CHAPTER 8

RECOMMENDATIONS AND FURTHER RESEARCH

8.1 INTRODUCTION

The research has focussed on the study of the growth of CMA over the past five decades as to how the villages in CMA have emerged and identified the most influencing variables behind the dynamics of the growth of CMA. An appropriate CA based simulation model of land use change has been designed, calibrated, validated and applied for land use change in three case study areas in CMA. The future scenarios thus simulated for the year 2016 have shown the probable direction in which these areas would develop under the respective contexts. There were limitations such as non-availability of micro level data and time frame. Nevertheless the research has been carried out with the available resources and the results of the simulation have been promising that it has given rise to certain recommendations to the industry within its scope. Every research opens up new avenues for further research. This chapter gives the recommendations of the research, its limitations and scope for further research and finally concludes the research.

8.2 RECOMMENDATIONS

- The study on the growth of CMA has revealed that the villages in CMA are undergoing drastic changes. The high growth villages constitute about 46% of the CMA. The extent of urbanized land has increased over the years. This implies that
the requirement of housing, transport and other infrastructure facilities in the villages is increasing every year and so plans should foresee the likely growth of these villages and plan accordingly. It is desirable to have a set of scenarios than a single monolithic plan for the reason that the scenarios will portray the various influences over the growth at different points of time during the plan period. Close monitoring of the developments is to be made and a suitable scenario may be selected for incorporating mid – course alterations in the plan for the rest of the plan period.

- The growth of settlements in CMA has been mainly influenced by the variables namely (i) accessibility to transportation network; (ii) proximity to work places; (iii) physical quality and land availability; and (iv) plans and policies among various other variables. The case study area Minjur is characterized by predominant residential development, few prominent religious and educational institutions and commercial developments. This is a slow growth village with less than 20% decadal population growth rate during 2001-2011. The frequency of transport facilities is much less in spite of the availability of major road and rail corridors. The areas which are closer to the transportation corridors alone have shown growth. The circulation pattern as well as the quality of riding surface is very poor in the entire case study area. There are residential developments very close to the water bodies which are prone to flooding during monsoon. Vacant lands are available in large parcels and so there is ample scope for development. The simulation of the first future scenario has resulted in a land use map with simulated residential development on either side of
the TPP Road. Further, in the second scenario i.e., the policy driven scenario, the ongoing construction of Outer Ring Road has altered the total weights of the cells along and around its alignment and so there is drastic change in the land use plan for the future year 2021.

In the second case study area, Thirumazhisai, the transport network is only by roads. This case study area is characterized by residential, religious, institutional, industrial, commercial and most amazingly a sizeable proportion of agricultural activities in the northern and western parts. This is a medium growth village (between >20% and < 50% decadal population growth rate) during 2001-2011. In this case study area, the developments are concentrated in the areas around the three ancient temples, on either side of Thiruvallur High Road and some parts along the road leading to Kavalcheri on the northern side of Thirumazhisai. Many water bodies and tanks are present in these villages which help in the practicing of agriculture even now. Many industries are present in the industrial estate developed by the Small Industries Development Corporation abutting the NH 4 and on the eastern side of Thiruvallur High Road close to the NH 4. Also industries exist along Thiruvallur High Road on the north western part of the case study area.

Large parcels of vacant land are available in this village also. However the road network, except the Thiruvallur High Road is in very poor condition without proper pavements. In the absence of underground sewerage system, rain water stagnation, overflow of sewage and drainage into the roads are common features. The Chennai Metropolitan Water Supply and
Sewerage Board is now constructing the sewage treatment plant along Thiruvallur High Road under Jawaharlal Nehru Urban Renewal Mission scheme. Commissioning of this plant would improve the present situation. In the overall planning of the TP area including the infrastructure facilities, the future scenarios for the year 2021 will serve as a guiding tool.

The third case study area, Sholinganallur has a road based transportation network. It is characterized by residential, commercial, industrial – IT industries in particular, institutional and recreational uses. This is a high growth village (with >50% decadal population growth rate) during 2001-2011. The road network constitutes the major roads viz., OMR, ECR, OMR-ECR link Road and OMR - Perumbakkam Road. The quality of road network is fairly good in this area. The area hosts many major IT industries and SEZ. The land use has seen drastic increase in the residential, industrial and commercial activities during 2006-2011. The two land use scenarios simulated for the year 2021 indicate developments along the ECR, OMR-ECR link road and OMR - Perumbakkam Road. The infrastructure planning will become an easy task with the availability of a set of land use scenarios.

