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ABSTRACT

Part 2 of a two-part report describes nine supplemental studies used to test K-MUST, the Kansas Manpower Utilization System for Training. For each study, an introduction, background information, procedures, analysis, and conclusions and recommendations are provided. The studies are: (1) a comparison of Federal matrix manpower needs projections and employer survey manpower needs projections for small labor markets, (2) an analysis of the accuracy of modified matrix projected occupational profiles for urban labor markets, (3) the use of manpower needs and student interest to plan vocational and technical education in Kansas, (4) an analysis of the net manpower needs in the Kansas City Standard Metropolitan Statistical Area from 1972 through 1976, (5) a physical facility utilization survey of the 14 area vocational-technical schools in Kansas, (6) participation rates of disadvantaged and handicapped groups in Kansas area vocational and technical school programs, (7) a cost/benefit analysis of training programs in Kansas' 14 vocational area schools, (8) the development of a decision model for vocational-technical education planning, and (9) handbook for vocational and technical education planners: cycle 2, January, 1973. A 15-page bibliography and 122 pages of appended material conclude the document. (AG)

FINAL REPORT

VOLUME II:

SUPPLEMENTAL STUDIES

KANSAS MANPOWER UTILIZATION SYSTEM FOR TRAINING

Division of Vocational Education
Kansas Department of Education
and
Department of Adult and Occupational Education
Kansas State University

KANSAS MANPOWER UTILIZATION SYSTEM FOR TRAINING (K-MUST)

FINAL REPORT

VOLUME II: SUPPLEMENTAL STUDIES

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FOREWORD

This second volume of the K-MUST Final Report documents nine major studies conducted to test system modules presented in Volume I. The first eight of the nine studies represent doctoral dissertations prepared by K-MUST staff members or other graduate students in the College of Education at Kansas State University. The ninth study is the second annual cycle of the K-MUST Handbook for Vocational and Technical Education Planners.

The first two studies examine the accuracy of the manpower demand projecting system module. Dr. Jimmie L. Downing, presently Academic Dean at Barton County Community College, investigated the accuracy of projections in small labor markets while Dr. R. B. Daniels, presently State Supervisor of Industrial Education, investigated the accuracy of projections in larger urban labor markets.

In the third study, Dr. Robert Price, presently a research project director at Southern Illinois University, examined the relationships between manpower demand and student interest to determine if these two factors are compatible planning criteria. He also studied the relationships between these two planning criteria and the present vocational enrollment in Kansas in an effort to determine the basis of past program planning in the state. During his investigations, he tested the student interest systems module.

Dr. Brynjulv Norheim, presently a lecturer at the University of Oslo in Norway, projected net manpower needs in the Kansas City Standard Metropolitan Statistical Area in the fourth study. Of special interest was an examination of overlapping efforts occuring because of coordination problems across the Kansas-Missouri state line. In the course of his study, he tested the interfacing system module and the interstate planning module.

In the fifth study, Dr. Jim Downs, presently an associate professor at Metropolitan State College in Denver, examined facility usage in Kansas' fourteen area schools. During the course of his work, he tested the facility usage system module.

The disadvantaged and handicapped system module was tested in the sixth study. Dr. David Jones, presently principal at Olathe High School in

Olathe, Kansas, examined the participation rates of five disadvantaged or handicapped groups in Kansas' fourteen area schools. Participation rates are presented by school, by program and by program type across schools.

In the seventh study, Dr. Jack De Vore, presently an assistant professor at the University of Arkansas, examined societal cost/benefit relationships of various training programs in Kansas' fourteen area schools. Of special interest was his approach to estimating payback periods and long run accrued benefits. During his study, he tested the cost-benefit system module.

In the eighth study, Dr. Dale Brooks, presently director of the Central Kansas Area Vocational Technical School, developed optimum program mixes for the CKAVTS service area and the state as a whole relative to placement of graduates in employment related to their training. A comparison of the optimum mixes and the present mixes proved very interesting. During the course of his work, he tested the optimum program mix system module.

Finally, in the ninth study, the K-MUST staff presents an interfacing of manpower demand and manpower supply for the state and eleven regions within the state, estimates of upgrading training needs, a summary of student interest data, and data tables summarizing potential student populations. This study is the second cycle of a continuing system report entitled the K-MUST Handbook for Vocational and Technical Education Planners.

Part 1

A COMPARISON OF FEDERAL MATRIX MANPOWER NEEDS PROJECTIONS AND EMPLOYER SURVEY MANPOWER NEEDS PROJECTIONS FOR SMALL LABOR MARKETS

Jimmie Lee Downing

Chapter 1

INTRODUCTION

BACKGROUND

The manpower and educational legislation of the last decade has continuously underlined the need for more and better information about the manpower needs of current and future local labor markets. Section 106 of the Manpower Development and Training Act[1] as amended and Section 123 of the 1968 Amendments to the 1963 Vocational Education Act[2] indicate that projections of present and future manpower needs are an essential part of the vocational planning effort.

The Department of Labor presently recognizes at least five major techniques which can be used to project manpower demand.[3] These are:

1. The Area Skills Survey,
2. The Leading Indicators Experiment Approach,
3. The Industry Expert Approach,
4. The Unfilled Job Openings - Occupational Outlook Handbook Approach, and
5. The BLS Occupation By Industry Approach.

Of these five, the two which have proven most popular are the Area Skills Survey and the BLS Occupation By Industry Approach. (Note: The latter is more commonly call the BLS Matrix Approach while the former is often called the Employer Survey.) In comparing these two approaches, several factors come to light including the following.[4]

1. Employer surveys are relatively expensive since the average interview costs more than six dollars when time, travel and processing are considered.

2. Employer surveys rely on a stratified random selection of firms to be surveyed for generalizability of the data. Since many firms do not respond, the generalizability of the data is in some question.

3. There is some question as to whether the average employer is able to make accurate projections of long-range manpower needs for his firm.

4. The matrix approach is usually restricted to statewide or large

urban area projections since input for the matrix includes labor market profile data which are normally not available for small labor markets.

5. When using the national matrix there is a question as whether the factors and ratios are applicable to small labor markets.

Analyzing the above factors, it might seem that the ideal way to gather labor market needs data would be to use the matrix approach to project the needs of larger labor markets such as a state or the nation and use the employer survey approach to project the needs of the local labor market.

Examination of other factors, however, indicates that most local vocational education administrators do not have the resources, time or expertise to conduct local surveys. Possibly the best solution to the problem of making manpower needs projections would be to modify present matrix approaches so that reasonably accurate data could be generated for the local administrator.[5]

In September of 1971, the Division of Vocational Education of the Kansas Department of Education contracted with Kansas State University for the development of a management information system to aid in the planning of vocational and technical education. An integral part of this system is a technique designed to forecast manpower needs in local labor markets. Because of limited funds, the employer survey technique was not deemed feasible which left only the matrix approach. However, as indicated above, the matrix approach was tied to labor market profiles which were not available for the small labor markets. A new matrix approach was derived which broke away from the profile concept by utilizing the BLS factors and ratios in conjunction with present local employment totals by Standard Industrial Classification (SIC).[6]

Although the modified matrix approach seems to be logically sound, there is no empirical evidence which can be used to evaluate the technique.

STATEMENT OF THE PROBLEM

This study will attempt to answer the question, "What is the size and source of error in manpower projections generated by the modified matrix technique?"

PURPOSE OF THE STUDY

Because of the immediate need for evaluation of the modified matrix technique, a longitudinal examination is not feasible.[7] Estimates of present employment by occupation generated by the technique, however, can be empirically examined using cross-sectional techniques.[8] The purpose of this study is to partially evaluate the modified matrix technique by comparing the estimated present employment by occupation with the actual occupational profile (100 percent employer survey) in two local areas in Kansas.

NEED FOR THE STUDY

Planning, evaluation and funding of vocational and technical education in Kansas will be based, in part, on the manpower needs projections generated by the modified matrix technique. It is essential, therefore, that these projections be as accurate as possible. If there are areas where significant inaccuracies result from the use of the technique, the system managers must be aware of both the type and degree of error as soon as possible.

This study will provide a partial evaluation of the accuracy of the technique at a level where error can best be identified and will indicate possible approaches for improving projections. In addition, the cross-sectional format of the study will provide evaluation results before other evaluations are possible and hence decrease reaction time for improvements of the technique.

ASSUMPTIONS

The analysis and interpretation of data done in this study are based on the following assumptions:

1. Employers will be able to define the occupations of their employees in terms used by the matrix approach.

2. Employers will be willing to cooperate in providing data on the number and type of employees in their organization.

3. Maximum error will be found in small labor markets where national and state ratios will be applied to local employment totals. (Note: Conversely, the larger the labor market, the better projections will be.) Hence, this study is testing situations where inaccuracies will be greatest.

4. Economic conditions will not significantly affect the degree of error found in small labor market projections generated by the modified matrix.

DELIMITATIONS

The following are delimitations of this study:

1. Only two small labor markets will be surveyed and compared with matrix projections.

2. Estimated employment will be compared with present employment, however, projected job openings cannot be compared with actual job openings for the projected period. This means that this study will provide only a partial evaluation of the technique.

HYPOTHESES

This study will evaluate the matrix technique by testing the following hypotheses.

Hypothesis 1

There will be a significant difference between the present occupational profile derived using the modified matrix approach and the occupational profile as determined by the employer survey.

Hypothesis 2

A rationale can be developed to define a scale table which will indicate accuracy of projections for various sized labor markets.

FOOTNOTES

[1]U.S. Congress, Senate, Committee on Education, Manpower Development and Training Act of 1962, Hearing, 87th Cong., 1st Sess., March 15, 1962 (Washington: Government Printing Office, 1963).

[2]U.S. Congress, House, Committee of Education, Vocational Education Act of 1963, Hearing, 88th Cong., 1st Sess., March 25, 1963 (Washington: Government Printing Office, 1964).

[3]William R. Fischer, "Project Vision: An Experiment with Occupational Needs Projection Techniques for Vocational Education Curriculum Planning Purposes," (Wisconsin State Employment Service, June, 1970). (Mimeographed).

[4]Statement by James L. Harris, K-MUST Project Director, personal interview, January 15, 1972.

[5]James L. Harris and Robert E. Scott, "Using a Matrix Approach to Project Manpower Needs in a Small Labor Market," (unpublished paper, Kansas State University, 1972), p. 2.

[6]Ibid., p. 5.

[7]Statement by John Snyder, Asst. Commissioner, Vocational Education, Kansas State Department of Education, personal interview, February 13, 1972.

[8]Statement by James L. Harris, K-MUST Project Director, personal interview, January 15, 1972.

Chapter 2

BACKGROUND INFORMATION

INTRODUCTION

This chapter is concerned with background information that identifies, defines and explains key concepts used in this study.

DEFINITIONS

Bureau of Labor Statistics (BLS)

The Bureau of Labor Statistics is a component of the Department of Labor which has the primary responsibility for the technical development and statistical adequacy of the matrix system used to project national manpower needs.[1]

Bureau of Labor Statistics Occupation by Industry Matrix (BLS Matrix)

The BLS Matrix is a set of employment and expansion ratios pertaining to various industries and occupations within industries. The matrix covers 116 industrial clusters and 162 occupational clusters which represent the entire economy.[2]

Experimental Employer Needs Survey

The Experimental Employer Needs Survey is a refined modification of the Area Skill Survey Technique used to project manpower needs. The Area Skill Survey is conducted by means of a mail or interview questionnaire which asks individual employers to forecast their employee requirements for a projection period, taking into account both replacement and expansion needs.[3]

Industry Expert Approach

The Industry Expert Approach is a method of projecting manpower needs using interviews with industry experts from a single industry group. This method is used to arrive at projections for a particular type of industry.[4]

Labor Force

The Labor Force is the total number of workers available minus the size of the armed forces and assuming a national unemployment rate of three percent.[5]

Labor Market

The Labor Market is the total number of jobs available in the economy.

Leading Industries Experiment Approach

The Leading Industries Experiment Approach projects manpower demand by identifying the leading firms which might be among the more progressive and whose occupational mix and projected employment trend might provide information useful for vocational education planning.[6]

Manpower Demand

Is the total number of measured or projected skilled persons needed during the time period under consideration, categorized according to specific skill, or "skill cluster."[7]

Manpower Supply

Is the total number of measured or projected skilled persons available during the time period under consideration, categorized according to specific skill or "skill cluster" and the supply source where this skilled person is located.[8]

Standard Industrial Classification (SIC)

Is a system whereby each industry is assigned a code on the basis of its major activity, which is determined by the project or group of products produced or handled, or services rendered. The structure of the system makes it possible to classify establishments by industry on a two digit, a three digit, or a four digit basis, according to the degree of detail in information which may be needed.[9]

Unfilled Job Openings - Occupational Outlook Handbook Approach

This is a technique for projecting manpower demand by using data available from selected records of the Employment Service agencies, in combination with routinely collected information from other Federal and State agencies to form its data base. This data may then be used for the planning of vocational programs.[10]

THE HISTORICAL SETTING

Over the past decade, manpower legislation has continuously emphasized the need for vocational education to be based on the manpower demands of the local community, the state and the nation. Examples of legislative acts which specifically address this need are:

1. The Area Redevelopment Act of 1961,[11]
2. The Manpower Development and Training Act of 1962,[12]
3. The Vocational Education Act of 1963,[13]
4. The Higher Education Facilities Act of 1963,[14]
5. The Economic Opportunity Act of 1964,[15]
6. The Civil Rights Act of 1964,[16]
7. The Higher Education Act of 1965,[17]
8. The Appalachian Act of 1965,[18]
9. The 1968 Amendments to the 1963 Vocational Education Act.[19]

The 1968 Amendments to the 1963 Vocational Education Act, possibly the most influential legislation on vocational education today, states that it is the responsibility of vocational educators to provide vocational training which is "realistic in the light of actual or anticipated opportunities for gainful employment."[20] To facilitate this mandate, the State Employment Security Commission offices are given the responsibility of "making available to the State board and local educational agencies occupational information regarding reasonable prospects of employment in the community and elsewhere..."[21]

In many cases, the State Employment Security Commissions have not been able to meet this responsibility. Medvin[22] comments on this problem as follows:

> The State Employment Services with no additional funding and with the traditional and costly skill survey technique available to them, have in many instances been unable to furnish the information which by law they are obligated to provide.

Given the responsibility to provide manpower needs data and without the funds to conduct manpower skill surveys, the Department of Labor has funded research to investigate alternative methods for projecting manpower needs. These include:

1. The Leading Indicators Experiment Approach,
2. The Industry Expert Approach,
3. The Unfilled Job Openings - Occupational Outlook Handbook Approach, and
4. The BLS Occupation by Industry Approach.[23]

Of these alternative methods, the most satisfactory is the BLS Occupation by Industry Approach more commonly referred to as the BLS Matrix Approach.[24] This approach provides a reasonably detailed (by occupation) picture of a given work force and is relatively inexpensive.[25]

The BLS Matrix Approach has two alternative techniques to the development of manpower needs projections; i.e., Area Projection Method A and Area Projection Method B. The first is a relatively simple system that is dependent upon both the base period national matrix (1960) and the projected national matrix (1975). The second is more complex; it requires the development of an area base period matrix (1960).[26]

The matrix itself consists of a set of tables reflecting trends in employment for occupations within Standard Industrial Classifications. In simplest terms, the methods are techniques for utilizing the matrix to first determine the occupational profile of the area and second determine the projected manpower needs in those occupations.[27]

There are two major criticisms of the BLS Matrix Approach; i.e., it applies national trends to local (state) situations[28] and it cannot provide projections for small labor markets.[29] In addition, State Employment Security Commissions are having difficulty findi j the financial resources necessary to develop projections utilizing this technique even though it is relatively inexpensive.[30]

In the late summer of 1971, the Division of Vocational Education of the Department of Education in Kansas contracted with Kansas State University for the development of a system to project manpower needs which could be used as a basis for planning vocational education.[31] One of the criteria on which the system was to be based was that it be inexpensive enough to be cycled at least once a year. Additionally, it was to have the capability of projecting manpower needs in small labor markets utilizing localized trend data to the greatest extent possible.[32]

The system development staff selected the matrix approach as that technique that most closely met the needs of the Department of Education. With the help of the State Employment Security Commission, the Regional Office of the Bureau of Labor Statistics and the Regional Manpower Administration Office, a new method of utilizing the matrix was developed which provided for the input of localized trends and allowed for projections of small labor markets.[33]

Preliminary examination of the output of this modified matrix approach indicates that the error in the development of occupational profiles for small labor markets is not a restricting factor, however, further investigation must be conducted with the intent of identifying areas where projections are weak and additional modifications might improve the final output.[34]

AREA PROJECTION METHOD A

Using this technique, estimates of area occupational requirements are made by applying 1960 and 1975 national industry-occupational patterns to appropriate area industry employment estimates; summing the occupational totals; computing a change factor (1960-1975) for each occupation; and applying the change factors.

The equation used is:

$$L_j\ (75) = \frac{\sum_{i=1}^{n} f_{ij}\ (75) L_i\ (75)}{\sum_{i=1}^{n} f_{ij}(60) L_i(60)} L_j(60)$$

where:

L_j (year) = total local employment in occupation j;

L_i (year) = total local employment in industry i;

f_{ij} (year) = National fraction of occupation j in industry i.

As an example, (1) if automobile mechanics were employed in automobile sales and automobile repair industries exclusively, (2) if there were 10,000 workers in automobile sales and 50,000 workers in automobile repair in a given labor market in 1960, and (3) if there are projected to be 12,000 workers in automobile sales and 55,000 workers in automobile repair in the same labor market in 1975, the calculations using Method A would be:

$$\frac{(.4965^{a} * 12{,}000^{b}) + (.2953^{a} * 55{,}000^{b})}{(.4417^{a} * 10{,}000^{c}) + (.3321^{a} * 50{,}000^{c})} \cdot (20{,}000^{c})$$

(Note: [a] indicates the data is from matrix tables, [b] indicates that data is estimated employment usually done by extrapolation of Unemployment Insurance Account records and [c] indicates that the data is from 1960 census occupational profiles and related data.)

or, there will be about 21,120 automobile mechanics employed in 1975 which is an increase of 1,120 (21,120 - 20,000) automobile mechanics jobs from 1960 to 1975.

This technique is limited in that 1960 census occupational profiles are not available for many local areas in the nation.

THE MODIFIED MATRIX TECHNIQUE[35]

The modified matrix technique developed by Kansas State University is based on the following assumptions.

1. The occupational structure of the local industries is similar to the national pattern for that type of industry.

2. Adjusting the derived local occupational profile in terms of the state occupational profile as presented by the Kansas Employment Security Commission will improve the local occupattional profile estimate.

3. National expansion figures for a particular type of occupation in a particular type of industry are a reasonable estimate of how that type of industry will expand in the local labor market.

4. Adjustments of the local expansion estimates in terms of past local labor market trends will improve the local expansion rate estimates.

5. National replacement factors are reasonable estimates of the replacement rates in local industry.

6. The use of the present year industrial structure will offset some of the error derived from using national base factors and ratios.

Based on the above assumptions, the modified matrix technique uses the following steps to project manpower needs.

1. Determine the Standard Industrial Classification (SIC) structure of the local community.

2. Determine the occupational profile estimate of the local community.

3. Adjust the local occupational profile estimate in terms of the state occupational profile provided by the Kansas Employment Security Commission.

4. Determine the projected expansion of employment for the projection period based on occupation by industry rates.

5. Adjust the projected expansion in terms of the past labor market trends of the local area.

6. Determine the need for replacement of workers in various occupations.

7. Sum replacement needs and expansion needs to determine total manpower needs over the projection period.

These seven steps are explained in detail below.

The Standard Industrial Classification (SIC) Structure of the Local Community

The modified matrix approach requires that all employing firms in the labor market be identified by (1) the nature of the work done by the firm as defined by SIC codes and (2) the number of employees in the firm. This data is accumulated into number of employees in a particular type of industry (SIC) in the local labor market.

The data on individual firms is based on a data set called Dun's Market Identifiers (R) which is purchased from Dun and Bradstreet, Inc. This data set is supplemented by the Employment Services Unemployment Insurance Account data, telephone directories, government directories, Department of Agriculture studies, and Wichita State University's Health Manpower Study.

Deriving the Occupational Profile

To break the employment by SIC into employment by occupation, percentages found in the BLS Matrix are used. For example, the percent of workers in the furniture and fixture manufacturing industry who are cabinetmakers (as indicated in the BLS Matrix) is presented in Table I below.

Table 1

Percentage Of Furniture And Fixture
Workers Who Are Cabinetmakers

	Percentage of Workers	
	1970	1980
Cabinetmakers	6.40	4.42

If in a local community in 1971 there were 1,000 workers in the furniture and fixtures manufacturing industry, then using a straight line technique, an estimated 62.02 cabinetmakers would be found in the industry locally. The formula used to derive this figure is:

$$\left(1970\ \text{Percent} - \frac{1970\ \text{Percent} - 1980\ \text{Percent}}{1980 - 1970}\right) \cdot \text{Number of Workers}$$

or:

$$\left(.64 - \frac{.064 - .0442}{10}\right) \cdot (1000) = 62.02$$

Estimate the Expansion Needs

To estimate the expansion needs for workers of a particular type in a given industry, figures in the BLS Matrix are used. Examples of these figures for cabinetmakers in the furniture and fixture manufacturing industry are found in Table II.

Table 2

Employment Of Cabinetmakers In Furniture
And Fixture Manufacturing

	1970 Employment	1980 Employment
Furniture and Fixture Manufacturing	135,950	182,500

Given the above figures, it is estimated that the number of cabinetmakers in furniture and fixture manufacturing will expand at a rate of approximately thirty-four percent over a ten-year period or abour 3.4 percent per year. In the example, if a three-year expansion need projection is required, then there would be a need for 6.32 cabinetmakers. The formula used to determine the number of cabinetmakers needed to meet expansion needs in the furniture and fixture manufacturing industry is:

(Annual Expansion Rate) . (Number of Years) . (Number of Workers)

or in the example:

.034 x 3 x 62.02

Once the expansion needs have been estimated, the total number of cabinetmakers and related expansion needs are summed for all SIC's. An example of how this might look is presented in Table III.

Table 3

Summation Of Cabinetmaker Data For All SIC's
In A Local Labor Market Situation

Standard Industrial Classification	Number of Cabinet-makers	Expansion Needs
Furniture and Fixture Manufacturing	62.02	6.32
Furniture Repair	9.43	1.20
Furniture Sales	11.96	2.33
Construction	6.01	.44
Other	4.34	.16
TOTAL	93.76 94	10.45 10

Adjustment of the Estimated Occupational Profile

The total number of cabinetmakers and related expansion needs computed for the local labor market are then adjusted in light of the difference between the BLS Matrix Model A estimates of the Kansas occupational profile as modified by the Kansas Employment Security Commission and the statewide unadjusted occupational profile generated by the modified matrix technique. For example, if the number of cabinetmakers generated by the modified matrix technique differ by a -8.2 percent, the number of cabinetmakers estimated in the local labor market would be reduced by that percent. The expansion needs are treated in the same way.

Adjustment of the Expansion Needs Based on Local Labor Market Histories

The history of the local labor market in terms of total employment is examined for the past ten years. If the average increase or decrease in employment is different than the change projected by the modified matrix for the total local labor market, then individual occupational changes are adjusted accordingly.

Computation of Replacement Needs

Workers to fill new job openings is not the only factor in the manpower demand picture and often it is not even the major element. The need to replace workers who die, retire or leave the occupation is also an important factor.

Annual replacement factors provided by the Employment Security Commission are used to compute the number of workers needed to replace those who die, retire, or leave the occupation. If the annual replacement factor for cabinetmakers is 2.7 percent then in the example, 7.60 workers would be needed to replace cabinetmakers in the next three years.

Total Needs

The total manpower needs is equal to the sum of the expansion needs and the replacement needs. In the example, there would be a need for approximately eighteen (7.60 + 10.45) cabinetmakers over the three-year period.

FOOTNOTES

[1]Department of Labor, Bureau of Labor Statistics, "Statement on the Industry; Occupational Matrix Program" (unpublished paper, Department of Labor, 1971), p. 7.

[2]Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. IV, The National Industry-Occupational Matrix and Other Manpower Data (Washington: Government Printing Office, 1969), p. 5.

[3]William R. Fischer, "Project VISION: An Experiment with Occupational Needs Projection Techniques for Vocational Education Curriculum Planning Purposes" (Wisconsin State Employment Service, June, 1970), p. 8. (Mimeographed.)

[4]Ibid., p. 11.

[5]Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. II, National Trends and Outlook: Industry Employment and Occupational Structure (Washington: Government Printing Office, 1969), p. 6.

[6]Fischer, op. cit., p. 10.

[7]Braden, Paul V., James L. Harris, and Krishan K. Pauls., et al., Occupational Training Information System: A Final Report Complete with System Documentation (Stillwater: Oklahoma State University Research Foundation, 1970), p. 21.

[8]Ibid., p. 22.

[9]Bureau of the Budget, Office of Statistical Standards, Standard Industrial Classification Manual (Washington: Government Printing Office, 1967), p. xi.

[10]Fischer, op. cit., p. 13.

[11]U.S. Congress, Area Redevelopment Act, Public Law 87-27, 87th Cong., 1961 (Washington: Government Printing Office, 1961).

[12]U.S. Congress, Manpower Development and Training Act of 1962, 87th Cong., 1962 (Washington: Government Printing Office, 1962).

[13]U.S. Congress, Vocational Education Act of 1963, Public Law 88-210, 88th Cong., 1963 (Washington: Government Printing Office, 1964).

[14]U.S. Congress, Higher Education Facilities Act of 1963, Public Law 88-210, 88th Cong., 1963 (Washington: Government Printing Office, 1963).

[15]U.S. Congress, Economic Opportunity Act of 1964, Public Law 89-4, 89th Cong., 1964 (Washington: Government Printing Office, 1964).

[16] U.S. Congress, Civil Rights Act of 1964, Public Law 88-371, 88th Cong., 1964 (Washington: Government Printing Office, 1965).

[17] U.S. Congress, Higher Education Act of 1965, Public Law 89-329, 89th Cong., 1965 (Washington: Government Printing Office, 1965).

[18] U.S. Congress, Appalachian Act of 1965, Public Law 89-502, 89th Cong., 1965 (Washington: Government Printing Office, 1965).

[19] U.S. Congress, Vocational Education Amendments of 1968, Public Law 90-576, 90th Cong., 1968 (Washington: Government Printing Office, 1968).

[20] Fischer, op. cit., p. 3.

[21] Norman Medvin, "Occupational Job Requirements: A Short-Cut Approach to Long-Range Forecasting," Employment Service Review, (January-February, 1967), p. 63.

[22] Ibid.,

[23] Fischer, op. cit., p. 8-15.

[24] Ibid., p. 4.

[25] Ibid.

[26] Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. II, Using National Manpower Data to Develop Area Manpower Projections (Washington: Government Printing Office, 1969), p. 11.

[27] Ibid., p. 7-10.

[28] Ibid., p. 5.

[29] Ibid.

[30] Medvin, op. cit., p. 64.

[31] Statement by James L. Harris, K-MUST Project Director, personal interview, March 13, 1972.

[32] Ibid.

[33] James L. Harris and Robert E. Scott, "Using a Matrix Approach to Project Manpower Needs in a Small Labor Market" (unpublished paper, Kansas State University, 1972), p. 2.

[34] Harris, op. cit.

[35] Harris and Scott, op. cit., p. 5.

Chapter 3

PROCEDURES

INTRODUCTION

The purpose of this chapter is to describe the procedures, data and tools that were used to evaluate the hypotheses presented in Chapter 1.

THE POPULATIONS

There are two types of populations directly involved in this study. The first is the population of counties with small labor markets in Kansas. The second is the population of jobs by occupational type in each county.

Since the economy of Kansas varies greatly from east to west with the eastern counties being involved with manufacturing, mining, and small farm operations, and the western counties being involved principally in large farming operations, the counties with small labor markets were roughly divided into two sub-populations, i.e., eastern counties and western counties for sample stratification purposes. A further refining of the two sub-populations was achieved by eliminating the central Kansas counties which are difficult to classify as either eastern or western counties. Once the central Kansas counties were eliminated, there were twelve eastern and thirty-three western counties with labor forces of less than 3,000 workers. A listing of these counties can be found in Appendix A.

The population of jobs (occupational profile) in the counties with small labor markets constitute the second major population type involved in this study. The modified matrix projects an occupational profile of 162 jobs or job clusters for each county. This profile represents all employment in the labor market.

THE SAMPLES

There are three samples involved in this study. The first is a stratified random sample of counties on the basis of the eastern and western classification. One eastern county (Wabaunsee) and one western county (Edwards) were randomly selected to be surveyed. The second two samples consisted of all employment in each of the two counties.

THE INSTRUMENT

The interview instrument (see Appendix B) was designed in the spring of 1972 in cooperation with the K-MUST staff. A copy of the instrument was used for each employer to be surveyed. The instrument consists of a listing of jobs and job clusters identical to those generated by the modified matrix with space provided to enter the number of employees in each job or job cluster during an interview. The instrument is not open-ended since every occupation is classifiable under the structure provided.

DATA COLLECTION

The data collected for this study consists of the number of workers by occupation of all non-farm employers in Wabaunsee and Edwards counties in Kansas. Each employer was visited to determine how many workers were employed and what occupations were involved. On-farm data used in this study was found in 1972 unpublished employment security data.

From June 7, 1972 through June 16, 1972, 146 employers in Wabaunsee County were surveyed. These employers reported 781 workers in 60 occupations. Every effort was made to contact all off-farm employers in the county and as far as can be determined, all were successfully surveyed.

From June 19, 1972, through June 26, 1972, 160 employers in Edwards County were surveyed. These employers reported 939 workers in 81 occupations. Again, every effort was made to contact all off-farm employers in the county and, again, as far as can be determined, all were successfully surveyed.

INTERVIEWING TECHNIQUES

It should be noted that 306 interviews were conducted during the course of this study. In no instance, was cooperation refused and in only two instances was the interview postponed. Interviewing was conducted strictly by the outline found in Scott's <u>Occupational Surveys</u>.[1] A description of the interview procedure is as follows.

1. The interviewer introduced himself, explained the subject and purpose of the study, explained that all employers in the county were being surveyed, and that the interview was confidential relative to specific employers.

2. The interviewer emphasized that cooperation was voluntary, that the survey was important to the interviewee and that the interviewee's answers were important to the survey results.

3. The interviewer dressed in accord with community standards which, in this case, included slacks and a dress shirt with no tie.

4. The interview was conducted in the place of business with no one present except the interviewer and the interviewee.

5. The questionnaire was explained and the interviewee responded with the number and occupation of employees.

6. Probes were used when responses were irrelevant, unclear, or incomplete.

7. Responses were recorded at the time they were made.

8. The interviewee checked the questionnaire to ascertain completeness and accuracy of the reporting before the interviewer left the place of business.

