were harvested in a year. At present area under paddy has decreased very much and land under cultivation is less. The crops now cultivated are Paddy, ragi, chillies, gingelly and brinjal and other vegetables. Recently coconuts and mango plants are also planted.

The farmers generally use their own labour. A major reason for this is the high cost of labour. Workers are attracted by the industries around this area where they can earn more money compared to agriculture activities. The normal wage is about Rs.100 and Rs.80 a day exclusive of transport charges which is paid by the employer.

In the early years, the farmers employed workers in the same village itself or from North Arcot and South Arcot districts. But now the scene is entirely different because of the industrial estates in and around the CMA which attracts more people to employ them at a cheaper rate. The people who are illiterate in the Pallikaranai area are selling their land to the real estate agencies to get money to purchase lands at a lower rate in nearby villages where they again start agricultural activities. Some of the

people in the village do not sell their land and continue agriculture wherever water is available.

(b) Tanks and Ponds

There are four tanks in the village. The tanks are namely Peria Eri, Anai Eri, Narayanapuram Eri and Killingle pallam Eri. One pond in Pallikaranai is preserved for drinking purposes while another, Narayanapuram eri, is not used for drinking purpose but for cattle and washing purposes. In both the ponds water is available fully. Anai Eri and Narayanapuram Eri are at present used for irrigation. Anai Eri is the main source for irrigation and this is not yet occupied for residential purpose.

The Narayanapuram tank has water to its full capacity. The Public Works Department is removing the earth and the filling in an area where the Government is going to construct housing plots for the urban development programmes, since the project area is low lying. In the Narayanapuram tank itself, illegal settlements are seen wherever open space is available. Parts of the command area of the tank have been developed for residential use. The depth of the tank is also very shallow and the water holding capacity is low compared to other tanks.

(c) Drinking water

In addition to the Panchayat Board water supply, ponds also used for drinking purpose. There are two overhead tanks in use and another tank is under construction and ready for use. In this area ground water is available at about 30 to 40 feet. The water is pumped from more than 60 feet depth is not good for drinking purpose since it is saline in nature. The scarcity of water occurs during the summer season because of the construction of houses and settlement of people at a faster rate. The scheduled caste people use agricultural wells to fetch the water during the summer. The foreshore areas of the tank are occupied by the people and some of them doing their cultivation using the water in the lake.

Very recently some tanker-lorries also came and purchased water from agricultural wells, at the rate of Rs.50 per tank of water. The cultivators felt that if the government permitted them to sell water, it would be beneficial compared to the agricultural activities, where the benefit are not up to their expectations. The reasons for selling plots to developers is mainly because of the water scarcity and this causes the valuable agricultural land to be converted to urban use especially to residential uses. Often people who buy the land do not want to construct immediately and keep the land for speculative purposes.

II(a) Thirunindravur

Thirunindravur, a Peri-urban settlement has got the potential for cultivation, but the recent invasion of real estate developers makes agriculture activities very difficult. The area has a big tank near to the Thirunindravur Railway station. The northern side of the tank has been encroached. Development in the channel causes the problem in cultivating the land.

Farmers are agitated about the encroachment, which is mainly done by local thugs and with political pressure.

Change in water use is visible and the conversion of agricultural land to urban use has an impact on the usage of the water. But now because of the conversion of agricultural land into residential plots, there is depletion in the supply of water to the tank. Every time farmers have to take risks to cultivate the land because of shortage of water in the tank. Availability of potable water is the main reason for the settlement process-taking place. Panchayat is providing water supply to the residential developments.

And the other problem faced by farmers is the non-availability of labour, due to the locations of industries in and around Thirunindravur. People prefer to work in the small industries for a daily wage where they get higher wages compared to work in agricultural activities.

The land owners also get more profit in selling the land for urban use than in cultivating, it Table 5.6.10. Discussion with the local people reveals that the landowners are ready to sell their land and move away to the nearby

Sl. No.	Distance .from Railway Station In K.M.S	1983	1988		1992
		Plot cost per ground (Rs)	Plot cost per ground (Rs)	Growth rate 1983-88	Plot cost per ground (Rs)
1	0.5	30,000	70,000	133	1,00,000
2	1.5	15,000	40,000	166	85,000
3	2.5	10,000	25,000	150	55,000
4	3.5	5,000	25,000	400	40,000

* 1 ground = 2400 Sq.ft.

Table 5.6.10 Land values in Thirunindravur

Source: Primary Survey 1992, Shiney K.A. Anna University, Chennai-25

village purchasing land utilizing a portion of the sale proceeds and cultivating it with their own labour. The remaining money they use for their savings. Some of the people who are educated feel that they wanted to go to urban areas since their daughters and sons are educated and employed they wanted to settle in the urban area itself. Some use their land for growing vegetables and part of the land is used for cultivation.

