STATISTICAL MODELS FOR STOCKS AND FLOWS OF STUDENTS IN AN EDUCATIONAL SYSTEM

BY

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SUMMARY OF CONTENTS

In developing countries education patterns are constantly changing due to rapid population growth and other socio-economic factors. This trend calls for transition models which incorporate factors which are internal or external to the system. These models are used together with the theory of stochastic processes to define various measures of academic retention. Estimates of these measures are computed using the stocks and flows data of the primary school system in Kenya. An attempt is made to control the system in two ways. First, control is made via some quantifiable factors which affect the system, so as to achieve some future desired educational characteristics. Secondly, some desired educational characteristics are specified and the problem is to find the transition process that should be followed in order to achieve the targets.

In chapter I an overview of mathematical modelling as applied to hierarchical processes is given. A brief description of the work already done in the area of modelling hierarchical processes in general and education systems in particular is also given in this chapter.

Chapter II examines the homogeneity of the Kenyan primary education system between 1964 to 1980. This is done by partitioning the entire period into equal intervals and comparing the average education characteristics of each of these intervals. Any appreciable difference in these characteristics would suggest departure from homogeneity of the process over the considered period.

The results of chapter II suggest possible inhomogeneity in the Kenyan primary education system. For this reason in Chapter III the assumption of homogeneity in the education process is relaxed. It is suggested here that the transition process changes in time. In particular a study is made of a number of transition models which attempt to incorporate endogeneous factors in the system over a period of time by means of time dependent probability distribution functions. These models are used together with the theory of the time dependent Markov chains, to compute various measures of academic retention.

Chapter IV describes a model which traces the flow of a cohort of students through the Kenyan primary education system. For the purpose of this study the term cohort is used to denote a group of

students regardless of age or socio-economic background, who enter the first grade in the same academic year. In particular the cohort transition model is used as an application of the more general Markov chain model described in chapter III.

In chapter V the transition process is modelled as a function of time dependent quantifiable factors. The proposed model is first used to describe some educational characteristics. Then an attempt is made to control some of the factors so as to achieve some desired future educational characteristics optimally.

Finally in Chapter VI we consider a control problem where the desired educational characteristics are specified and we aim at finding the transition process to be followed in order to achieve the desired targeted characteristics optimally.

The thesis ends with a few general remarks by way of conclusion, regarding the results obtained in the present work and possible problems for future research. These conclusions form the contents of Chapter VII.

Every model proposed in the thesis has been illustrated by computing numerical values of several educational characteristics. The results

of such computations are given in tables throughout the thesis.

The theoretical contents of this thesis is mostly based on the theory of Markov chains, especially the time dependent Markov chains. Use is also made of linear regression models and statistical control theory in multivariate regression models.