9. The interviewer thanked each interviewee before leaving.

STATISTICAL TOOLS

Two statistical tools were used to analyze the data for this study. The two tools used are techniques normally described in standard statistics text books. Hypothesis 1 requires the use of the Chi Square Test of Independence while Hypothesis 2 requires the use of Curvilinear Regression Analysis.

The Chi Square Test of Independence is an extremely useful statistical procedure for determining whether two nominal (or higher level) measures are related. If one of the variables is group membership, and the other a criterion of some sort, the test may be used to determine whether two or more populations are distributed in the same fashion with respect to the criterion.[2]

In this case, data generated by the modified matrix technique and data determined through the survey constitute membership in two different groups while occupations constitute the criterion on which the groups are distributed.

A Chi Square value is calculated where the size of the value is determined by the discrepancies in the match of the two data groups with respect to the criterion; the value being higher where the discrepancy is greater. If the Chi Square value is greater than some pre-determined figure, then a significant difference is said to exist. The confidence in which this statement can be made rests on the pre-determined figure selected. In this study, ninety-five percent confidence will be acceptable and hence, the figure will be selected on this basis.

The first step in determining the Chi Square value is to arrange the data into rows and columns with the rows being occupations and the columns being group membership. If, for example, ten workers were projected to be welders by the modified matrix column and the welder row would be ten.

Once the data has been arranged in this fashion, the values in the columns and rows are summed. When the columns and rows have been summed, the expected frequency for each cell is computed. Expected frequencies are the values which would exist in the cells if the row and column sums did not change and if the distributions were identical. The expected frequency for each cell is derived by multiplying the row total times the column total and dividing by the total of all entries.

The Chi Square contribution of each cell is computed by squaring the difference of the cell's expected frequency and actual value and dividing by the expected frequency. The Chi Square value is the sum of all Chi Square contributions.

The pre-determined value for the ninety-five percent confidence level is computed with the following formula:

$$\chi^2 = \frac{1}{2} (1.6449 + \ 2df - 1)^2$$

In this formula, df stands for degrees of freedom while χ^2 stands for the pre-determined or tabular Chi Square value.

The degrees of freedom are determined by multiplying the number of rows minus one, times the number of columns, minus one. The reason one is subtracted is that if a set number of items is assigned to a set number of cells where row and column totals are fixed, one row and one column of cells are not free to vary.

Again, if the Chi Square value computed using the two distributions is greater than the tabular Chi Square value, then a significant difference is said to exist between the two distributions.

Curvilinear Regression is a special case of Bivariate linear regression where the second independent variable is a function of the first independent variable. In the case presented in this study, scattergram evidence indicates that the greater the size of the labor market, the less the percent of error which suggests that the relationship between size of projection and the degree of error may be forecasted by some second degree polynomial. If this is the cas ., then the first independent variable (number projected by matrix) is related to the second independent variable (number projected by matrix squared) in the manner expressed in the following function:

$$X_1^2 = X_2$$

It should be noted that Snedecor and Cochran[3] describe Curvilinear Regression as a technique for fitting a curve to data or curve fitting. This is in effect what is being done in this analysis. They also indicate that extrapolation of the curve is a dangerous procedure and should not be used unless such extrapolation is absolutely necessary. Since the counties examined in this study do not have any large occupational clusters and since it is desirable to estimate the average error for large occupational clusters, extrapolation has been accepted while the limitations of such a procedure will be noted. One restriction is placed on this extrapolation, however, estimating error will be limited to a curve sigment which stops considerably short of the inflection point.

The problem is to determine the constants b_1, b_2 and c in the polynomial. The Curvilinear Regression Equations to make these determinations are:

$$b_1 = \frac{(\Sigma x_1 y)\ (\Sigma x_2^2) - (\Sigma x_1 x_2)\ (\Sigma x_2 y)}{(\Sigma x_1^2)\ (\Sigma x_2^2) - (\Sigma x_1 x_2)^2}$$

$$b_2 = \frac{(\Sigma x_1^2)\ (\Sigma x_2 y)\ (\Sigma x_1 x_2)\ (\Sigma x_1 y)}{(\Sigma x_1^2)\ (\Sigma x_2^2) - (\Sigma x_1 x_2)^2}$$

$$c = \frac{\Sigma Y - b_1\Sigma X_1 - b_2\Sigma X_2}{N}$$

The variables in the equations above are derived as follows:

1. $\Sigma x_1^2 = \Sigma X_1^2 - \frac{(\Sigma X_1)^2}{N}$

2. $\Sigma x_2^2 = \Sigma X_2^2 - \frac{(\Sigma X_2)^2}{N}$

3. $\Sigma x_1 x_2 = \Sigma X_1 X_2 - \frac{(\Sigma X_1)(\Sigma X_2)}{N}$

4. $\Sigma x_1 y = \Sigma X_1 Y - \frac{(\Sigma X_1)(\Sigma Y)}{N}$

5. $\Sigma x_2 y = \Sigma X_2 Y - \frac{(\Sigma X_2)(\Sigma Y)}{N}$

Where:

1. ΣX_1^2 is the number projected for each occupation squared then summed for all occupations.

2. $(\Sigma X_1)^2$ is the sum of all numbers projected by the matrix which is then squared.

3. ΣX_2^2 is the number projected for each occupation squared then summed for all occupations.

4. $(\Sigma X_2)^2$ is the sum of all numbers projected by the matrix squared, then summed for all occupations.

5. $\Sigma X_1 X_2$ is the number projected by the matrix times the number projected squared.

6. ΣX_1 is the sum of all numbers projected by the matrix.

7. ΣX_2 is the sum of all numbers projected squared.

8. $\Sigma X_1 Y$ is the number projected for each occupation times the number of error for each occupation then summed for all occupations.

9. ΣY is the sum of all error in the matrix projections.

10. $\Sigma X_2 Y$ is the number projected for each occupation squared times the number of error for each occupation then summed for all occupations.

ANALYSIS PROCEDURES

The analysis procedures used to affirm or reject the hypotheses examined in this study are explained below.

Hypothesis 1

Hypothesis 1 which states "There will be a significant difference between the present occupational profile derived using the modified matrix and the occupational profile as determined by the employer survey." will be tested by comparing the two distributions for two Kansas counties.

The hypothesis will be affirmed if both Chi Square Tests indicate a significant difference. The hypothesis will be rejected if both Chi Square tests indicate no significant difference. The hypothesis will be considered unaffirmed but not rejected if a significant difference is found in one test but not in the other.

The .05 level of significance will be used in both Chi Square tests. This means that on either test, ninety-five percent confidence can be assured that the hypothesis was not affirmed by chance.

In cases where the matrix projected zero employment due to rounding and no employment was found in the occupations through the survey, .5 was inserted as the matrix value. This should serve to maximize the possible computed Chi Square contributions and hence make the test conservative.

In an examination of the tables, it will be found that many of the cells have a zero value. Roscoe and Byers[4] indicate that this will not affect the accuracy of the Chi Square Test if the average cell value is greater than five. The data meets this qualification.

Hypothesis 2

Hypothesis 2 which states "A table can be developed which will indicate the average error in projections of occupational profiles for various sized labor markets." will be tested using curvilinear regression analysis. If a curve that describes the relationship between the size of an estimate for a given occupation in the occupational profile and the error in the estimate expressed in number of workers can be determined and if the correlation (R) is sufficiently high to warrant the assumption of a fit of the curve to the data, the hypothesis will be affirmed. Given affirmation of the hypothesis, a table will be generated using average number of workers in each occupation to determine percent of error in a local labor market.

Since agriculture census data were used to determine on-farm employment and must also be used to measure error, this occupation was eliminated from the regression analysis to insure that error was not underestimated at the higher end of the curve.

FOOTNOTES

[1]Robert E. Scott, Occupational Surveys (Pittsburg, Kansas: Kansas State College at Pittsburg, 1967).

[2]John T. Roscoe, Fundamental Research Statistics for the Behavioral Sciences (New York: Holt, Rinehardt and Winston, Inc., 1969).

[3]George W. Snedecor and William G. Cochran, Statistical Methods (Ames, Iowa: The Iowa State University Press, 1967), p. 453.

[4]John T. Roscoe and Jackson A. Byers, "Chi Square Approximation of Multinomial and Selected Alternatives" (paper read at the Annual Educational Research Association Convention, March, 1970, Minneapolis, Minnesota).

Chapter 4

ANALYSIS

INTRODUCTION

This chapter presents (1) the statistical analysis and the disposition of the hypotheses examined in this investigation and (2) a discussion of various factors which contributed to the disposition of the hypotheses.

ANALYSIS AND DISPOSITION OF HYPOTHESIS 1

Hypothesis 1 which states "There will be a significant difference between the present occupational profile derived using the modified matrix approach and the occupational profile as determined by the employer survey," could not be affirmed or rejected. In Edwards County a significant difference was found in the two occupational profiles while in Wabaunsee County a significant difference could not be determined.

Significant contributors to the computed Chi Square value in Edwards County were the Machine Tool Operator criterion, the Machinists criterion, the Auto Attendants criterion and the Salesworkers criterion. In the case of the Machine Tool Operator criterion, six workers were projected and 40 were identified by survey. For Machinists, 34 workers were projected and eight were identified by survey. There were 126 Salesworkers projected while only 70 were identified by survey while eight Auto Attendants were projected and 24 were identified by survey. It should be noted that if Machinists and Machine Tool Operators were group as Machinist Trade, the calculated Chi Square value would be well under the tabular Chi Square value.

The results of the statistical analysis for Edwards County were the following. The null hypothesis that there was no significant difference between the occupational profile derived from the matrix and the occupational profile determined by the survey was rejected on the basis of a computed Chi Square value of 196.78 and a tabular Chi Square value of 162.883 for the .05 level of significance. See Table 4 for the cell values and calculations used to derive the computed Chi Square value.

TABLE 4

CHI SQUARE ANALYSIS DATA TABLE FOR EDWARDS COUNTY

OCCUPATION	(A) OBSERVED FREQUENCY FROM MATRIX	(B) OBSERVED FREQUENCY FROM SURVEY	(C) TOTAL OB-SERVED IN ROW	(D) EXPECTED FREQUENCY FROM MATRIX	(E) EXPECTED FREQUENCY FOR SURVEY	(F) CHI SQUARE CONTRIBUTION FROM MATRIX	(G) CHI SQUARE CONTRIBUTION FROM SURVEY	(H) TOTAL CON-TRIBUTION FOR ROW
	X	Y	A+B	A.C/N	B.C/N	$(A-D)^2/D$	$(B-D)^2/E$	F+G
Engineer, Aero	.5	0.	.5	.27	.23	.18	.23	.41
Engineer, Chemical	.5	0.	.5	.27	.23	.18	.23	.41
Engineer, Civil	4.	0.	4.	2.12	1.88	1.67	1.88	3.55
Engineer, Elec.	3.	1.	4.	2.12	1.88	.37	.41	.78
Engineer, Ind.	2.	0.	2.	1.06	.94	.83	.94	1.77
Engineer, Mech.	4.	4.	8.	4.24	3.76	.01	.01	.02
Engineer, Metal	.5	0.	.5	.27	.23	.18	.23	.41
Engineer, Mining	.5	0.	.5	.27	.23	.18	.23	.41
Chemist	.5	0.	.5	.27	.23	.18	.23	.41
Ag. Scientist	1.	1.	2.	1.06	.94	.00	.00	.00
Bio. Scientist	.5	0.	.5	.27	.23	.18	.23	.41
Geologists	.5	0.	.5	.27	.23	.18	.23	.41
Mathematician	.5	0.	.5	.27	.23	.18	.23	.41
Physicist	.5	0.	.5	.27	.23	.18	.23	.41
Draftsman	4.	13.	17.	9.03	7.97	2.80	3.17	5.97
Surveyors	0.	5.	5.	2.65	2.35	2.65	2.99	5.64
Air Traffic Controller	.5	0.	.5	.27	.23	.18	.23	.41

TABLE 4 (CON'T)

Radio Operator	.5	0.	.5	.27	.23	.18	.23	.41
Dentist	2.	2.	4.	2.12	1.88	.01	.01	.02
Dietician	.5	0.	.5	.27	.23	.18	.23	.41
Nurses, R. N.	13.	27.	40.	21.24	18.76	3.20	3.62	6.82
Optometrists	0.	1.	1.	.53	.47	.53	.60	1.13
Osteopaths	.5	0.	.5	.27	.23	.18	.23	.41
Pharmacists	3.	5.	8.	4.24	3.76	.36	.41	.77
Physicians	3.	3.	6.	3.19	2.81	.01	.01	.02
Psychologists	1.	0.	1.	.53	.47	.42	.47	.89
Tech, Med. & Dental	4.	4.	8.	4.24	3.76	.01	.01	.02
Vets.	3.	1.	4.	2.12	1.88	.37	.41	.78
Teachers	79	63	142.	75.40	66.60	.17	.19	.36
Economists	.5	0.	.5	.27	.23	.18	.23	.41
Statisticians	.5	0.	.5	.27	.23	.18	.23	.41
Accountants	9.	2.	11.	5.84	5.16	1.71	1.94	3.65
Airplane Pilot	1.	1.	2.	1.06	.94	.00	.00	.00
Architects	.5	0.	.5	.27	.23	.18	.23	.41
Artists & Entertainer	0.	2.	2.	1.06	.94	1.06	1.19	2.25
Clergymen	9.	14.	23.	12.21	10.79	.84	.95	1.79
Designers	1.	o.	1.	.53	.47	.42	.47	.89
Editors and Reporters	0.	2.	2.	1.06	.94	1.06	1.19	2.25
Lawyers and Judges	6.	6.	12.	6.37	5.63	.02	.02	.04
Librarians	4.	3.	7.	3.72	3.28	.02	.02	.04
Personnel Workers	1.	1.	2.	1.06	.94	.00	.00	.00
Photographers	.5	0.	.5	.27	.23	.18	.23	.41
Social & Welfare	3.	3.	6.	3.19	2.81	.01	.01	.02
Conductors	.5	0.	.5	.27	.23	.18	.23	.41
Creditmen	1.	0.	1.	.53	.47	.42	.47	.89
Postmasters & Asst.	3.	5.	8.	4.24	3.76	.36	.41	.77
Steno. Typists	65.	63.	128.	67.96	60.04	.13	.15	.28

TABLE 4 (CON'T)

Office Mach. Oper.	9.	2.	11.	5.84	5.16	1.71	1.94	3.65
Accounting Clerk	10.	11.	21.	11.15	9.85	.12	.13	.25
Bookkeepers, Hand	18.	9.	27.	14.34	12.67	.94	1.06	2.00
Bank Tellers	5.	3.	8.	4.24	3.76	.14	.15	.29
Cashiers	22.	18.	40.	21.24	18.67	.03	.03	.06
Mail Carriers	11.	9.	20.	10.62	9.38	.01	.02	.03
Postal Clerks	9.	10.	19.	10.09	8.91	.12	.13	.25
Ship & Rec Clerks	3.	7.	10.	5.31	4.69	1.00	1.14	2.14
Telephone Oper.	6.	1.	7.	3.72	3.28	1.40	1.58	2.98
Salesworkers	126.	70.	196.	104.7	91.93	4.59	5.23	9.82
Carpenters	5.	6.	11.	5.84	5.16	.12	.14	.26
Brickmasons	1.	0.	1.	.53	.47	.42	.47	.89
Cement & Concrete	.5	0.	.5	.27	.23	.18	.23	.41
Electricians	4.	2.	6.	3.19	2.81	.21	.23	.44
Excavating Mach. Op.	4.	1.	5.	2.65	2.35	.69	.78	1.47
Painters & Paper hangers	5.	1.	6.	3.19	2.81	1.03	1.17	2.20
Plasterers	.5	0.	.5	.27	.23	.18	.23	.41
Plumbers & Pipe Fitters	4.	6.	10.	5.31	4.69	.32	.37	.69
Roofers & Slaters	.5	0.	.5	.27	.23	.18	.23	.41
Structural Metal Workers	.5	0.	.5	.27	.23	.18	.23	.41
Machinists	34.	8.	42.	22.3	19.7	6.14	6.95	13.09
Blacksmiths	.5	0.	.5	.27	.23	.18	.23	.41
Boilermakers	.5	0.	.5	.27	.23	.18	.23	.41
Heat Treaters	0.	1.	1.	.53	.47	.53	.60	1.13
Millwright	.5	0.	.5	.27	.23	.18	.23	.41
Molders, Metal	2.	0.	2.	1.06	.94	.83	.94	1.77
Pattern Makers	.5	0.	.5	.27	.23	.18	.23	.41
Rollers & Roll Hands	.5	0.	.5	.27	.23	.18	.23	.41
Sheet Metal Workers	4.	0.	4.	2.12	1.88	1.67	1.88	3.55
Tool & Diemakers	6.	4.	10.	5.31	4.69	.09	.10	.19
Compositors	0.	3.	3.	1.59	1.41	1.59	1.79	3.38

TABLE 4 (CON'T)

Electrotypers	.5	0.	.5	.27	.23	.18	.23	.41
Engravers	.5	0.	.5	.27	.23	.18	.23	.41
Photo Engraver	.5	0.	.5	.27	.23	.18	.23	.41
Pressmen	0.	2.	2.	1.06	..94	1.06	1.19	2.25
Linemen	15.	7.	22.	11.68	10.32	.94	1.07	2.01
Locomotive Eng.	.5	0.	.5	.27	.23	.18	.23	.41
Locomotive Firemen	.5	0.	.5	.27	.23	.18	.23	.41
Airplane Mech.	.5	0.	.5	.27	.23	.18	.23	.41
Motor Veh. Mech.	20.	18.	38.	20.18	17.82	.00	.00	.00
Office Machine Mech.	1.	0.	1.	.53	.47	.42	.47	.89
Radio & TV Mech.	1.	2.	3.	1.59	1.41	.22	.25	.47
RR & Car Shop Mech.	.5	0.	.5	.27	.23	.18	.23	.41
Bakers	.5	0.	.5	.27	.23	.18	.23	.41
Cabinet Makers	.5	0.	.5	.27	.23	.18	.23	.41
Cranemen	1.	0.	1.	.53	.47	.42	.47	.89
Glaziers	0.	1.	1.	.52	.47	.53	.60	1.13
Jewelers	0.	3.	3.	1.89	1.41	1.59	1.79	3.38
Loom Fixers	.5	0.	.5	.27	.23	.18	.23	.41
Opticians	.5	0.	.5	.27	.23	.18	.23	.41
Inspectors, Log & Lbr.	.5	0.	.5	.27	.23	.18	.23	.41
Upholsterers	3.	0.	3.	1.59	1.41	1.25	1.41	2.66
Drivers, Bus & Truck	50.	35.	85.	45.13	39.87	.53	.59	1.12
Deliverymen	14.	10.	24.	12.74	11.26	.12	.14	.26
Brakemen	.5	0.	.5	.27	.23	.18	.23	.41
Power Sta. Oper.	0.	1.	1.	.53	.47	.53	.60	1.13
Furnacemen	5.	0.	.5	.27	.23	.18	.23	.41
Heaters, Metal	.5	0.	.5	.27	.23	.18	.23	.41
Welders	13.	5.	18.	9.56	8.44	1.24	1.40	2.64
Assemblers A	2.	5.	7.	3.72	3.28	.80	.90	1.70
Assemblers B	7.	8.	15.	7.96	7.04	.12	.13	.25
Inspectors B	2.	0.	2.	1.06	.94	.83	.94	1.77

TABLE 4 (CON'T)

Machine Tool Op. B	6.	40.	46.	24.42	21.58	13.89	15.72	29.61
Electroplaters	0.	1.	1.	.53	.47	.53	.60	1.13
Electroplaters Help.	0.	1.	1.	.53	.47	.53	.60	1.13
Knitters & Loopers	.5	0.	.5	.27	.23	.18	.23	.41
Spinners	.5	0.	.5	.27	.23	.18	.23	.41
Weavers	.5	0.	.5	.27	.23	.18	.23	.41
Sewers	.5	0.	.5	.27	.23	.18	.23	.41
Asbestos Ins.	.5	0.	.5	.27	.23	.18	.23	.41
Attendants, Auto	8.	24.	32.	16.99	15.01	4.76	5.38	10.14
Blasters	.5	0.	.5	.27	.23	.18	.23	.41
Laundry & Dry Cln.	5.	3.	8.	4.24	3.76	.14	.15	.29
Meat Cutters	2.	2.	4.	2.12	1.88	.01	.01	.02
Firemen	6.	0.	6.	3.19	2.81	2.48	2.81	5.29
Guards	3.	0.	3.	1.59	1.41	1.25	1.41	2.66
Policemen & Detective	9.	7.	16.	8.50	7.50	.03	.03	.06
Bartenders	2.	2.	4.	2.12	1.88	.01	.01	.02
Cooks	29.	27.	56.	29.73	26.27	.02	.02	.04
Counter & Fountain	6.	4.	10.	5.31	4.69	.09	.10	.19
Waiters & Waitresses	33.	22.	5.5	29.20	25.80	.49	.56	1.05
Airline Stewardess	.5	0.	.5	.27	.23	.18	.23	.41
Attendant, Inst.	17.	27.	44.	23.36	20.64	1.73	1.96	3.69
Charwomen, Cleaners	4.	7.	11.	5.84	5.16	.58	.67	1.25
Practical Nurses	5.	2.	7.	3.72	3.28	.44	.50	.94
Laborers	53.	35.	88.	46.72	41.28	.84	.96	1.80
Farmers & Farm Wks.	425.	429.	854.	453.43	400.57	1.78	2.02	3.80

N = 2479.5 df. = 134 $\Sigma A = 1316.5$ $\Sigma B = 1163$ $\chi^2_c = 196.78$ $\chi^2_T = 162.883$

Significant contributers to the computed Chi Square value for Wabsunsee County were the Workers in Arts and Entertainment and Salesworkers. In the case of Workers in Arts and Entertainment, 33 were projected and zero were identified by the survey. It should be noted that this error could be traced back to an error in the SIC classifications in the source data. For Salesworkers, 126 were projected while 66 were identified by survey.

The results of the statistical analysis for Wabaunsee County were the following. The null hypothesis that there was no significant difference between the occupational profile derived from the matrix and the occupational profile determined by the survey could not be rejected on the basis of a computed Chi Square value of 161.720 and a tabular Chi Square value of 162.883 for the .05 level of significance. See Table 5 for the cell values used to derive the computed Chi Square value.

ANALYSIS AND DISPOSITION OF HYPOTHESIS 2

Hypothesis 2 which states "A table can be developed which will indicate the average error in projections of occupational profiles for various sized labor markets," was affirmed subject to certain limitations. Probably the most serious limitations are that the rationale from which the table was developed depends on (1) extrapolation of a curvilinear regression equation and (2) the assumption that projections will have a similar proportion of error in urban situations and rural situations. An additional limitation is that the average error found in occupational profile projections for a given sized labor market is estimated on the basis of the average error of the average projection for that labor market.

With respect to the first limitation, extrapolation of the curvilinear regression equation was terminated well before an inflection point on the equation was reached. The second and third limitations could not be circumvented within the parameters of this study.

The rationale used to develop the table or error for various sized labor markets is based on a curve which associates a certain amount of error with a certain sized occupational profile projection. To determine the equation of the curve a curvilinear regression analysis of the size of the projection versus the size of the error was performed. (Note: See Table 6 for the values and calculations used in the regression analysis.)

TABLE 5

CHI SQUARE ANALYSIS DATA TABLE FOR WABAUNSEE COUNTY

OCCUPATION	(A) OBSERVED FREQUENCY FROM MATRIX	(B) OBSERVED FREQUENCY FROM SURVEY	(C) TOTAL OBSERVED IN ROW	(D) EXPECTED FREQUENCY FROM MATRIX	(E) EXPECTED FREQUENCY FOR SURVEY	(F) CHI SQUARE CONTRIBUTION FROM MATRIX	(G) CHI SQUARE CONTRIBUTION FROM SURVEY	(H) TOTAL CON-TRIBUTION FOR ROW
			A+B	A.C/N	B.C/N	$(A-D)^2/D$	$(B-D)^2/E$	F+G
Engineers, Aero	.5	0.	.5	.27	.23	.18	.23	.41
Engineers, Chemical	.5	0.	.5	.27	.23	.18	.23	.41
Engineers, Civil	2.	1.	3.	1.61	1.39	.09	.11	.20
Engineers, Elec.	1.	0.	1.	.54	.46	.39	.46	.85
Engineers, Ind.	.5	0.	.5	.27	.23	.18	.23	.41
Engineers, Mech.	1.	0.	1.	.54	.46	.39	.46	.85
Engineers, Metal	.5	0.	.5	.27	.23	.18	.23	.41
Engineers, Mining	.5	0.	.5	.27	.23	.18	.23	.41
Chemist	2.	0.	2.	1.07	.93	.81	.93	1.74
Ag. Scientist	1.	1.	2.	1.07	.93	.00	.00	.00
Bio. Scientist	.5	0.	.5	.27	.23	.18	.23	.41
Geologist	.5	0.	.5	.27	.23	.18	.23	.41
Mathematician	.5	0.	.5	.27	.23	.18	.23	.41
Physicist	.5	0.	.5	.27	.23	.18	.23	.41
Draftsmen	1.	0.	1.	.54	.46	.39	.46	.86
Surveyors	.5	0.	.5	.27	.23	.18	.23	.41
Air Traffic Controller	.5	0.	.5	.27	.23	.18	.23	.41
Radio Operator	.5	0.	.5	.27	.23	.18	.23	.41

TABLE 5 (CON'T)

Dentist	2.	1.	3.	1.61	1.39	.09	.11	.20
Dietician	.5	0.	.5	.27	.23	.18	.23	.41
Nurses, R. N.	13.	6.	19.	10.20	8.80	.77	.89	1.66
Optometrists	0.	1.	1.	.54	.46	.54	.63	1.17
Osteopaths	.5	0.	.5	.27	.23	.18	.23	.41
Pharmacists	3.	3.	6.	3.22	2.78	.01	.02	.03
Physicians	3.	2.	5.	2.68	2.32	.04	.04	.08
Psychologists	1.	1.	2.	1.07	.93	.00	.00	.00
Tech, Med. & Dental	4.	3.	7.	3.77	3.23	.01	.02	.03
Vets.	4.	1.	5.	2.68	2.32	.65	.75	1.40
Teachers	153.	107.	260.	139.54	120.46	1.30	1.50	2.80
Economists	.5	0.	.5	.27	.23	.18	.23	.41
Statisticians	.5	0.	.5	.27	.23	.18	.23	.41
Accountants	7.	0.	7.	3.77	3.24	2.78	3.24	6.02
Airplane Pilots & Nav.	1.	0.	1.	.54	.46	.39	.46	.85
Architects	.5	0.	.5	.27	.23	.18	.23	.41
Workers in Arts & Ent.	33.	0.	33.	17.71	15.29	13.20	15.29	28.49
Clergymen	11.	11.	22.	11.80	10.19	.05	.06	.11
Designers	.5	0.	.5	.27	.23	.18	.23	.41
Editors	0.	1.	1.	.54	.46	.54	.63	1.17
Lawyers and Judges	4.	2.	6.	3.22	2.78	.19	.22	.41
Librarians	4.	3.	7.	3.77	3.24	.01	.02	.03
Personnel & Labor Rel.	2.	0.	2.	1.07	.93	.81	.93	1.74
Photographers	.5	0.	.5	.27	.23	.18	.23	.41
Social & Welfare	3.	3.	6.	3.22	2.78	.01	.02	.03
Conductors, RR	.5	0.	.5	.27	.23	.18	.23	.41
Creditmen	1.	0.	1.	.54	.46	.39	.46	.85
Postmaster & Asst.	3.	4.	7.	3.77	3.24	.16	.18	.34
Steno. Typist	61.	50.	111.	59.57	51.43	.03	.04	.07
Office Mach. Oper.	6.	2.	8.	4.29	3.71	.68	.79	1.47
Accounting Clerks	9.	3.	12.	6.44	5.56	1.01	1.18	2.19

TABLE 5 (CON'T)

Bookeepers, Hand	17.	18.	35.	18.78	16.22	.17	.20	.37
Bank Tellers	4.	9.	13.	6.98	6.02	1.27	1.48	2.75
Cashiers	5.	6.	11.	5.90	5.10	.14	.16	.30
Mail Carriers	11.	6.	17.	9.12	7.88	.39	.45	.84
Postal Clerks	9.	6.	15.	8.05	6.95	.11	.13	.24
Shipping & Rec. Clks.	2.	1.	3.	1.61	1.39	.09	.11	.20
Telephone Oper.	4.	1.	5.	2.68	2.32	.65	.75	1.40
Salesworkers	126.	66.	192.	103.05	88.50	4.91	5.72	10.63
Carpenters	11.	3.	14.	7.51	6.49	1.62	1.88	3.50
Brickmasons	1.	0.	1.	.54	.46	.39	.46	.85
Cement & Concrete	.5	0.	.5	.27	.23	.18	.23	.41
Electricians	3.	4.	7.	3.77	3.23	.16	.18	.34
Excavating Mach. Oper.	3.	4.	7.	3.77	3.23	.16	.18	.34
Painters & Paperhangers	5.	0.	5.	2.68	2.32	2.01	2.32	4.33
Plasterers	6.	3.	9.	4.83	4.17	.28	.33	.61
Plumbers & Pipefitters	.5	0.	.5	.27	.23	.18	.23	.41
Roofers & Slaters	.5	0.	.5	.27	.23	.18	.23	.41
Structural Metal	.5	0.	.5	.27	.23	.18	.23	.41
Machinists	2.	0.	2.	1.07	.93	.81	.93	1.74
Blacksmiths	.5	0.	.5	.27	.23	.18	.23	.41
Boilermakers	.5	0.	.5	.27	.23	.18	.23	.41
Heat Treaters	.5	0.	.5	.27	.23	.18	.23	.41
Millwrights	.5	0.	.5	.27	.23	.18	.23	.41
Molders, Metal	.5		.5	.27	.23	.18	.23	.41
Pattern Makers	0.	[illegible]	1.	.54	.46	.54	.63	1.17
Rollers	.5	0.	.5	.27	.23	.18	.23	.41
Sheetmetal Workers	.5	0.	.5	.27	.23	.18	.23	.41
Tool & Diemakers	.5	0.	.5	.27	.23	.18	.23	.41
Compositors	.5	0.	.5	.27	.23	.18	.23	.41
Electrotypers	0.	1.	1.	.54	.46	.54	.63	1.17
Engravers	.5	0.	.5	.27	.23	.18	.23	.41

TABLE 5 (CON'T)