The land in Thirunindravur is good for cultivation. But in recent times, the quantity of water that the Thirunindravur tank receives has become less due to the urban development activities. So the inflow of the water into the tank has gradually reduced. As a result, the farmers could not cultivate in their ayacut. Only a small extent of land adjoining the main supply channels or near tank are under cultivation. But most of the lands are kept uncultivated with the idea of selling for residential purposes. The foreshore of the tank has been encroached by the squatters. As Chennai city is growing fast in terms of population and extent, the spill over population is moving to peripheral areas of CMA for residential plots. This phenomenon is taking

place more in the major corridors and since Thirunindravur is in the western corridor, it has attracted people for residential plots. Also the land values in Thirunindravur are comparatively cheap with good transportation facilities.

(b) Conclusions

The two case studies clearly show that conversion of agricultural land to urban uses is occurring along the southern and western corridors. The increase in land values makes it attractive for farmers to sell. Moreover agricultural wages do not keep pace with wages the result in other sectors and that agriculture is no longer remunerative in these areas. Developers are anxious to purchase land in the peripheral areas for speculation and development purposes, particularly after the revocation of the Urban Land Ceiling Act. Availability of water and requirements that homeowners look for. In these two corridors where these requirements are met, urban growth has been occurring rapidly.

However, the impact of this growth is that the natural drainage and flow of water is seriously affected, which lowers the extent of recharge of ground water. On the other hand, the demand for water is growing due to an increase in population. There is therefore a “mismatch” between land and water management in the CMA.

5.6.2 Evaluation of Indicators

The Chapter 5 incorporates several case studies in tune with the objectives of the study, namely appreciation of the socio economic characteristics of settlements around CMA with particular reference to Peri urban settlements, secondly to test the indicators formulated to identify the Peri urban settlements and thirdly to appreciate the environmental impact arising out of Peri urban formation. The main focus of the analysis has been to identify the settlements having Peri urban status among all the settlements classified as urban and rural by census of India as Peri urban is a status between urban and rural.

The first exercise is through the case study I which deals with 52 settlements classified as urban by census of India in whole of CMA. Extensive analysis of socio-economic characteristics through available information as well as in comparison with the indicators formulated in chapter 2 (Socio-economic indicators, agriculture indicators and infrastructure indicators) has revealed that 24 settlements out of 52 settlements are found to be having Peri urban status (Table 5.1.37). Similarly, the analysis in case study II for settlements which are primarily classified as rural, it is found that seven settlements (Table 5.2.28) fall in the category of Peri-urban and one settlement in urban category.

Having identified settlements of the Peri urban status, a comparative analysis of the socio-economic characteristics and the level of service facilities in an urban, Peri urban and rural settlement located along three major corridors was found essential to evaluate the validity of the indicators formulated. The case study 3 and 4 are the efforts in this direction. With the

background of several case studies it has become possible to identify indicators which have greater relevance to identify Peri urban areas. It may also be stated that if a settlement is designated as Peri urban it should satisfy the indicators formulated

I. Socio-economic indicators

Population: The population is an important indicator, however for the purpose of identifying Peri urban area, the definition of census of India that > 5000 is urban and < 5000 is rural may not be suitable as the population in Peri urban areas show great variation.

Population Density: Population density would be more realistic as the density is an indicator of the demand for development or settlement of people. To be more realistic this may have to be supported by the extend of land and land use disposition prevailing in the settlements.

Literacy: As per the definition of census of India, if a person knows reading and writing he / she is called literate. While literacy rate may be significant from socio-cultural point of view, it may not indicate its relevance to economic status and activity. The higher the level of education, the better the opportunity of funding gainful employment. Therefore instead of literacy level, education level again with a further classification on the type of education can lead to a better identification of Peri urban area as indicated in the case studies 3 and 4.

Workforce: Workforce represents, the share of population in the working age group. In Indian cities where there is significant unemployment, all the people in the age group getting employment is not possible. Therefore, even if 50 percent of the workforce is employed it should represent an urban and or a Peri urban status. In the present day context, female in the working age group engaged in a job is significant in urban area. In rural area it is insignificant excepting in agriculture. But in Peri urban area, female work force is engaged in several of the factories and industries which have the potential of attracting female workforce. Therefore, workforce share is considered to be a relevant indicator. The share of dependents is an indication of the level of employment or the unemployment. It is an indicator which is directly related to the economic well-being.

Non agricultural workers: The share of non agricultural workforce, is a significant indicator as any settlement having more than 75% non agricultural workforce can be classified as urban or Peri urban. The share of agricultural workforce is significant in rural areas. Therefore, the percentage share of agricultural work force as an indicator can help identifying a Peri urban settlement.

