



Decision criteria related to university building programs
by Earl Bay Peterson

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY in Agricultural Economics
Montana State University
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Abstract:

The task of an administrator is decision making under uncertainty. That is, actions must be taken when outcomes can, at best, be expressed only in probability terms. Business and industry have applied a technique known as decision criteria to the solving of many types of management problems. The objective of this study was to apply one type of decision criterion to a specific problem for an institution of higher learning. The criterion required the use of a multivariate Bayesian statistical model. The objective was to minimize losses for building married student housing units when enrollments, numbers of married students, and demand for housing were uncertain.

Data sources included a mailed questionnaire concerning characteristics of married students in general, the types of housing they lived in, and personal information such as monthly income, size of family, and student status of the spouse. From this, a model was developed which was used in the estimation of rent paid for apartment units, given the monthly income of the respondent, size of the apartment in number of bedrooms, and quality of the structure based upon age.

Projection of student population numbers, in total, and married students, in particular, required an analysis of enrollment trends. Independent variables were analyzed which a priori one would expect to be meaningful indicators for prediction of numbers of married students in the future. Bayesian probability statements were developed, utilizing sets of information which, in effect, were a posteriori probabilities for the uncertain states of nature, the expected numbers of married students.

A loss table, or matrix, in which the cells indicate losses for over or underbuilding varying magnitudes of housing units was completed. The losses represent interactions of choices for building decisions available to the decision maker relative to possible states of nature, or estimated numbers of married students. The Bayes strategy is to select the action which minimizes the losses, utilizing sets of information along with a priori probabilities concerning the state of nature.

In addition to the Bayesian statistical model, this study produced a presentation of anticipated future enrollments, given certain assumptions, an analysis of building program-decision-making rules, a procedure for an analyst to follow in preparing information prior to turning it over to the decision maker for his actions, and a discussion of the influences that subjective weights, held by the administrator, would have upon the decision choice.

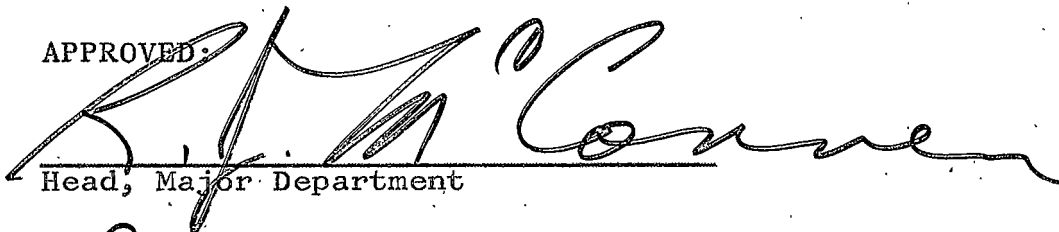
The advantage of the Bayesian inference for decisions made under uncertainty is that an administrator can utilize his experience, background, or intuition in the selection of the a priori probabilities with respect to future states of nature. Flexibility can be obtained by altering the probability statements as more evidence or stronger feelings about outcomes are forthcoming. Final choice of a decision or action by an administrator would need further information in, order to use the model presented in this study. The loss must be quantified and placed in the model format before definite action programs relative to a building program can be made.

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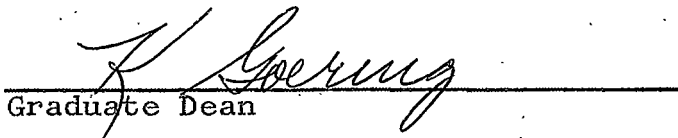
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TABLE OF CONTENTS