Photo engravers	0.	1.	1.	.54	.46	.54	.63	1.17
Pressmen	0.	1.	1.	.54	.46	.54	.63	1.17
Linemen	.5	0.	.5	.27	.23	.18	.23	.41
Locomotive Eng.	.5	0.	.5	.27	.23	.18	.23	.41
Locomotive Firemen	.5	0.	.5	.27	.23	.18	.23	.41
Airplane Mech.	2.	0.	2.	1.07	.93	.81	.93	1.74
Motor Veh. Mech.	7.	10.	17.	9.12	7.88	.49	.57	1.06
Office Mach. Mech.	.5	0.	.5	.27	.23	.18	.23	.41
Radio & TV Mech.	.5	0.	.5	.27	.23	.18	.23	.41
RR & Car Shop Mech.	.5	0.	.5	.27	.23	.18	.23	.41
Bakers	.5	0.	.5	.27	.23	.18	.23	.41
Cabinetmakers	1.	1.	2.	1.07	.93	.00	.00	.00
Cranemen	1.	1.	2.	1.07	.93	.00	.00	.00
Glaziers	.5	0.	.5	.27	.23	.18	.23	.41
Jewelers	2.	0.	2.	1.07	.93	.81	.93	1.74
Loom Fixers	.5	0.	.5	.27	.23	.18	.23	.41
Opticians	.5	0.	.5	.27	.23	.18	.23	.41
Inspector, Log & Lbr.	.5	0.	.5	.27	.23	.18	.23	.41
Upholsters	.5	0.	.5	.27	.23	.18	.23	.41
Drivers, Bus & Truck	56.	58.	114.	61.18	52.82	.44	.51	.95
Deliverymen	11.	11.	22.	11.81	10.19	.06	.06	.12
Brakemen	.5	0.	.5	.27	.23	.18	.23	.41
Power Station Opr.	.5	0.	.5	.27	.23	.18	.23	.41
Furnacemen	.5	0.	.5	.27	.23	.18	.23	.41
Heaters, Metal	.5	0.	.5	.27	.23	.18	.23	.41
Welders	3.	2.	5.	2.68	2.32	.04	.04	.08
Assemblers, Metal Wk. A	1.	0.	1.	.54	.46	.39	.46	.85
Assemblers B	.5	0.	.5	.27	.23	.18	.23	.41
Inspectors B	.5	0.	.5	.27	.23	.18	.23	.41
Machine Tool Opr. B	1.	0.	1.	.54	.46	.39	.46	.85
Electroplaters	.5	0.	.5	.27	.23	.18	.23	.41

TABLE 5 (CON'T)

Electroplaters helper	.5	0.	.5	.27	.23	.18	.23	.41
Knitters, Loopers, Etc.	.5	0.	.5	.27	.23	.18	.23	.41
Spinners	.5	0.	.5	.27	.23	.18	.23	.41
Weavers	.5	0.	.5	.27	.23	.18	.23	.41
Sewers	.5	0.	.5	.27	.23	.18	.23	.41
Asbestos, Ins.	.5	0.	.5	.27	.23	.18	.23	.41
Attendants	8.	43.	51.	27.37	23.62	.12	.12	.24
Blasters	.5	0.	.5	.27	.23	.18	.23	.41
Laundry	2.	2.	4.	2.15	1.85	.01	.01	.02
Meat Cutters	7.	7.	14.	7.51	6.49	.03	.03	.06
Firemen	8.	0.	8.	4.29	3.71	3.21	3.71	6.92
Guards	2.	0.	2.	1.07	.93	.81	.93	1.74
Policemen	6.	9.	15.	8.05	6.95	.52	.60	1.12
Bartenders	2.	4.	6.	3.22	2.78	.46	.54	1.00
Cooks	38.	48.	86.	46.16	39.84	1.44	1.67	3.11
Counter & Fountain Wks.	9.	5.	14.	7.51	6.49	.30	.34	.64
Waiters	39.	22.	61.	32.24	28.26	1.20	1.39	2.59
Airline St.	.5	0.	.5	.27	.23	.18	.23	.41
Attendant, Inst.	19.	45.	64.	34.45	29.65	1.14	1.32	2.64
Charwomen	4.	12.	16.	8.59	7.41	2.45	2.84	5.29
Janitors	40.	21.	61.	32.74	28.26	1.61	1.87	3.48
Nurses, Practical	5.	5.	10.	5.37	4.63	.03	.03	.06
Laborers	79.	50.	129.	69.23	59.77	1.38	1.60	2.98
Farmers & Farm Wks.	758.	761.	1519.	815.24	703.76	4.02	4.66	8.68

N = 3140.5 $\Sigma A = 1685.5$ $\Sigma B = 1455$ $\chi^2_c = 161.72$ $\chi^2_T = 162.883$

Table 6

CURVILINEAR REGRESSION ANALYSIS DATA TABLE

OCCUPATION	ERROR IN MATRIX PROJECTION Y	NUMBER PROJECTED BY MATRIX X_1	NUMBER PROJECTED BY MATRIX SQUARED X_2	ERROR IN MATRIX PROJECTION SQUARED Y^2	NUMBER PROJECTED BY MATRIX SQUARED X_1^2	NUMBER PROJECTED BY MATRIX SQUARED SQUARED X_2^2	NUMBER PROJECTED TIMES NUMBER ERROR X_1Y	NUMBER PROJECTED SQUARED TIMES NUMBER ERROR X_2Y	NUMBER PROJECTED TIMES NUMBER PROJECTED SQUARED X_1X_2
Engineer, Aero	.5	.5	.25	.25	.25	.06	.25	.12	.12
Engineer, Chemical	.5	.5	.25	.25	.25	.06	.25	.12	.12
Engineer, Civil	4.	4.	16.	16.	16.	256.	16.	64.	64.
Engineer, Elec.	2.	3.	9.	4.	9.	81.	6.	18.	27.
Engineer, Ind.	2.	2.	4.	4.	4.	16.	4.	8.	8.
Engineer, Mech.	0.	4.	16.	0.	16.	256.	0.	0.	64.
Engineer, Metal	.5	.5	.25	.25	.25	.06	.25	.12	.12
Engineer, Mining	.5	.5	.25	.25	.25	.06	.25	.12	.12
Chemist	.5	.5	.25	.25	.25	1.	.25	.12	.12
Ag. Scientist	0.	1.	1.	0.	1.	.06	0.	0.	1.
Biological Scientist	.5	.5	.25	.25	.25	.06	.25	.12	.12
Geologist	.5	.5	.25	.25	.25	.06	.25	.12	.12
Mathematician	.5	.5	.25	.25	.25	.06	.25	.12	.12
Physicist	.5	.5	.25	.25	.25	.06	.25	.12	.12
Draftsman	9.	4.	16.	81.	16.	256.	36.	2204.	64.
Surveyors	5.	0.	0.	25.	0.	.06	0.	0.	0.
Air Traffic Controler	.5	.5	.25	.25	.25	.06	.25	.12	.12
Radio Operator	.5	.5	.25	.25	.25	.06	.25	.12	.12
Dentist	0.	2.	4.	0.	4.	16.	0.	0.	8.
Dietician	.5	.5	.25	.25	.25	.06	.25	.12	.12
Nurses, R.N.	14.	13.	169.	196.	169.	28561.	182.	2366.	2197.
Optometrists	1.	0.	0.	1.	0.	0.	0.	1.	0.
Osteopaths	.5	.5	.25	.25	.25	.06	.25	.12	.12
Pharmacists	2.	3.	9.	.4	9.	81.	6.	18.	27.
Physicians	0.	3.	9.	.0	9.	81.	0.	0.	27
Psychologists	1.	1.	1.	1.	1.	1.	1.	1.	1.

Table 6 (Continued)

Tech, Med. & Dental	0.	4.	4.	0.	4.	16.	0.	0.	16.
Vets.	2.	3.	9.	4.	9.	81.	6.	18.	27.
Teachers	16.	79.	4241.	256.	4241.	17986081.	1264.	67856.	335039.
Economists	.5	.5	.25	.25	.25	.06	.25	.12	.12
Statisticians	.5	.5	.25	.25	.25	.06	.25	.12	.12
Accountants	17.	9.	81.	40.	81.	6561.	63.	567.	729.
Airplane Pilot	0.	1.	1.	0.	1.	1.	0.	0.	1.
Architects	.5	.5	.25	.25	.25	.06	.25	.12	.12
Artists	2.	0.	0.	4.	0.	0.	0.	0.	0.
Clergymen	5.	9.	81.	25.	81.		45.	405.	729.
Designers	1.	1.	1.	1.	1.	1.	1.	1.	1.
Editors	2.	0.	0.	4.	0.	0.	0.	0.	0.
Lawyers	0.	6.	36.	0.	36.		0.	0.	216.
Librarians	1.	4.	16.	1.	16.	256.	4.	16.	64.
Personnel Wks.	0.	1.	1.	0.	1.	1.	0.	0.	1.
Photographers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Social & Welfare	0.	3.	9.	0.	9.	81.	0.	0.	27.
Conductors	.5	.5	.25	.25	.25	.06	.25	.12	.12
Credit men	1.	1.	1.	1.	1.	1.	1.	1.	1.
Postmasters	2.	3.	9.	4.	9.	81.	6.	18.	27.
Steno. Typists	2.	65.	4225.	4.	4225.	17850625.	130.	8450.	274625.
Office Machine Op.	7.	9.	81.	49.	81.	6561.	63.	567.	729.
Accounting clerk	1.	10.	100.	1.	100.	1000.1	10.	100.	1000.
Bookkeepers	9.	18.	324.	81.	324.	104976.	162.	2916.	5832.
Bank Tellers	2.	5.	25.	4.	25.	625.	10.	50.	125.
Cashiers	4.	22.	484.	16.	484.	234256.	88.	1936.	10648.
Mail Carriers	2.	11.	121.	4.	121.	14641.	22.	242.	1331.
Postal Clerks	1.	9.	81.	1.	81.	6561.	9.	81.	729.
Shipping & Rec.	4.	3.	9.	16.	9.	81.	12.	36.	27.
Telephone	5.	6.	36.	25.	36.	1296.	30.	180.	216.
Sales workers	56.	126.	15876.		15876.	2520473.	7056.	889056.	2000376.
Carpenters	1.	5.	25.	1.	25.	625.	5.	25.	125.
Brick Masons	1.	1.	1.	1.	1.	1.	1.	1.	1.
Cement & Concrete	.5	.5	.25	.25	.25	.06	.25	.12	.12
Electricians	2.	4.	16.	4.	16.	256.	8.	32.	64.
Excavating Mach.	3.	4.	16.	9.	16.	256.	12.	48.	64.
Painters	4.	5.	25.	16.	25.	625.	20.	100.	125.
Plasterers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Plumbers	2.	4.	16.	4.	16.	256.	8.	32.	64.
Roofers	.5	.5	.25	.25	.25	.06	.25	.12	.12

Table 6 (Continued)

Structural Mtl.	.5	.5	.25	.25	.25	.06	.25	.12	.12
Machinists	26.	34.	1156.	676.	1156.	1336386.	884.	30056.	39304.
Blacksmiths	.5	.5	.25	.25	.25	.06	.25	.12	.12
Boilermakers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Heat treaters	1.	0.	0.	1.	0.	0.	0.	0.	0.
Millwrights	.5	.5	.25	.25	.25	.06	.25	.12	.12
Molders	2.	2.	4.	4.	4.	16.	4.	8.	8.
Pattern makers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Rollers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Sheet metal wks.	4.	4.	16.	16.	16.	256.	16.	64.	64.
Toól & Die makers	2.	6.	36.	4.	36.	1296.	12.	72.	216.
Compositors	3.	0.	0.	9.	0.	0.	0.	0.	0.
Electrotypers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Engravers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Photo Engravers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Pressmen	2.	0.	0.	4.	0.	0.	0.	0.	0.
Linemen	8.	15.	225.	64.	225.	50625.	120.	2000.	3375.
Locomotive Eng.	.5	.5	.25	.25	.25	.06	.25	.12	.12
Locomotive Firemen	.5	.5	.25	.25	.25	.06	.25	.12	.12
Airplane Mech.	.5	.5	.25	.25	.25	.06	.25	.12	.12
Motor Veh. Mech.	2.	20.	400.	4.	400.	160000.	40.	800.	8000.
Office Mach. Mech.	1.	1.	1.	1.	1.	1.	1.	1.	1.
Radio & TV Mech.	1.	1.	1.	1.	1.	1.	1.	1.	1.
RR & Car Shop Mech.	.5	.5	.25	.25	.25	.06	.25	.12	.12
Bakers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Cabinet makers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Cranemen	1.	1.	1.	1.	1.	1.	1.	1.	1.
Glaziers	1.	0.	0.	1.	0.	0.	0.	0.	0.
Jewelers	3.	0.	0.	9.	0.	0.	0.	0.	0.
Loom fixers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Opticians	.5	.5	.25	.25	.25	.06	.25	.12	.12
Inspectors, lumber	.5	.5	.25	.25	.25	.06	.25	.12	.12
Upholsters	3.	3.	9.	9.	9.	81.	9.	27.	27.
Drivers, bus & truck	15.	50.	2500.	225.	2500.	6250000.	750.	37500.	125000.
Deliverymen	4.	14.	196.	16.	196.	38416.	56.	784.	2744.
Breakmen	.5	.5	.25	.25	.25	.06	.25	.125	.125
Power Station Opr.	1.	0.	0.	1.	0.	0.	0.	0.	0.
Furnacemen	.5	.5	.25	.25	.25	.06	.25	.125	.125
Heaters metal	.5	.5	.25	.25	.25	.06	.25	.125	.125
Welders	8.	13.	169.	64.	169.	28561.	104.	1352.	2197.
Assemblers, Class A	3.	2.	4.	9.	4.	16.	6.	12.	8.
Assemblers, Class B	1.	7.	49.	1.	49.	2401.	7.	49.	343.

Table 6 (Continued)

Inspectors, Class B	2.	2.	4.	4.	4.	16.	4.	8.	8.
Machine Tool Opr.	34.	6.	36.	1156.	36.	1296.	204.	1224.	216.
Electroplaters	1.	0.	0.	1.	0.	0.	0.	0.	0.
Electroplaters helper	1.	0.	0.	1.	0.	0.	0.	0.	0.
Knitters	.5	.5	.25	.25	.25	.06	.25	.125	.125
Spinners	.5	.5	.25	.25	.25	.06	.25	.125	.125
Weavers	.5	.5	.25	.25	.25	.06	.25	.125	.125
Sewers	.5	.5	.25	.25	.25	.06	.25	.125	.125
Asbestos Inst.	.5	.5	.25	.25	.25	.06	.25	.125	.125
Attendants, Auto	16.	8.	64.	256.	64.	4096.	128.	1024.	512.
Blasters	.5	.5	.25	.25	.25	.06	.25	.125	.125
Laundry & Dry cleaning	2.	5.	25.	4.	25.	625.	10.	50.	125.
Meat Cutters	0.	2.	4.	0.	4.	16.	0.	0.	8.
Firemen	6.	6.	36.	36.	36.	1296.	36.	216.	216.
Guards	3.	3.	9.	9.	9.	81.	9.	27.	27.
Police	2.	9.	81.	4.	81.	6561.	18.	162.	729.
Bartenders	0.	2.	4.	0.	4.	16.	0.	0.	8.
Cooks	2.	29.	841.	4.	841.	707281.	58.	1682.	24389.
Counter & fountain workers	2.	6.	36.	4.	36.	1296.	12.	72.	216.
Waiters & Waitresses	11.	33.	1089.	121.	1089.	1185921.	363.	11979.	35937.
Airline Stewardess	.5	.5	.25	.25	.25	.06	.25	.125	.125
Attendants, hosp.	10.	17.	289.	100.	289.	83521.	170.	2890.	4913.
Charwomen, cleaners	3.	4.	16.	9.	16.	256.	12.12	48.	64.
Janitors	4.	33.	1089.	16.	1089.	1185921.	132.	4356.	35937.
Practical nurses	3.	5.	25.	9.	25.	625.	15.	75.	125.
Laborers	18.	53.	2809.	324.	2809.	7890481.	954.	50562.	148877.
WABAUNSEE									
Engineer, Aero	.5	.5	.25	.25	.25	.06	.25	.125	.125
Engineer, Chemical	.5	.5	.25	.25	.25	.06	.25	.125	.125
Engineer, Civil	1.	2.	4.	1.	4.	16.	2.	4.	8.
Engineer, Elec.	1.	1.	1.	1.	1.	1.	1.	1.	1.
Engineer, Ind.	.5	.5	.25	.25	.25	.06	.25	.125	.125
Engineer, Mech.	1.	1.	1.	1.	1.	1.	1.	1.	1.
Engineer, Metal	.5	.5	.25	.25	.25	.06	.25	.125	.125
Engineer, Mining	.5	.5	.25	.25	.25	.06	.25	.125	.125
Chemist	2.	2.	4.	4.	4.	16.	4.	8.	8.
Ag. Scientist	0.	1.	1.	0.	1.	1.	0.	0.	1.
Biological Scientist	.5	.5	.25	.25	.25	.06	.25	.125	.125
Geologist	.5	.5	.25	.25	.25	.06	.25	.125	.125
Mathematician	.5	.5	.25	.25	.25	.06	.25	.125	.125
Physicist	.5	.5	.25	.25	.25	.06	.25	.125	.125

Table 6 (Continued)

Draftsman	1.	1.	1.	1.	1.	1.	1.	1.	1.
Surveyors	.5	.5	.25	.25	.25	.06	.25	.125	.125
Air Traffic Controler	.5	.5	.25	.25	.25	.06	.25	.125	.125
Radio Operator	.5	.5	.25	.25	.25	.06	.25	.125	.125
Dentist	1.	2.	4.	1.	4.	16.	2.	4.	8.
Dietician	.5	.5	.25	.25	.25	.06	.25	.125	.125
Nurses, R. N.	7.	13.	169.	49.	169.	28561.	91.	1183.	2197.
Optometrists	1.	0.	0.	1.	0.	0.	0.	0.	0.
Osteopaths	.5	.5	.25	.25	.25	.06	.25	.125	.125
Pharmacists	0.	3.	9.	0.	9.	81.	0.	0.	27.
Physicians	1.	3.	9.	1.	9.	81.	3.	9.	27.
Psychologists	0.	1.	1.	0.	1.	1.	0.	0.	1.
Tech, Med. & Dental	1.	4.	16.	1.	16.	256.	4.	16.	64.
Vets.	3.	4.	16.	9.	16.	756.	12.	48.	64.
Teachers	46.	153.	23409.	2116.	23409.	547981281.	7038.	1076814	3581577.
Economists	.5	.5	.25	.25	.25	.06	.25	.125	.125
Statisticians	.5	.5	.25	.25	.25	.06	.25	.125	.125
Accountants	7.	7.	49.	49.	49.	2401.	49.	343.	343.
Airplane Pilots	1.	1.	1.	1.	1.	1.	1.	1.	1.
Architects	.5	.5	.25	.25	.25	.06	.25	.125	.125
Workers, Auto	33.	33.	1089.	1089.	1089.	1185921.	1089.	35937.	35937.
Clergymen	0.	11.	121.	0.	121.	14641.	0.	0.	1331.
Designers	.5	.5	.25	.25	.25	.06	.25	.125	.125
Editors	1.	0.	0.	1.	0.	0.	0.	0.	0.
Lawyers	2.	4.	16.	4.	16.	256.	8.	32.	64.
Librarians	1.	4.	16.	1.	16.	256.	4.	16.	64.
Personnel Wks.	2.	2.	4.	4.	4.	16.	4.	8.	8.
Photographers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Social and Welfare	0.	3.	9.	0.	9.	81.	0.	0.	27.
Conductors, R. R.	.5	.5	.25	.25	.25	.06	.25	.12	.12
Creditmen	1.	1.	1.	1.	1.	1.	1.	1.	1.
Postmasters	1.	3.	9.	1.	9.	81.	3.	9.	27.
Steno. Typists	11.	61.	3721.	121.	3721.	13845841.	671.	40931.	226981.
Office Mach. Opr.	4.	6.	36.	16.	36.	1296.	24.	144.	216.
Accounting Clerks	6.	9.	81.	36.	81.	6561.	54.	326.	729.
Bookkeepers, hand	1.	17.	289.	1.	289.	83521.	17.	289.	4913.
Bank tellers	5.	4.	16.	25.	16.	256.	20.	80.	64.
Cashiers	1.	5.	25.	1.	25.	625.	5.	25.	125.
Mail Carriers	5.	11.	121.	25.	121.	14641.	55.	605.	1331.
Postal Clerks	3.	9.	81.	9.	81.	6561.	27.	243.	729.

Table 6 (Continued)

Shipping and Rec.	1.	2.	4.	1.	4.	16.	2.	4.	8.
Telephone Opr.	3.	4.	16.	9.	16.	256.	12.	54.	64.
Salesworkers	60.	126.	15876.	3600.	15876.	252047376.	7560.	952560.	2000376.
Carpenters	8.	11.	121.	64.	121.	14641.	88.	968.	1331.
Brick masons	1.	1.	1.	1.	1.	1.	1.	1.	1.
Cement	.5	.5	.25	.25	.25	.06	.25	.125	.125
Electricians	1.	3.	9.	1.	9.	81.	3.	9.	27.
Excavating Mach. Opr.	1.	3.	9.	1.	9.	81.	3.	9.	27.
Painters	5.	5.	25.	25.	25.	625.	25.	125.	125.
Plasterers	3.	6.	36.	9.	36.	1296.	18.	108.	216.
Plumbers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Roofers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Structural Metal	.5	.5	.25	.25	.25	.06	.25	.125	.125
Machinists	2.	2.	4.	4.	4.	16.	4.	8.	8.
Blacksmiths	.5	.5	.25	.25	.25	.06	.25	.125	.125
Boilermakers	.5	.5	.25	.25	.25	.06	.25	.125	.125
Millwright	.5	.5	.25	.25	.25	.06	.25	.125	.125
Molders	.5	.5	.25	.25	.25	.06	.25	.125	.125
Pattern makers	1.	0.	0.	1.	0.	0.	0.	0.	0.
Rollers	.5	.5	.25	.25	.25	.06	.25	.125	.125
Sheet Metal Wks.	.5	.5	.25	.25	.25	.06	.25	.125	.125
Tool & Die Makers	.5	.5	.25	.25	.25	.06	.25	.125	.125
Compositors	.5	.5	.25	.25	.25	.06	.25	.125	.125
Electrotypers	1.	0.	0.	1.	0.	0.	0.	0.	0.
Engravers	.5	.5	.25	.25	.25	.06	.25	.125	.125
Photoengravers	1.	0.	0.	1.	0.	0.	0.	0.	0.
Pressmen	1.	0.	0.	1.	0.	0.	0.	0.	0.
Linemen	.5	.5	.25	.25	.25	.06	.25	.125	.125
Locomotive Eng.	.5	.5	.25	.25	.25	.06	.25	.125	.125
Firemen	.5	.5	.25	.25	.25	.06	.25	.125	.125
Airplane Mech.	2.	2.	4.	4.	4.	16.	4.	8.	8.
Motor Veh. Mech.	3.	7.	49.	9.	49.	2401.	21.	147.	343.
Office Mach. Mech.	.5	.5	.25	.25	.25	.06	.25	.125	.125
Radio & TV Mech.	.5	.5	.25	.25	.25	.06	.25	.12	.12
R. R. Car Mech.	.5	.5	.25	.25	.25	.06	.25	.12	.12

Table 6 (Continued)

Bakers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Cabinetmakers	0.	1.	1.	0.	1.	1.	0.	0.	1.
Cranemen	0.	1.	1.	0.	1.	1.	0.	0.	1.
Glaziers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Jewelers	2.	2.	4.	4.	4.	16.	4.	8.	8.
Loom fixers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Opticians	.5	.5	.25	.25	.25	.06	.25	.12	.12
Inspectors, Log and Lumber	.5	.5	.25	.25	.25	.06	.25	.12	.12
Upholsters	.5	.5	.25	.25	.25	.06	.25	.12	.12
Drivers, Bus & Truck	2.	56.	3136.	4.	3136.	9834496.	112.	6272.	175616.
Deliverymen	0.	11.	121.	0.	121.	14641.	0.	0.	1331.
Breakmen	.5	.5	.25	.25	.25	.06	.25	.12	.12
Power Station Opr.	.5	.5	.25	.25	.25	.06	.25	.12	.12
Furnacemen	.5	.5	.25	.25	.25	.06	.25	.12	.12
Heaters, metal	.5	.5	.25	.25	.25	.06	.25	.12	.12
Welders	1.	3.	9.	1.	9.	81.	3.	9.	27.
Assemblers A	1.	1.	1.	1.	1.	1.	1.	1.	1.
Assemblers B	.5	.5	.25	.25	.25	.06	.25	.12	.12
Inspectors B	.5	.5	.25	.25	.25	.06	.25	.12	.12
Machine Tool Opr.	1.	1.	1.	1.	1.	1.	1.	1.	1.
Electroplater	.5	.5	.25	.25	.25	.06	.25	.12	.12
Electroplater helper	.5	.5	.25	.25	.25	.06	.25	.12	.12
Knitters	.5	.5	.25	.25	.25	.06	.25	.12	.12
Spinners	.5	.5	.25	.25	.25	.06	.25	.12	.12
Weavers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Sewers	.5	.5	.25	.25	.25	.06	.25	.12	.12
Asbestos Inst.	.5	.5	.25	.25	.25	.06	.25	.12	.12
Attendants, Auto	35.	8.	64.	1225.	64.	4096.	280.	2240.	512.
Blasters	.5	.5	.25	.25	.25	.06	.25	.12	.12
Laundry and Dry cleaning	0.	2.	4.	0.	4.	16.	0.	0.	8.
Meat Cutters	0.	7.	49.	0.	49.	2401.	0.	0.	343.
Firemen	8.	8.	64.	64.	64.	4096.	64.	512.	512.
Guards	2.	2.	4.	4.	4.	16.	4.	8.	8.
Police	3.	6.	36.	9.	36.	1296.	18.	108.	216.
Bartenders	2.	2.	4.	4.	4.	16.	4.	8.	8.
Cooks	10.	38.	1444.	100.	1444.	2085136.	380.	14440.	54872.
Counter & fountain workers	4.	9.	81.	16.	81.	6561.	36.	244.	729.

Table 6 (Continued)

Waiters	17.	34.	1521.	289.	1521.	2313441.	663.	25857.	59319.
Airline Stewardess	.5	.5	.25	.25	.25	.06	.25	.12	.12
Attendants, Inst.	26.	19.	361.	676.	361.	130321.	494.	9386.	6859.
Charwomen	8.	4.	16.	64.	16.	256.	32.	128.	64.
Janitors	19.	40.	1600.	361.	1600.	2560000.	760.	30400.	64000.
Practical nurses	0.	5.	25.	0.	25.	625.	0.	0.	125.
Laborers	29.	79.	6241.	841.	6241.	38950081.	2291.	180989.	493039.

$\Sigma Y = 124$ $\Sigma X_1 = 293$ $\Sigma X_2 = 20487.50$ $\Sigma Y^2 = 7896.75$ $\Sigma X_1^2 = 20487.50$ $\Sigma X_2^2 = 266023658.36$ $\Sigma X_1 Y = 8590.50$

$\Sigma X_2 Y = 996491.725$ $\Sigma X_1 X_2 = 2237318.725$

The curve appears to fit the data well with R = .803 and the standard error of estimate = 4.55. The equation which was derived from the curvilinear regression analysis was:

$$Y = .7721 + .368X - .00019X^2$$

The inflection point of this equation is at X = 968.42 and possibly extrapolation of the data should end before X = 900. In any case, this should be considered when using the data found in the table of error for various sized labor markets.

The next step in the rationale for developing the table was to translate the size of the error for a given projection into a percent of error by dividing the size of the projection into the size of the associated error. For example, if the projection was for 600 workers and average error expressed in number of workers was 153.17 as found using the derived equation, then the average error expressed in percent would be 25.52.

The last step in determining the values found in the table of error for various sized labor markets was to multiply the number of workers times the number of occupations in the matrix. This in essence makes the number of workers the average number projected for all occupations within that labor market.

Table 7 summarizes the data on error estimated for occupational projections and associated labor markets by number of workers. An additional feature of this table is the expression of the average size of manpower demand prejection versus error estimates. This is also based on averages, i.e., the expected annual demand for workers in Kansas' labor force will be approximately four percent of the present total number of workers and hence an occupation with 600 workers would have a demand for 24 new workers annually.

SUMMARY

Hypothesis 1 was neither affirmed nor rejected since no significant difference was found between the matrix profile and the acutal profile in Wabaunsee County while a significant difference was found between the matrix profile and the actual in Edwards County. Although no significant difference was found in Wabaunsee County, there was one profile error which sheds light on possible error contributions, i.e., a need for Workers in the Arts and

Table 7

ERROR ANALYSIS FOR PROFILE PROJECTIONS AND ASSOCIATED LABOR MARKET AND MANPOWER NEED ESTIMATES

SIZE OF OCCUPATIONAL PROJECTION (MATRIX ESTIMATE OF NUMBER OF WORKERS IN A GIVEN OCCUPATION)	ASSOCIATED SIZE OF LABOR MARKET (BASED ON THE ASSUMPTION THAT THE PROFILE PROJECTION IS AN AVERAGE SIZED PRO-JECTION	ASSOCIATED AVERAGE ANNUAL MANPOWER DEMAND (BASED ON AVERAGE DEMAND)	MEAN PERCENT ERROR IN PROFILE AND ASSOCIATED NEEDS AND LABOR MARKET
50	8100	2	37.38
100	16200	4	35.67
150	24300	6	34.46
200	32400	8	33.38
250	40500	10	32.35
300	48600	12	31.35
350	56700	14	30.36
400	64800	16	29.39
450	72900	18	28.42
500	81000	20	27.45
550	89100	22	26.48
600	97200	24	25.50
650	105300	26	24.56
700	113400	28	23.61
750	121500	30	22.65
800	129600	32	21.69
850	137700	34	20.74
900	145800	36	19.74

Entertainment was projected while none existed. This error could be traced back to the source data which had a SIC code error. Although a significant difference was found between profiles in Edwards County, the difference could be attributed to the Machinist and Machine Tool Operator classifications, one of which was greatly overestimated and one of which was greatly underestimated. This mismatch was caused by the classification of employees of one firm. If Machinists and Machine Tool Operators had been grouped into a single category, there would have been no significant difference found between profiles in Edwards County.

Using curvilinear regression to match a curve to projection size versus size of error data, a table of estimated error for various sized projections and associated manpower needs projections and labor market sizes was developed. The data seemed to fit the curve well since R was calculated to equal .803. Error ranged from 37.38 for smaller projections to 19.74 for larger projections.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

This chapter presents conclusions based on the findings presented in Chapter 4 and recommendations based on these conclusions.

CONCLUSIONS

The conclusions presented here are of three types. Type One Conclusions relate to the accuracy of the modified matrix technique while Type Two Conclusions relate to the sources of error and Type Three Conclusions relate to the evaluation techniques used in this study.

Type One Conclusions

1. There is a large degree of error in profile estimates for small (under 3,000 job) labor markets.
2. The larger the labor market, the less the percent of error in the projections.
3. Some occupations such as Salesworkers seem to be overestimated in small labor markets while other occupations such as Auto Service Station Attendants appear to be underestimated.
4. The matrix technique may have trouble discriminating between closely related occupations such as Machinists and Machine Tool Operators.
5. The modified matrix technique tends to overestimate employment in small rural labor markets.
6. Accurate SIC coding is extremely important in small labor markets where a single miscoded firm can cause extreme error.

