To the Graduate Council:

I am submitting herewith a dissertation written by Fadia M. Alvic entitled "A Mathematical Site Selection Procedure for Future Community College Locations, Including an Analysis of Community College Geographic Locations within 34 States." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Educational Administration and Supervision.

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A MATHEMATICAL SITE SELECTION PROCEDURE FOR FUTURE COMMUNITY COLLEGE LOCATIONS, INCLUDING AN ANALYSIS OF COMMUNITY COLLEGE GEOGRAPHIC LOCATIONS WITHIN 34 STATES

A Dissertation

Presented for the

Doctor of Education

Degree

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Fadia M. Alvic

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DEDICATION

This dissertation is affectionately dedicated to my two children, Philip and Donia, who realized early in their lives that education is a way of life in our home.

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ABSTRACT

The purpose of this study was to examine the set of criteria used for the development of community college facilities and to develop appropriate guidelines for selecting possible locations for the development of future facilities. In addition, the developed locational criteria were applied to Tennessee.

To achieve the purposes of the study, letters were sent to community college governing agencies of all 50 states requesting state plans for the establishment and location of community college facilities. From 50 states, 34 agencies responded. Content analysis was used to secure relevant criteria amenable to future community college site selection. These criteria were applied to the locational model so that alternative sites for community college facilities may be proposed objectively.

The use of the model allowed several variables to be analyzed simultaneously in order to determine the suitability for the location of community college facilities. Some of the findings and conclusions of the study are listed below:

1. Modeling technique is a useful tool for statewide screening. Thus, scanning the states as a whole should always precede any decision pertaining to the specific site location of community college facilities.

2. Based on the content analysis summary of the 27 state plans, five major criteria were recommended for site analysis and

used in Chapter IV. These criteria are listed below in order of importance.

1. Number of potential students and enrollment projection.
2. Accessibility--major roads and highways.
3. Location of site near population centers.
4. Nearness to other educational institutions.
5. Major industry in the area.

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CHAPTER I

INTRODUCTION TO THE STUDY

I. INTRODUCTION

In the evolution of higher education within the United States one of the most striking developments has been the establishment and growth of the community college. According to Edmund Gleazer, the community college:

> . . . Is adaptable. It is capable of change in response to new conditions and demands, or circumstances; . . . operates with a continuing awareness of its community; . . . has continuing relationships with the learner; . . . extends opportunity of the "unserved;" . . . accommodates to diversity; . . . and has a nexus function in the community's learning system (Gleazer, 1980:15).

The community college movement was and is perhaps the most dynamic force in American higher education. The community college, today known as the "people's college" has experienced an exciting growth from 1 in 1901 to over 1,000 in 1980, along with this growth, many changes have taken place.

Initially, the community college emerged as a product of the union between higher education and secondary education (Gleazer, 1968:4). However, it was not long before the community college had developed an identity and purpose all its own. In the early 1900's, the "people's college of today," the community college, started as a two-year junior college, founded to democratize opportunities for higher education by providing the first two years of the baccalaureate

program at low cost and within short traveling distance for most prospective students.

Since the establishment of junior colleges, technological changes have swept the country and the world at a rapid rate requiring flexibility of programs and purposes to parallel the growing diversification of demands placed upon the educational institutions. Rapid technological changes in this country especially during the period following World War II, contributed to an increased need for more kinds of educational programs for more people. Many adults found their previous education of little use in keeping up with such technological advances. And as education became vital to many people as a means to many ends (such as good jobs and a better life) a more flexible, responsive, and comprehensive alternative system of education became necessary. Formerly single-purpose junior colleges responded to this need by rapidly becoming multi-purpose community colleges during the 1940's and 1950's. During the 1960's an average of one new community college per week opened. Reflecting the ideals of life-long education for all people and the American commitment to accessible education for all citizens for the maintenance of democracy, community colleges multiplied and expanded at a higher rate than any other segment of American higher education, and the growth has continued.

Although the community college has its historical roots in the junior college, it is philosophically different among educational institutions. The community college exists to meet

both the educational and training needs of all people within a particular geographical area, wherever and whenever these needs exist. The philosophy of the community college is universal yet each individual institution remains unique, because the functions and programs of each community college are determined by the needs of the citizenry it serves. A comprehensive community college is an integral part of the community not separate from it. The community college changes as its community changes. It both affects and is affected by its clientele. Community colleges, therefore, though philosophically alike, are as different from one another as one town is different from all other towns.