	<u>Page</u>
VITA.	ii
ACKNOWLEDGMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES.	vi
LIST OF FIGURES	ix
ABSTRACT.	x
CHAPTER I: INTRODUCTION.	1
The Role of the University	1
The Impact of Enrollments.	8
Institutional Planning Procedures.	11
CHAPTER II: DEFINITION OF THE PROBLEM.	25
Justification of the Study	25
Statement of the Problem	26
Objectives of the Study.	27
Procedures	28
CHAPTER III: PRESENTATION OF DATA.	31
Historical Enrollments and Projections	31
Survey Procedures.	53
Description of Variables Resulting from Survey.	54
Results of Data Analysis	55
CHAPTER IV: DECISION MODELS.	58
Models and Decision Makers	58
Bayesian Decision Model.	71
Application of Model	79
The Bayesian Estimator	89
Loss Tables.	94

	<u>Page</u>
CHAPTER V: RISK, UNCERTAINTY AND UTILITY	106
Decision Rules	118
CHAPTER VI: SUMMARY AND CONCLUSIONS.	127
Conclusions.	134
Further Research	136
APPENDICES.	140
Appendix A	141
Appendix B	148
Appendix C	153
Appendix D	157
LITERATURE CITED.	159

LIST OF TABLES

<u>Tables</u>	<u>Page</u>	
I	STUDENT ENROLLMENTS EXPRESSED AS NET ENROLLEES BY CATEGORY OF STUDENTS, NOVEMBER 1, 1960-61 THROUGH 1970-71, MONTANA STATE UNIVERSITY.	10
II	NUMBER OF MARRIED STUDENTS COMPARED TO TOTAL STUDENTS FOR FALL QUARTER, 1960-61 THROUGH 1970-71, MONTANA STATE UNIVERSITY.	31
III	NUMBER OF RENTAL UNITS AVAILABLE, FALL QUARTER, 1960-61 THROUGH 1970-71, COMPARED TO NUMBER OF MARRIED STUDENTS, MONTANA STATE UNIVERSITY.	32
IV	NUMBER OF MARRIED STUDENTS BY CATEGORY AND PERCENTAGE CHANGE, FALL QUARTER, 1960-61 THROUGH 1970-71, MONTANA STATE UNIVERSITY	34
V	NUMBER OF CHILDREN, MARRIED STUDENTS, FALL QUARTER, 1960-61 THROUGH 1970-71 MONTANA STATE UNIVERSITY.	35
VI	ESTIMATED MID-YEAR POPULATION, RATE OF BIRTHS PER 1,000 ESTIMATED POPULATION, AND NUMBER OF LIVE BIRTHS, 1910 THROUGH 1970, MONTANA	38
VII	NUMBER OF YEARS BETWEEN HIGH AND LOW FIGURES, NUMBER OF LIVE BIRTHS, 1910 THROUGH 1970, MONTANA	41
VIII	CHANGES IN POPULATION GROWTH AND BIRTH RATE PER 1,000 OF POPULATION, 1910 THROUGH 1969, MONTANA	43
IX	PROJECTIONS OF POPULATION AND NUMBERS OF LIVE BIRTHS, 1971 THROUGH 1981, MONTANA	46
X	NUMBER OF LIVE BIRTHS AGGREGATED INTO A COLLEGE POOL FOR POTENTIAL ENROLLEES, 1960 THROUGH 1990, MONTANA.	48