Non agricultural activities is classified as, manufacturing and household industry and other services. Peri urban areas have always provided the opportunity to establish consumer oriented industries. Therefore wherever, the share of people employed in manufacturing industry is more it could reveal urban or Peri urban condition. Therefore, the non agricultural workforce and the share of manufacturing industry could be reasonable indicators.

Conclusion

It can therefore be concluded that indicators namely, population density, education level, workforce, non agricultural workers, employment in manufacturing sector could be selected for identifying Peri urban area or the Peri urban areas should have these indicators and the values in position.

II. Agricultural indicators

Agricultural land use: The share of agricultural land use in a settlement is a significant indicator of Peri urban / rural area. But the area under actual cultivation would be a more realistic indicator. Since agricultural activity in an urban area is almost non existent, it would be visible in Peri urban area and predominant in rural area. Therefore, the share of land under agricultural use is considered as an indicator.

Agricultural workforce: This is the most important indicator of Peri urban/rural status.

Type of crops: Agricultural activity is said to be intense in areas of CMA where paddy cultivation is highly pronounced. Often local bodies have records of crops grown and the area under cultivation for every year. Therefore, having agricultural produce as an indicator is not only possible but reasonable too.

Cottage and small scale industries: Presence of cottage and small scale industries is common in settlements away from the city and food industries can easily be identified as they are mostly found in Peri urban area as they are continued even after the rural area is gradually converted to urban areas.

Conclusion

Two agricultural indicators are found reasonable in the selection of Peri-urban settlements. The rest of the indicators are found less significant in view of the fact that bulk of the supply come from far off rural areas and very less from Peri-urban areas.

III Infrastructure indicators

There are nine indicators formulated and tested in identifying Peri urban settlements in CMA. The indicators which have significant implication are those which establishes the distance of the settlement from the city center and the nearness to major transport corridors particularly rail corridors. The other indicators relating to education facility, health facility, shopping facility water supply, latrines and septic tanks and drainage facilities are all available in all type of settlements. However, the level and standard of the facility differs depending upon the type of settlement and the local body. Observations made during interaction with the local people did not indicate that availability of the service facilities is treated as an important criteria for selection of settlement for residence by the new settlers. Instead majority expressed that transport accessibility as the most important fact and avail facilities at a nearby major settlement (urban areas).

Conclusion:

Out of the 10 indicators only 2 indicators namely, distance from the center of the city and nearness to major transport corridors (road/rail) are found to be establishing a Peri-urban status.

Impact of the reviewed set of indicators in establishing Peri-urban Status of a settlement

The Table 5.6.11 shows the list of indicators before (28 indicators) and after review (12 indicators) for the identification of peri-urban settlements.

The settlements (52) in the case study- I and the settlements (80) in case study- II have been again subjected to analysis to identify periurban status using the revised list of 12 indicators (Table 5.1.40). The Table 5.6.12 indicates the periurban status of 52 settlements before and after review. In the case of former, 24 settlements were identified as periurban; in the later case 21 settlements have been found to have the periurban status. Three settlements have undergone a change from periurban to urban status among the fifty two settlements. Similarly in the case of case study II, all the settlements excepting

Sl. no.	Category of Indicators	Indicators	
		Before Review	After Review
1.	Socio-economic Indicators	1. Population ≥ 5000 2. Density Persons/Sq.Km ≥ 400 3. Literacy $\geq 75\%$ 4. Workforce-Men $\geq 50\%$ 5. Workforce-Women $\geq 25\%$ 6. Dependents $\leq 60\%$ 7. Non-Agricultural Workforce $\geq 75\%$ 8. Agricultural Workforce $\leq 5\%$ 9. Manufacture & HHI $\geq 2\%$ 10. Other Services $\geq 95\%$ 11. Cultivators $\geq 50\%$ 12. Agricultural Labourers $\geq 50\%$	1. Density Persons/Sq.Km ≥ 400 2. Literacy $\geq 75\%$ 3. Workforce-Men $\geq 50\%$ 4. Dependents $\leq 60\%$ 5. Non-Agricultural Workforce $\geq 75\%$ 6. Agricultural Workforce $\leq 5\%$ 7. Manufacture & HHI $\geq 2\%$ 8. Other Services $\geq 95\%$
2.	Agricultural Indicators	1. Agricultural land use $\leq 10\%$ 2. Crops ≤ 100 tons 3. Horticulture Y/N 4. Cottage & SSI Industries Y/N 5. Dairy Farms Y/N 6. Poultry & Meat Y/N	1. Agricultural land use $\leq 10\%$ 2. Crops ≤ 100 tons