Type Two Conclusions

1. At least part of the profile error can be attributed to error in the SIC coding of base data.

2. At least occasionally, the matrix technique will have difficulty discriminating between closely related occupations causing one of the occupations to be overestimated and the other to be underestimated.

3. Wabaunsee and Edwards Counties were extremely rigorous tests for the modified matrix technique since Wabaunsee has an economy which is strictly agricultural and agricultural service oriented and Edwards County has a single firm which can, by itself, distort the profile.

4. Rural residents commute to urban centers for many goods and services which will distort the rural profile.

5. There is probably better coverage of rural businesses by Dun and Bradstreet which cause overestimates of rural employment when state adjustment factors are applied.

6. In small firms, occupations overlap with workers functioning in several occupational areas. As an example, the owner of a small retail store may be classified as a manager but will probably also function as a bookkeeper, salesclerk, etc.

Type Three Conclusions

1. Evaluations such as that used to examine Hypothesis 1 in this study should be directed towards investigations of source of error because it leads to very little useful information about degree of error.

2. Because of the critical need to know about error parameters for the modified matrix technique extrapolation of a linear regression equation is justified until further research on larger labor markets can be conducted.

3. Since both counties involved in this study were of rural nature, an additional county which contains an urban center should be examined to determine rural-urban effect on the projections.

RECOMMENDATIONS

The following recommendations are divided into two classifications, i.e., recommendations pertaining to the use of the modified matrix technique data and recommendations pertaining to future research.

Type One Recommendations

1. Data on small labor markets should be used with extreme care and

any user should be thoroughly familiar with limitations of the data.

2. If possible, planning should be based on labor markets consisting of several counties, with confidence in the data increasing as the labor market size increases.

3. When possible, planning should be based on clusters of related occupations as accuracy increases as detail decreases.

4. When extremely unusual or impossible predictions are found in the data, the SIC coding of the source data should be examined.

Type Two Recommendations

1. A study of a larger labor market which includes a significant urban center should be conducted to determine if the linear regression equation does in fact predict the error found in projections.

SUMMARY

In summary, the evaluation of the modified matrix presented in this study indicates that the technique can be used to plan vocational and technical education programs for small labor markets but that when doing such planning, limitations of the data must be taken into account.

Confidence in the data can be increased by either grouping related occupations into clusters or by increasing the size of the planning area to include a larger labor market (several counties for example).

Part 2

AN ANALYSIS OF THE ACCURACY OF MODIFIED MATRIX PROJECTED OCCUPATIONAL PROFILES FOR URBAN LABOR MARKETS

R. B. Daniels

Chapter 6

INTRODUCTION

BACKGROUND

The 1968 Amendments to the 1963 Vocational Education Act (P.L. 90-576) require that vocational and technical training programs be designed to prepare workers for jobs that either exist presently or will exist in the near future.[1] This implies that programs should only be implemented in occupational areas where manpower needs have been identified. Before this requirement can be met, a system for projecting manpower needs must be developed to provide valid data to be utilized by vocational and technical education program planners.

In 1971, the Division of Vocational Education of the Kansas State Department of Education contracted with Kansas State University for the development of a management information system which would generate data on manpower needs annually.[2] The developmental project was designated "The Kansas Manpower Utilization System for Training" (K-MUST). The original plan was to conduct an employer survey which would be updated annually; however, this plan was abandoned when it became clear that costs of such a system would exceed the funds available.[3] Representatives of the Division of Vocational Education of the State Department of Education asked the project director to explore other approaches which might be used to produce adequate manpower needs data at a lower cost.[4]

The technique which was finally selected was a modified version of the Bureau of Labor Statistics (BLS)Matrix Method A. In this approach, employment by Standard Industrial Classification (Department of Commerce classifications) is broken into employment by occupation using ratios developed by the Bureau of Labor Statistics (BLS). Employment by Standard Industrial Classification can be obtained from Dun and Bradstreet, Inc. or, in some instances, from the local Employment Security Division. Once the employment-by-occupation data has been generated, manpower expansion and replacement needs are calculated on the basis of BLS factors. All resulting data is adjusted in terms of the state occupational profile and history of the county labor market.[5]

Although the modified matrix approach appears to be logically sound, there is some question as to the accuracy of a technique which applies national ratios and factors to local situations. It is impossible to examine the accuracy of the manpower needs projections since the projection period lies in the future; however, it is possible to make a partial examination of the technique by looking at the occupational profile generated by the modified matrix method in light of an actual occupational profile. Downing[6] conducted a study on error found in the occupational profile projections produced by the modified matrix technique in the summer of 1972. His findings indicated that error was related to the size of projections with larger projections having a smaller percent of error. He considered his study to be limited in that he examined small labor markets which might cause an overestimate of error. He recommended:[7]

> A study of a larger labor market which includes a significant urban center should be conducted to determine if the curvilinear regression equation (developed in his study) does in fact predict the error found in (profile) projections.

Mr. John Snyder, Assistant Commissioner of Education for Vocational Education, for the State of Kansas, agreed that the study of a county which contains a significant urban center should be conducted since the data will influence vocational and technical education planning across the state.[8]

STATEMENT OF THE PROBLEM

This study will attempt to answer the question, "Does the curvilinear regression equation developed by Downing to predict the error in the modified matrix occupational profiles accurately reflect error in occupational profile projections for larger labor markets?"

PURPOSE OF THE STUDY

The purpose of the study is to examine the manpower profile estimates generated by the modified matrix technique in general and to check the error prediction equation developed by Downing in particular. If findings indicate the Downing error prediction equation is valid for larger urban areas, then planners can have additional confidence in the data; while if the error equation is found to be unsatisfactory for larger urban areas, then it can be modified.

NEED FOR THE STUDY

Planning, evaluating and funding of vocational and technical education programs in Kansas must be based, in part, on the manpower needs projections generated by the modified matrix technique. It is essential, therefore, that these projections be as accurate as possible. In addition, a knowledge of the expected degree of error in the projections will allow the planner to base his decisions on a range instead of a point estimate.

Downing has conducted a study which establishes an error factor. This factor is based on data from small labor markets and probably overestimates the size of error. This study will expand the work Downing has done to include larger urban labor markets and will modify the error equation if necessary. If the expected error factor does decrease as expected, then planners, evaluaters, and other school administrators will be able to perform their jobs with more confidence in the data on which many of their decisions must be based.

ASSUMPTIONS

The analysis and interpretation of data performed in this study is based on the following assumptions.

1. Employers will be able to define the occupations of their employees in terms used by the modified matrix approach.

2. Employers will be willing to cooperate in providing data on the number and type of workers in their organization.

3. Economic conditions will not significantly affect the degree of error found in labor market profiles generated by the modified matrix approach.

DELIMITATIONS

This study is subject to the following delimitations.

1. Only one county will be surveyed and compared with the modified matrix technique profile projections.

2. Estimated employment will be compared with present employment; however, projected job openings cannot be compared with actual job openings for the projection period. This means that this study will provide only a partial evaluation of the modified matrix technique. It should be noted, however, the procedure used to develop the Downing error prediction equation is also used in this study and hence the error prediction equation can be tested fully.

HYPOTHESES

This study will test two hypotheses; i.e., one related to the accuracy of Downing's equation and one related to the development of an error prediction equation for larger urban labor market profile projections.

Hypothesis 1

This study will evaluate the generalizability of Downing's equation to an urban situation by testing the following hypothesis.

The actual error found in occupational profile projections generated by the modified matrix technique will be similar to the error predicted by Downing's equation.

Hypothesis 2

This study will evaluate the need for an urban error prediction equation by testing the following hypothesis.

A scale table which will indicate the accuracy of the modified matrix profile projections on the basis of percent urban population of the forecast area and size of profile projection can be developed.

FOOTNOTES

[1]U.S. Congress, Vocational Education Amendments of 1968, Public Law 90-576, 90th Cong., 1968 (Washington: Government Printing Office, 1968.

[2]K-MUST contract number 1231, State Department of Education, Division of Vocational Education.

[3]K-MUST contract modification, letter from State Department of Education, Division of Vocational Education, October 18, 1971.

[4]Ibid.

[5]James L. Harris and Robert E. Scott, "Techniques Used to Project Manpower Needs" (unpublished paper, Kansas State University, 1972.

[6]Jimmie Lee Downing, "A Comparison of Federal Matrix Manpower Needs Projections and Employer Survey Manpower Needs Projections for Small Labor Markets." (unpublished Doctor's dissertation, Kansas State University, 1972).

[7]Ibid., p. 66.

[8]Statement by John E. Snyder, Assistant Commissioner, Vocational Education, Kansas State Department of Education, personal interview, February 13, 1972.

Chapter 7

BACKGROUND INFORMATION

INTRODUCTION

This chapter is concerned with background information which provides a foundation for the study. Chapter 7 has two objectives: (1) an investigation of background information that identifies, defines and explains key concepts used in this study, and (2) a review of similar research and its relevance to this study.

DEFINITIONS

The following important terms are defined as they apply to this study.

Actual Error

Actual error is the absolute value of the number of workers by occupation classification projected by the modified BLS Matrix technique minus the number of actual workers by occupation classification determined by the survey.

Bureau of Labor Statistics (BLS)

The Bureau of Labor Statistics is a component of the Department of Labor which has the primary responsibility for the technical development and statistical adequacy of the matrix system used to project national manpower needs.[1]

Bureau of Labor Statistics Occupation by Industry Matrix (BLS Matrix)

The BLS Matrix is a set of employment and expansion ratios pertaining to various industries and occupations within industries. The matrix covers 116 industrial clusters and 162 occupational clusters which represent the entire economy.[2]

Downing Equation (The)

An equation which expresses the relationship between the size of estimated occupational profiles and the size of the expected error in the estimate. The equation is expressed as follows:

$$Y = .7721 + .368X - .00019X^2$$

where Y is the size of error and X is the size of projection.[3]

Dictionary of Occupational Titles (The)

The Dictionary of Occupational Titles (DOT) is a current inventory of occupations within the American economy and as such is the most comprehensive single source of occupational information available. The third edition of the DOT, prepared by the U.S. Department of Labor, is published in a two-volume set. Volume I, entitled Definitions of Titles, is a dictionary of occupations which provides a basic source of occupational language and job descriptions. Volume II, entitled Occupational Classification, contains the classification structure and the coding system used by the Department of Labor for gathering, compiling, and disseminating employment information.[4]

Estimated Error

Estimated error is the error estimate produced by the Downing Equation for various profile projection sizes.

Forecast Area

Is a specified location with certain geographical boundaries designated for the purpose of predicting or estimating manpower needs.

Kansas Manpower Utilization System for Training (K-MUST)

Is a management information system used by the Kansas State Department of Education, Division of Vocational Education. Its principle functions include the projection of manpower needs and supply for occupational forecast areas in Kansas.[5]

Labor Force

The Labor Force is the total number of workers available minus the size of the armed forces and assuming a national unemployment rate of three percent.[6]

Labor Market

The Labor Market is the total number of jobs available in the economy.[7]

Manpower Demand

Is the total number of measured or projected skilled persons needed during the time period under consideration, categorized according to specific skill, or "skill cluster."[8]

Manpower Development Training Act (1962)

A federal act administered by the Department of Labor and Department of Health, Education, and Welfare. The act provides for training of persons who are unemployed and underemployed as well as the retraining of persons who are displaced due to automation and technological change.[9]

Manpower Supply

Is the total number of measured or projected skilled persons available during the time period under consideration, categorized according to specific skill or "skill cluster" and the supply source where this skilled person is located.[10]

Occupational Clusters

Is a taxonomy of the total spectrum of occupations, classified into logically related groups on the basis of identical or similar elements or characteristics.[11]

Occupational Outlook Handbook (The)

Is the Bureau of Labor Statistics' outstanding contribution to the training and guidance fields. Published biannually, the Handbook provides current and long-range information on occupations concerning 90 percent of the 16 million employed in professional, managerial, and technical occupations; nearly all of the 4.5 million sales workers; about half of the 10.7 million clerical workers; and about 40 percent of the 9.3 million service workers.[12]

Occupational Profile

The occupational profile is the number of workers in a labor force categorized by number of workers by occupational type.[13]

Occupational Survey

A form of occupational census, taken by personnel trained to determine the number of qualified workers in designated occupations in a specific geographic or economic area, and to evaluate the need for increasing or limiting the numbers available for employment in the occupations surveyed.[14]

Non-Farm Employment

Employment in any non-farm industry or business. This employment is not covered by the agricultural census conducted periodically by the Department of Agriculture.

Profile Estimate

The profile estimate is the number of workers by occupation in a forecast area as determined by using the modified matrix technique.

Profile Projection (Also referred to as workers within an occupation)

Profile projection is an estimate of occupational profile produced by the modified matrix approach.

Program Planners (Also referred to as Planners)

The planning process can be described as research, goal-setting, and plan formulation.[15] In the context of this study, planning is a management tool used by vocational educators. It is the rational process of specifying the objectives of vocational programs determining the present attainment levels for those objectives, and selecting strategies. Planners are individuals involved in the planning process.

Projection Period

Projection period refers to the time frame under which manpower needs projections are made. For example, manpower needs projections for 1971 through 1976 would refer to the 1971-1976 projection period. Profile estimates for 1971 would refer to the 1971 projection period.

Standard Industrial Classification (SIC)

Is a system whereby each industry is assigned a code on the basis of its major activity, which is determined by the product or group of products produced or handled, or services rendered. The structure of the system makes it possible to classify establishments by industry on a two digit, a three digit, or a four digit basis, according to the degree of detail in information which may be needed.[16]

Standard Metropolitan Statistical Area (SMSA)

Standard Metropolitan Statistical Area refers to a county or group of counties containing at least one city of 50,000 inhabitants or more, or "twin cities" with a combined population of at least 50,000. In addition to the county or counties, containing such a city or cities contiguous counties are included in the SMSA if they are essentially metropolitan in character and are socially and economically integrated with the central city or cities.[17]

State Plan for Vocational Education

The document submitted by the State Board for Vocational Education to the U.S. Office of Education describing the state's vocational education program. Includes policies followed by the state in maintaining, extending, and improving existing programs and establishing new programs to meet the intent of the Vocational Education Acts. Prerequisite for receiving federal funds under the acts.[18]

Technical Education

The branch of education devoted to instruction and training in occupations above the craftsman or trade level, but generally not professional in nature. Instruction may not be baccalaureate in content but is evaluated usually by credit criteria rather than by clock hour. The courses qualify persons for employment in paraprofessional positions and as technicians, engineering aids, and production specialists.[19]

Urban Counties

Urban counties, as defined in this study, include counties where the 1970 United States Census has identified 50 percent or more of the population in the county as living in one urban center containing more than 10,000 persons.

Vocational Education

Vocational or technical training or retraining which is given in schools or classes (including field or laboratory work and remedial or related academic and technical instruction incident thereto) under public supervision and control or under contract with a state board or local educational agency, and is conducted as part of a program designed to prepare individuals for gainful employment as semiskilled or skilled workers or technicians or subprofessionals in recognized occupations and new and emerging occupations, or to prepare individuals for enrollment in advanced technical programs, but excluding any program to prepare individuals for employment in occupations generally considered professional or which require a baccalaureate or higher degree.[20]

Vocational Education Act of 1963

A law enacted to authorize federal grants to states to assist them to maintain, extend, and improve existing programs of vocational education, to develop new programs of vocational education, and to provide part-time employment for youths who need the earnings from such employment to continue their vocational training on a full-time basis so that persons of all ages in all communities of the states--those in high school, those who have completed or discontinued their formal education and are preparing to enter the labor market, those who have already entered the labor market but need to upgrade their skills or learn new ones, and those with special educational handicaps--will have ready access to vocational training or retraining which is of high quality, which is realistic in the light of actual or anticipated opportunities for gainful employment, and which is suited to their needs, interest, and ability to benefit from such training.[21]

Vocational Education Amendments of 1968

An act which amended all previous vocational education acts and repealed the Vocational Education Act of 1963. The declaration of purpose differed from the Vocational Education Act of 1963 in that those in post-secondary schools were specified among the groups which will have access to vocational training or retraining.[22]

REVIEW OF RELATED LITERATURE

The past few years have witnessed a prominent interest in creating a viable technique for forecasting occupational job requirements.[23] This is partly due to the emphasis manpower legislation has placed on manpower needs and job opportunities data within the various acts. The Area Redevelopment Act of 1961 states that before any training courses could be approved, there had to be "reasonable expectation of employment" for the trainee upon completion of the course.[24] This concept is also found in the Manpower Development and Training Act of 1962,[25] the Vocational Education Act of 1963 and its Amendments of 1968.[26]

The review presented here will (1) describe the major techniques used to forecast manpower needs in the United States today, (2) describe selected major research projects which have attempted to project manpower needs, (3) describe the Modified Matrix Technique used to project manpower needs in Kansas, and (4) describe the Downing study which partially evaluated the Modified Matrix technique.

MAJOR METHODS FOR DETERMINING MANPOWER NEEDS

There are six major methods of determining manpower needs for given labor markets. These techniques are (1) the Experimental Employer Needs Survey Technique (Area Skill Survey), (2) the Unfilled Job Openings - Occupational Outlook Handbook strategy, (3) the Leading Industries Experiment Approach, (4) the Bureau of Labor Statistics Matrix Approach, (5) the Econometric Approach, and (6) the Occupation by Population Approach.[27] Each of the six techniques or strategies for determining manpower needs have strengths and weaknesses.

Experimental Employer Needs Survey

The Experimental Employer Needs Survey is a refined modification of the Area Skills Survey Technique. The Area Skill Survey is conducted by means of a mail or personal interview instrument which asks individual employers to forecast their employee requirements for a projected period, taking into account both replacement and expansion needs.[28]

When personal interviews are used to collect data, probes and other interview techniques can be employed to improve the quality of the data. Additionally, the number of occupations can be as extensive as resources will permit. Finally, data detail can be expanded.[29]

On the other hand, the technique is costly and time consuming. It is based on a stratified random selection of firms and since no two firms are identical, stratification is often difficult. Also, many experts feel that employers cannot predict their manpower needs for long-range periods. Frequently, a personnel officer or some other subordinate official who does not know the long-range plans of the firm is designated to complete the questionnaire.[30]

Unfilled Job Openings -
Occupational Outlook Handbook

The Unfilled Job Openings - Occupational Outlook Handbook strategy uses data available from selected records of Employment Service Offices such as unfilled job openings in combination with routinely collected information from other federal and state agencies. Basic to the technique is the application of the Occupational Outlook Handbook forecasts of national trends in specific occupations.[31]

The technique's chief advantages are the economics of data gathering and the ease of repeating the analytical study at frequent intervals. The technique has certain deficiencies, however, since for some occupational areas, the Employment Service records may contain data which are neither adequate nor representative. In addition, the method has no real predictive devices related to labor demand in selected occupations in a given local area. A critical shortcoming is that job openings do not always indicate a shortage of workers, e.g., the jobs could be undesirable.[32]

Leading Industry
Experiment Approach

The Leading Industry Experiment Approach projects manpower demand by identifying and surveying firms which might be among the more progressive and whose occupational mix and projected employment trends might provide information useful for vocational education planning.[33]

This technique is relatively inexpensive and quick and can be applied at the local level. The interview is open-ended and allows the interviewee the opportunity to express his opinions extensively. On the negative side, the technique is designed for a limited industrial activity which employs all or a large proportion of the workers in the occupations to be studied.[34]

Bureau of Labor Statistics (Area Projection Method A)

The Area Projection Method A is one of the alternative techniques of the Bureau of Labor Statistics Approach to the development of manpower needs projections. Using this technique estimates of area occupational requirements are made by applying 1960 and 1975 national industrial-occupational patterns to appropriate area industry employment estimates; summing the occupational totals; computing a change factor (1960-1975) for each occupation; and applying the change factors.[35]

This technique is limited in that local projections are not possible in many cases, it is time consuming, it is relatively expensive and requires the services of an expert occupational analyst who is familiar with the forecast area. On the other hand, it has certain distinct advantages, foremost of which is its extremely well thought out predictive technique.[36]

Econometric Methods

Econometric Methods of projecting manpower needs use data from comprehensive models of the national economy. In the United States most of the data is collected by the U.S. Bureau of the Census. Major components of the gross national product are projected into the future, providing estimates of the total demand for goods and services on an annual basis. These estimates of total products and services demand are translated into manpower needs by type of industry and occupation.[37]

Time and cost factors are relatively favorable using this technique, especially with respect to large labor markets. Data are available from the Bureau of Census and the Bureau of Labor Statistics. Economists are needed to interpret and analyze data and manpower needs for sub-national labor markets are extremely difficult to predict using this technique.[38]

Occupation by Population Approach

The Occupation by Population Approach uses factors based on past Census Reports to determine the number of certain types of workers per 1,000 population. For example, there might be 2.7 welders predicted for every 1,000 inhabitants in the forecast area.[39]

This technique is surprisingly accurate for certain occupations in large labor markets. It is not appropriate for smaller labor markets and has no predictive device.

Most of the significant studies to date utilize the Area Skills Survey Technique or the Bureau of Labor Statistics Matrix Approach. The models selected to be discussed in this paper are the 1966 Roney-Braden Study, the 1969 Pennsylvania Study, the 1966 Michigan Study and the 1970 Occupational Training Information System (OTIS) Study.

In 1966 Oklahoma State University attempted to develop information for curriculum planners and data inputs for manpower forecasters in the electro-mechanical technology cluster. Their projections are based on a national sample and the technique used appears to be a mixture of the Leading Industry Experiment Approach and the Area Skills Survey Approach.[40]

The sample was stratified by size (number of employees) and type of product, however, no effort to consider occupational homogenity was made.[41] David Kidder indicates that the demand data was probably questionable due to the total lack of workers in these occupations; hence, employer inability to determine manpower needs based on past experience.[42]

In the Pennsylvania Study, Arnold applied the Bureau of Labor Statistics Change Factors (Matrix) to state level occupational distributions. Needs by year are filled in by employing straight line projections.[43]

It is doubtful that Pennsylvania conforms to national trends and no attempt was made to regionalize the projections on an interstate basis. In addition, only a few occupations (less than thirty) were projected. On the positive side, however, this attempt was innovative and should be considered a forerunner of what will probably happen on the national scene in the future.[44]

The Michigan study, an attempt to forecast occupational manpower needs over a period of fifteen years, was designed to develop estimates of future labor demands by industry, occupational, and educational attainments. They developed an occupational-educational matrix for the state using available data plus survey data.[45]

The economic and sociological assumptions on which this study is based seem unrealistic. Michigan's economy will probably not remain unchanged for fifteen years. Furthermore, conversion to a curricular framework would be required. It is clear that supply and demand by educational categories are not independent when computed by the occupational-educational matrix developed in this study.[46]

The Occupational Training Information System (OTIS) utilizes the Area Skills Survey Approach to collect demand data. The Oklahoma Employment Security Commission does a complete statewide-industry-wide survey once every four years to set a data base. Industrial Coordinators survey specific industry sectors (manufacturing, service, etc.) in the intervening years. This data is used to update the base set by the Employment Security Commission.[47]

The OTIS project has been called a system for the future in operation today. If theory and practice were synonomus, it would indeed be a significant solution to the problem of forecasting manpower needs. In practice, however, the approach proves to be extremely expensive. In addition, the data collected by the Industrial Coordinators is somewhat incomplete and frequently in error. Usually, the Employment Security Commission data is only slightly modified in light of the Industrial Coordinator data. The resultant effect is that demand data loses validity between base data periods. As a whole, however, the system is probably one of the best in operation today.[48]

In 1971, the K-MUST Project at Kansas State University attempted to develop a manpower forecasting system which was reasonably accurate, inexpensive and quick. The general approach selected was a modification of the Bureau of Labor Statistics Technique. The Method A Approach was modified through the adjustment of national change factors relative to local situations. Also, instead of projecting from a fixed Census base year, projections are based on present employment by standard Industrial Classification.

A simplified explanation[49] of what takes place within the modified BLS Matrix approach is best represented by utilizing a flow chart. (See Figure 1).

In step 1 of the modified matrix technique, all employing organizations in the labor market are identified by SIC code and number of employees. The data on individual organizations is based on Dunn and Bradstreet Market Identifiers (R), Unemployment Insurance Accounts, Government Directories, Department of Agriculture studies, and other state-based studies. This data is accumulated into number of employees in a particular type of industry (SIC).

In step 2, the occupational profile is derived by breaking employment

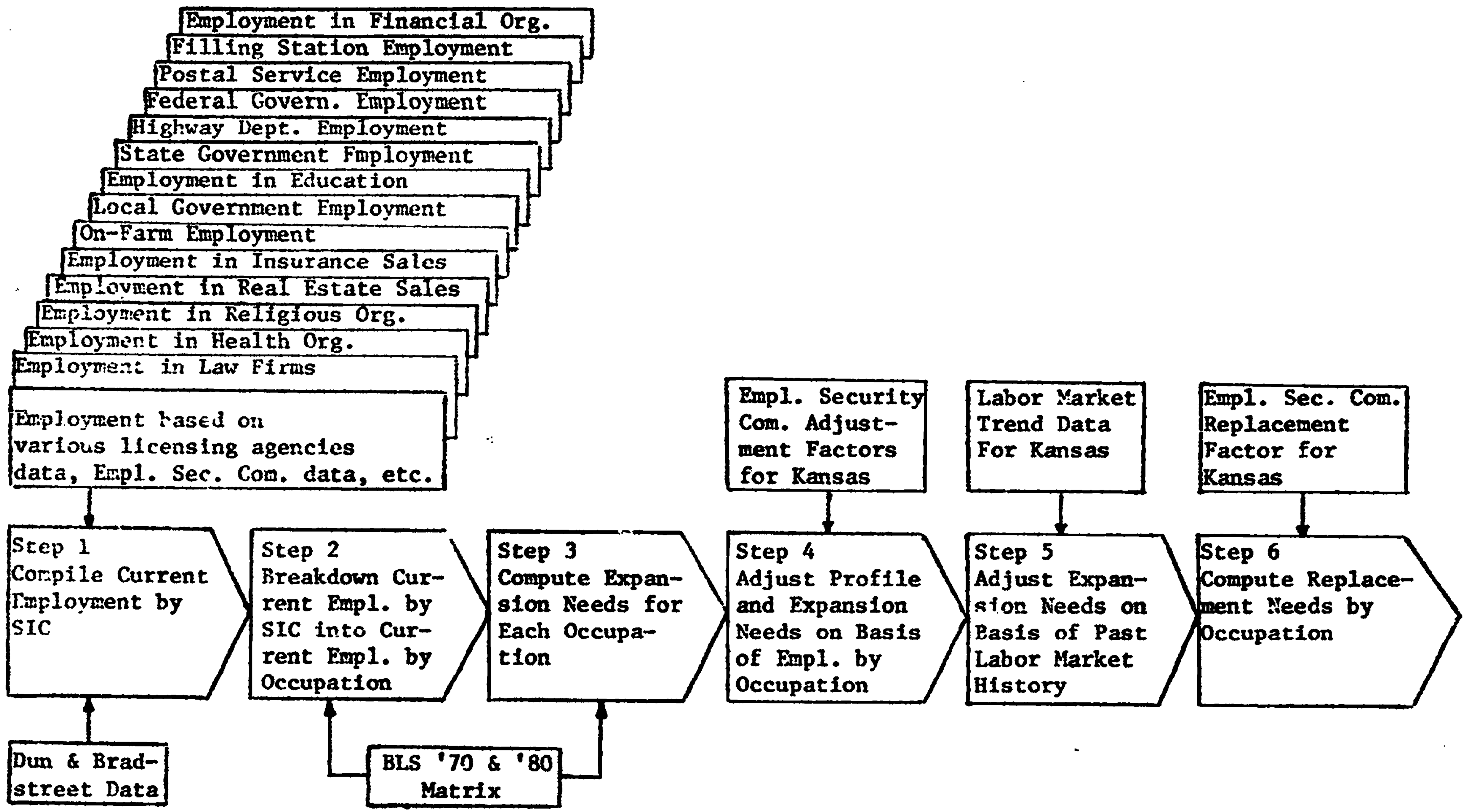


Figure 1. Flow Chart Depicting Procedures of the Modified Matrix Approach

by SIC code into employment by occupation utilizing percentages generated from the BLS 70-80 matrix.

In step 3, which is almost simultaneous with step 2, expansion needs for each occupation in each industry are computed using percentages from the matrix. The expansion needs for each occupation are then summed.

In step 4, both profile and expansion figures are adjusted on the basis of employment by occupation figures provided by the Kansas Security Commission. This is, in effect, adjusting profiles and expansion to the Kansas situation.

In step 5, the expansion needs are further adjusted to the local situation using local labor market trend data provided by the Employment Security Commission.

In step 6, replacement needs are calculated using percentage factors from the Employment Security Commission which are based on the job mobility of workers, the age of workers, and mortality statistics.

The accuracy of this approach was tested in the Downing study of 1972.[50] The study was designed to evaluate the modified matrix technique by comparing estimated present employment by occupation generated by the technique with actual employment by occupation determined by a 100 percent employer survey in two Kansas counties. The basic purpose of the study was to determine the size and source of error in manpower profile projections generated by the technique.

The Downing investigation was limited to the population of Kansas counties with small labor markets (less than three thousand workers). The nature of the matrix indicates that error is probably inversely associated with labor market size. Therefore, by selecting the smallest labor markets in Kansas, the error would be greatest.

Since the economy of Kansas varies greatly from east to west, the eastern counties being involved with manufacturing, mining, and small farm operations, and the western counties being involved principally with large farming operations, the counties with small labor markets were roughly divided into two subpopulations, i.e., eastern counties and western counties. A further refining of the two subpopulations of counties was achieved by eliminating the central Kansas counties which were difficult to classify as either eastern or western. Once the central Kansas counties were eliminated, there were twelve eastern and thirty-three western counties with labor forces of less than three thousand workers. Next, one eastern county (Wabaunsee) and one western county (Edwards) were randomly selected to be the subjects of a 100 percent employer survey.

The interview instrument consisted of a listing of occupations and occupational clusters identical to those generated by the modified matrix. Space was provided to enter the number of employees in each occupation during the interview. The instrument was not open-ended since every occupation was classifiable under the structure used.

Every non-farm employer in Wabaunsee and Edwards counties was interviewed to determine how many workers were employed in the various occupations. On-farm data used in the study was obtained from the agricultural census conducted by the Department of Agriculture.

Using curvilinear regression to analyze survey and profile projection data, Downing attempted to develop an equation which would associate size of error with size of profile projection. The equation derived was $Y = .7721 + .368X - .00019X^2$, where X is the profile projection size and Y is the size of error. The equation seemed to fit the profile size-error size relationship since R was equal to 1803. Displayed graphically (See Figure 2), it is observed that the increase in error size diminishes as the profile projection size increases.

When error size is translated into percent of error, the equation becomes $Y = \frac{.7721 + .368 - .00019X^2}{X}$. Displayed graphically in Figure 3, it can be seen that the percent of error decreases as projection size increases.