<u>Tables</u>	<u>Page</u>	
XI	COMPARISON OF CHANGES IN COLLEGE POOL, WITH NOVEMBER 1 NET ENROLLMENTS, FALL QUARTERS, 1952-53 THROUGH 1971-72, MONTANA STATE UNIVERSITY.	50
XII	PROJECTED NET ENROLLMENTS UNDER VARIOUS GROWTH RATES, FALL QUARTERS, 1971 THROUGH 1990, MONTANA STATE UNIVERSITY. . .	52
XIII	ENROLLMENT OF VETERANS UNDER G. I. BILL PROGRAM EXPRESSED AS A PERCENTAGE OF TOTAL ENROLLMENTS, MONTANA STATE UNIVER- SITY, 1945-46 THROUGH 1970-71	73
XIV	GRADUATE AND OTHER STUDENTS EXPRESSED AS A PERCENTAGE OF TOTAL ENROLLMENTS, MONTANA STATE UNIVERSITY, 1945-46 THROUGH 1970-71 .	75
XV	PER CAPITA INCOME ADJUSTED FOR CONSUMER PRICE INDEX, 1957-59 BASE	76
XVI	PROJECTION OF NUMBERS OF MARRIED STUDENTS THROUGH 1985-86, MONTANA STATE UNIVERSITY .	82
XVII	HOUSING REQUIREMENTS AND CURRENT INVENTORY LEVELS FOR ADJUSTED FAMILY UNITS, SIZE OF FAMILY AND INCOME LEVELS, 1970-71 TO 1985-86, MONTANA STATE UNIVERSITY	83
XVIII	ESTIMATED RENT AMOUNTS GIVEN MEAN INCOME AND ASSUMING SIZE AND QUALITY FACTORS . . .	86
XIX	ALLOCATION OF CURRENT INVENTORY BETWEEN FAMILY UNITS OF LESS THAN OR MORE THAN TWO CHILDREN.	88
XX	† TABLE VALUES AND PROBABILITY ESTIMATES. .	93
XXI	PER-UNIT COST FOR OVER-CONSTRUCTION OF FAMILY UNITS, GIVEN CERTAIN ASSUMPTIONS . .	98
XXII	LOSSES FOR UNDERBUILDING OR OVERBUILDING ASSUMING VARIOUS STATES OF NATURE	101
XXIII	VALUE OF ALTERNATIVE ACTIONS, GIVEN THE PROBABILITY OF THE STATE OF NATURE OCCURRING	103

<u>Tables</u>		<u>Page</u>
XXIV	ADJUSTMENTS TO AGGREGATE LOSSES FOR ADDITIONAL DISUTILITY FOR OVERBUILDING. . .	113
XXV	RANK ORDER OF ACTIONS WITH ADDED DIS- UTILITY FOR OVERBUILDING FROM 10 THROUGH 35 PERCENT.	114
XXVI	INCREASING DISUTILITY FOR OVERBUILDING AT AN INCREASING RATE	117

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1.	VARIABLES INFLUENCING INSTITUTIONS OF HIGHER EDUCATION.	6
2.	FLOW CHART OF DECISIONS REQUIRING CONSIDERATION WHEN ANALYZING BUILDING PROGRAM NEEDS.	29
3.	NUMBER OF LIVE BIRTHS, 1910 THROUGH 1970, MONTANA.	40

ABSTRACT

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CHAPTER I

INTRODUCTION

The Role of the University.

Institutions of higher learning may have a variety of aims, goals, programs, or purposes, depending upon individual peculiarities or conditions. Over the past 100 years, or since the emergence of the "university", if one considers John Hopkins to be the initial institution to so qualify, in 1876, considerable controversy has arisen over the role or function of such an organism in our society. Certainly, a university can be thought of as becoming more involved in the affairs of greater numbers of individuals and organizations throughout society. To state that controversy and misunderstanding are prevalent is almost absurd. Clark Kerr comments that:

The functions of the university have always been more or less complex and never as simple as some have supposed. The historical tendency has been for university functions to become more complex, and to leave simplicity even further behind. Yet, there are those who still cry for¹ the simple life, the homogeneous institution.

That question or controversy would emerge regarding the purpose or reason for existence of an institution seems natural and logical. Universities are a haven for scholars, scientists, and possessors of the "inquiring mind". Edward H. Levi, in his Inaugural Convocation Address, given at the University of Chicago, November 14, 1968, spoke of the "disturbingly impressive" goals, achievements, and traditions of that institution.² He considers the mission of pioneering to be primary. Faith

is placed not upon financial resources or material goods but upon the intellectual powers of the mind. He stated:

It was considered important, more important than anything else in the world, to uncover and understand the cultures of the past, to appreciate the works of the mind, to penetrate the mysteries of the universe, to know more about the environment, the societies, and the nature of man. The university's seriousness of purpose was proven from the first by its insistence upon freedom of inquiry and discussion.³

Not all institutions can or should adopt this point of view as its central theme. Dr. Levi recognizes this when he calls attention to the mission of the University of Chicago as being primarily the intellectual search for truth and the transmission of intellectual values. He concedes, however, that among colleges, schools, and universities, there are important differences. The histories, capacities, and objectives are not all the same, and each institution must find its own mission.