3.	Infra structure Indicators	1.Distance from the City Centre <=25 km 2.Distance from Major Road/Rail Corridor <=2km 3. Transport Communication availability of Bus/Rail facilities Y/N 4. Higher Education Institutions <=5 km 5. Primary Health center <=3km 6. Shopping Facilities Y/N 7.Presence of MNC Y/N 8.Water Supply Y/N 9.Latrines with Septic tank Y/N 10.Drainage Y/N	1. Distance from City Centre <=25km 2. Distance from Major Road/Rail Corridor <=2km
Total Indicators	28	12	

Table:5.6.11 Indicators before and after review

4 have not undergone any change in the status. Even in the case of four settlements which have undergone changes three have become urban from periurban and one has become peri urban from rural. Thus 95% of the settlements have not undergone any change in status.

Conclusion

In as much as the indicators before and after review have not brought in major changes in the status of the settlements, it may be concluded it is enough that 12 indicators (Table: 5.6.12) are used to establish the periurban status instead of 28 indicators.

6 NETWORKING

6.1 Introduction

Networking has been identified as an important component in the preparation of WP2 background paper. Since the e-mail networking has not been successful for a variety of reasons, personal contact was found to be the best to get some reaction from the professionals, planners etc. Various issues relating to peri-urban area have been posed to a select group of professionals, planners and academicians most of whom have also attended the Workshop and expressed similar views on the related issues. The consolidated report on the views expressed against the question is presented in the following paragraph.

Q (a) The Metropolitan cities in India in general and Chennai in particular have witnessed tremendous growth both inside the city and outside the city, that is in the metropolitan region where peri-urban is a part. What are the reasons, which could be attributed to such a phenomenal growth particularly outside the city?

First of all, though the term peri-urban seems to be a new-terminology, the characteristics and the developmental trends assumed to be prevailing in peri-urban area have already been recognized and the metropolitan region classified to be comprising of Urban, rural fringe and rural, areas. The major problem is the non-recognition of the changes that have been talking place in these areas in time to check the extensive environmental damage already caused.

The major reasons for such a growth are,

- The tremendous pressure for vertical growth in the city and the resultant high cost of land and congestion.
- High rental values within the city forced the people particularly middle and lower income to seek residence outside the city at economically affordable range.
- People having a housing property in the city found it profitable to either sell the property for high rise development and buy large piece of land at lower prices outside the city or enter in to a joint venture for a high rise building to benefit both monetarily as well as residing in one unit at the same property after development.
- With the consistent improvement to the public transport both rail and road, a major portion of the metropolitan region has better transport access. This is one of the major reasons for the tremendous growth of the so-called peri-urban areas particularly along the transport corridors. This is clearly visible in the commuter load on the system both in the morning and evening peaks along these corridors.
- Tremendous increase of private mode of transport coupled with saturated carrying capacity of roads, the delay caused to the traffic is enormous due to congestion. Even short distance travel has become more time consuming whereas from the peri-urban areas even if the distance is more time taken for travel from residence to work place is very less either through long route bus transport or rail transport. Thus locating a residence along a major transport corridor

specifically rail corridor is more advantageous.

- Increase in distance causes increase in travel cost also. But the comfort, less congestion, less exposure to environmental pollution etc offset the cost. The people are prepared to pay a little more towards transport; as the public transport is still the cheapest in Indian cities.
- With the liberalization policy, education, healthcare, shopping have all become highly commercialized. The spread of these facilities in peri-urban areas is more, though the city is still sought after for higher education, medical care and shopping. Thus peri-urban areas satisfy most of the needs of the people and living is more comfortable.
- Most of the Metropolitan cities with a higher population concentration suffer from inadequate water supply. The cost of private supply is also more. Therefore people prefer to live in peri-urban area where plenty of ground water is found available.
- Ethnic affinity, friend's influence more often influence people to settle in peri-urban areas where almost all the basic facilities are available to a greater degree of satisfaction within reachable distance.
- Availability of housing finance at a low rate of interest (7 to 8%) and the income tax benefit offered by the Government have given an enormous boost to the salaried class and people engaged in trade and commerce to have their own house built on a piece of land. Peri-urban areas provide adequate opportunity to buy a piece of land at affordable cost and construct a housing unit.

Q (b) What are the reasons that can be attributed for the irregular developments that are taking place in the peri-urban areas at the cost of environment? Are the peri-urban areas compensated for all the waste (sewage and solid waste) that these areas receive? Is it because of inadequate laws governing the peri-urban areas?