In occupations where manpower need is sufficiently large to support a training program, it was found that associated profile error is less than twenty percent.

Four major causes for error in the profiles produced by the modified matrix approach were identified in the Downing study.

The first source of error seemed to be the inability of the matrix to discriminate between closely related occupations. For example, in Edwards County, six machine tool operators and thirty-four machinists were identified by survey. If these and other related occupations had been grouped, error would have been reduced significantly.

The second source of error could be attributed to the nature of the counties surveyed (both had small labor markets). Salesworkers tended to be

FIGURE 2

ERROR SIZE/PROJECTION SIZE RELATIONSHIP
(WABAUNSEE AND EDWARDS COUNTIES)

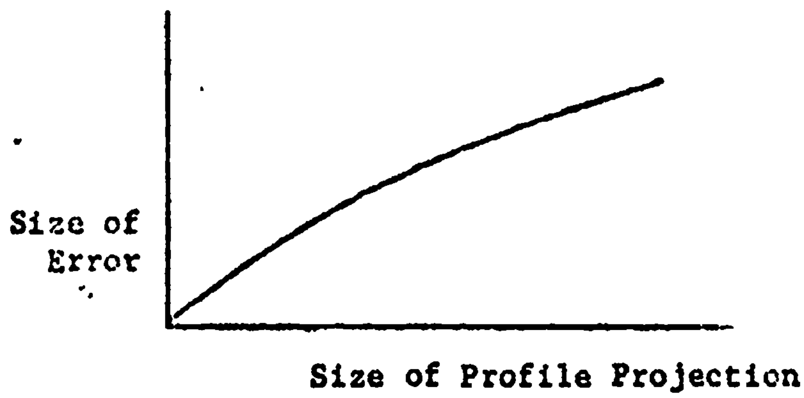
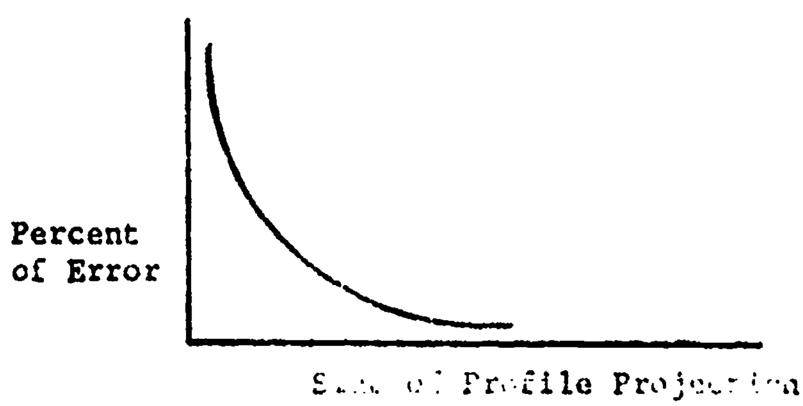


FIGURE 3

PERCENT OF ERROR/PROJECTION SIZE
(WABAUNSEE AND EDWARDS COUNTIES)



overestimated in these small counties. This difference indicates the possibility that small county residents may tend to purchase a number of their goods in surrounding urban centers, whereas they may tend to purchase most of their services at home and these same services require a greater percentage of service workers.

The third source of error, which could not logically be attributed to the matrix, was the fact that many workers in the small firms surveyed performed multiple functions. For example, a manager was often also a bookkeeper, a sales clerk and a custodian. In the survey, the worker was classified according to his major function. The matrix, of course, prorated the workers on the basis of functions to be performed.

The last source of error identified was in the input data. The importance of correct SIC coding was apparent when the matrix projected thirty-three workers in arts and entertainment in Wabaunsee County. This was a rather obvious error which could be attributed to miscoding of input data.

Downing arrived at the following conclusions concerning the accuracy of the modified matrix approach:

1. Error in the profile projections is related to the size of the projection with small projections having greater percent error than larger projections. Therefore, accuracy could be improved by grouping counties into regions.

2. Profile error will be less than twenty percent in most cases where manpower needs projections produced using the matrix are of a sufficient size to warrant vocational training programs.

3. Accuracy of the matrix projections can be improved by grouping related occupations.

4. Sales occupations tend to be overestimated and service occupations underestimated in small counties using the modified matrix approach.

5. Error in SIC codes caused a great deal of error in the matrix projections.

FOOTNOTES

[1]U.S. Department of Labor, Bureau of Labor Statistics, "Statement on the Industry: Occupational Matrix Program" (unpublished paper, Department of Labor, 1971), p. 7.

[2]U.S. Department of Labor, Bureau of Labor Statistics, "Tomorrow's Manpower Needs." Vol. IV. (Washington: Government Printing Office, 1969), p. 5.

[3]Jimmie L. Downing, "A Comparison of Federal Matrix Manpower Needs Projections and Employer Survey Manpower Needs Projections for Small Labor Markets." (unpublished Doctor's dissertation, Kansas State University, 1972), p. 2.

[4]Division of Guidance and Testing, Ohio State Department of Education, Ohio Vocational Education Notebook. (Columbus, Ohio: Ohio State Department of Education, 1967), p. 122.

[5]Division of Vocational Education, Kansas Department of Education and Department of Adult and Occupational Education, Kansas State University, Kansas Manpower Utilization System for Training: Handbook for Vocational and Technical Education Planners, (Contract No. 1231). (Manhattan, Kansas: Kansas State University, 1972).

[6]U.S. Department of Labor, "Tomorrow's Manpower Needs," op. cit., p. 6.

[7]Ibid., p. 7.

[8]Paul V. Braden, James L. Harris, and Krishan K. Pauls, et. al. Occupational Training Information System: A Final Report Complete with System Documentation. (Stillwater, Oklahoma: Oklahoma State University Research Foundation, 1970), p. 21.

[9]U.S. Congress, Manpower Development and Training Act of 1962, 87th Congress, 1962, (Washington: Government Printing Office, 1962).

[10]Braden, Harris, and Paul, op. cit., p. 22.

[11]Robert O. Hatton and Wm. G. Lommis, Guide to Structure and Articulation of Occupational Education Programs. (Salem, Oregon: Oregon State Department of Education, 1968), p. 12.

[12]James L. Harris and Robert E. Scott, "Techniques Used to Project Manpower Needs" (unpublished paper, Kansas State University, 1972), p. 32.

[13]U.S. Department of Labor, "Tomorrow's Manpower Needs," op. cit., p. 9.

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[31]James L. Harris and Robert E. Scott, op. cit.

[32]William R. Fisher, op. cit.

[33]William R. Fisher, op. cit., p. 10.

[34]Ibid.

[35]James L. Harris and Robert E. Scott, op. cit., p. 33.

[36]Norman Medvin, op. cit., p. 3.

[37]James L. Harris and Robert E. Scott, op. cit., p. 3.

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[47]James L. Harris and W. D. Frazier, op. cit.

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[50] Jimmie L. Downing, op. cit.

Chapter 8

PROCEDURES

INTRODUCTION

The purpose of this chapter is to describe the procedures, data and statistical methodology that were used to evaluate the hypotheses stated in Chapter 7 (see page 60).

POPULATIONS

There are two populations directly involved in this study. The first is the population of urban counties in Kansas. The second is the population of jobs by occupational type in these counties.

In this study, urban counties are those where the majority of people live in urban areas as defined by the 1970 United States Census.

The population of jobs by occupation (occupational profile) in the urban counties constitute the second population found in this study. The modified matrix technique projects an occupational profile of 162 jobs or job clusters for each county. This profile is inclusive of all employment in the labor market. For the purpose of this study, the "Farmer and Farm Laborer" classification will not be used since the Agricultural Census was used to develop this figure in the modified version of the matrix and hence the accuracy of the Census would be checked instead of the accuracy of the technique.

THE SAMPLE

Harvey County was selected to represent urban counties in this study. It was selected because (1) it is centrally located and hence has elements similar to western Kansas economies and elements similar to eastern Kansas economics[1], (2) it is located near a Standard Metropolitan Statistical Area (SMSA) and therefore is influenced by an exceptionally large (for Kansas) urban concentration, (3) it is not part of the Standard Metropolitan Statistical Area and therefore is not a segment of a larger community, (4) it has a diversified economic base including representation from most major Standard Industrial Classification (SIC) categories as well as having extensive manufacturing elements, and (5) it has a labor force that is small enough to make a direct contact survey feasible and yet large enough to have urban characteristics.

The second sample (from the second population) consists of all employment (100 percent) in Harvey County as defined by the occupational groupings found in the modified matrix technique.

THE INSTRUMENT

The interview instrument (see Appendix B) was designed in the spring of 1972 by Downing in cooperation with the K-MUST staff. The instrument has been pretested and used in the Downing study and has proved to be a valid data gathering tool.[2] A copy of the instrument was used during each interview.

The first section of the form is for recording identification data on the firm being surveyed. Items include (1) name of organization, (2) mailing address, (3) representative being interviewed, (4) representative's title, (5) total number of employees, and (6) major activity (SIC).

The body of the instrument consists of three columns; i.e., one column contains a list of occupation and occupational cluster titles generated by the modified matrix technique, one column contains census occupation titles that correspond to the modified matrix technique titles and one column where the number of workers under each modified matrix technique job title could be recorded. The instrument is not open ended since the modified matrix technique occupational profile should cover all occupations.

DATA COLLECTION

The data collected for this study consists of the number of workers by occupation for all off-farm employers in Harvey County, Kansas. Each employer was visited to determine how many workers of each occupational type were employed by that organization.

From August 14, 1972, through August 18, 1972, 736 employers were surveyed in Harvey County. The survey was conducted by members of the K-MUST staff, members of the Central Kansas Area Vocational and Technical School staff and members of the staff of the Division of Vocational Education of the State Department of Education. These employers reported 9,413 (off-farm) workers in 119 different occupations or occupational clusters. Every effort was made to contact all off-farm employers in the county, and as far as can be determined, all were contacted. (Note: see Appendix C for a list of the employers contacted).

INTERVIEW TECHNIQUES

It should be noted that none of the 736 employers contacted refused to cooperate. The Central Kansas Area Vocational and Technical School staff had previously contacted the seven largest employing organizations in the county and these organizations had prepared employment rosters prior to being contacted by interviewers. In addition, the Newton (the county seat of Harvey County) newspaper had published a series of articles explaining the purposes of the survey and many employers were expecting the interviewers.

The interviews were conducted strictly in accord with the procedures and techniques outlined in Scott's Occupational Surveys.[3] The success of the interviewers can probably be attributed to the adherence to this outline. A summary of the procedures and techniques used is as follows.

Step 1

Upon meeting the interviewee, the interviewer explained the subject and purpose of the study, explained that all employers in the county were being contacted and explained that the data was confidential as far as any specific reference to a given firm was concerned.

Step 2

The interviewer emphasized that participation in the interview was voluntary and that the survey was important to the people of Harvey County. He also indicated that the employer's answers to all questions were important to the survey results.

Step 3

The interviewer dressed in accord with the standards of the community. In this case, a dress shirt and tie with no coat was appropriate.

Step 4

The interview was conducted in the place of business and in private, if possible.

Step 5

The questionnaire was explained and the interviewee responded with the number and type of employees in his organization.

Step 6

Probes were used when responses were irrelevant, unclear or incomplete.

Step 7

Responses were recorded on the premises with the interviewee observing.

Step 8

The interviewee checked the form to insure that responses were accurate before the interviewer left the premises.

Step 9

The interviewer thanked the interviewee before he left the premises.

STATISTICAL TOOLS[4]

Two statistical tools were used to analyze the data in this study. Both tools are standard techniques normally found in statistics text books. Hypotheses 1 requires the use of linear regression analysis while hypothesis 2 requires the use of curvilinear regression analysis.

Linear regression analysis is an extremely useful tool for predicting the relationship between two variables. The relationship may be expressed as a line drawn on a scattergram or as a linear equation ($Y = bX + c$). The slope of the line gives an indication of the rate at which Y changes with change in X. In this case, Y will equal the actual error of a given profile projection while X will equal the estimated error in a given profile projection calculated from the Downing equation. The closer the slope of the line is to +1 and the closer the line passes to the point (0,0) the more nearly a one to one correlation exists, i.e., there is no difference in the error in profile projections determined by survey and the error projections determined by Downing's equation. The relationship between the line derived by linear regression and the line described by the equation Y = X describes the relationship between the two types of error in profile projections.

The problem is to calculate the "b" and the "c" in the linear regression equation. The "b" constant is calculated with the following formula.

$$b = \frac{\Sigma XY - \frac{(\Sigma X)\ (\Sigma Y)}{N}}{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}$$

The "c" constant is calculated with the following formula.

$$c = \bar{Y} - b\bar{X}$$

In these equations,

1. X is an actual error in a profile projection,
2. Y is the estimated error in a profile projection,
3. N is the number of occupations or occupational clusters,
4. $\bar{X}$ is the mean of the X's, and
5. $\bar{Y}$ is the mean of the Y's.

Another consideration that must be taken into account is "How good does the data fit the linear regression equation?" To answer this question, the standard error of the estimate must be calculated.

The standard error of the estimate is calculated with the following formula.

$$SE = \frac{Y^2 - \frac{(\Sigma Y)^2}{N}}{N - 2} \qquad 1 - \frac{\Sigma XY - \frac{(\Sigma X)\ (\Sigma Y)}{N}}{\Sigma X^2 - \frac{(\Sigma X)^2}{N} \quad \Sigma Y^2 - \frac{(\Sigma Y)^2}{N}}$$

Curvilinear regression is a special case of bivariate linear regression where the second independent variable is a function of the first independent variable. In the case presented in this study, scattergram evidence indicates that the greater the size of the profile projections, the less the percent of error which suggests the relationship between the size of projection and the degree of error may be forecasted by some second degree polynomial. If this is the case, then the first independent variable (number projected by matrix) is related to the second independent variable (number projected by matrix squared) in the manner expressed in the following function.

$$X_1^2 = X_2$$

It should be noted that Snedecor and Cochran[5] describe curvilinear regression as a technique for fitting data to a curve or curve fitting. This is in effect, what is being done in this analysis.

The curvilinear regression equation can be expressed as a curve drawn on a scattergram or as a polynomial equation

$$(Y = c + b_1X + b_2X^2).$$

The problem is to determine the constants b_1, b_2 and c in the polynomial. The Curvilinear Regression Equations to make these determinations are:

$$b_1 = \frac{(\Sigma x_1 y)\ (\Sigma x_2) \ - \ (\Sigma x_1 x_2)\ (\Sigma x_2 y)}{(\Sigma x_1^2)\ (\Sigma x_2^2) \ - \ (\Sigma x_1 x_2)^2}$$

$$b_2 = \frac{(\Sigma x_1^2)\ (\Sigma x_2 y) \qquad (\Sigma x_1 x_2)\ (\Sigma x_1 y)}{(\Sigma x_1^2)\ (\Sigma x_2^2) \ - \ (\Sigma x_1 x_2)^2}$$

$$c = \frac{\Sigma Y - b_1 \Sigma X_1 \ - \ b_2 \Sigma X_2}{N}$$

The variables in the equations above are derived as follows:

1. $\Sigma x_1^2 = \Sigma X_1^2 - \frac{(\Sigma X_1)^2}{N}$

2. $\Sigma x_2^2 = \Sigma X_2^2 - \frac{(\Sigma X_2)^2}{N}$

3. $\Sigma x_1 x_2 = \Sigma X_1 X_2 - \frac{(\Sigma X_1)(\Sigma X_2)}{N}$

4. $\Sigma x_1 y = \Sigma X_1 Y - \frac{(\Sigma X_1)(\Sigma Y)}{N}$

5. $\Sigma x_2 y = \Sigma X_2 Y - \frac{(\Sigma X_2)(\Sigma Y)}{N}$

Where:

1. ΣX_1^2 is the number projected for each occupation squared then summed for all occupations,

2. $\Sigma X_1)^2$ is the sum of all numbers projected by the matrix which is then squared,

3. ΣX_2^2 is the number projected for each occupation squared then summed for all occupations,

4. $\Sigma X_2)^2$ is the sum of all numbers projected by the matrix squared, then summed for all occupations,

5. $\Sigma X_1 X_2$ is the number projected by the matrix times the number projected squared,

6. ΣX_1 is the sum of all numbers projected by the matrix,

7. ΣX_2 is the sum of all numbers projected squared,

8. $\Sigma X_1 Y$ is the number projected for each occupation times the number of error for each occupation then summed for all occupations,

9. ΣY is the sum of all error in the matrix projections, and

10. $\Sigma X_2 Y$ is the number projected for each occupation squared times the number of error for each occupation then summed for all occupations.

ANALYSIS PROCEDURE

The analysis procedures used to retain or reject the hypotheses examined in this study are described below.

Classification Analysis

On September 8, 1972, members of the survey team analyzed all data that had been collected during the survey period. At this time, the results were organized into total employment by occupation. In addition, standardization of the classification of occupations was checked. The analysis indicated that it was extremely difficult to discriminate between Assemblers A, Assemblers B and Other Assemblers during the survey phase of the project. Because of this difficulty, these occupations have been grouped for statistical analysis purposes. In addition since workers in the printing trades often performed a multitude of different jobs, printing occupations were grouped. The matrix had been modified since the Downing study so that machine and machine tool operators were grouped under the Machinists, etc. category.

Hypothesis 1

Hypothesis 1 which states "The actual error found in occupational profile projections generated by the modified matrix technique will be similar to the error predicted by Downing's equation." will be tested using actual error and predicted error in the Harvey County data.

Actual error will be calculated by determining the difference between actual employment and projected employment for each occupation or occupational cluster. Predicted error will be determined by inserting actual employment for the "X" value in the Downing equation.

A linear regression equation will be determined using actual error in the profile projections as the "Y" value and estimated error (from Downing's equation) as the "X" value.

The test will be an examination of how well this equation fits the $Y = X$ equation.

Hypothesis 2

Hypothesis 2 which states "A scale table which will indicate the accuracy of the modified matrix profile projection on the basis of percent urban population of the forecast area can be developed." will be tested by analyzing the Harvey County data to see if a curvilinear regression equation that describes the relationship between size of error and size of projection can be developed with an acceptable (above .05) correlation which can be fitted to the data.

If such an equation can be determined, then the hypothesis will be retained, but if not, the hypothesis will be rejected.

Development of a Scale Table

If Hypothesis 2 is retained, a scale table of estimated error in profile projections relative to percent of urban population in the forecast area and size of projection will be developed.

The table entries will be calculated by prorating the error on a basis of percent urban and percent rural population. The Downing equation will be used to calculate error for small rural-oriented profile estimates. The equation developed in this study will be used to calculate error for larger urban-oriented profile estimates.

FOOTNOTES

[1]Jimmie Lee Downing, op. cit., p. 25.

[2]Jimmie Lee Downing, op. cit.

[3]Robert E. Scott, "Occupational Survey," (Puttsburg, Kansas: Kansas State College of Pittsburg, 1967), (Mimeographed).

[4]John T. Roscoe, Fundamental Research Statistics for the Behavioral Sciences, (New York: Holt, Rinehart and Winston, Inc., 1969).

[5]William G. Cochran and George W. Snedecor, Statistical Methods (Iowa: The Iowa State University Press, 1967).

Chapter 9

ANALYSIS

INTRODUCTION

This chapter presents the statistical analysis and the disposition of the hypotheses examined in this investigation and a description of additional findings.

DISPOSITION OF HYPOTHESIS 1

Hypothesis 1 which states "The actual error found in occupational profile projections generated by the modified matrix technique will be similar to the error predicted by the Downing equation" was retained.

The linear regression equation obtained using actual error found in profile projections in Harvey County as the X entries and estimated error in the profile projections derived from the Downing equation as the Y entries was

$$Y = 1.015X + 5.590$$

with $R = .89$. A list of the values used to calculate the linear regression equation of actual error versus estimated error can be found in Table 8.

If the Downing equation was completely accurate in predicting error, the linear regression equation would have been $Y = X$ with $R = 1.00$. The slope of the calculated line is 1.015 while the slope of the perfect fit line is 1.000. The calculated line runs approximately 5.590 Y units above the perfect fit line which means that the Downing equation tends to overestimate error in profile projections for urban labor markets, however, this error is marginal when projections are of a significant size.

For a graphic representation of the comparison of the perfect fit line and the computed linear regression line, see Figure 4.

Table 8

Linear Regression Analysis Data

OCCUPATION	ACTUAL ERROR X	ESTIMATED ERROR Y	ACTUAL ERROR TIMES ESTIMATED ERROR XY	ACUTAL ERROR SQUARED X^2	ESTIMATED ERROR SQUARED Y^2
Aero Engineer	2	1.51	3.02	4	2.28
Chemical Engineer	2	1.87	3.74	4	3.50
Civil Engineer	3	9.14	27.42	9	83.54
Electrical Engineer	10	5.52	55.20	100	30.47
Industrial Engineer	16	8.42	134.72	256	70.90
Mechanical Engineer	21	12.00	252.00	441	144.00
Metal Engineer	4	1.14	4.58	16	1.30
Mining Engineer	0	.77	0	0	.59
Other Engineer	21	8.78	184.38	441	77.09
Chemist	3	4.43	13.29	9	19.62
Ag. Scientist	2	1.51	3.02	4	2.28
Biological Scientist	1	1.14	1.14	1	1.30
Geologist and Related	1	1.14	1.14	1	1.30
Mathematician	0	.77	0	0	.59
Physicist	0	.77	0	0	.59
Other Natural Scientist	1	1.14	1.14	1	1.30
Draftsman	7	11.28	78.96	49	127.24
Surveyor	2	2.61	5.22	4	6.81
Air Traffic Controller	1	.77	.77	1	.59
Radio Operator	6	1.87	11.22	36	3.50
Technicians, Other	6	13.42	80.52	36	180.10
Dentist	26	15.89	413.14	676	252.49
Dietitian	4	4.43	17.72	16	19.62
Professional Nurse	28	80.08	2242.24	784	6412.81
Optometrist	4	3.34	13.36	16	11.16
Osteopath	4	2.24	8.96	16	5.02
Pharmacist	2	4.80	9.60	4	23.04
Physicians & Surgeons	27	21.48	579.96	729	461.39
Psychologist	0	2.61	0	0	6.81

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Table 8 (continued)

OCCUPATION	ACTUAL ERROR X	ESTIMATED ERROR Y	ACTUAL ERROR TIMES ESTIMATED ERROR XY	ACTUAL ERROR SQUARED X^2	ESTIMATED ERROR SQUARED Y^2
Technician, Medical & Dental	46	29.00	1334.00	2116	841.00
Other Med., Health, N.E.C.	6	16.60	99.60	36	275.56
Teachers	42	198.02	8316.84	1764	39211.92
Economists	1	1.14	1.14	1	1.30
Statisticians	2	1.51	3.02	4	2.28
Other Social Scientists	3	.72	2.31	9	.59
Accountants	30	19.05	571.50	900	362.90
Airplane Pilots	9	4.07	36.63	81	16.56
Architects	0	.77	0	0	.59
Workers, Arts & Entertainment	5	20.09	100.45	25	403.61
Clergymen	16	13.77	220.32	256	189.61
Designers (except Draftsmen)	0	2.61	0	0	6.81
Editors & Reporters	13	2.97	38.61	169	8.82
Lawyers	2	7.33	14.66	4	53.73
Librarians	8	10.21	81.68	64	104.24
Personnel Workers	0	2.61	0	0	6.81
Photographers	2	3.34	6.68	4	11.16
Social & Welfare Workers	1	5.16	5.16	1	26.63
Professional, Other	35	39.28	1374.80	1225	1542.92
Conductors	17	12.71	216.07	289	161.54
Creditmen	6	4.07	24.42	36	16.56
Postmasters & Assistants	4	4.07	16.28	16	16.56
Purchasing Agents	16	6.25	100.00	256	39.06
Managers, N.E.C.	114	174.83	19930.62	12996	30565.53
Secretaries and Related	79	106.59	8420.61	6241	11361.43
Office Machine Operators	37	18.34	678.58	1369	336.36
Accountant Clerks	4	20.09	80.36	16	403.61
Bookkeepers	45	40.25	1811.25	2025	1620.06
Bank Tellers	37	7.33	271.21	1369	53.73
Cashiers	15	41.87	628.05	225	1753.10
Mail Carriers	5	11.28	56.40	25	127.24
Postal Clerks	4	9.85	39.40	16	97.02
Shipping & Receiving Clerks	3	10.57	31.71	9	111.72
Telephone Operators	4	17.28	69.12	16	298.60

Table 8 (continued)

OCCUPATION	ACTUAL ERROR X	ESTIMATED ERROR Y	ACTUAL ERROR TIMES ESTIMATED ERROR XY	ACTUAL ERROR SQUARED X^2	ESTIMATED ERROR SQUARED Y^2
Clerical & Kindred	104	158.22	16454.88	10816	25033.57
Salesworkers	220	171.25	37675.00	48400	29326.56
Carpenters	14	43.80	613.20	196	1918.44
Brickmasons	10	5.89	58.90	100	34.69
Cement & Concrete Finishers	4	2.61	10.44	16	6.81
Electricians	24	19.74	473.76	576	389.67
Evacuating, Grading Mach. Op.	14	12.00	168.00	196	144.00
Painters and Paperhangers	3	16.60	49.80	9	275.56
Plasterers	2	1.51	3.02	4	2.28
Plumbers and Pipefitters	24	17.65	423.60	576	311.52
Roofers and Slaters	5	3.70	18.50	25	13.69
Structural Steel Workers	6	7.33	43.98	36	53.73
Foremen, N.E.C.	92	84.95	7815.40	8464	7216.50
Machinist	51	88.78	4527.78	2601	7881.89
Blacksmith	1	4.07	4.01	1	16.56
Boilermakers	8	3.70	29.60	64	13.69
Heat Treaters	2	1.51	3.02	4	2.28
Millwrights	4	3.34	13.36	16	11.16
Molders, Metal	0	4.43	0	0	19.62
Patternmakers	10	4.43	44.30	100	19.62
Rollers and Roll Hands	0	.77	0	0	.59
Sheet Metal Workers	28	27.16	760.48	784	737.67
Tool and Die Makers	1	10.93	10.93	1	119.47
Printing	0	15.89	0	0	252.49
Linemen and Servicemen	26	3.70	96.20	676	13.69
Locomotive Engineers	17	12.71	216.07	289	161.54
Locomotive Firemen	4	2.61	10.44	16	6.81
Airplane Mechanics	3	3.70	11.10	9	13.69
Motor Vehicle Mechanics	9	38.30	344.70	81	1466.89
Office Machine Mechanics	7	3.34	23.38	49	11.16
Radio and TV Mechanics	2	6.25	12.50	4	39.06
RR and Carshop Mechanics	5	12.93	54.65	25	167.18
Other Mechanics	41	55.70	2283.70	1681	3102.49

Table 8 (continued)

OCCUPATION	ACTUAL ERROR X	ESTIMATED ERROR Y	ACTUAL ERROR TIMES ESTIMATED ERROR XY	ACTUAL ERROR SQUARED X^2	ESTIMATED ERROR SQUARED Y^2
Bakers	1	5.89	5.89	1	34.69
Cabinetmakers	17	4.43	75.31	289	19.62
Cranemen, etc.	12	7.33	87.96	144	53.73
Glaziers	0	2.24	0	0	5.02
Jewelers	0	2.24	0	0	5.02
Loom Fixers	0	.77	0	0	.59
Lens Grinders and Opticians	1	.77	0	1	.59
Inspectors, Log and Lumber	2	1.51	3.02	4	2.28
Inspectors, Other	33	13.42	442.86	1089	180.10
Upholsterers	3	3.70	11.10	9	13.69
Craftsmen and Kindred, N.E.C.	51	30.01	1530.51	2601	900.60
Drivers, Bus, Truck, & Tractor	11	76.20	838.20	121	5806.44
Deliverymen, Routemen	17	23.53	400.01	289	553.66
Brake and Switchmen	8	23.53	188.24	64	553.66
Power Station Operators	0	.77	0	0	.59
Heaters, Metal	1	.77	.77	1	.59
Welders and Flamecutters	74	65.01	4810.74	5476	4226.30
Assemblers and Operators, N.E.C.	29	168.42	4884.18	841	28365.23
Inspectors, Metal Class B	0	9.14	0	0	83.54
Electroplaters	2	1.51	3.02	4	2.28
Electroplater Helpers	3	1.87	5.61	9	3.50
Knitters and Loomers	0	.77	0	0	.59
Spinners, Textile	0	.77	0	0	.59
Weavers, Textile	0	.77	0	0	.59
Sewers and Stitchers	2	14.04	28.08	4	197.12
Asbestos, Insulation Workers	0	.77	0	0	.59
Attendants, Auto Service	39	37.19	1450.41	1521	1383.10
Blasters, Powermen	0	1.14	0	0	.59
Laundry and Dry Cleaning Op.	35	18.70	654.50	1225	349.69
Meat Cutters, (exc. Meat Packing)	2	10.93	21.86	4	119.47
Mine Op, Laborers, N.E.C.	1	.77	.77	1	.59
Firemen	0	8.78	0	0	77.09
Guards, Watchmen, Doorkeepers	8	5.89	47.12	64	34.69
Policemen	0	13.42	0	0	180.10

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Table 8 (continued)

OCCUPATION	ACTUAL ERROR X	ESTIMATED ERROR Y	ACTUAL ERROR TIMES ESTIMATED ERROR XY	ACTUAL ERROR SQUARED X^2	ESTIMATED ERROR SQUARED Y^2
Bartenders	11	6.25	68.75	121	39.06
Cooks	23	69.38	1595.74	529	4813.58
Counter & Fountain Workers	2	15.89	31.78	4	252.49
Waiters & Waitresses	24	87.71	2105.04	576	7693.04
Airline Stewardess	2	1.51	3.02	4	2.28
Attendants, Hospital and Other Institutions	46	92.03	4233.38	2116	8469.52
Charwomen and Cleaners	30	14.04	421.20	900	197.12
Janitors and Sextons	8	52.32	418.56	64	2737.38
Practical Nurses	70	37.99	2603.30	4900	1443.24
Other Service Workers	72	65.17	4692.24	5184	4247.13
Laborers, exc. Farm & Mine	14	123.88	1734.32	196	15346.25

$\Sigma X = 2410$ $\Sigma Y = 3032.08$ $\Sigma XY = 154969.32$ $\Sigma X^2 = 140485$ $\Sigma Y^2 = 261759.46$

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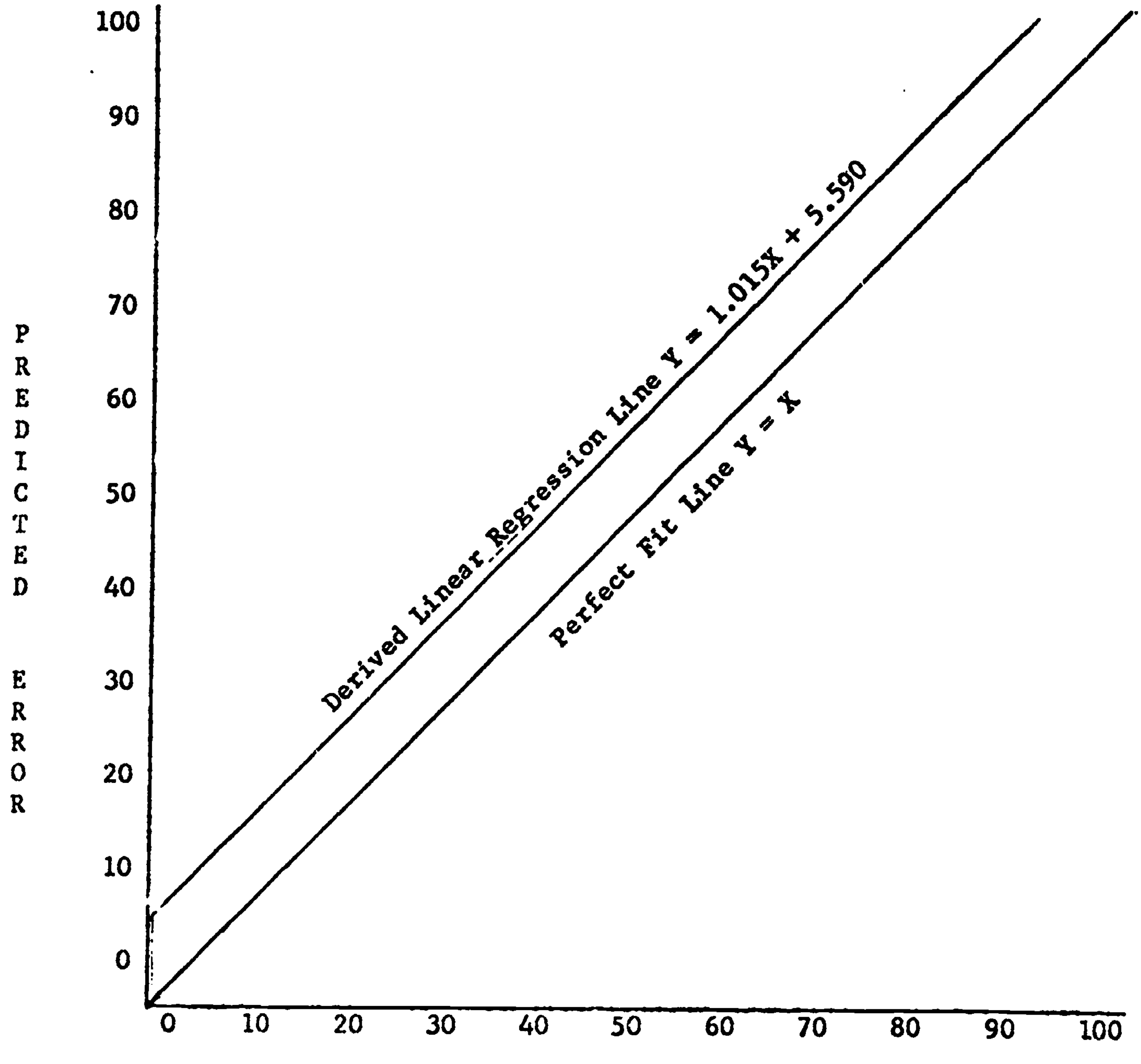
FIGURE 4

A GRAPHIC COMPARISON OF THE RELATIONSHIP
THE EQUATIONS Y = 1.015X + 5.590 AND Y = X



ACTUAL ERROR IN PROJECTIONS

DISPOSITION OF HYPOTHESIS 2

Hypothesis 2 which states "A scale table which will indicate the accuracy of the modified matrix profileprojections on the basis of percent urban population of the forecasted area and the size of projections can be developed" was retained.

