MODELLING OF EDUCATION AND LEARNING SYSTEMS WITH APPLICATIONS

by

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Dedicated

to

All "THOSE" who "LIVE" for "OTHERS"

CERTIFICATE

This is to certify that the thesis entitled ***Modelling of Education and Learning Systems with Applications*** which is being submitted by Mr. A. Chandramouli to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy in Electrical Engineering, is a record of bona fide work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which has attained the standard required for a Ph.D. degree of the Institute. The results presented in this thesis have not been submitted elsewhere for the award of any other degree or diploma.

P. S. Satsangi

(P.S. SATSANGI)

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Abstract

Without education, no society could have progressed much. Education paves the way for innovations and inventions of new technologies. Though the contribution of education to the society is rich / big, its fruits would not have been so ripe and sweet unless it is properly cultivated / managed. As time passes and situation / society changes, both the education and management components have to adapt / learn to come up to the new / changed situation. These three components have quite complex causal relationships with the economic system / set up prevalent in a society. Thus the thesis work is a study on the education system and learning system with a management perspective so as to improve the performance of a system through intervention at the highest policy making / design level.

An education system might be modelled at various (hierarchical) levels, viz. global / regional level, local / institute level and micro / component level. At global level the scope of the education system would be to consider it as a subsystem of a larger socioeconomic system. At the local level each educational institute would be a subsystem of a larger regional education system. And at the micro level the individual component subsystems such as students, personnel, physical facilities would need to be considered. However, in this thesis, the modelling applications at two of the three levels i.e., regional and local levels have been addressed in the field of higher technical education.

The crux of the issue of the education system modelling is having a control over the education system process by manipulating student intake for instance. To handle this problem the education system at regional level, in the thesis, is modelled as technical manpower planning which is captured through a dynamic education - employment process model. Further, the technical manpower planning is viewed at two levels, one at the aggregate level and the other at the disaggregate or discipline-wise level. Different policy options and their individual effects in terms of sensitivity

on the system behavior have been studied through simulation of a system dynamics model. An illustrative case study for the state of Uttar Pradesh, India, is presented.

Education system at the local / institute level has been modelled to study how the internal dynamics of the educational institute affects its own growth as well as its output to the outside environment. An example of development of alternate profiles of evolution of dynamics of the Indian Institute of Technology, Delhi at the macroscopic level during the VIII five year plan period (1990-95) has been illustrated through direct and transformed system dynamics model simulations.

A model of learning system, Knowledge Automaton, developed in the thesis subsumes most of the existing models of learning as special cases. This model is applied, conceptually, to both technical manpower planning and educational institute planning studies.

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