- It is accepted by one and all that there is no dearth of laws governing the control and regulation of developments. The 73 rd and 74 th constitutional amendments empower the local body for better powers and responsibility. It is the lack of implementation of law due to various reasons. The local bodies though endowed with powers neither has technical manpower nor can afford to pay for the salaries. Thus violation of rules and regulations is rampant.
- The jurisdictional complexity is more in peri-urban area where too many government organs are involved and often none takes immediate responsibility.
- Local politics and local bigwigs interfere in every developmental activity, these are often responsible for extensive exploitation of the natural resources in peri-urban and rural.

Q (c) The response to the questions relating to the reasons for encroachment on government land, Water bodies etc from the local body functionaries, planners and local people was overwhelming.

The responses have been;

- Deliberate actions of Government agencies for developmental activities have resulted in encroachment on public land and water bodies.
- Lack of organized groups to ensure protection of water

bodies from the development agencies and the encroachers.

- Drastic reduction in agricultural activity has resulted in ignoring water bodies for the water.
- Deliberate encroachments for speculative purposes.

Q (d) The response to a question on the declining state of agriculture and large-scale conversion of Agriculture land for other purposes has been that;

- Majority of the landowners have up to an extent of one hectare only.
- The high cost of agricultural inputs and the labour cost is no longer profitable to carry on with agriculture.
- Lucrative offers from land developers for other developments
- Sudden spurt in establishment of educational institutions, IT industries, recreation centers have increased the opportunity for selling agriculture land for higher prices.
- Lack of governmental effort to introduce scientific farming practices for the cultivation of cash crops to augment earnings from agriculture has been another major cause for declining agriculture practices.

Q (e) The response obtained from the local people particularly the labour class during the socio-economic survey on the availability of jobs, earnings and assistance from government are;

- Reduction in agricultural activities is forcing the agricultural labourers to seek employment in unorganized sector, particularly as construction workers, vegetable vendors or daily wage labourers.
- The days when jobs are not available money is borrowed at an exorbitant rate of interest from moneylenders and become perennially debted.
- Manufacturing industries located in nearby settlements though offer employment; it is always on daily wages. Thus even with the establishment of industries the job opportunities has not been created. In some of the garment factories and electronic industries a few women get employment on daily or weekly wages.

Q (f) For an enquiry on the pollution of water and land in the Peri urban areas, the response from planners and engineers is listed below

- In densely populated Peri urban settlements ground water depletion is faster during dry seasons.
- One of the common features in Peri urban area is that the absence of sewerage system and installation septic tanks often cause pollution. The more the density of residents the more is the level of contamination arising out of latrines with septic tank.
- Open drains carrying bathroom waste kitchen waste and septic tank effluent cause mosquito breeding and diseases.
- Water bodies are polluted by people and cattle and open drains let into the water body by the local bodies.
- Often water bodies are found to be the convenient spots for dumping solid wastes and letting out wastewater brought from septic tanks through tankers.

Pallikaranai Solid waste dumping site



Polluted Pallikaranai Lake.



6.2 Workshop on WP2 – Socio Economic Characteristics in peri-urban area – Oct. 6th to 10th 2003

6.2.1 Minutes of the Workshop

As per the programme, the workshop started on 6th Oct. 2003. The first day was devoted to a presentation by the local coordinator, TERI on the work progress and future course of action. Following the review of the work progress, TERI presented characteristics of some Peri-urban areas in and around Bangalore & Haryana. Data gathered and interactions made with various authorities to understand these settlements and issues in Peri-urban areas were discussed. The team members sought further suggestions on the preliminary reports and certain aspects that could be further explored were also discussed.

An interesting point that the discussion brought out was that there are laws that were formed outside the Peri-urban domain, but which had important consequences for Peri-urban areas. The discussion also brought out

the point that Peri-urban areas had important positive linkages with adjoining towns, and that there was a case for strengthening these linkages.

IRMA study partners presented the progress made in the WP3 paper--the energy scenario in a village of Gujarat and certain basic information on the socio-economic characteristics prevailing in another Peri-urban area.

During the course of discussion, it was made clear that there is no paucity of Acts, rules and regulations in India for each of the institutions at different levels responsible for rural development and management. However what is lacking is coordination and accountability towards natural resource management. Therefore, it was suggested that instead of suggesting new types of institutions the emphasis should be on coordination among the existing institutions, as a multiplicity of institutions was often found ineffective.

Followed by WP3 presentation, WP4 team presented a brief on the aspects related to their work package. They expressed the need for harnessing more details on the energy consumption pattern in Peri-urban areas particularly in the Indian context.

There was no representation from WP5, hence no detailed discussions could take place on it, excepting that a combined workshop for WP4 and WP5 is proposed to be held in Oct 2004. WP4 partners will be in touch with WP5 partners to coordinate the workshop.