The first step in developing a scale of error table was to develop an equation similar to the Downing equation from the Harvey County data (Note: As indicated previously, Harvey County has an urban economy). Using actual error in the profile projections found by survey as the Y entries and the size of the profile projections from the modified matrix technique as the X entries, curvilinear regression yielded an equation which associated size of error with size of profile projection. This equation was $Y = 1.660 + .277X - .00019X^2$ with $R = .81$ where Y is the estimated error and X is the size of projection. Figure 5 is a graphic representation of this equation in comparison with the Downing equation. A list of the values used to calculate the equation can be found in Table 9.

The second step used to develop the scale of error table was to calculate the size of error for given projections for urban areas (using $Y = 1.660 + .277X - .00019X^2$) and the size of error for given projections for rural areas (using the Downing equation $Y = .7721 + .368X - .00019X^2$).

The third step used to develop the scale of error table was to prorate the error developed in step two depending on the percent of urban and rural population. For example, if urban projections of 600 workers had 20 percent error and rural projections of 600 workers had 10 percent error, then an area which was fifty percent urban and fifty percent rural would have 15 percent error in 600 worker projections. Table 10 is the scale of error table relative to size of projection and percent urban population in the forecast area.

ADDITIONAL FINDINGS

Downing indicates that in Wabaunsee and Edwards counties, salesworkers and managers were overestimated. This was also true in Harvey County. Due to modifications in the projection technique which were based on the Downing

FIGURE 5

A GRAPHIC COMPARISON OF THE DOWNING EQUATION AND THE EQUATION DEVELOPED IN THIS STUDY (THE DANIELS EQUATION)

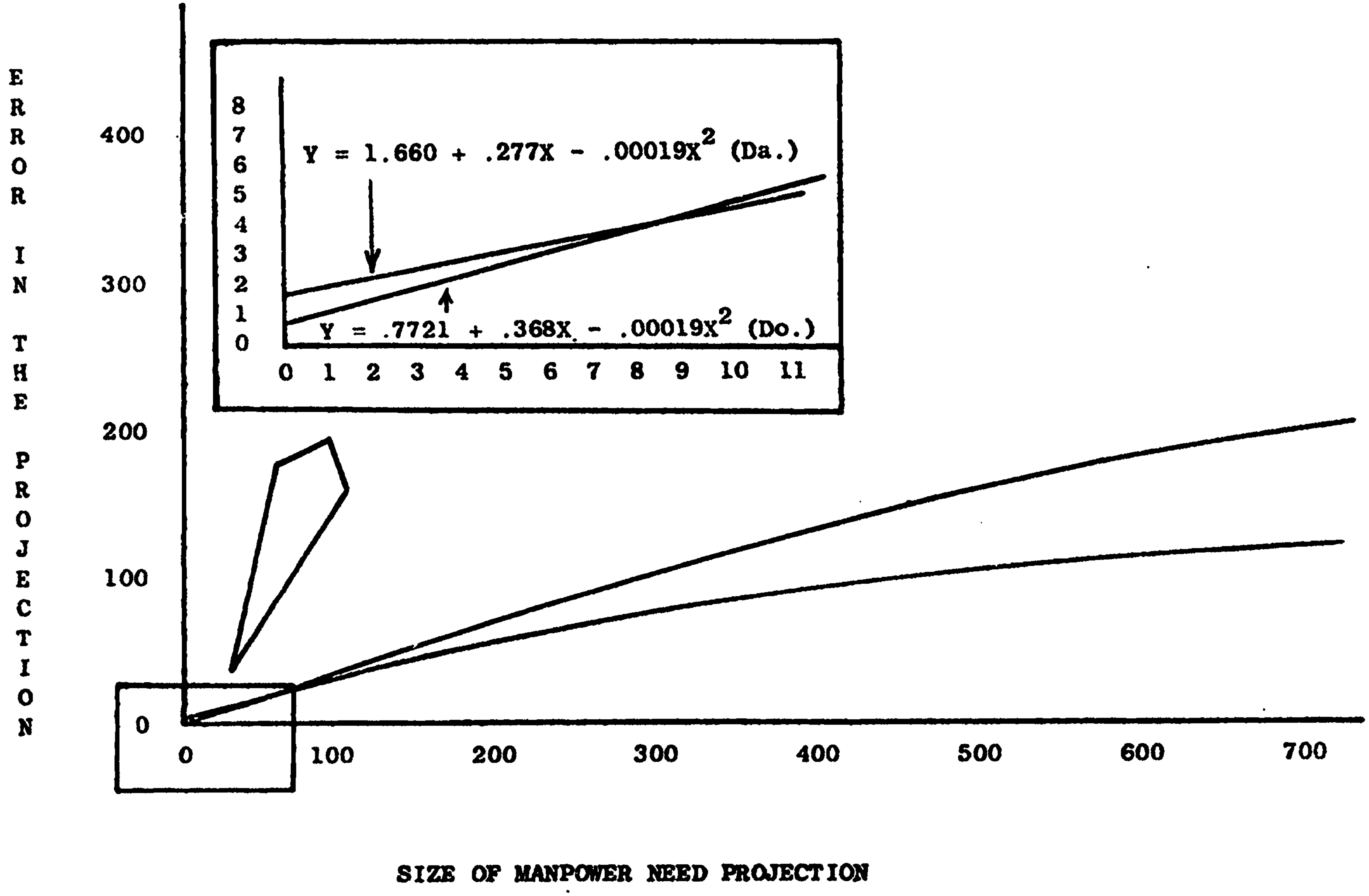


Table 9

Curvilinear Regression Analysis Data

OCCUPATION	ERROR IN MATRIX PROJECTION Y	NUMBER PROJECTED BY MATRIX X_1	NUMBER PRO-JECTED BY MATRIX SQUARED X_2	ERROR IN MATRIX PRO-JECTION SQUARED Y^2	NUMBER PRO-JECTED BY MATRIX SQUARED X_1^2	NUMBER PRO-JECTED BY MATRIX SQUARED SQUARED X_2^2	NUMBER PRO-JECTED TIMES NUMBER ERROR X_1Y	NUMBER PRO-JECTED SQUARED TIMES NUMBER ERROR X_2Y	NUMBER PRO-JECTED TIMES NUMBER PRO-JECTED SQUARED X_1Y_2
Engineer, Aero	2	2	4	4	4	16	4	8	8
Engineer, Chemical	2	3	9	4	9	81	6	18	27
Engineer, Civil	3	23	529	9	529	279841	69	1587	12167
Engineer, Electrical	10	13	169	100	169	28561	130	1690	2197
Engineer, Industrial	16	21	441	256	441	194481	336	7056	9261
Engineer, Mechanical	21	31	961	441	961	923521	651	20181	29791
Engineer, Metal	4	1	1	16	1	1	4	4	1
Engineer, Mining	0	0	0	0	0	0	0	0	0
Engineer, Other	21	22	484	441	484	234256	462	10164	10648
Chemist	3	10	100	9	100	10000	30	300	1000000
Ag. Scientist	2	2	4	4	4	16	4	8	8
Biological Scientist	1	1	1	1	1	1	1	1	1
Geologist	1	1	1	1	1	1	1	1	1
Mathematician	0	0	0	0	0	0	0	0	0
Physicist	0	0	0	0	0	0	0	0	0
Other Natural Scientist	1	1	1	1	1	1	1	1	1
Draftsman	7	29	841	49	841	707281	203	5887	24389
Surveyor	2	5	25	4	25	625	10	50	125
Air Traffic Controller	1	0	0	1	0	0	0	0	0
Radio Operator	6	2	4	36	4	16	12	24	8
Technicians, Other	6	35	1225	36	1225	1500625	210	7350	42875
Dentist	26	42	1764	676	1764	3111696	1092	45864	74088
Dietitian	4	10	100	16	100	10000	40	400	1000
Professional Nurse	28	247	61009	784	61009	3722098081	6916	1708252	15069223
Optometrist	4	7	49	16	49	2401	28	196	343
Osteopath	4	4	16	16	16	256	16	64	64
Pharmacist	2	11	121	4	121	14641	22	242	1331
Physicians and Surgeons	27	58	3364	729	3364	3316496	1566	90828	195112
Psychologists	0	5	25	0	25	625	0	0	125

Table 9 (continued)

OCCUPATION	ERROR IN MATRIX PROJECTION Y	NUMBER PROJECTED BY MATRIX X_1	NUMBER PRO-JECTED BY MATRIX SQUARED X_2	ERROR IN MATRIX PRO-JECTION SQUARED Y^2	NUMBER PRO-JECTED BY MATRIX SQUARED X_1^2	NUMBER PRO-JECTED BY MATRIX SQUARED SQUARED X_2^2	NUMBER PRO-JECTED TIMES NUMBER ERROR X_1Y	NUMBER PRO-JECTED SQUARED TIMES NUMBER ERROR X_2Y	NUMBER PRO-JECTED TIMES NUMBER PRO-JECTED SQUARED X_1Y_2
Technicians, Med. and Dental	46	80	6400	2116	6400	40960000	3680	294400	512000
Other Medical, Health N.E.C.	6	44	1936	36	1936	3748096	264	11616	85184
Teachers	42	536	287296	1764	287296	82538991616	22512	12066932	153990656
Economists	1	1	1	1	1	1	1	1	1
Statisticians	2	2	4	4	4	16	4	8	8
Other Social Scientists	3	0	0	9	0	0	0	0	0
Accountants	30	51	2601	900	2601	6765201	1530	78030	132651
Airplane Pilots	9	9	81	81	81	6561	81	729	729
Architects	0	0	0	0	0	0	0	0	0
Workers in Arts, Entertainment	5	54	2916	25	2916	8503056	270	14580	157464
Clergymen	16	36	1296	256	1296	1679616	576	20736	46656
Designers (except Draftsmen)	0	5	25	0	25	625	0	0	125
Editors and Reporters	13	6	36	169	36	1296	78	468	216
Lawyers	2	18	324	4	324	104976	36	648	5832
Librarians	8	26	676	64	676	456976	208	5408	17576
Personnel Workers	0	5	25	0	25	625	0	0	125
Photographers	2	7	49	4	49	2401	14	98	343
Social and Welfare Workers	1	12	144	1	144	20736	12	144	1728
Professional Other	35	111	12321	1225	12321	151807041	3885	431235	1367631
Conductors (RR)	17	33	1089	289	1089	1185921	561	18513	35937
Creditmen	6	9	81	36	81	6561	54	486	729
Postmasters and Assistants	4	9	81	16	81	6561	36	324	729
Purchasing Agents	16	15	225	256	225	50625	240	3600	3375
Managers, N.E.C.	114	821	674041	12996	674041	454331269681	93594	76840674	553387661
Secretaries & Related	79	345	119025	6241	119025	14166950625	27255	9402975	41063625
Office Machine Operators	37	49	2401	1369	2401	5764801	1813	88837	117649
Accountant Clerks	4	54	2916	16	2916	8503056	216	11664	157464
Bookkeepers	45	114	12996	2025	12996	168896016	5130	584820	1481544
Bank Tellers	37	18	324	1364	324	104976	666	11988	5832
Cashiers	15	119	14161	225	14161	200533921	1785	212415	1685159
Mail Carriers	5	29	841	25	841	707281	145	4205	24386
Postal Clerks	4	25	625	16	625	390625	100	2500	15625
Shipping & Receiving Clerks	3	27	729	9	729	531441	81	2187	19683
Telephone Operators	4	46	2116	16	2116	4477456	184	8464	97336

Table 9 (Continued)

OCCUPATION	ERROR IN MATRIX PROJECTION Y	NUMBER PROJECTED BY MATRIX X_1	NUMBER PRO- JECTED BY MATRIX SQUARED X_2	ERROR IN MATRIX PRO- JECTION SQUARED Y^2	NUMBER PRO- JECTED BY MATRIX SQUARED X_1^2	NUMBER PRO- JECTED BY MATRIX SQUARED SQUARED X_2^2	NUMBER PRO- JECTED TIMES NUMBER ERROR X_1Y	NUMBER PRO- JECTED SQUARED TIMES NUMBER ERROR X_2Y	NUMBER PRO- JECTED TIMES NUMBER PRO- JECTED SQUARED X_1Y_2
Clerical and Kindred N.E.C.	104	638	407044	10816	407044	165684817936	66352	42332576	259694072
Salesworkers	220	767	588289	48400	588289	346083947521	168740	129423580	45121766
Carpenters	14	125	15625	196	15625	244140625	1750	218750	1953125
Brickmasons	10	14	196	100	196	38416	140	1960	2744
Cement & Concrete Finishers	4	5	25	16	25	625	20	100	125
Electricians	24	53	2809	576	2809	7890481	1272	67416	148877
Excavating, Grading Mach. Op.	14	31	961	196	961	923521	434	13454	29791
Painters & Paperhangers	3	44	1936	9	1936	3748096	132	5808	85184
Plasterers	2	2	4	4	4	16	4	8	8
Plumbers & Pipefitters	24	47	2209	576	2209	4879681	1128	53016	103824
Roofers & Slaters	5	8	64	25	64	4096	40	320	512
Structural Metal Workers	6	18	324	36	324	104976	108	1944	5832
Foremen, N.E.C.	92	265	70225	8464	70225	4931550625	24380	6460700	18609625
Machinist & Related	41	263	69169	1681	69169	4784350561	10783	2835929	18191447
Blacksmith	1	9	81	1	81	6561	9	81	729
Boilermakers	8	8	64	64	64	4096	64	512	512
Heat Treaters	2	2	4	4	4	16	4	8	8
Millwrights	4	7	49	16	49	2401	28	196	343
Molders, Metal	0	10	100	0	100	10000	0	0	1000
Patternmakers	10	10	100	100	100	10000	100	1000	1000
Rollers & Roll Hands	0	0	0	0	0	0	0	0	0
Sheetmetal Workers	28	78	6084	784	6084	37015056	2184	170352	474552
Tool & Die Makers	1	28	784	1	784	614656	28	784	21952
Printers	0	42	1764	0	1764	3111696	0	0	74088
Linemen & Servicemen	26	8	64	676	64	4096	208	1664	512
Locomotive Engineers	17	33	1089	289	1089	1187109	561	3713	35973
Locomotive Firemen	4	5	25	16	25	625	20	100	125
Airplane Mechanics	3	8	64	9	64	4096	24	192	512
Motor Vehicle Mechanics	9	108	11664	81	11664	136048896	972	104976	1296712
Office Machine Mechanics	7	7	49	49	49	2401	49	343	343
Radio & TV Mechanics	2	15	225	4	225	50625	30	450	3375
Railroad & Carshop Mech.	5	28	784	25	784	614654	140	3920	21952
Other Mechanics	41	163	26896	1684	26896	723394816	6683	1102736	4384048

Table 9(continued)

OCCUPATION	ERROR IN MATRIX PROJECTION Y	NUMBER PROJECTED BY MATRIX X_1	NUMBER PRO-JECTED BY MATRIX SQUARED X_2	ERROR IN MATRIX PRO-JECTION SQUARED Y^2	NUMBER PRO-JECTED BY MATRIX SQUARED X_1^2	NUMBER PRO-JECTED BY MATRIX SQUARED SQUARED X_2^2	NUMBER PRO-JECTED TIMES NUMBER ERROR X_1Y	NUMBER PRO-JECTED SQUARED TIMES NUMBER ERROR X_2Y	NUMBER PRO JECTED TIMES NUMBER PRO-JECTED SQUARED X_1Y_2
Bakers	1	14	196	1	196	38416	14	196	2744
Cabinetmakers	17	10	100	289	100	10000	170	1700	1000
Cranemen	12	18	324	144	324	104976	216	3888	5832
Glaziers	0	4	16	0	16	256	0	0	64
Jewelers	0	4	16	0	16	256	0	0	64
Loom Fixers	0	0	0	0	0	0	0	0	0
Lens Grinders, Opticians	1	0	0	1	0	0	0	0	0
Inspectors, Log & Lumber	2	2	4	4	4	16	4	8	8
Inspectors, Other	33	35	1225	1089	1225	1498875	1155	40425	42825
Upholsterers	3	8	64	9	64	4096	32	192	512
Craftsmen & Kindred N.E.C.	51	83	6889	2601	6889	47458321	4233	351339	571787
Drivers, Bus, Truck, Tract.	11	233	54289	121	54289	2947295521	2563	597179	12649337
Deliverymen, Routemen	17	64	4096	289	4096	16777216	1088	69632	262144
Brakemen & Switchmen	8	64	4096	64	4096	16777216	512	32768	262144
Power Station Operators	0	0	0	0	0	0	0	0	0
Heaters, Metal	1	0	0	1	0	0	0	0	0
Welders & Flamecutters	74	194	37636	5476	37636	1416468496	14356	2785064	7301384
Assemblers & Operatives NEC	29	1204	1449616	841	1449616	2101386547456	34916	42038864	1745337664
Inspectors, Metal Class B	0	23	529	0	529	279841	0	0	12167
Electroplaters	2	2	4	4	4	16	4	8	8
Electorplater Helpers	3	3	9	9	9	81	9	27	27
Knitters & Loomers	0	0	0	0	0	0	0	0	0
Spinners, Textile	0	0	0	0	0	0	0	0	0
Weavers, Textile	0	0	0	0	0	0	0	0	0
Sewers, Stitchers	2	37	1369	4	1369	1874161	74	2738	51652
Asbestos Insulation Wkrs	0	0	0	0	0	0	0	0	0
Attendants, Auto Service	39	105	11025	1521	11025	121550625	4095	429975	1157625
Blasters, Powermen	0	1	1	0	1	1	0	0	1
Laundry & Drycleaning Op.	35	50	2500	1225	2500	6250000	1750	87500	125000
Meat Cutters, except Meat Packers	2	28	784	4	784	614656	56	1586	21952
Mine Op, Laborers N.E.C.	1	0	0	1	0	0	0	0	0
Firemen	0	22	484	0	484	234256	0	0	10648
Guards, Watchmen, Doorkprs	8	14	196	64	196	38416	112	1568	2716
Policemen	0	35	1225	0	1225	1500625	0	0	42875

Table 9 (continued)

OCCUPATION	ERROR IN MATRIX PROJECTION Y	NUMBER PROJECTED BY MATRIX X_1	NUMBER PRO-JECTED BY MATRIX SQUARED X_2	ERROR IN MATRIX PRO-JECTION SQUARED Y^2	NUMBER PRO-JECTED BY MATRIX SQUARED X_1^2	NUMBER PRO-JECTED BY MATRIX SQUARED SQUARED X_2^2	NUMBER PRO-JECTED TIMES NUMBER ERROR X_1Y	NUMBER PRO-JECTED SQUARED TIMES NUMBER ERROR X_2Y	NUMBER PRO-JECTED TIMES NUMBER PRO-JECTED SQUARED X_1X_2
Bartenders	11	15	225	121	225	50625	165	2475	3375
Cooks	23	209	43681	529	43681	1908029761	4807	1004663	9129329
Counter, Fountain Wkrs.	2	42	1764	4	1764	3111696	84	3532	74088
Waiters, Waitresses	24	253	64009	576	64009	4097152081	6072	1536216	16194277
Airline Stewardesses	2	2	4	4	4	16	4	8	8
Attendants, Hospital & Other Institutions	46	292	85264	2116	85264	7269949696	13432	3922144	24897088
Charwomen & Cleaners	30	37	1369	900	1369	1874161	1110	41070	50653
Janitors, Sextons	8	152	23104	64	23104	533794816	1216	184832	3511808
Practical Nurses	70	105	11025	4900	11025	121550625	7350	771750	1157625
Other Service Workers	72	196	38416	5184	38416	1475789056	14112	2765952	7529536
Laborers, except Farm & Mine	14	430	184900	196	184900	34188010000	6020	2588600	79507000

$\Sigma Y = 2210$ $\Sigma X_1 = 10190$ $\Sigma X_2 = 4457532$ $\Sigma Y^2 = 139485$ $\Sigma X^2 = 4457534$ $\Sigma X_2^2 = 3229223005806$ $\Sigma X_1Y = 591585$

$\Sigma X_2Y = 339100528$ $\Sigma X_1X_2 = 3437165984$

Table 10

Error Analysis for Error Relative to Percent Urban Population

Size of Profile Projection (Workers)	Associated Needs Projection (Annually)	Percent Error from Downing's Study (51 percent urban)	Percent Error from Daniels' Study (57 percent urban)	Percent Error in Areas Which Are:				
				40 Percent Urban or Less	45 Percent Urban	50 Percent Urban	55 Percent Urban	60 Percent Urban or More
50	2	37.38	30.07	46.73	41.53	36.33	31.13	25.93
100	4	35.67	27.46	46.22	40.36	34.50	28.65	22.79
150	6	34.46	25.96	45.39	39.32	33.25	27.18	21.11
200	8	33.38	24.73	44.46	38.32	32.14	25.97	19.80
250	10	32.35	23.62	43.51	37.31	31.11	24.91	18.71
300	12	31.35	22.55	42.60	36.35	30.10	23.85	17.30
350	14	30.36	21.52	41.70	35.40	29.10	22.80	16.50
400	16	29.39	20.52	40.73	34.43	28.13	21.83	15.53
450	18	28.42	19.51	39.85	33.50	27.15	20.80	14.45
500	20	27.45	18.53	38.88	32.50	26.18	19.83	13.48
550	22	26.48	17.55	37.91	31.56	25.21	18.86	12.51
600	24	25.50	16.57	36.93	30.58	24.23	17.88	11.53
650	26	24.56	15.61	35.99	29.64	23.29	16.94	10.59
700	28	23.61	14.63	35.13	28.73	22.33	15.93	9.53
750	30	22.65	13.67	34.17	27.77	21.37	14.97	8.57
800	32	21.69	12.71	33.21	26.81	20.41	14.01	7.61
850	34	20.74	11.74	32.26	25.86	19.46	13.06	6.66
900	36	19.74	10.78	31.36	24.96	18.56	12.16	5.76
950+	36+	19.74	10.78	31.36	24.96	18.56	12.16	5.76

study, the problems he found in "machinist," "machine tool operators," "auto service attendants" and "workers in arts and entertainment" clusters were not found in Harvey County data.

During the survey-many managers who were also skilled workers; i.e., cosmetologists, repairmen, salesmen, etc; were identified. These people, more often than not, preferred to be classified as skilled workers rather than management. This contributed to a low figure relative to managers.

In addition, it appears that the modified matrix technique is better suited to urban areas than it is to rural areas since the error projection line for urban areas falls below the error projection line for rural areas.

Again, error was found when the matrix was projecting related occupations (this time in the printing trades), however, it cannot be determined whether the error was in the survey techniques or in the projection techniques. The problem was overcome by grouping printing trades under a single category.

A new source of error not found in the Downing study was the situation where the employing organization was located outside the county but workers were based in the county. This was corrected as far as railroad workers were concerned. It is possible that the error in projecting managers and salesworkers is also related to this type of problem.

SUMMARY

Hypothesis 1 was retained. The Downing equation projected error in the profiles similar to that found in the survey. It should be noted, however, that the Downing equation error projections differed slightly from actual errors in that they were consistently higher.

Hypothesis 2 was also retained. A table was developed which estimated error relative to size of projection and percent urban population in the forecast area. The percent of urban population in the forecast area seems to have a profound effect on the percent error in projections.

Chapter 10

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

This chapter presents conclusions based on the findings presented in Chapter 9 and recommendations based on the conclusions.

CONCLUSIONS

1. The projections produced by the modified matrix approach are accurate enough for planning vocational and technical education programs.

2. Based upon the finding, the Modified Matrix is a relatively superior technique for determining manpower needs projections in terms of cost, timeliness and accuracy.

3. The percent of error in the projections decrease as the size of the profile projection increases.

4. The percent of error in the projection decreases as the urban/rural population ratio increases.

5. The matrix has difficulty discriminating between closely related occupations and therefore grouping of occupations will increase the accuracy of projections. For example, a grouping of the printing occupations produces more accurate projections than projections than projections for each of the printing trades.

6. The small labor market effect identified in the Downing study is less identifiable in Harvey County.

7. Workers in managerial occupations often prefer to be identified as skilled workers, i.e., cosmetologists, repairmen, etc.

8. A weakness of the interview technique is the inability to prorate workers on the basis of a multitude of job functions. In addition, classification is often a subjective decision on the part of the interviewee.

9. Miscoding of source data was not identifiable in Harvey County. (Note: Downing found miscoding to be a major factor in Wabaunsee County).

10. Workers employed in surrounding counties who actually worked in Harvey County posed a problem in developing occupational profiles.

RECOMMENDATIONS

1. The Kansas State Department of Education, Division of Vocational Education, should use the Modified Matrix Technique data for (1) developing Table of the State Plan for Vocational Education, (2) input into decisions about initiating new programs and retaining existing programs and, (3) input into the state funding formula. (Conclusion 1 and 2)

2. The State Department of Education, Division of Vocational Education should place planning emphasis on state wide total manpower needs projections first and regional (county groups) manpower needs projections second. County manpower needs projections should be considered to a lesser extent. (Conclusion 3 and 9) This would indicate that the State Department of Education, Division of Vocational Education, should move toward regional program planning and funding.

3. Rural areas should place less emphasis on the regional manpower needs data than should urban areas. (Conclusion 4 and 6)

4. Programs should evolve into cluster based programs first, and into specific occupational areas second. (Conclusion 5)

SUMMARY

The Modified Matrix Technique is a satisfactory tool for projecting manpower needs data to be used in the vocational education planning process. Accuracy of projections improve when the forecast area is large (regional) and urban, and when occupational clusters are used.

It is recommended that the Kansas State Department of Education, Division of Vocational Education utilize this technique and data generated thereof for input into the planning and funding of vocational and technical education programs. In addition, it is recommended that a regional/statewide planning approach be developed. This implies that regions within the state be designated as planning regions. Finally, it is recommended that the program cluster concept be explored since accuracy of data improves when occupations are clustered.

Part 3

THE USE OF MANPOWER NEEDS AND STUDENT INTEREST TO PLAN VOCATIONAL AND TECHNICAL PROGRAMS IN KANSAS

Robert Gregg Price

Chapter 11

THE PROBLEM

INTRODUCTION

The Vocational Education Amendments of 1968 require that vocational and technical education programs prepare students for job vacancies that either presently exist or will exist in the near future. The law also states that student interest should be considered when planning vocational offerings.[1]

Using student interest and manpower needs as criteria for planning vocational and technical education, may lead to difficulties if the two factors are not compatible. If student interest and manpower needs are compatible, then neither criteria need be relegated to a secondary position, since high student interest in a program will generally occur when manpower need for the type of worker produced by the program is high. On the other hand, if the criteria are not compatible, then one of the criteria most likely will be emphasized over the other.

There is no set policy in Kansas which dictates the mix of student interest and manpower needs necessary for the establishment of a vocational or technical program.[2] If student interest and manpower needs are compatible, it may not be necessary that a set policy exist. If the two criteria are incompatible, then the establishment of a policy may be desirable.

When the two criteria are not in agreement, one of two situations probably exists, i.e., either manpower needs have been subjugated to student interest or student interest has become subordinate to manpower needs in terms of the planning process. In the case where one of the criteria is subordinate to the other, it is possible that present decision making procedures are satisfactory to the policy maker. When this is not the situation, the policy maker would probably want to make an adjustment in the planning process.

Before the need for a policy which dictates the mix of student interest and manpower needs can be determined, chief state school administrators and other policy makers should understand the relationships between the two criteria that are presently used to establish programs.