Customarily, universities have been assigned these functions: teaching, research, and service. Dr. Kerr prefers to categorize these in a different manner by referring to them as:

...a series of services relating to production, to consumption, and to citizenship.⁴

His reasoning on this point seems important enough to warrant inclusion of the entire explanation:

1. The functions related to production are all those that potentially add to the output of goods and services in society:

The Talent Hunt.--the selection, guidance, rating, and placement of students for productive occupations. Higher education acts as a great sorting machine. It rejects as well

as selects and grades.

The training in vocational, technical, pre-professional, and professional skills.--

This is carried on at three levels:

terminal vocational work often included in the junior college program leading to a certificate or an Associate in Arts degree, introductory technical training leading to the Bachelor's and Master's degree, and advanced professional training leading to the Doctor's degree. Related to this is postgraduate retraining.

Research.

Service.--Through formal and informal advice and consultation.

All of these functions are best carried out by specialists and through highly organized programs that proceed in sequence, step by step. They draw support from industry, government, the professions, and the academic world itself. The test of performance is technical competence. This line of authority is from the expert to the novice.

2. The consumption functions are those that relate to current consumption of goods and services by the students or by others in the campus community, or to 'durable' consumption through changed tastes, sensitivities, skills, and opportunities that lead to a fuller life for the individual.

General education.--This gives the student a better understanding of his cultural heritage and perhaps of other cultures as well, and assists him to understand more deeply himself and his relationships with others. The classics, with their emphasis on personal character, were once the single chosen instrument for general education. Now there are several approaches available. General education for cultural and recreational purposes is increasingly demanded and is available also at the older adult level.

Provision of community life on campus.--Once this life was highly moral and reli-

gious; later it came to be predominantly collegiate--athletics, journalistic activities, fraternities, sororities, and so forth. Currently, the emphasis is more on external political activity, on service projects to aid others, on experimental cultures of dress and conduct, on artistic affairs; and increasingly when there is the tendency to consider people other than strictly defined members of the campus as part of the 'community'--the walls fall down. In the early American colleges, community life was determined by the college itself.

Beginning with the movement for student control of extracurricular activities a century ago, the nature of the community life has been more responsive to the changing interest of the students, than to the wishes of the peer group.

Custodial.--Students, somehow, must be housed and fed, given medical care and personal counseling, and preferably kept out of trouble during the period between the time they leave the homes of their parents and start their own families.

Holding operation.--Many students, particularly at the lower division, but also at the M. A. level, are uncertain about what they want to do--get a job, get married, get more education, choose a new field of emphasis. The college provides a place for them to be and an excuse for being while they survey their opportunities and make up their minds. The high dropout rate at these levels can also be viewed as a high 'drop-in' rate to other activities. The college, by providing a holding pattern for many students, extends their practical range of choices and the time to make these choices, and thus may improve the quality of the choices.

These several functions are best assisted by persons oriented not so much toward subject matter as toward students as individual human beings,

and through programs that are flexible and diversified in response to the changing and varied interests of the students. These functions consider the student--not industry, government, the professions, or the academic world--as their main source of orientation. The test of performance is less in technical competence and more in student acceptance. The line of authority is more from the consumer (the student) and less from the teacher and the administrator. Influence over the student relies more on guidance than on control of a technical program. This is the realm for the generalist, not the specialist.

3. The citizenship functions of higher education are those that relate to the performance of students, alumni, and faculty members in relation to their civic responsibilities:

Socialization.--This involves giving the student a basic understanding of the nature of and the rule governing political, economic, and community life. Some would add: indoctrination.

Evaluation.--This calls for critical analysis of the purposes and conduct of established society, and for opportunities to voice objections and make proposals. Some would add: direct social action.