Several problems faced by partners in using the Peri-urban website--the connectivity and establishing the link, uploading of information and usage of different sections of the web--were discussed. Discussions on this were held later towards end of the workshop in detail.

The WP3 study team expressed great difficulty in getting response from partners and the public through the e-mail discussion forum on various issues relating to WP3. The study partners have been requested to respond to the request on priority basis.

In the afternoon session, Mr.N.Dharmalingam, retired Chief Urban Planner of CMDA Chennai, presented a brief account on the Chennai Metropolitan Area, the development pattern and trends and different tiers of administration prevailing in Chennai Metropolitan Area. This helped team members in familiarization of Chennai and its environs before undertaking the field visits.

Subsequently, Mr.R.Elango-President of a Kuthambakkam panchayat union, located at the outskirts of Chennai Metropolitan Area presented a wide spectrum of the opportunities and challenges prevailing in undertaking sustainable development, particularly in communities, which are subject to various socio-economic pressures and political influences. The presentation was highly informative and brought in to focus the varied problems of a Peri-urban area.

The study partners were then presented with certain basic facts about the settlements selected for the field visit on 7th and 8th Oct. The meeting ended for the day.

On the second day (7th Oct 2003), field visit was undertaken to visit Peri-urban settlements (Poonamallee, Thirumazhisai and Kuthambakkam) to collect first hand information on the process and changes arising out of Peri-

urban development along the western corridor of the Chennai Metropolitan Area. The visit to Kuthambakkam and the meeting with the President and locals provided opportunity to gather responses on various socio-economic and rural development issues pertaining to sustainable development.

On the third day (8th Oct 2003), the partners visited a new town development (Maraimalai Nagar), which was conceived as a satellite town and later on converted in, to a New Town along the Southern corridor of CMA. Following the visit to MM Nagar, another village Thirukatchur located opposite to a major car manufacturing industry (FORD) was visited. The visit to the village provided opportunity to interact with the local residents and elicit response on varied socio-economic and environmental issues prevailing in the rural area.

On the 4th day (9th Oct 2003), the participants from outside the project also attended the workshop. The list of participants is annexed. The discussions were on various issues arising out of the presentation made by Dr.A.M.Thirumurthy the Principal Coordinator for WP2 study.

Dr.A.N.Sachithanandan, former Dean of School of Architecture and Planning, Anna University chaired the session. The presentation was divided into three parts namely,

- I. The conceptual framework of the process of Peri-urban formation particularly in Indian context.
- II. Socio-economic characteristics prevailing in Peri-urban area.
- III. The environmental impact in Peri-urban areas.

The following are the salient features of the presentation, deliberations and the suggestions made out in the workshop.

- WP2 is commendable in view of the exhaustive coverage and wealth of data
- The Peri-urban formation along the major transportation corridors is the common feature in all metropolitan cities of India.
- Availability of water is another major factor which attracts developments leading to Peri-urban development
- Major industries attracted to the Peri-urban areas should contribute towards creation of basic facilities like roads, water supply, sewerage etc in the surrounding settlements.
- The major industries should also be made responsible to make good all the environmental losses arising out of the industries.
- The dwindling agriculture and horticultural activities in the Peri-urban area need to be revived with modern agricultural practice.
- The comparison of socio-economic characteristics for 135 settlements of varying sizes in the Chennai Metropolitan area is exhaustive and provides scope for framing indicators for Peri-urban development process.
- The comparative study of socio economic characteristics of urban, Peri-urban and rural areas is highly informative and indicative of Peri-urban character.
- It was suggested that the comparison of the socio economic characteristics prevailing in the 11 case study settlements may be carried out separately and reported in the final report

- It was also suggested that the relevance of the study to conceptual framework is elaborated little more in the final report.
- It is strongly viewed that the present trend of vehicular growth and energy consumption is unsustainable in the long run and therefore public transport planning and introduction is the basic need of the hour in Peri-urban areas.
- Lack of strong institutions at the local level is the major cause for environmental degradation.
- It was requested that the settlements identified for personal contact and interaction is located on a map.
- It was also suggested that energy consumption in Peri-urban area is given in more detail if data is available.