Program enrollment is a direct measure of the program planning process. Consequently, the mix of student interest and manpower needs in the planning process can be examined by investigating the relationships between student interest and manpower needs and program enrollment.

STATEMENT OF THE PROBLEM

This study will attempt to answer a series of questions designed to aid policy makers in determining the need for a set procedure to be used in planning the vocational and technical program mix for Kansas.

The first question to be answered is, "Are student interest and manpower needs compatible criteria on which vocational and technical programs can be established?"

If the answer to the first question is "Yes" then the second question will be, "Are these criteria the basis on which the present program mix has been established?"

If the answer to the first question is "No" then the second question will be, "Which of the two criteria, if either, is dominate in the program planning process?"

HYPOTHESES TO BE TESTED

The following hypotheses will be statistically tested in this study.

Hypothesis 1

There is a significant positive correlation between the rank order of occupational clusters by student interest and the rank order of the occupational clusters by manpower needs.

Hypothesis 2 (Alternative 1)

There is a significant positive correlation between the rank order of occupational clusters by program enrollment and the rank order of the occupational clusters by program enrollment and the rank order of occupational clusters by a combination factor derived from manpower needs and student interest.

Hypothesis 2-A (Alternative 2)

There is a significant positive correlation between the rank order of occupational clusters by program enrollment and the rank order of the occupational clusters by student interest.

Hypothesis 2-B (Alternative 2)

There is a significant positive correlation between the rank order of occupational clusters by program enrollment and the rank order of the occupational clusters by manpower needs.

DELIMITATIONS

This study is subject to the following delimitations or parameters.

1. This study is limited to include only those occupations which are covered in the Kansas Manpower Utilization System for Training (K-MUST) Project, and the Kansas Vocational Information for Education and Work (K-VIEW) system and for which training programs exist in Kansas.

2. Student interest data is limited to data on those students who have referenced the occupations in the K-VIEW system.

3. Manpower needs figures represent only those manpower needs of the state of Kansas.

4. Vocational and technical program enrollments used in this study include only full-time public school enrollments within the state of Kansas.

5. The study is cross-sectional in nature and the data is, therefore, restricted to the 1971-72 school year K-VIEW references which were used to determine student interest, 1971-72 school year vocational program enrollments and 1972-76 Kansas manpower needs data from the 1973 K-MUST report.

ASSUMPTIONS

The study is based on the following assumptions.

1. Student references to the K-VIEW system are assumed to indicate student occupational preference (interest) in much the same manner that Nielsen Surveys represent national preference of television programming.[3]

2. The job cards available in the K-VIEW system are assumed to include the majority of subprofessional jobs which interest potential Kansas vocational

and technical students.

3. Vocational program enrollment figures obtained from the Kansas State Department of Education are assumed to represent actual enrollments in vocational and technical training programs in Kansas.

4. It is assumed that figures obtained from the 1973 K-MUST Report are a reasonably accurate representation of manpower needs in the state of Kansas.

5. Recorded occupational references to the K-VIEW system are assumed to represent Kansas junior high and high school student interests in subprofessional occupations.

SUMMARY

Manpower needs and student interest are important criteria to consider when planning vocational and technical programs. A policy specifying the mix of manpower needs and student interest necessary for the establishment of vocational and technical programs does not exist in Kansas.

If the two criteria are incompatible, the establishment of a policy concerning the mix may be desirable. Under these circumstances, if one of the criteria does not exhibit dominance in planning, an adjustment in the planning process may be needed.

Program enrollment is identified as a direct measure of past program planning. The relationship between manpower needs, student interest and program enrollment should be examined in an effort to determine the combination of student interest and manpower needs previously used in the program planning process. If a significant positive correlation is found between manpower needs and student interest, an attempt will be made to determine if a significant positive correlation exists between an average of the ranks for manpower needs and student interest and the ranks for program enrollment thus indicating that past planning conformed to the 1968 Amendments.

If no significant positive relationship between these two criteria is revealed, comparisons of each of these criteria will be made with program enrollment to identify whether manpower needs, student interest or some other factors dominate in the planning process. The determination of the desirability of predominance of one of these criteria over the other in program planning procedure is a socio-political decision. If decision makers should decide that the dominate criterion was unacceptable as the most important consideration of the two criteria when planning vocational and technical programs, the state, most likely, should develop a planning policy.

FOOTNOTES

[1]United State Statutes at Large, 90th Cong., 2D Sess., 1968, Vol. 82, Public Law 90-576, (Washington: Government Printing Office, 1968), pp. 1064-1098.

[2]Statement by R. B. Daniels, Program Administrator of Industrial Education, Division of Vocational Education, personal interview, June 14, 1972.

[3]See Chapter 2 for further discussion.

Chapter 12

BACKGROUND INFORMATION

INTRODUCTION

This chapter contains a list of definitions designed to help the reader understand terms used in the study. In addition, there is a review of literature concerning student interest and manpower needs.

DEFINITIONS

Agricultural Workers

Workers in these occupations are concerned with growing, harvesting, catching, and gathering land and aquatic plant and animal life and the products thereof; and providing services in support of these activities.[1]

Bureau of Labor Statistics (BLS)

This bureau has the main responsibility for developing and testing the adequacy of the matrix system used to project manpower needs. The Bureau of Labor Statistics is part of the Department of Labor.[2]

Bureau of Labor Statistics Occupation by Industry Matrix (BLS Matrix)

This is a set of employment and expansion ratios for various industries and occupations within industries. One hundred and sixteen industries and one hundred and sixty-two occupational clusters representing the national economy are included in the matrix.[3]

Clerical Workers

These are workers concerned with making, classifying, and filing records including written communications.[4]

Construction Workers

These workers are in craft and non-craft occupations, not elsewhere classified, concerned with the building and repairing of structures.[5]

Drivers and Deliverymen

These occupational workers are concerned with transporting cargo over highways, city streets, or within compounds of industrial construction or mining areas, by driving vehicles powered by gasoline, diesel, propane, or related fuels, or electricity.[6]

Food Service Workers

This area includes workers concerned with preparing food and beverages and serving them to patrons of such establishments as hotels, clubs and restaurants.[7]

Manpower Needs

These are the gross manpower needs listed in the Handbook for Vocational and Technical Education Planners released by the Division of Vocational Education, Kansas Department of Education and the Department of Adult and Occupational Education, Kansas State University.[8]

Mechanics and Repairmen

Workers in this group are concerned with repairing engines and accessories, power trains, suspension systems, and other mechanical units of automobiles, trucks, tractors, buses, and trackless trolleys; graders, bulldozers, cranes, power shovels, portable air compressors, and other gasoline, diesel-powered engineering equipment; motorized materials, handling equipment and wheeled or tracked military vehicles.[9]

Medical Workers

These workers include those subprofessionals concerned with the health care of humans or animals, or work in occupations in sanitation, environmental and public health, or in laboratories or other health facilities.[10]

Metal Craftsmen

Workers in this area, not elsewhere classified, are concerned with shaping and conditioning metal by rolling, forging, extruding, drawing out, punching, blanking, and press working.[11]

Printing Craftsmen

This group includes workers concerned with assembling and setting type matter for printing by means of typesetting or composing machines. It includes craftsmen at linotype machines which assemble letters into lines and cast strips of type from type metal; and monotype machines which compose type matter in separate letters.[12]

Protective Service Workers

Workers in this area are concerned with protecting the public against crime, fire, accidents, and acts of war.[13]

Sales Workers

These workers are to be found in occupations concerned with selling commodities when knowledge of the commodities sold is required.[14]

Service Workers N.E.C.

These are workers in service occupations that have not been previously classified.

Standard Industrial Classification (SIC)

This is a code assigned to each industry on the basis of its major activity, which is determined by the product or group of products produced or handled, or services rendered. Establishments may be classified on a two, three or four digit basis depending upon the specificity required.[15]

Program Enrollment

This is the 1972 full-time public school vocational and technical program enrollment in the state of Kansas.

Student Interest

Student interest is defined in this study as student preference for various subprofessional occupations and/or training programs. This interest is measured by references to various occupations or training programs in the K-VIEW system with occupations or programs referenced most, considered to be preferred occupations or programs.

Subprofessional Occupations

These are jobs requiring educational preparation at less than the baccalaureate level.

Technicians N.E.C.

These are workers in technical occupations not classified as medical.

Textile Occupations

Workers in these occupations are concerned with shaping, joining, spinning, weaving and otherwise fabricating textiles, textile products, fur and hair.[16]

The K-MUST System

This is a project initiated by the Division of Vocational Education in Kansas designed to furnish meaningful information to Kansas vocational and technical education planners for decision-making purposes.

The K-VIEW System

This is an information system designed to provide Kansas students with information concerning occupations, training programs and training institutions in the state. The information is brief, easy to read and includes sources where additional information may be obtained on the occupations being referenced.

Transportation and Public Utilities N.E.C.

This division includes operators concerned with moving people or materials by means of automotive and railway vehicles, aircraft, freshwater of seagoing vessels, pipes, and pumps. Their activities include loading bulk materials into conveyances; ascertaining number of passengers and kind of materials being conveyed; directing course of carrier routing materials;

servicing carriers; and related activities.[17]

These are occupations concerned with generation, transmission, and distribution of electricity; generation and distribution of steam for heat and power, including marine propulsion; generation of utility gas, and storage and distribution of natural and manufactured gas for power, illumination, or heating purposes; filtration, purification, and distribution of water for domestic, commercial, or industrial consumption; and collection, treatment, and disposal of sewage and refuse.[18]

Vocational and Technical Education

This represents that portion of education responsible for preparing students to work in subprofessional occupations.

Vocational and Technical Education Programs

This is educational training designed to prepare students for specific subprofessional occupations.

Vocational and Technical Students

These are students enrolled in vocational and technical programs.

STUDENT INTEREST

This section describes, (1) standardized instruments and other techniques which have been used to measure vocational interests, (2) studies that have attempted to evaluate vocational interest data that has been generated, (3) studies that have attempted to examine the relationship between vocational interests and manpower needs and (4) a rationale for the approach used to determine student vocational interests in this study.

Standardized instruments that will be discussed in this section include (1) the Strong Vocational Blank, (2) the Minnesota Vocational Interest, and (3) the Kuder Preference Record (Form DD). Non-standardized techniques discussed are centered around the questionnaire approach.

The Strong Vocational Interest Blank (SVIB) is scored by a weighting agreement with the occupational group. Pluses indicate agreement. Minuses indicate disagreement. The SVIB occupational groups are mainly at the professional and/or college trained level. The possible responses to items are 'like', 'indifferent', and 'dislike'.[19]

O'Shea and Harrington indicated that there is a considerable body of evidence indicating predictive validity of the SVIB.[20] Campbell feels that interests, as measured by the SVIB are stable over long periods of time.[21]

The Minnesota Vocational Interest Inventory (MVII) was scored in manner similar to the SVIB. Possible responses are 'like' and 'dislike'. The occupational groups are at the technical level.[22]

Results of a study of the MVII by Silber and Barnette indicate concurrent and predictive validity for vocational high school boys. This study used twenty-one of the MVII occupational groups for comparison.[23]

The Kuder Preference Record (Form DD), also known as the OIS, is scored using a coefficient which reflects similarity between a person's response to all one hundred items in the inventory with the norm group's responses to all one hundred items rather than to only those that distinguish an occupational group from men-in-general. The OIS reports for occupations over the entire occupational spectrum. Possible responses are markings of most and least liked alternatives of a triad of items describing varied activities.[24]

Zytowski indicated that there is a lack of co-variance between any two or the three above mentioned tests (SVIB, MVII, and OIS) which might be attributed to deficiencies in response format and scoring or to lack of equivalence in the occupational norm groups.[25] There are many additional instruments that attempt to measure student vocational or career interests such as the Career Maturity Inventory[26] developed by Crites. These other instruments are similar to the three mentioned above.

All of the standardized instruments described to this point have two severe limitations, i.e., they are based on student responses to questionnaires and do not measure any student initiated action which might indicate his occupational preference, and they are limited to either broad clusters of occupations or to a small number of detailed occupations. Kansas vocational educators are becoming disillusioned with these subjective measures and are seeking a broadly based, yet detailed, objective occupational interest assessment system.[27]

Roe and Siegelman indicate that early environmental factors were not satisfactory predictors of vocational interests. They did find, however, that the interactions between parent and child develop attitudes in the child which may play a significant part in the selection of an occupation. This implies that one way to predict student vocational interests would be to evaluate the attitudes of the communities towards certain occupations.[28] Such a community evaluation would most likely pose many problems.

Holland assumed that a person's vocational choice is the product of the interaction of his heredity and a variety of cultural and personal forces including peers, parents and significant adults, his social class, American culture and the physical environment. He has identified a hierarchy of habitual or preferred methods for dealing with environmental tasks such as making a vocational choice. He has defined six major occupational envionments.

The motoric environment includes people in occupations such as laborers, machine operators, aviators, truck drivers, and carpenters. The intellectual environment is represented by physicists, anthropologists, chemists, mathematicians and biologists. Social workers, teachers, interviewers, vocational counselors and therapists are designated as the supportive encironment. The conforming environment is comprised of bank tellers, secretaries, bookkeepers and file clerks. Salesmen, politicians, managers, promoters, and business executives personify the persuasive encironment. The esthetic environment includes musicians, artists, poets, sculptors and writers.[29]

Viernstein translated the Holland classifications into the <u>Dictionary of Occupational Titles</u> classifications. The fact that this translation is possible and can be done well illustrates the strong relationship between Holland's occupational environments and specific occupations.[30]

Williams concludes that students select vocations which agree with their values and personality. He found that life values, work values and personality characteristics could be feasibly separated into Holland's six environments.[31] However, this theory has not been developed to the point that specific occupational preferences can be predicted.

Several studies have used the questionnaire approach as a method for defining student interest. Thirty-eight thousand Indiana High School graduates completed a twenty-two item questionnaire specifying curriculum and occupational choices related to their educational and vocational plans. The characteristics and geographical distribution of this sample group compared favorably to the total high school senior population in the state. Approximately forty-three percent were vocationally oriented in terms of their high school studies. Student interest in vocational education increased in the senior year with preferences for business and service.[32]

One thousand, one hundred and forty-six seniors for the year 1965, 416 graduates of the 1960 and 1962 class, 1,034 fifth grade parents and 250 business firms identified the vocational and technical educational needs in the Shiawassee-Clinton area of Michigan by responding to questionnaires. Data analysis showed that present vocational offerings were not adequate in terms of student interest. Occupational education was needed in the high schools and post-secondary institutions and programs were needed in variety of occupational areas.[33]

A survey was conducted by the Master Planning Committee for occupational education of the Garden City Community College, Garden City, Kansas. One hundred and six graduates of the 1967 and 1969 classes completed and returned questionnaires. Survey results indicated that high school programs pursued in order fo popularity were college preparation, general business and agriculture.[34]

In an effort to find significant relationships between interests and manpower needs, a four county study of youth and adult interests in community college occupational programs was conducted in Michigan. Student interests and employer needs for auto mechanics, secretaries, and salespeople correlated. Employer needs and student interest did not correlate in other occupations indicated.[35]

Although the survey approach has many advantages and is used extensively, it has at least two major disadvantages, i.e., the student must answer as to preference even if he has no preference among the possible alternatives, and the Hawthorne Effect could cause students to select the more prestigeous occupations.

This study used a new student vocational interest measurement technique. Student references to job descriptions in the K-VIEW system are clustered by similar occupations. The clusters with the greatest number of references are considered to contain occupations most preferred by the students. Broad inferences are made about large bodies of students which should contribute to making this a suitable method for determining student interest in this study.

The technique can be classified as unobstrusive in that while the student completes the reference card each time he uses the K-VIEW deck, there is no pressure to make any given response. Instructors or other school personnel are usually not present. The student's name does not appear on the card. The student has no idea as to how the data will be used. Webb states that when using such unobstrusive measures for obtaining information, there is little possibility these measures will influence behavioral changes or require role-playing which would refute the data acquired.[36]

A similar data collection technique which is well-known is the method Nielsen uses to determine television program preference. Nielsen has developed an indirect measure of interest whereby observation of actions or the results of actions of individuals is not necessary. Measurement of those who subscribe to a newspaper or magazine in terms of their sex, income, and household purchases represents another indirect measurement.[37]

Gallup Robinson Inc. conducts interviews with magazine readers to determine what ads they recall with the magazine closed. Since the readers are not monitored when expressing interest in a particular ad, this represents an indirect measure of interest.[38] There techniques like the K-VIEW reference technique are unobstrusive in that indirect measurement of a sample member action is achieved.

The K-VIEW technique is also similar to the survey method because it allows the student to choose from a group of occupations. An advantage over the survey technique is that in the K-VIEW technique action is usually student initiated. Students who are completely undecided or unconcerned do not use the system.

Cooley indicated that preferences for broad categories of occupational classifications should be more predictable than narrow classifications.[39] In a report of Project TALENT Cooley states:

> We have been citing recent researchers to illustrate the strong tendency of vocational psychologists today to focus inquiry on differences among a few large groups or families of occupations, rather than on specific occupations. This tendency is partly a recognition of the reality that specific occupations do not work well as research criteria. There are far too many of them and there far too much overlapping among them in any measurement space. Successful empiricism requires discriminably taxonomies.[40]

Using the K-VIEW technique, occupations can be grouped into broad job clusters or dealth with as specific jobs since the occupations are identified by census categories.

One limitation of the technique is that data can be obtained only from those students in schools where K-VIEW services are offered. On the other hand, K-VIEW schools cover approximately fifty-seven percent of all Kansas high school and junior high school enrollment. There is no indication that student attitudes in schools not having the K-VIEW system. There have been more than one thousand references made to the occupations listed in the K-VIEW system to date.

In conclusion, information obtained from the K-VIEW system represents an attempt to acquire unsolicited occupational student interest data. Its specificity presents the opportunity to relate data obtained to vocational and technical program enrollment and net manpower needs in Kansas. As the K-VIEW system matures and more schools use it, K-VIEW procedures will be expanded and improved both cross-sectionally and longitudinally making student interest data obtained from the system more meaningful for future studies.

MANPOWER NEEDS

This section includes (1) background information concerning national efforts to identify manpower needs, (2) a description of some of the methods used to determine manpower needs and their application and (3) a brief history of the development of a net subprofessional manpower needs system for Kansas. During the last decade despite an otherwise prosperous economy, the nation has experienced a somewhat high unemployment rate. A substantial proportion of this unemployment has been attributed to structural unemployment. Structural unemployment may occur where:

1. The unemployed may not possess the necessary skills.
2. Older workers may need retraining or upgrading skills.
3. Young workers may require training before getting a job.

Nonwhite workers between the ages of sixteen and nineteen present an especially perplexing problem in that their 1968 unemployment rate was the same as the overall unemployment rate during the 1930's depression. In addition, the 6.8 percent unemployment rate of the urban unskilled laborer is comparable to the rates reached by these workers during postwar recessions.[41]

The structural nature of unemployment indicates that vocational education. Recent legislative acts concerned with this issue are:

1. The Area Redevelopment Act of 1961,[42]
2. The Manpower Development and Training Act of 1962,[43]
3. The Vocational Education Act of 1963,[44]
4. The Higher Education Facilities Act of 1963,[45]
5. The Economic Opportunity Act of 1964,[46]
6. The Civil Rights Act of 1964,[47]
7. The Higher Education Act of 1965,[48]
8. The Appalachian Act of 1965,[49] and
9. The Vocational Education Amendments of 1968.[50]

Vocational educators should provide training "realistic in the light of actual or anticipated opportunities for gainful employment"[51] according to the 1968 Amendments of the 1963 Vocational Education Act. It is the responsibility of the state employment security commission to make available to the state board and local education agencies occupational information on reasonable prospects of employment in the community and elsewhere.[52] Medvin felt that in many instances, state employment services are unable to meet this responsibility because of the costly survey techniques that are used.[53]

In an effort to assist state employment security commissions attempting to provide adequate manpower needs data inexpensively, the Department of Labor has financially encouraged research to investigate alternative methods for projecting manpower needs. Some of these methods are:

1. The Experimental Employer Needs Survey Technique,
2. The Industry Expert Approach,
3. The Leading Indicators Approach,
4. The Unfilled Job Opening-Occupational Outlook Handbook Approach, and
5. The BLS Occupation by Industry Approach.[54]

The Experimental Employer Needs Survey Technique uses information obtained from employers to project manpower needs. Phone calls, letters or personal interviews may be used for acquiring information. This method promotes contact between school representatives and employers. It can be used as a basis for getting additional information. Occupational examination can be extensive if funds are available for this purpose.

The Employer Survey Technique is relatively expensive. The stratified random samples approach to larger labor markets requires explicit identification of all firms in the labor market being surveyed. Reliability of answers given by employers is questionable. Survey procedures must be repeated if data updating is required. Bias may be introduced by uncooperative firms. The survey method can be time consuming.[55]

The Occupational Training Information System (OTIS) developed in Oklahoma represents an application of the Experimental Employer Needs Survey Technique. Surveyed employers report their manpower needs to personnel from the vocational education system. The unemployed and individuals learning skills on the job are estimated from the records of the State Employment Security Office. Projected supply and projected demand data are matched to determine differences which are used in planning the state vocational programs. An Advisory Committee which includes education officials, employer representatives and the OTIS staff, monitor the system and recommend needed changes.[56]

The Industry Expert Approach represents an appropriate method to use where a limited industrial activity employs all or a large part of the workers in the occupations to be studied. Local Chambers of Commerce, manufacturing executives, employment services and vocational educators may be contacted to assist in selecting a list of local industrial experts to be questioned. Specific questions should be designed to obtain opinions on present and future industrial trends and anticipated training needs.[57]

The Industry Expert Approach is not effective in obtaining information on broad inter-industry oriented occupations. However, it does provide accurate, comprehensive occupational information for vocations restricted to a particular activity. Interviewers should know how to analyze occupations, understand the local industrial community being considered and be familiar with the industry being studied. The costs of interviewing can be minimized if the industrial representatives are carefully selected.[58]

The conference, an alternative to the individual interview, allows the moderator to obtain the opinion of several industrial representatives simultaneously. If conducted properly, it has the added advantage of allowing group discussion of the opinions presented at the conference.

Roney and Braden in a study of occupational education beyond high school in Oklahoma obtained the opinions of experts from fifty Oklahoma organizations on their future need for technicians. The major activities included in the study were manufacturing, public utilities, service, government agencies, and petroleu, service and public utilities. The organizational representatives indicated that two-year post-high school demand greatly exceeded the supply even if all Oklahoma graduate technicians stayed in Oklahoma.[59]

In the Leading Indicators Approach, successful industries are analyzed to determine their present and future employment by occupation. This information is used as a basis for planning vocational education. It is assumed that (1) successful industries can be identified, (2) data obtained can be used to show the change in occupational structure over time and (3) occupational structure is related to productivity.

An experiment conducted by Fischer in Project VISION involved efforts to determine indicators which would bring about a change in the occupational mix of an area. Change in capacity or product line and the possibility of relocation were considered as likely occurrences that would result in the readjustment of an area's occupational mix. Returned questionnaires revealed that capacity was difficult to define and product lines remained relatively constant. Data was not acquired from new firms due to their inability to complete the questionnaire adequately. Researchers felt that intramarket firm mobility had little effect on the occupational mix.[60]

The Unfilled Job Openings-Occupational Outlook Handbook Technique utilizes available data such as unfilled job openings from employment service agency records. Forecasts of national trends for specific occupations obtained from The Occupational Outlook Handbook may be used in this technique.[61]

This method of computing manpower needs is systematic and straightforward. The data is separated by occupation, but judgment by informed officials is necessary when making forecasts. The accuracy of forecasts using the Unfilled Job Opening-Occupational Outlook Handbook Technique has not been checked. This is due partly to the way in which the data is presented. Medvin feels that the data should reveal trends and directions as well as pinpointing occupations with continuous shortages.[62]

Because of its relatively low cost and the adequately explicit occupational picture of a specified work force it presents, the BLS Occupation by Industry Approach (BLS Matrix Approach) is considered the most promising of the alternative methods. The BLS Matrix is a set of tables indicating employment trends for occupations based on Standard Industrial Classifications. The methods used attempt to identify an area's occupational profile and project manpower needs for these occupations.[63]

Two improtant limitations of the approach are that national trends are appliend to local (state) situations and projections cannot be provided for small labor markets.[64] Despite its low cost, state employment security commissions are experiencing difficulty when attempting to fund the BLS Matrix Approach.

The discussion of alternatives to projecting manpower needs presented above indicates that each of the techniques has advantages and disadvantages. What appears to be needed is a combination and modification of techniques that will maximize advantages and minimize disadvantages.

In 1971, a contract to develop a system for projecting Kansas' manpower needs was made by the Division of Vocational Education of the Department of Education with Kansas State University. The system was to be used in planning vocational education in Kansas.[65]

Annual cycling of the system was to be financially feasible. Where possible, small labor market manpower needs were to be determined using localized trend data. It was decided that a modified version of the BLS Matrix Approach would come closest to meeting these requirements.

The Modification of the BLS Matrix Approach is designed to include localized trends and possible projections for small labor markets with the assistance of the State Employment Security Commission, the Regional Office of the Bureau of Labor Statistics and the Regional Manpower Administration Office.

The Modified Matrix Technique is based on the following assumptions:

1. Local industrial occupational structures are similar to national industrial occupational patterns.

2. Using the Kansas Employment Security Commission's state occupational profile as a means for adjusting the local profile improves the estimates.

3. Reasonable estimates can be made of how local labor markets will expand using national expansion figures.

4. Local expansion rate estimates can be improved by making adjustments for past labor market trends.

5. Local replacement factors can be reasonably estimated using national replacement factors.

6. Error resulting from the use of national base factors and ratios

can be partially reduced by using the present year industrial structure.

Manpower needs were projected in accordance with the following procedures.

1. The Standard Industrial Classification (SIC) structure of the local community was determined.

2. An estimate of the occupational profile in the local community was made.

3. The local occupational profile was adjusted in terms of the state occupational profile provided by the Kansas Employment Security Commission.

4. Occupation by industry rates were used to compute the expected employment expansion for the projection period.

5. Local labor market trends were applied to the projected expansion figures.

6. The need for occupational replacements was determined.

7. Manpower needs for the projection period was defined as the sum of replacement needs and expansion needs.

Upon initial examination of the output utilizing the Modified Matrix Approach, error in developing occupational profiles for small labor markets does not seem to be a restricting factor. Efforts will be made to investigate and identify areas where projections are weak and additional modifications might improve the final output.[66]

SUMMARY

The Strong Vocational Interest Blank, the Minnesota Vocational Interest Inventory, the Kuder Preference Record (Form DD) and other standardized instruments seem to have two severe limitations relative to predicting student preference for various types of vocational training, i.e., they are based on student initiated action which might indicate his occupational preference, and they are limited to either broad clusters of occupations or to a small number of detailed occupations.

The popular and frequently used survey approach also has two limitations, i.e., the student must answer as to preference even if he has no preference among the possible alternatives, and the Hawthorne Effect could cause students to select the more prestigeous occupations.

The K-VIEW system (selected to determine student interest in this study) uses unobstrusive data gathering techniques to collect information on student preferences in a wide variety of occupations. This technique was selected as there is little possibility that the measure will contribute to behaviorial changes or require role-playing which could refute the data acquired. It is also preferred by Kansas vocational education administrators as it is an objective unsolicited student action measure.

The Experimental Employer Needs Survey Technique, the Industry Expert Approach, the Leading Indicators Approach, the Unfilled Job Openings-Occupational Outlook Handbook Approach, and the BLS Occupation by Industry Approach were each deemed to have limitations which caused them to be unsatisfactory for projecting manpower needs in Kansas. A modification of the BLS Occupation by Industry Approach was developed to project manpower needs. Data used in this study was generated by this paproach.

FOOTNOTES

[1]Department of Labor, Manpower Administration, Dictionary of Occupational Titles, Vol. II (Washington: Government Printing Office, 1965), p. 78.

[2]Department of Labor, Bureau of Labor Statistics, "Statement on the Industry; Occupational Matrix Programs," (unpublished paper, Department of Labor, 1971), p. 7.

[3]Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. IV, The National Industry-Occupational Matrix and Other Manpower Data, (Washington: Government Printing Office, 1969), p. 5.

[4]Department of Labor, Dictionary of Occupational Titles, op. cit., p. 55.

[5]Ibid., p. 193.

[6]Ibid., p. 198.

[7]Ibid., P. 69.

[8]Robert E. Scott et al., Handbook for Vocational and Technical Education Planners, (Manhattan: Division of Vocational Education, Kansas Department of Education, and Department of Adult and Occupational Education, Kansas State University, 1973).

[9]Department of Labor, Dictionary of Occupational Titles, op. cit., p. 129.

[10]Ibid., p. 39.

[11]Ibid., p. 125.

[12]Ibid., p. 134.

[13]Ibid., p. 75.

[14]Ibid., p. 64.

[15]Bureau of the Budget, Office of Statistical Standards, Standard Industrial Classification Manual, (Washington: Government Printing Office, 1967), p. XI.

[16]Department of Labor, Dictionary of Occupational Titles, op. cit., p. 140.

[17]Ibid., p. 198.

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Chapter 13

PROCEDURES

INTRODUCTION

This chapter presents the populations, samples, data collection techniques, data tabulation techniques, statistical tools and analysis techniques used to evaluate the hypotheses presented in Chapter 11.

THE POPULATIONS

There are five populations used to evaluate the hypotheses in this study. The first is the population of sub-professional occupations in Kansas, the second is the population of vocational and technical training programs, the third population is students enrolled in Kansas Vocational and Technical programs, the fourth is the population of potential vocational and technical students in Kansas and the fifth is the population of future job vacancies in Kansas.

THE SAMPLES

The five samples used to conduct this study are representative of the five populations. The sample of occupations from the population of sub-professional occupations in Kansas which is examined in this study is that group of occupations specified by the Kansas Employment Security Commission and the Division of Vocational Education, Kansas State Department of Education and covered in both the K-VIEW and K-MUST systems. The sample of training programs includes all training programs in Kansas as identified by the State Department of Education.

Annual enrollment in Kansas public school vocational and technical programs represents all vocational and technical students in Kansas. The Division of Vocational Education, Kansas State Department of Education has provided data on this sample.

The population of potential vocational and technical students is represented by a sample of potential students who referenced the K-VIEW system. One thousand, one hundred and nineteen references to discrete occupations were tabulated.

Data on the population of future job vacancies in Kansas has been obtained from the records of the K-MUST project and the Kansas Employment Security Commission. This data represents the sample used here.

THE DATA COLLECTION TECHNIQUES

The techniques used to collect information for this study will be designed to obtain the necessary data as accurately and efficiently as possible. The Division of Vocational Education, State Department of Education will provide data on the 1972 enrollment in vocational-technical programs in the state of Kansas. The K-MUST report released in January, 1973, will represent the source for Kansas manpower needs. Student interest data on potential vocational-technical students will be acquired from the K-VIEW Evaluation Form which was completed by the student using the K-VIEW facilities.