Several land use plans are prepared by various planning organisations in the country. Hardly these plans are prepared adopting any scientific tool. They do not prefer to adopt any such tool for paucity of updated techniques, time and resource. More specifically, the main constraint in adopting such tools is insufficient personnel with knowledge in the field of urban modeling, GIS and land use planning support systems.
The simulation tool in this research has been designed to be as simple as possible but at the same time a flexible and efficient one in helping to make quick decisions in planning. It does not require experts to run the model. It only requires understanding the CA based principle of the model and assigning of weightages according to the transition rules already designed. Adopting such a scientific tool in the process of preparation of plans will enable the planning organisations substantiate their decisions avoiding criticism from various stake holders.

The CA based simulation model has proved to be more time efficient with GIS interface in many studies and practical applications. The planning organisations may very well make use of the database in the GIS environment so that the model could be run for several iterations to get more precise results.

It is also easy to alter the variables and their parameters and weights based on the changing influences. Actual land use maps are not prepared or updated regularly for the villages in the metropolitan area. The actual land use maps shall be updated every year so as to have the latest baseline data for preparation of plans. The respective local bodies shall update the land use at shorter intervals and the apex organisations shall collect the same and incorporate in the comprehensive land use map.

The results are similar in the three categories of case study areas. Therefore, model is applicable for all the villages in CMA. Further, the same model is extendable for the entire metropolitan area. However, more accurate and micro level land use data is required to achieve better results.
8.3 **LIMITATIONS**

Every research will encounter constraints and limitations. The constraints and limitations of this research are:

- The micro level land use data for the three case study areas during the years 1991 and 2006 are not available. There are differences between the actual land use and the land use in the maps available for the corresponding time periods. This has resulted in the decrease in the percentage of agreement between actual land use and simulated land use.

- The cell size plays a major role in the simulation of land use at village level which requires lesser cell size. A cell size of minimum 150m x 150m has been used in the CA based simulation model. A less coarse cell size could have been adopted had there been micro level data available.

- The number of variables is limited to four in the simulation model, though these four variables very well bring out the land use change in the metropolitan area context. More variables could be incorporated in the model with availability of data and time. e.g., infrastructure facilities, land value and ownership of land parcels (whether public or private).

8.4 **FURTHER RESEARCH**

The research has paved way for further research in the field. Further research could be taken up with an additional set of variables for CA based simulation of land use. Also the size of the cells in the grid could be reduced and it is definite that the results would improve further.
The land use plans, transportation plans and infrastructure development plans are prepared and implemented in isolation in many cases. This results in the repetition of works and wastage of resource. Therefore, the plans need to be integrated and a comprehensive plan has to be prepared. The simulation model will be of great use for preparing such plans.

The simulation model has been designed for the metropolitan area context. However, for regional level or rural area context, the variables can be reworked for application of the model, which had been carried out in many studies in different parts of the world by various researchers.

8.5 CONCLUSION

The research started to tackle the problem confronted by the planners in evolving land use plans. The problems include time and resource constraint to prepare alternate plans for decision making, non-availability of simple tools for developing alternate scenarios to foresee the influence of various policy decisions and implementation of a project on the urban growth. In order to relieve the pressure on the urban planners and to facilitate the process of planning with a simple yet efficient tool, the research has attempted to build a land use simulation model after elaborate study of urban growth, the variables influencing urban growth, modeling urban growth, scenario planning and land identification for future development.

The research has brought out the main features of the phenomena of urban growth in the context of metropolitan area with specific reference to CMA. In general, the growth of villages in CMA is along the transportation corridors over the years. The variables which influence the urban growth have been identified and the most important among them are (i) accessibility to transportation network; (ii) proximity to work places; (iii) physical quality and land availability; and (iv) plans and policies. The varied tools available
for land use change analysis are studied and the simple and flexible method of Cellular Automata has been adopted in the construction of the simulation model for land use change. The CA based simulation model for land use change has been designed, calibrated and validated for the three case study areas viz., Minjur, Thirumazhisai Town Panchayat and Sholinganallur. Two scenarios namely business as usual scenario and policy driven scenario are simulated to foresee the likely changes in the land use in the three case study areas.

The model so developed is simple, flexible in design and easy to operate though it requires manual input of parameter weights for the cells. The intention is to build a simple tool for land use change analysis and so the due importance is given for the structure of the model than software incorporation. Further the model is intended for the planning authorities where the application of GIS is very much limited. The strength of the model is not altered either. However, the model is capable to be run in the GIS environment which will make it more efficient in terms of time consumption. Recommendations which have turned out of the research are spelt out and the directions for further research are indicated as well.