Remedial.--Students drawn from many types of homes, many different communities, many diverse school systems come to the campus with quite different qualities of preparation. Once there, the concept of equality of opportunity requires that provision be made so that deficiencies can be made up and subsequent competition put on a more equal footing.⁵

To further illustrate the potential role of any institution, a diagram has been prepared. Figure 1 identifies individual ingredients that are influential in determining the needs, goals, objectives, or role of any single institution. These ingredients are not all-inclusive, nor will all possible relationships or interactions between

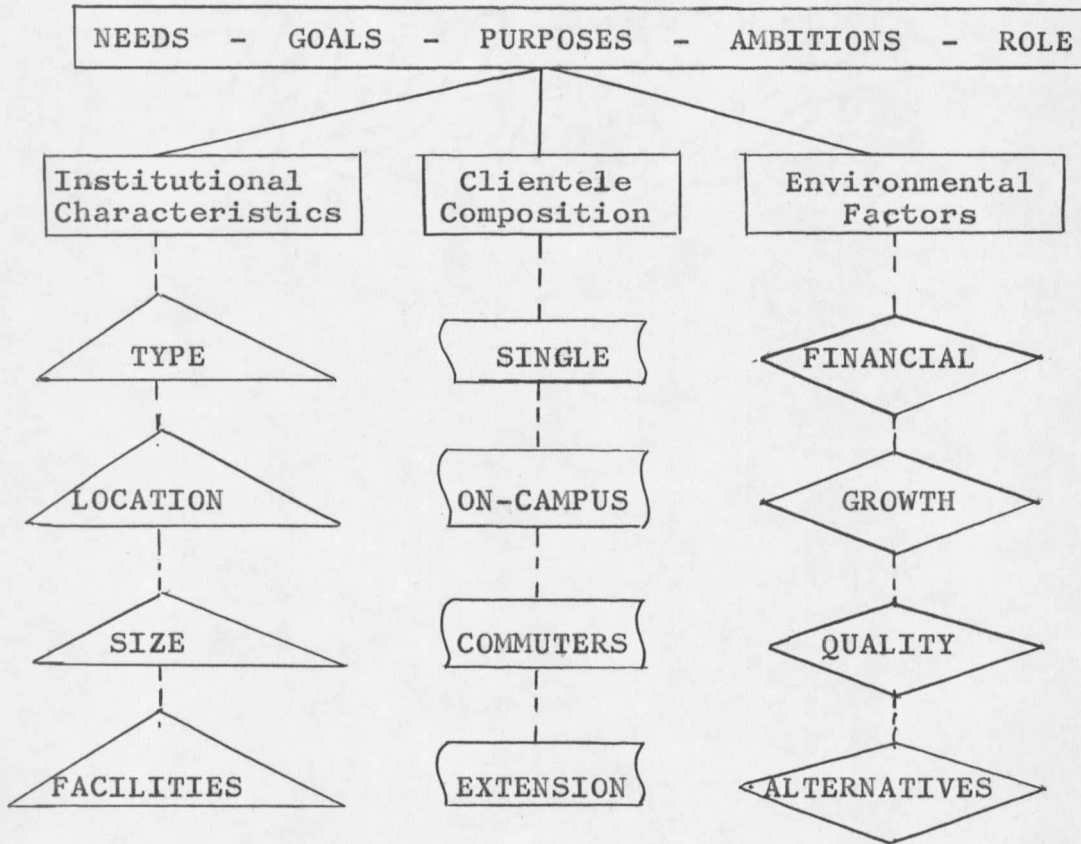


FIGURE I. Variables Influencing Institutions of Higher Education.

and among various components be explained. The purpose of the diagram is to represent the complexities of an institution and serve as a guide in identifying specific components or variables that are essential in the selection of alternatives for decision-making administrators.

The role of an institution has been defined as:

...a series of services relating to production, to consumption, and to citizenship.⁶

Figure 1 describes an institution in terms of the factors which influence the institution. These have been divided into three broad categories--institutional characteristics, composition of the clientele being served, and environmental factors in which the institution must exist.