THE DATA TABULATION TECHNIQUES

Data obtained for the research project will be tabulated using several techniques depending upon the type of data and the manner in which it is available for use. Kansas sub-professional manpower demand data has been accumulated from authoritative sources by the K-MUST project. The manpower needs (demand) data is listed in the 1973 K-MUST report. Using the Kansas Employment Security Commission's occupational breakdown as a guide, the demand data as identified in the K-MUST report will be clustered by occupational category. These occupational clusters will be used to represent the manpower needs data for this study.

Records obtained from the Kansas State Department of Education represented 1972 enrollments in vocational-technical programs and were separated by type of educational institution and vocational-technical program. The enrollment information will be accumulated by vocational-technical program and grouped in accordance with the same procedure used to identify manpower needs for the study.

Student interest data was specified as being student referenced occupations listed on the completed K-VIEW evaluation forms. These forms will be tabulated by occupation as designated in the United States Census. Occupational totals will then be clustered following the same format used in specifying manpower needs and vocational-technical program enrollments.

After grouping manpower needs, vocational-technical program enrollment and student interest data by occupational clusters, these clusters will be ranked in each of the three areas from the occupational cluster with the greatest number of personnel indicated to the occupational cluster with the least number of personnel indicated. Tied numbers will be given equal rankings each representing an average of the consecutive rank placements which would have been filled by the tied numbers.[1]

STATISTICAL TOOLS

The Spearman Rank Correlation Coefficient has been chosen as an appropriate statistical tool to use to determine relationships between manpower needs and student interest and vocational-technical program enrollment. The Spearman Rank Correlation Coefficient is a non-parametric statistic requiring neither normality of distribution nor homogeneity of variance.[2] Ranks rather than numerical values are used in computing the statistic. Approximations improve with larger samples.[3] Distribution of the numberical values used in this study is heterogeneous making the appearance of tied values unlikely. The Spearman Rank represents a good approximation of the Pearson formula.

To determine the Spearman Rank Correlation Coefficient, two of the three areas, manpower needs, student interest or program enrollment will be chosen to compute the statistic. The ranks of the two areas will be matched for each of the occupational clusters. The difference between the ranks of the two areas for each occupational cluster will be determined and squared. The squared remainders for the occupational clusters will be summed and multiplied by six. The product will be divided by the number of occupational clusters cubed minus the number of occupational clusters. The quotient will be subtracted from one. The remainder will represent the Spearman Rank

Correlation Coefficient.

The formula for the Spearman Rank Correlation Coefficient appears as follows:

$$R = 1 - \frac{6\Sigma d^2}{N^3 - N}$$

where:

R = Spearman Rank Correlation Coefficient

Σd^2 = Sum of the squared differences between the ranks for the two areas being compared

N = Total number of occupational clusters.[4]

The computed Spearman Coefficient may range from a plus one indicating a perfect positive relationship where high rankings of one area correlate with high rankings of the other area, to a negative one indicating a perfect negative relationship where high rankings of one area correlate with low rankings of the other area.[5]

A correlation between .20 and .35 shows a very slight relationship between the variables. Correlations ranging from .35 to .65 are statistically significant beyond the one percent level. Crude group predictions may be achieved around .50. Accurate group predictions are possible for correlations at .65 or better. Correlations over .85 indicate close relationships and are rarely found in educational studies. Plus values are positive relationships, minus values, negative relationships.[6]

THE ANALYSIS PROCEDURES

Techniques to be used in the effort designed to aid policy makers in determining the need for a set procedure in planning the vocational and technical program mix for Kansas involve computing Spearman Rank Correlation Coefficients between manpower needs and student interest and vocational-technical program enrollment and analyzing the coefficients for significant positive correlations. The procedure followed in computing the Spearman Coefficients for any two of the three areas to be compared has been designed to answer successive questions cited in the statement of the problem.

If a significant positive correlation is found between student interest and manpower needs, these areas will be considered compatible criteria on which to establish vocational-technical programs. In order to determine if manpower needs and student interest are the basis on which the present program mix is established, an average of the rankings of these two areas will be compared to vocational-technical program enrollment. If a significant positive correlation is found, manpower needs and student interests will be considered criteria on which the present program mix is established.

If significnat positive correlation is not found between manpower needs and student enrollment, then an attempt will be made to determine if either area was used as a basis for establishing vocational-technical program enrollment using the Spearman formula. If a significant positive correlation is found to exist, then student interest will be considered the dominate criterion.

If, however, there is no significant positive correlation, then occupational cluster rankings for manpower needs will be compared to vocational-technical program enrollment. If a significant positive correlation is identified, manpower needs will be considered the dominate criterion in the program planning process. If no significant positive correlation is found in the comparison process, then neither student interest nor manpower needs will be ascertained as significant criteria upon which vocational-technical programs are established in Kansas.

SUMMARY

Five Kansas populations (1) sub-professional occupations, (2) vocational and technical training programs, (3) vocational and technical students, (4) potential vocational and technical students, and (5) future job vacancies are identified. A representative sample from each of the five populations will be obtained for the study. The source of each sample is specified as follows:

1. Sub-professional occupations - Kansas Employment Security Commission and the Division of Vocational Education, Kansas State Department of Education.

2. Vocational and technical training programs - Division of Vocational Education, Kansas State Department of Education.

3. Vocational and technical program enrollment - Division of Vocational Education, Kansas State Department of Education.

4. Occupations in which potential vocational and technical students are interested - K-VIEW system.

5. Future job vacancies - Kansas Manpower Utilization System for Training.

Sample data will be collected on sub-professional occupations, vocational and technical training programs, vocational and technical program enrollment and future job vacancies using the information obtained from the sources listed above. The occupations in which potential vocational and technical students are interested will be acquired by collecting the referenced occupations recorded on the evaluation forms completed by the users of the K-VIEW system.

The techniques employed to tabulate data involve grouping the data into occupational clusters. Vocational and technical program enrollment, occupations in which potential vocational and technical students are interested and future job vacancies will be arranged to correspond to these occupational clusters. Amounts accumulated for each occupational cluster will be ranked from the occupational cluster with greatest amount to the occupational cluster with the least amount for student interest, manpower needs and program enrollment.

The statistical tool chosen to detect significant relationships between manpower needs and student interest and program enrollment is the Spearman Rank Correlation Coefficient. Ranks for two of the three areas indicated will be chosen to compute the statistic. The areas will be selected according to set procedure.

Using the Spearman formula, an attempt will be made to determine if manpower needs and student interest are compatible. A significant positive correlation will reveal compatibility. The next step will be to match an average of the ranks of student interest and manpower needs to program enrollment to see if a combination of these two items is used to plan vocational and technical pro-rams in Kansas. A significant positive correlation will imply that both are used in the planning process.

Where there is no significant positive correlation between manpower needs and student interest, each category will be matched with program enrollment using the Spearman Rank Coefficient formula to determine the dominance, if any, of student interest or manpower needs in planning vocational and technical programs. 161

FOOTNOTES

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Chapter 14

ANALYSIS

INTRODUCTION

This chapter is concerned with analyzing the data obtained by methods outlined in Chapter 13. The first step presented is the technique used to cluster or interface the data, the second step is ranking the data and the third step is testing the hypotheses.

Hypotheses 1 will be tested to determine if manpower needs and student interest are compatible criteria for planning vocational and technical education. (Note: Compatible criteria are criteria that have a significant positive correlation). If the criteria are compatible, Hypothesis 2 (Alternative 1) will be tested. If the criteria are not compatible Hypotheses 2, A and B, (Alternative 2) will be tested. An analysis will be made of base data in an attempt to determine why hypotheses were either retained or rejected.

CLUSTERING THE DATA

The first step in clustering the data was to identify (1) all training programs offered by public education in Kansas, (2) all occupations utilized by the K-MUST System and (3) all occupations included in the K-VIEW deck, The second step was to define broad clusters under which programs, occupations and K-VIEW cards could be grouped. Census occupational groupsings were used to define these clusters. Occupations were easily classified under this clustering scheme. Training programs were classified under specific clusters indicated by Vocational Education and Occupations[1] which interfaces occupations and training programs. K-VIEW reference cards carry a Dictionary of Occupational Titles disignation and were classified similar to the techniques used to classify occupations. Table 11 depicts the interfacing scheme developed.

Table 11

Interfacing Strategy

Manpower Needs	Student Interest	Program Enrollment
	Agricultural Workers	
Farmers and Farm Workers	Groundskeepers	Production Agriculture
Groundskeepers	Nursery Workers	Agriculture Supervision and Service
Nursery Workers	Dairy Farm Hands	Agricultural Products
Agricultural Mechanics	Agriculture Technologists	Agricultural Mechanics
Agricultural Sales Workers	Farm Workers	Horticulture
Agricultural Service Workers		Agricultural Resources
Agricultural Products Workers		Forestry
Conservation Workers		
	Clerical Workers	
Stenos, Typists, Secretaries	Secretaries	Accounting and Computing
Office Machine Operators	File Clerks	Business Data Processing
Keypunch Operators	Duplicating Machine Operators	Filing, Office Machine
Computer Programmers	Clerk Typists	Information Communication
Computer Operators	Cashiers	Material Support
Shipping and Receiving Clerks	Stock Clerks	Personnel
	Telephone Operators	Management
		Typing and Related

Table 11 (Continued)

Manpower Needs	Student Interest	Program Enrollment
	Clerical Workers (Continued)	
Telephone Operators	Receptionists	Steno, Secretary and Related
Accounting Clerks	Library Helpers	
Hand Bookkeepers		
Bank Tellers		
Cashiers		
Other Clerical and Kindred		
Personnel Clerks		
Managers and Supervisors		
	Construction Workers	
Carpenters	Electrician Apprentices	Carpentry
Electricians	Electrician Helpers	Electricity
Brick Masons	Painter Apprentices	Masonry
Tile Setters	Carpenter Apprentices	Other Construction Maintenance
Excavating and Grading Machine Operators	Bricklayer Apprentices	Plumbing and Pipefitting
Cabinet Makers	Bricklayer Helpers	
Plumbers	Plumber Apprentices	
Painters	Floor Cover Installers	
	Painter Helpers	
	Plasterer Apprentices	
	Plasterer Helpers	
	Cement Masons	
	Carpenter Helpers	
	Tile Setter Apprentices	
	Pipefitter Apprentices	
	Glazier Helpers	
	Roofer Helpers	
	Hod Carriers	

Table 11 (Continued)

Manpower Needs	Student Interest	Program Enrollment
	Drivers and Deliverymen	
Drivers	Tractor-Trailer Drivers Deliverymen Bus Drivers Taxicab Drivers	Transportation Truck Driving
	Food Service Workers	
Cooks Waiters/Waitresses Fountain Workers Bartenders	Bus Boys Counter Girls Waiters Bakers Helpers Quantity Food Preparers and Supervisors	Quantity Food Occupations
	Medical Workers	
Dental Assistants Medical Assistants Medical Lab Technicians Licensed Practical Nurses Registered Nurses Medical Secretaries Medical Record Clerks Ward Clerks Dental Hygienists Nurse Aides	Dental Assistants Nurses Aides Medical Orderlies Medical Lab Technologists Medical Research Technicians Medical Technologists Pre-Cytechnologists Certified Lab Assistants Medical Records Librarians Practical Nurses	Dental Assistant Dental Hygiene Medical Lab Assistant Associate Degree Nurse Practical Nurse Nurse Aide Medical Records Medical Assistant Pharmacology

Table 11 (Continued)

Manpower Needs	Student Interest	Program Enrollment
	Medical Workers (Continued)	
	Pharmacologists	
	Registered Nurses	
	Associate Degree Nurses	
	Recreational Therapists	
	Radiology Technologists	
	Mental Health Technologists	
	Mental Health Retardation Technologists	
	Certified Medical Assistants	
	Inhalation Therapists	
	Mechanics and Repairmen	
Office Machine Mechanics	Auto Mechanic Helpers	Small Engine Repair
Air Conditioning Mechanics	Auto Mechanics	Refrigeration
Appliance Repairmen	Aeronautical Mechanics	Instrument Maintenance and Repair
Airplane Mechanics	Auto Technologists	Air Conditioning
Diesel Mechanics	Appliance and Refrigeration Repair	Auto Mechanics
Electronic Mechanics		
Motor Vehicle Mechanics		
Radio and TV Repairmen		
Small Engine Repairmen		
	Metal Craftsmen	
Machinists and Related	Tool and Die Makers	Body and Fender
Sheet Metal Workers	Ironworker Apprentices	Welding

Table 11 (Continued)

Manpower Needs	Student Interest	Program Enrollment
	Metal Craftsmen (Continued)	
Welders and Flame Cutters Auto Body Mechanics	Sheet Metal Apprentices Auto Body Helpers Auto Body Repair Workers Metal Fabrication Workers Machine Tool Workers Welders Machinist Apprentices Machine Shop Workers	Machine Shop Sheet Metal
	Printing Craftsmen	
Printing Craftsmen	Graphic Arts Craftsmen Litho Printers	Graphic Arts Occupations
	Protective Service Workers	
Policemen, Detectives and Sheriffs Security Guards	Law Enforcement Personnel	Police Science Law Enforcement Training
	Sales Workers	
Sales Workers	Retail Salesmen Marketing and Distribution Workers	Advertising Services Apparel and Accessories Automotive

Table 11 (Continued)

Manpower Needs	Student Interest	Program Enrollment
	Sales Workers (Continued)	
	Mid-Management Personnel	Finance and Credit
	Business Managers	Floristry
	Fashion Merchandise Personnel	Food Distribution
	Distribution Managers and Educators	Food Services
	Retail Marketing Educators	General Merchandise
	Retail Managers	Hardware, Building Materials
	Mid-Managers of Financial Institutions	Industrial Marketing
		Insurance
		International Trade
		Personal Services
		Petroleum
		Real Estate
		Home Furnishings
		Hotel and Lodging
	Service Workers N.E.C.	
Cosmetologists	Cosmetologists	Cosmetology
Janitors and Sextons	Laundry Laborers	Other Personal Services
Child Care Personnel	Machine Pressers	Other Public Service Occupations
Laundry Workers	Custodians	Custodial Services
Service Station Attendants	Florist Helpers	Child Care and Guidance
Charwomen	Dairy Routemen	Petroleum
	Grocery Checkers	
	Service Station Attendants	
	Parking Lot Attendants	
	Home Economics Personnel	
	Ornamental Horticulturalists	
	Child Day Care Personnel	
	Teacher Aides	

Table 11 (Continued)

Manpower Needs	Student Interest	Program Enrollment
	Technicians N.E.C.	
Draftsmen Civil Technicians Surveyors Electronic Technicians Commercial Artists Photographers	Electronics Technicians Aeronautical Technicians Civil Technicians Electricity Technicians Industrial Plastics Personnel Computer Technicians Air Conditioning and Refrigeration Technicians Air Traffic Control Technicians Cabinet Making Personnel Broadcasting Personnel Draftsmen Commercial and Advertising Artists Photographers	Electronic Technology Commercial Art Occupations Commercial Photography Occupations Drafting Occupations Electronic Occupations Plastics Occupations Woodworking Occupations Civil Technology Electric Occupations Electric Occupations Blueprint Reading Photography
	Transportation and Public Utilities Workers N.E.C.	
Linemen	Linemen Electric Power and Distribution Personnel Commercial Pilots Women-Aviation Personnel Equipment Operation Personnel	Stationary Energy Sources Occupations Aviation Occupations Linemen

Table 11 (Continued)

Manpower Needs	Student Interest	Program Enrollment
	Textile Occupations	
Upholsterers	Sewers	Clothing Management and Production
Sewing Machine Operators	Furniture Upholster Helpers	Textile Production and Fabrication
	Garment Cutters	Leatherworking
	Tailors	Upholstery
	Clothing Service Personnel	
	Industrial Sewing Machine Operators	
	Drapery Construction Design Personnel	

RANKING THE DATA

After the clustering process was completed, total employment, total enrollment, and total number of student references (student interest) were computed for each cluster. The clusters were ranked in descending order (largest cluster first, smallest cluster last) for each of the three categories, i.e., employment, enrollment and student interest. Table 12 presents the clusters, data on which ranks were calculated, and rank orders by category.

DISPOSITION OF HYPOTHESIS 1

Hypothesis 1 which states, "There is a significant positive correlation between the rank order of occupational clusters by student interest and the rank order of occupational clusters by manpower needs," was retained. The computed R was equal to .5367 which Borg (see Chapter 13) indicates is satisfactory for a crude group prediction. Table 13 contains the data used to compute R.

A review of the data listed in Table indicates that significant contributors to d^2 (259.50) were the Food Service Workers cluster (36.00), the Mechanics and Repairman cluster (25.00), the Metal Craftsmen cluster (25.00), the Technicians N.E.C. cluster (100.00), and the Agricultural Workers cluster (49.00). The Agricultural Workers cluster and the Food Service Workers cluster were ranked higher in demand than in student interest. The other three major contributing clusters ranked higher in student interest than in demand.

DISPOSITION OF HYPOTHESIS 2 (ALTERNATIVE 1)

Since Hypothesis 1 was retained, Hypothesis 2 (Alternative 1) was tested. This hypothesis states, "There is a significant positive correlation between the rank order of occupational clusters by student enrollment and the rank order of occupational clusters by a combination factor derived from manpower needs and student interest ranks." This hypothesis was retained. The computed R equals .6833 which is an accurate group prediction according to Borg's criteria. Table 14 contains the data used to compute R.

Table 12

Values and Ranks by Variable and Occupational Cluster

Occupational Clusters	Manpower Needs (Demand)	Rank	Student Interest (No. of References)	Rank	Program Enrollment	Rank
Agricultural Workers	17,224	2	46	9	8,295	1
Clerical Workers	60,751	1	161	2.5	5,499	2
Construction Workers	4,248	8	58	8	937	8
Drivers and Deliverymen	5,275	7	43	10	81	15
Food Service Workers	11,411	6	25	12	99	14
Medical Workers	15,159	3	161	2.5	1,023	7
Mechanics and Repairmen	4,070	9	116	4	2,211	4
Metal Craftsmen	3,534	10	97	5	1,900	5
Printing Craftsmen	592	15	9	15	538	9
Protective Service Workers	1,404	12	24	13	214	11
Sales Workers	13,277	4	80	6	2,463	3
Service Workers N.E.C.	11,861	5	67	7	243	10
Technicians N.E.C.	1,672	11	176	1	1,502	6
Textile Occupations	1,086	13	34	11	133	12
Transportation and Public Utilities Workers N.E.C.	741	14	22	14	120	13

Table 13

Spearman Rank Coefficient Data for Manpower Needs Versus Student Interest

Occupational Clusters	Manpower Needs Rank	Student Interest Rank	d	d^2
Clerical Workers	1	2.5	1.5	2.25
Agricultural Workers	2	9	7.0	49.00
Medical Workers	3	2.5	.5	.25
Sales Workers	4	6	2.0	4.00
Service Workers N.E.C.	5	7	2.0	4.00
Food Service Workers	6	12	6.0	36.00
Drivers and Deliverymen	7	10	3.0	9.00
Construction Workers	8	8	.0	.00
Mechanics and Repairmen	9	4	5.0	25.00
Metal Craftsmen	10	5	5.0	25.00
Technicians N.E.C.	11	1	10.0	100.00
Protective Service Workers	12	13	1.0	1.00
Textile Occupations	13	11	2.0	4.00
Transportation and Public Utilities N.E.C.	14	14	.0	.00
Printing Craftsmen	15	15	.0	.00
				$\Sigma d^2 = 259.50$

Table 14

Spearman Rank Coefficient Data for Program Enrollment Versus
An Average of Ranks of Student Interest and Manpower Needs

Occupational Clusters	Program Enrollment Rank	Student Interest Rank Plus Manpower Needs Rank Divided by Two	d	d^2
Agricultural Workers	1	5.5	4.50	20.25
Clerical Workers	2	1.75	.25	.06
Sales Workers	3	5	2.00	4.00
Mechanics and Repairmen	4	6.5	2.50	6.25
Metal Craftsmen	5	7.5	2.50	6.25
Technicians N.E.C.	6	6	.00	.00
Medical Workers	7	2.75	4.25	18.06
Construction Workers	8	8	.00	.00
Printing Craftsmen	9	15	6.00	36.00
Service Workers N.E.C.	10	6	4.00	16.00
Protective Service Workers	11	12.5	1.50	2.25
Textile Occupations	12	12	.00	.00
Transportation and Public Utilities Workers N.E.C.	13	14	1.00	1.00
Food Service Workers	14	9	5.00	25.00
Drivers and Deliverymen	15	8.5	6.50	42.25

$\Sigma d^2 = 177.37$

A review of the data listed in Table 14 indicates that significant contributors to d^2 (177.37) were the Printing Craftsmen cluster (36.00), the Drivers and Deliverymen cluster (42.25) and the Food Service Workers cluster (25.00). Enrollment ranked higher than the combined manpower needs--student interest factor in the Printing Craftsmen cluster. The Drivers and Deliverymen cluster and the Food Service Workers cluster ranked lower in enrollment than they ranked in the combined manpower needs--student interest factor.

FURTHER EXAMINATION OF THE DATA

Since Hypothesis 1 was retained on the basis of a relatively weak correlation, Hypothesis 2, A and B, (Alternative 2) were examined to determine if one of the two criteria, student interest or manpower needs, had received greater emphasis in past planning than the other criterion. The correlation between student interest and enrollment was .6384 (see Table 15) while the correlation between manpower needs and enrollment was .4893 (see Table 16). This indicates that student interest has received precedence as a planning criterion in the past.

Neither of these correlations was as great as the correlation between the rank of clusters based on a combination of manpower needs and student interest and the rank of clusters based on enrollment. (Note: This correlation was .6833: see Dieposition of Hypothesis 2, Alternative 1). This indicates that while student interest received priority as a planning criteria, manpower needs was also considered in the planning process.

SUMMARY

The findings developed in this chapter indicate the following relationships between student interest, manpower needs and past vocational and technical education planning in Kansas.

1. Manpower needs and student interest are compatible criteria for planning vocational and technical education programs.

2. There is an extremely strong indication that planning in the past has been based on a combination of the student interest and manpower needs criteria.

Table 15

Spearman Rank Coefficient Data for Program
Enrollment Versus Student Interest

Occupational Clusters	Enrollment Rank	Student Interest Rank	d	d^2
Agricultural Workers	1	9	8.0	64.00
Clerical Workers	2	2.5	.5	.25
Sales Workers	3	6	3.0	9.00
Mechanics and Repairmen	4	4	.0	.00
Metal Craftsmen	5	5	.0	.00
Technicians N.E.C.	6	1	5.0	25.00
Medical Workers	7	2.5	4.5	20.25
Construction Workers	8	8	.0	.00
Printing Craftsmen	9	15	6.0	36.00
Service Workers N.E.C.	10	7	3.0	9.00
Protective Service Workers	11	13	2.0	4.00
Textile Occupations	12	11	1.0	1.00
Transportation and Public Utilities N.E.C.	13	14	1.0	1.00
Food Service Workers	14	12	2.0	4.00
Drivers and Deliverymen	15	10	5.0	25.00

$\Sigma d^2 = 202.50$

Table 16

Spearmen Rank Coefficient Data for Program
Enrollment Versus Manpower Needs

Occupational Clusters	Enrollment Rank	Manpower Needs Rank	d	d^2
Agricultural Workers	1	2	1	1
Clerical Workers	2	1	1	1
Sales Workers	3	4	1	1
Mechanics and Repairmen	4	9	5	25
Metal Craftsmen	5	10	5	25
Technicians N.E.C.	6	11	5	25
Medical Workers	7	3	4	16
Construction Workers	8	8	0	0
Printing Craftsmen	9	15	6	36
Service Workers N.E.C.	10	5	5	25
Protective Service Workers	11	12	1	1
Textile Occupations	12	13	1	1
Transportation and Public Utilities N.E.C.	13	14	1	1
Food Service Workers	14	6	8	64
Drivers and Deliverymen	15	7	8	64
				$\Sigma d^2 = 286$

3. There is also a strong indication that student interest has been emphasized over manpower needs in past planning.

FOOTNOTES

[1]Department of Health, Education and Welfare, Office of Education, Manpower Administration, <u>Vocational Education and Occupations</u>, (Washington: Government Printing Office, 1969), pp. 3-198.

Chapter 15

CONCLUSIONS, RECOMMENDATIONS AND SUMMARY

INTRODUCTION

This chapter contains a list of conclusions based on the findings of the study. Recommendations originating from the conclusions are indicated. A summary of the study completes the chapter.

CONCLUSIONS

The following conclusions were reached based on the findings of the study:

1. It is feasible to use a combination of student interest and manpower needs as a criterion for planning vocational and technical education.

2. It appears that Kansas vocational and technical education has been planned using a combination of manpower needs and student interest as one of several criteria.

3. In the past, it appears that Kansas vocational and technical education planners have used student interest more than manpower needs for planning purposes.

4. Since there is not a perfect correlation between manpower needs and student interest, a weighting scheme must be used when considering these two criteria in the planning process.

5. Some factors not investigated in this study have a marked influence on the program planning process. The combination of student interest and manpower needs account for approximately forty-seven percent ($.685^2$) of the planning for vocational and technical programs in Kansas. Separately, student interest accounts for approximately forty percent ($.49^2$) of the planning.

6. Despite the discovery of a significant positive correlation between the averaged ranks of occupational clusters for manpower needs and student interest, and the rank for program enrollment, discrepancies exist

between the two categories for certain occupational clusters. For example, Agricultural Workers have a noticeably higher rank for program enrollment than for the combined planning criteria. The Drivers and Deliverymen and Food Service Workers clusters rank higher for the combined planning criteria than for enrollment.

RECOMMENDATIONS

The following recommendations are made based on the conclusions reached in the study:

1. It is recommended that the Kansas State Department of Education continue to use manpower needs and student interest as dual criteria in the vocational and technical program planning process as outlined in the 1968 Amendments to the 1963 Vocational Education Act.

2. It is recommended that the Kansas State Department of Education develop a weighting system relative to the manpower needs and student interest criteria on which future vocational and technical programs should be based.

3. It is recommended that the Kansas State Department of Education establish a system to inform students about occupations where manpower needs are high and student interest is low. Implementation of the career education concept should provide an excellent opportunity for promulgating this information.

4. It is recommended that research be conducted to determine why discrepancies exist between ranks for the combined student interest--manpower needs factor and program enrollment in specific occupational clusters.

5. It is recommended that further research be conducted to determine what criteria other than manpower needs and student interest have been used to plan vocational and technical education in Kansas.

6. It is recommended that research be conducted to determine the effects occupational interests of specific types of students such as the disadvantaged, handicapped, different age groups, males and females have on the planning of vocational and technical programs in Kansas.

7. It is recommended that studies identical to the one just completed be conducted in the future to assess trends in manpower needs and student interests and their relationship to the planning process.

SUMMARY

This study was concerned with identifying the effect of authorized criteria on the planning of vocational and technical programs in Kansas. The criteria that were supposed to have been given serious consideration when establishing vocational and technical programs were manpower needs and student interest. In an effort to determine the effect of these criteria on the planning process, attempts were made to find relationships between manpower needs, student interest and program enrollment. Program enrollment was considered a direct measure of the program planning process.

Sample occupational data was acquired for the three categories. Amounts obtained for every occupation were clustered using census arrangements and ranked from the cluster with the largest amount to the cluster with the smallest amount for each category. Manpower needs amounts by occupation were obtained from the Kansas Employment Security Commission. Student interest amounts were acquired from the recorded occupational references to the K-VIEW system. Program enrollment amounts were represented by data obtained from the Division of Vocational Education, Kansas State Department of Education.

Several hypotheses were examined using the Spearman Rank Coefficient or Correlation to expose significant positive correlations between manpower needs, student interest and program enrollment. A set procedure was followed. If a significant positive correlation was found between the ranks for manpower needs and student interest, an average of the ranks for these two criteria would be compared with the ranks of program enrollment. A significant positive correlation between the combined factors and program enrollment would indicate that both manpower needs and student interest were used in the planning process.

If no significant positive correlation was found between manpower needs and student interest, the Spearman formula would be used to determine if either of the two criteria, when matched with program enrollment, predominated in the planning process.

The computed statistic for matching the ranks of occupational clusters for manpower needs and student interest indicated a significant positive correlation and compatibility of the two criteria. An average of the ranks of occupational clusters for these criteria compared with the ranks for program enrollment showed another significant positive correlation.

Since the correlation between the manpower needs--student interest factor and program enrollment was considered a weak group prediction of positive correlation by Borg, further analysis was conducted to explore the possibility of relationships between manpower needs and program enrollment, and student interest and program enrollment. The Pearson formula was used to compare the ranks of the occupational clusters for student interest to program enrollment. The same procedure was followed to determine the relationship between manpower needs and program enrollment. Results of these comparisons revealed that student interest showed a greater positive correlation with program enrollment than manpower needs.

The findings of the study were that (1) student interest and manpower needs are compatible criteria for planning vocational and technical programs, (2) a combination of student interest and manpower needs was probably used for planning vocational and technical programs in Kansas, and (3) student interest in contrast to manpower needs, most likely, predominated in the planning process.

One conclustion reached, based on the findings of the study, was that student interest and manpower needs are compatible criteria for planning vocational and technical education. It was concluded that a combination of manpower needs and student interest was used among several criteria in planning vocational and technical education in Kansas. Of these two criteria, student interest appears to have the greatest influence on planning.

The disclosure of a less than perfect correlation between program enrollment and a combination of student interest and manpower needs led to the conclustion that a weighting system should be used when considering these two criteria in the planning process. The influence of student interest, manpower needs and the student interest--manpower needs combination of the planning of vocational and tehcnical programs resulted in the conclustion that factors other than manpower needs and student interest affect the planning of programs. The last conclusion was that noticeable differences existed between the ranks for specific occupational clusters when comparing the averaged ranks for manpower needs and student interest to program enrollment.

A list of recommendations was made based on the conclusions reached in the study. It was recommended that the Kansas State Department of Education be encouraged to continue using a combination of student interest and manpower needs for planning vocational and technical programs. It was recommended that a weighting policy be established relative to the manpower needs and student interest criteria. The implementation of an occupational information system as a part of career education to inform students of career opportunities where demand is high and supply low was suggested. An investigation of the differences between the averaged ranks for student interest and manpower needs and the ranks for program enrollment for specific occupational clusters was prescribed.

Research was encouraged to determine what criteria other than manpower needs and student interest affect program enrollment. It was advised that the occupational interests of the disadvantaged, handicapped, different age groups, males and females be explored to discover their effect on the planning process. The final recommendation was that future studies identical to the one just completed be conducted to assess trends in manpower needs and student interests and how these criteria relate to vocational and technical program planning.

Part 4

AN ANALYSIS OF THE NET MANPOWER NEEDS IN THE KANSAS CITY STANDARD METROPOLITAN STATISTICAL AREA FROM 1972 THROUGH 1976

Brynjulv D. Norheim