The Experts participated in the Workshop

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1	A.N.Sachithanandan	Institute of Town Planning	Chairman	26285158
2	N.Dharumalingam	Former Chief Planner	CMDA	24897175
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5	G.Umadevi	Anna University	Asst. Professor	22203258
6	S.Gurusamy	CMDA	Senior Planner	28534855
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8	G.Manian	Private	Consultant	25502986
9	S.R.S.Pandian	CMDA	Deputy Planner	26561651
10	N.Dhakshinamurthy	DM (MTC)	Deputy Manager	25322566
11	N.V.Rakhunath	CMDA	Chief Urban Planner	28593696
12	A.P.Ellappan	State Express Transport Corporation	Managing Director	25368323
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28	A.M.Thirumurthy	Anna University	Principal Co-ordinator	22203259
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7 STUDY FINDINGS AND CONCLUSIONS

7.1 General

a) Master Plans and Development Plans prepared for several cities have identified an intermediate area between urban and rural areas namely the rural fringe. The rural fringe is almost equal to the peri urban areas. The development regulations, if not at the same standards as that of urban area, are also existing, but the institutions at the local level are neither adequately man powered nor the finances are in sound condition. Thus, regulation and control of developments are haphazard, subject to local politics. Often the irregularities are neither brought to the notice of higher levels nor the higher-level authorities have a system of monitoring and control. Thus the intermediate area has always been neglected.

b) The new awakening and concern for sustainable development has brought in the new concept of Sustainable Periurban development. The definition for a periurban condition, though not fully clear, the developed world has been successful in reconciling itself to a definition which is commonly accepted or agreed upon. However it is a challenge to precisely define a peri-urban in a developing country's context particularly in India.

c) It is increasingly perceived that rural Peri-urban and urban environments operate as a system rather than independently and that rural development and urban planning are necessarily linked activities. Activities or interventions in one arena have consequences in the other often negative. On the other hand, creative policies and programmes can turn liabilities into potential resources and bridge the rural -urban divide.

d) The term Peri-urban is often used in literature and discussions, yet definitions are largely situational and case specific. It is in general an area, which is in constant state of flux exhibiting rural- urban spectrum as dynamic interactive and transformative.

e) The definition of a periurban area is crucial to identify the problems and prospects prevailing in areas around metropolitan cities and solutions for a sustainable development approach. It is stated to be a process addressing the stages of development before a rural area is converted into urban area. Certainly this process is predominantly taking place around metropolitan cities and its influence zone.

f) Peri-urban as concept itself is new and does not find a place in the formal definitions of Census of India. Thus, the Peri-urban area should have both rural and urban characteristics. The pertinent issue here is what is that proportion? What is the range upto, which a settlement can be, classified one way or the other. Certainly, prescribing such standards and limits may not be of any great significance at any point of time as the transition is dynamic in character but there is an imperative need for formulating appropriate indicators for physical identification of settlements which are undergoing transition.

- g) Extensive analysis of basic data available for more than 135 settlements in Chennai Metropolitan area has indicated the fact that Peri-urban characteristics are not of uniform ranges, they vary according to the size, location, traditional activities and transportation connectivity. Therefore any policy initiative for sustainable development needs to be based on indicators, which will address the problem of all areas.
- h) From the study of different settlements falling under Peri-urban category, the dimensions of the problems vary and so also the values of the indicators. Therefore grouping of settlements under common indicators having values in similar ranges seem to be the prerequisite before any sustainable development strategy is applied.
- i) One of the important findings of this study is that there is an imperative need for extensive study and research to establish indicators or a system of identifying periurban settlement/area. The present study has attempted to formulate the indicators with the available information, which certainly call further study and research.
- j) The idea of Electronic networking of professionals, academicians, administrators etc. is to constantly get feed back on peri-urban issues. However experience shows that, it has not been successful for a variety of reasons. Therefore alternative methods to be found out to get feed back from a wide spectrum of professionals and others.

7.2 Conceptual Framework

- a) With the available evidence in Super Metros of India and the case studies for CMA it can safely be concluded that transportation corridors (road/rail) are primarily responsible for attracting developments and inducing Peri-urban formation.
- b) Evidences also suggest that if a corridor is served by both road and rail, the intensity of development is more and Peri-urban formation is quicker.
- c) It is also found that the corridors where availability of good water, land and basic infrastructure facilities is found undergo faster developments leading to Peri-urban formation than other corridors.
- d) It makes economic sense to locate industries (work centres) along major transportation corridors, obviously because of high order accessibility and cheaper land cost.
- e) Introduction of 'missing links', 'ring roads', 'bye-passes' etc. have greatly influenced formation of Peri-urban developments outside the city in the Metropolitan region.
- f) Peri-urban development is the natural sequel to the high land cost in the cities beyond the reach a vast majority of people (middle income).
- g) Increasing congestion in the city and insufficiency of basic service facilities force people to seek better living environment outside the city leading to formation of peri-urban area.
- h) Availability of good water supply (ground water) is one of the major attractions for the people to migrate to the peripheral areas.