The characteristics of an institution are further subdivided into: 1) type--public, private, land grant, liberal arts, junior college or graduate, for example; 2) location--urban or rural, metropolitan with high population or low population density; 3) size; and 4) facilities--the nature of the physical plant. These components are interrelated, with the latter--facilities--being more dependent upon the others. The need for or justification of a large stadium or fieldhouse, the functions of the student union facility, requirements for residence halls, married student housing, food services, health complex, or theatre would depend, in part, upon the characteristics of the institution, the composition of the clientele, and environmental factors. A large, urban, liberal arts institution serving predominantly commuter or evening school students may have no justification for married student or residence hall facilities. An institution devoting major efforts to graduate or extension activities might not have

elaborate student union facilities or food services available.

Environmental factors include the financial atmosphere in which the institution must function and the concept of quality in terms of excellence or acceptability. Related to finances are matters of growth--enrollment trends, new programs, expanding tax base, alumni and their impact, and the potential alternatives that are available in the community, both in terms of organizations and facilities.

The common denominator of all factors influencing an institution is the student. Whether an institution considers its mission to be one of an intellectual process, service to the immediate community or an intricate web of many functions, the central core for existence must be students. Without a continuing stream of new clientele, no institution could long exist.

The Impact of Enrollments

The past two decades have been periods of tremendous growth for many institutions of higher learning. Increases as large as four-fold are not uncommon for the time span from 1950 to 1970. Factors influencing this growth include the "war baby" phenomenon of 1945, resulting in greater elementary school enrollments, a higher rate of retention of students through secondary school years, an increasing propensity for high school graduates to enter higher education, lengthening of the time period students are enrolled in higher education because of the growth in graduate degrees, variety in curriculum offerings, and uncertainty of students in selection of a subject matter

field in which to specialize. Recently, the composition of the mixture of students has been shifting. Table 1 presents the figures for Montana State University for the past ten years.

The figures indicate more than a doubling in enrollment during the decade of the 1960's. This is true for both categories shown. The past five years present a picture which bears some discussion. Graduate and other enrollments increased annually from 1965-66 at 2.17 percent, 14.3 percent, 21.4 percent, 0.4 percent, and 0.4 percent through 1970-71, a mean increase of 9.67 percent. The last two years show a significant change in the trend established over the preceding three years, or the mean of the five-year period. Dr. Kenneth J. Goering, Dean of the Graduate College, Montana State University, attributed this change to at least four factors:⁷

1. A change in federal legislation affecting draft deferment status for graduate enrollment. Prior to 1969-70, graduate school was eligible for draft deferment.
2. Status of federal funding for research projects. The overheated economy resulted in excessive inflationary pressures as early as fiscal year 1968. To combat this, the administration employed one of the tools available to remedy this ill--that of monetary policy--by reducing support for federally sponsored research at colleges and universities. An unusually large number of graduate students at Montana State University receive monetary support for their education. The majority of this support came from federal research funds.
3. Employers of graduate students reduced their recruiting efforts at the Master's or the Ph. D. levels. The recessive economy

TABLE I. STUDENT ENROLLMENT EXPRESSED AS NET ENROLLEES
AS OF NOVEMBER 1, 1960-61 THROUGH 1970-71, BY
CATEGORY OF STUDENT, MONTANA STATE UNIVERSITY*

Year	Undergraduate ^{1/}	Graduate + Other ^{2/}	Total
1960-61	3573	316	3889
1961-62	3974	300	4274
1962-63	4256	352	4608
1963-64	4350	389	4739
1964-65	4780	414	5194
1965-66	5402	485	5887
1966-67	5773	495	6268
1967-68	6202	566	6768
1968-69	6587	687	7274
1969-70	7028	690	7718
1970-71	7494	693	8187

^{1/} Includes students holding one B. S. but working toward a second undergraduate degree.

^{2/} Includes students taking graduate courses but not pursuing a graduate degree.

* Source: Registrar's Office, Summary of Registration Report, Montana State University, Bozeman, Montana.