Because of its philosophical character, its multi-purpose programs, its ability to respond rapidly to the demands of diverse clientele, much care should be taken in the selection of a site for each community college to be established from this time forward. Otherwise their potential for service may not be maximized, and reliable resources will be wasted.

Much forethought and planning must be exercised in every facet of planning for this valuable institution, but the first major decision affecting the community college is determining its geographic location. Understanding how these institutions were originally established and sited is, therefore, helpful and the first requirement for developing site selection criteria.

II. STATEMENT OF THE PROBLEM

Although community colleges are one of the fastest growing sectors of higher education in recent history, literature about their site selection plans is scarce. The location of existing facilities by comprehensive state plans apparently has not been used to any great extent. Five states including Indiana and Nebraska do not have any guidelines for locating community college facilities nor any systematic basis for decision making for their establishment (Indiana and Nebraska). Historically, decisions for the establishment of community colleges were made by the legislative body of each state for the purpose of providing full educational opportunities to every individual in the state (Martorana, 1978:38). However, many of the decisions for the location of these community college facilities seem to have been made haphazardly. As a result, many facilities were placed in close proximity to each other or too far from clientele, causing problems with program duplications as well as wasting resources.

The public has become more aware of the community college idea and has increased its use of present community college facilities. As both inflation and the shrinking educational dollar become major problems for many community colleges, accessibility both to and for their clientele increases in importance. Community colleges are commuter institutions, and as the rising

cost of fuel forces frugality in the use of automobiles, it becomes extremely important that analytical, comprehensive plans be used in the siting of any future community college facilities.

Based on this premise there is a need for siting guidelines for future community college facilities, taking into account those facilities that already exist. Such guidelines, both objective and comprehensive, would be useful for locating new facilities in order to help ensure maximum utilitation of resources, maximum potential for serving new clientele, and reduction of continuing competition among existing higher educational institutions.

III. PURPOSES OF STUDY

One purpose of this study was to develop appropriate guidelines for selecting possible locations for the development of future community college facilities. Another purpose of the study was to illustrate the use of a siting model by applying the locational criteria to a selected state to see whether alternative sites for community colleges could be adequately purposed.

IV. DEFINITION OF TERMS

Following are the terms defined as they were used in this study.

Community college. A diversified institution both in scope and clientele designed to offer multi-purpose learning opportunities tailored to the vocational, avocational, and academic educational needs of those residing within its service area.

Content analysis. The qualitative assessment of state plans relative to the concepts used for site selection of community college facilities.

General site analysis. Analysis of a possible service area from whic- a specific community college site can be chosen. General site analysis considers the location of a place relative to some other place: its accessibility or its distance or direction from some other place.

Junior college. A single purpose institution which provides two years of academic college work for those who desire an associate degree or who wish to transfer to a four-year institution.

Scaling. A method of ranking units to show the relative positioning of each unit to others in relation to a specific criterion.

Scanning process. To examine and analyze a defined area (a state) with respect to specifically stated variables (criteria). The purpose is

to define areas within a unit (state) that is most in need of community college services. The process used in the study was implemented by the use of general site analysis method.

Site specific analysis. The actual choosing of a specific parcel of land after making general site analysis.

Suitability score. Score ranging from 1 to 100 is interpreted as an indication of the relative ability of a unit (county) to support the proposed community college facility in accordance with the objectives of the study and subject to the limitations of the responses.

Weights. Value assigned to each criterion based on the frequency distribution found by content analysis of the state plans.

V. PROCEDURES

To determine the various criteria presently used by states in selecting sites for community colleges, a six-step procedure was developed: step one was completed by sending letters to each state office of higher education to ascertain what has been done in the past and what is proposed regarding the location of future community college facilities. Thirty-four states responded to the request for this information. Their masterplans were then examined and analyzed.

