CHAPTER 7

RESULTS AND DISCUSSION

7.1 INTRODUCTION

Started with a set of research questions, the research progressed in many stages laid out in a series of Chapters. The research aimed at developing a model for simulating land use changes based on the dynamics of urban growth in a metropolitan area context, with three case studies at Town Panchayat level in the Chennai Metropolitan Area. A cellular automata based simulation model has been developed to achieve the aim of the research. The simulation model has been calibrated with the historic data for the years 1973-2006 for the three case study areas and then applied for simulating the future land use scenarios for the years 2006 and 2021.

In this chapter, the results of the calibration phase and the application phase are deliberated in detail. Followed by this, the answers the research has offered for the research questions are described. An extensive discussion is made on how the aim of the research has been realized, by looking back the chapters.

7.2 RESULTS

The Chapter 3 dealt in detail about the dynamics of growth of CMA (excluding the Chennai City). About 48% of the population in CMA lives in rest of CMA area. The population in the rest of CMA has grown with a growth rate of over 59% as compared to over 27% in CMA including city.
About 21% of the villages in CMA experienced a decadal growth rate of over 50% which has doubled (46%) in the year 2011. The land use in the rest of CMA has evolved from an agriculture based growth to a land use with residential, commercial, industrial and institutional based growth over the decades.

The development of villages in CMA over the decades since 1971 had taken place mainly along the transportation corridors, in proximity to work places where there were no physical constraints for development. Plans and policies of the government and the private initiatives had also contributed considerably in the patterns of urban growth over these decades. The study of the dynamics of urban growth in CMA and the literature related to urban growth have paved way for selection of variables for the land use change analysis in the case study areas.

Validation tests can be understood as procedures to verify whether or not the model results reflect reality to the desired degree (Batty 1976). Balci (1997) states that Model Verification is substantiating that the model is transformed from one form into another, as intended, with sufficient accuracy. Model verification deals with ‘building the model right’. The accuracy of transforming a problem formulation into a model specification or the accuracy of converting a model representation from a micro flowchart form into an executable computer program is evaluated in model verification. Model Validation is substantiating that the model, within its domain of applicability, behaves with satisfactory accuracy consistent with the Models and Simulations objectives. Model validation deals with ‘building the right model’. However, as Crooks et al (2008) points out, the validity of a model should not be thought of as binary event (i.e. a model cannot simply be classified as valid or invalid); a model can have a certain degree of validity.
which of course is encapsulated by various measures of fit (Law & Kelton 1991).

Barredo et al (2003) quotes the approach for testing the model results by evaluating the degree to which the two maps (the simulation and the actual land use map) are in line with each other, by means of a coincidence matrix and the associated $k$ indices. The index $k$ is the ratio between the number of cells in simulation matching with a particular land use to the total number of cells in the simulation. This approach is useful for identifying the cells that are identical in both maps, considering their state in a cell-by-cell comparison. Although this approach generates quantitative measures of coincidence for the two maps, there are some limitations in their implementation in urban CA models (White et al 1997; Torrens & Sullivan 2001). The coincidence matrix procedure is not able to evaluate patterns, since the procedure is based on independent comparisons between pairs of cells, and therefore is unable to take account of patterns or distributions per se. This means that small displacements are identified as discordances, and the same discordance will be stated if the displacement is of 100 cells instead of 1. On the other hand, in land uses with a low number of cells, the $k$-value will not yield a useful statistical indicator. Regardless of these limitations the technique is applied for testing the simulations.

There were no significant practical studies on the practical use of a CA model for physical land use planning on a micro scale. The CA based simulation model in this research has behaved consistently in all the three case study areas. It has been able to simulate land use changes close to an agreement of 57% to 68% in respect of residential land use. The model has captured the industrial land use with over 90% agreement in Thirumazhisai during 2011 and Sholinganallur in 2006. However, in 2011, the agreement of industrial land use is about 62% in Sholinganallur.
7.3 SUMMARY

In the present chapter (Chapter 7), the salient features of the growth of CMA over the decades since 1971 are brought out. The results of the calibration of the CA based land use simulation model and the results of the research with reference to the research questions, aim and objectives and the chapter wise contents are discussed in detail.

The model is built not as black box but transparent and as flexible as possible so that it is possible to include almost any additional data that is relevant to the modelling of urban land use change. Thus as the simulation tool is moved closer to end users such as urban planners who have access to a wealth of data, it will be possible to foresee the likely future scenarios under various conditions which would ease the process of decision making. The recommendations of the research and the scope for further research in this direction are discussed in the concluding chapter, Chapter 8. The limitations of the present research are also spelt out in the chapter.