- i) The pattern of densification that has been taking place over a decade from 1991 till 2001 clearly establishes a scenario, which fits in to the general hypothesis that as the land cost increases and the affordability reduces, new settlements take place away from the city. The first choice being the second order settlement namely the Municipalities, then to Town Panchayats and then to village Panchayats. Here the Town Panchayats have undergone greater densification indicating the fact that it is the middle income and lower income people who are responsible for the kind of development.
- j) The Peri-urban areas are created over a period by gradual urbanization process starting from the city boundary. While the city boundary itself could be redrawn according to the urbanization trend, perhaps this might induce faster urbanization along the new boundary.

7.3 Socio-economic Characteristics

- a) Though TamilNadu has been registering higher levels of literacy, it is yet to achieve 100 percent. Majority of the settlements in CMA study area fall in the range of 81 to 90 percent literacy, which is higher than National average. Given the importance to education by the State and Federal governments there has been tremendous improvement in literacy rate and almost all the Periurban settlements are having higher levels of literacy.
- b) It is the employees of Government and other organisations create more demand for housing sites outside the city particularly along major transport corridors leading to formation of periurban areas.
- c) Construction industry workers often choose the Peri-urban area because of cheap land and nearness to the developing locations.
- d) Income level determines the affordability for housing, transport and other facilities. It is the affordability that essentially determines the location of housing for a vast majority of the people. It is found that the section of population earning more than Rs.4800 per month at 1995 prices is less in far off settlements. Thus affordability becomes a crucial factor in deciding the housing location.
- e) Rental value being very high in city area for a little more expenditure on transport a cheaper and better accommodation is availed by a majority of the people in the Peri-urban areas.
- f) It is predominantly the middle income and lower income group people who prefer periurban areas of city where land cost is within the affordable range and construction of residential houses is possible with financial assistance from financial institutions at low rates of interest due to the government policy for increasing the house stock.
- g) Establishment of large activities by Multi-national Companies in periurban areas has not induced great deal of economic activity among the local people let alone the local people getting employed in the companies. If at all a few jobs are available it would be unskilled jobs on a day-to-day basis with very little extra income to the locals.
- h) Majority of the respondents felt that the indiscriminate conversion of agricultural land for residential purposes has displaced large number of farm workers. Many small land owners (farmers) sold the piece of land for high

value and bought land elsewhere and said to be continuing with the agricultural activity, as they do not know any other activity.

i) Displacement of agricultural labourers by realtors and introduction of farm machinery have been a serious issue among the locals who could not find gainful employment and end up in construction industry as casual laborers.

j) Monsoon dependent agricultural activities often bring misery to the farmers because of monocrop pattern. In the absence of diversified practice, financial assistance and training, what could have been a lucrative employment and earnings is totally missing in most of the Peri-urban settlements.

k) The agricultural labourer during the days of “no work” borrows money from moneylenders at an exorbitant rate of interest. Thus most of the labour class is perennially under debt.

7.4 Institutional Mechanism

a) Weak local bodies and ineffective administrative control mechanism have made the conversion of land for non-agricultural use. The extensive conversion is causing greater environmental deterioration.

b) Weak local bodies having poor financial capabilities are unable to resist enormous pressure generated by developers of land for various purposes. Although the local bodies tend to collect more taxes from the new developments, the amount collected is not commensurate with the demand for creation and protection of the basic facilities.

c) The National Water Policy does mention the revival of the traditional water systems - tanks and there are laws that protect the wetland ecosystem in Tamil Nadu. The Environment (Protection) Act and the Water (Prevention and Control of Pollution) Act strictly prohibits non – conforming uses near these eco – assets. The M.M.A. Ground water regulation act 1987 restricts the over – exploitation, while the Tamil Nadu State Ground Water Development and Management Act 2000 lays down conditions on the use of these water resources. The C.M.D.A. has also come up with compulsory introduction of rainwater harvesting provisions to enable building permits, are all examples of the legal tools adopted to save and protect the water resources. The legal tool is more than adequately equipped but the implementation and the enforcement has to be tightened. Strict adherence to the laws has to be enforced.

7.5 Environmental Impact:

a) Urbanization and consequent formation of Peri-urban areas have resulted in extensive exploitation of agricultural land and land from water bodies and wasteland, which were maintaining an ecological balance for centuries in that area.

b) Monsoon dependent agriculture can be sustained only through adequate water storage system like the lakes and ponds. Systematic erosion of water bodies by authorities for developmental activities (housing schemes) and encroachments has resulted in drastic depletion of both surface and ground water. The farmers have been used to cultivation of paddy using huge

quantity of water, since the water bodies are gradually lost, availability of water is practically nill. The cultivators also find it difficult to switch over to cultivation of other kinds of crops. Therefore Government initiative is called for introduction of new farming techniques and crops, with the available water as well as arrest further erosion of water bodies.

c) The common pool properties are either encroached or mis-used by local politicians and with the result, the traditional grazing lands and other public land are not available for the usage of the locals.

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