The second step in the study identified criteria for locations. Content analysis of the state plans was then done to determine the variables used in their siting locations. The content analysis

produced a set of criteria mentioned most frequently in the various state plans. The resulting criteria were then applied to a model similar to one developed at Oak Ridge National Laboratories (ORNL) (Dobson, 1977:16). The locational model used by ORNL was modified to best determine the general locations of community colleges by changing the criteria to be made applicable to higher educational institutions. The model is summarized and is expressed in this study as follows:

$$S_j = \sum_{i=1}^{N} (w_i \cdot c_{ij}) \Big/ \sum_{i=1}^{N} w_i .$$

where S_j = the suitability of county $_j$.

c_{ij} = the locational criteria $_i$ of county $_j$, standard score,

w_i = the weight, or importance of locational criteria $_i$.

N = total number of criteria.

The applied model had these benefits: it was inexpensive to use and could quickly be developed; it minimized cost to the state, maximized community college services by reaching most people in the state, and above all, it was easily understood. The model developed a suitability score for each location (in this case counties) based on criteria deemed important for the community colleges. The model allowed several variables to be analyzed simultaneously in order to determine the suitability of the

locations for community college facilities. The most critical aspect of the model-development task was determining the locational criteria to be used and then weighting those criteria in some logical and orderly fashion.

The third step of the study was assigning weights for each criterion (variable). These weights were determined from the absolute frequency of each criterion. That is, each criterion (variable) was assigned a weight based on the number of times a variable was mentioned in the state plans for use in choosing potential sites.

In step four, Tennessee was used as an example in the application of the model. Once the criteria were selected and weighted, they were used to analyze the site selection suitability of each county in the State of Tennessee. County units were used because data were available from the United States Census and other state sources.

After demographic information relating to each criteria by county was obtained, step five was the development of a compatability index reflecting the importance of each criterion on the siting decision. County ratings were developed by ranking the value of the criterion variable in order of importance, with 100 being a high importance factor and 1 being low. The ratings were obtained by scaling all 95 counties in Tennessee from 1 to 100. The scaling, done on a computer, was obtained by using a Rank procedure of a

Statistical Analysis System (SAS User's Guide, 1979) program. The rank procedure computed ranks on one or more numeric variables in the data set, creating a new data set containing the ranks in place of the original values (SAS User's Guide, 1979). Results of this step showed the relative positioning of counties in Tennessee to each other in relation to each specific criterion used in the model.

The sixth step was to calculate a suitability score, obtained by multiplying weights determined by the content analysis times the ratings of the criteria per county. The summation of the product per county yielded a score for each county. The higher the final score, the more desirable the specific county was for the location of a future community college in Tennessee.

VI. ORGANIZATION OF THE STUDY

This study contains five chapters. Chapter I contains the introduction, statement of the problem, purposes for the study, definition of terms used, procedures, and organization of the study. Chapter II is a review of literature with the major concentration on national state plans for the siting of community college facilities. Chapter III presents the methodology used for data collection, development of locational criteria, and the weighting of these criteria for siting of community colleges. Chapter IV contains data obtained on the county level for the State of Tennessee and an

application of the criteria established in a model as is used for the State of Tennessee. Chapter V presents the summary, conclusions, implication for further research and recommendations for site locations in the State of Tennessee.

CHAPTER II

REVIEW OF LITERATURE

I. INTRODUCTION

The community college, a phenomenon product of the past 30 years, has achieved outstanding recognition as an innovative and comprehensive institution, different from all other institutions of higher education. How does one describe the community college? And what is the phenomenon of the community college? The following quotation best describes such a college.

> Within the last three decades no institution has had more to do with redirecting the emphasis of higher education than the community college. All across the United States, people from every age and ethnic group, from every educational attainment level, from every economic background have discovered the colleges with the open doors and beckoning programs. Even in these years of dwindling or stabilizing higher education enrollments, the people and the people's colleges are finding each other in constantly increasing numbers, thus creating a vast interdependent network, a thriving symbiosis based on the expressed wants and sometimes unexpressed needs of a diverse clientele heretofore unserved by traditional higher education institutions. This is the phenomenon of the community college, not all things to all people, not an institution that does all that there is to do, but one which does well all that it chooses to do within its own capabilities, its own strengths--an institution working in concert with business and industry, with other educational institutions, other social services and government agencies (McCullough, 1977:4).

The community college has become a dynamic force in higher education today, perhaps because education is becoming an important

aspect of the continuing life of most people. Education today is considered part of life, not as preparation for life; it must be a prerogative of all the people, not merely of only the juveniles (Birdwell, 1967:65). The open-door admission policies of the community college coupled with its low tuition policies, a wide variety of programs, and its geographic distribution have created distinctive functions in American higher education for the community college. It is the geographic distribution of these unique institutions that is being examined in this study.

II. CRITERIA RELATED TO PHILOSOPHY AND FUNCTIONS OF THE COMMUNITY COLLEGE

Because a community college's location represents an integral part of the total education plan, decisions regarding its selection and development should be based on criteria fulfilling the educational goals, philosophy, and functions of the institutions it is to support (Florida State Department of Education, 1963). Images of what a good community college is, or should be, vary in accordance with a person's knowledge and understanding, and although some view it differently from others, there are certain general features of a genuine community college that need to be considered if one is to discuss the site selection of such facilities. For example, what is the philosophy of the community college, what are its functions,

and what are its distinctive characteristics? Perhaps the following statement is most useful here:

> In the true sense of the word, the community college is unique, philosophically and functionally unique within the entire higher education spectrum. It represents not only a unique movement, but a unique individuality. No community college is programmatically like another. Their philosophies may be similar--even exact, but their programs must reflect the wants and needs of the communities they serve, and since their communities are different, they must be different (McCullough, 1977:4).

The President's Commission on Higher Education has recognized the unique position of the community college. Fields contended that:

> Whatever form the community college takes, its purpose is educational service to the entire community, and this purpose requires of it a variety of functions and programs. It will provide college education for the youth of the community certainly, so as to remove geographic and economic barriers to educational opportunity and discover and develop individual talents at low cost and easy access. But in addition, the community college will serve as an active center of adult education. It will attempt to meet the total post-high school needs of its community (Fields, 1962:63).

It is not uncommon to read in the general information section of most college catalogs the following concerning the philosophy of the institution:

> The institution is committed to providing quality, relatively inexpensive continuing education opportunities at facilities located within commuting distance. The college opens its doors to everyone of suitable age who has the need and desire to learn (Balden Technical Institute, 1976-1978).

Closely related to this philosophy is the statement of functions. The phenomenal growth of the community college can be attributed to the expansion of functions to accommodate the needs

of varied groups of individuals. The community college must have many varied functions, due to the heterogeneity of most communities, in order to meet the needs of its community and provide extended educational opportunity to the diverse population within that community.

One major characteristic of the community college is comprehensiveness, a concept which has been generally accepted by most people. According to Edmund Gleazer:

> The community college has become a comprehensive institution with a great variety of programs to match the cross section of the community represented in its students. . . . This means preparation for employment as well as transfer to four-year colleges and includes a number of other community-related services. The comprehensive community college exists to give students opportunity beyond the high school to find suitable lines of educational development in a social environment of wide range of interests . . . capacities, aptitudes, and types of intelligence (Gleazer, 1968:18).

This statement indicates that the institution should offer the full range of technical and semi-professional programs, liberal arts, and science programs for students who will eventually transfer to four-year colleges. In addition, the comprehensive college offers a vast variety of educational and cultural services to meet the community needs and interests of its particular service area (Young, 1970:24). This is what makes one community college different from another. A false concept of comprehensiveness, however, was presented in the plan for developing Connecticut's Regional Community College System, whereby each college offers all the programs offered by all

other colleges. This makes for homogeneity of the system rather than heterogenity; it almost guarantees wasted potential and unmet needs.

Another major characteristic of the community college is its "open door" admission policy. The Carnegie Commission on Higher Education, in their report of 1974, attributed the rapid advance of community colleges to their open-admissions policies, their geographic distribution across the country, and their usually low tuition policies (A Digest of Reports of the Carnegie Commission on Higher Education, 1974:23). The commission also believed:

> . . . That there should be an opportunity within the total system of higher education in each state for each high school graduate or otherwise qualified person to enter higher education (A Digest of Reports on the Carnegie Commission on Higher Education, 1974:24).

Thus by following an open-enrollment policy, community colleges play a crucial role in the provision of universal access (A Digest of Reports of the Carnegie Commission on Higher Education, 1972). The community college should reflect the needs of the local region as well as the more generalized and changing needs of a scientific and technological society (Young, 1970:25).

Arthur Cohen in a paper entitled "The Urban Design Implication of the Community College" said:

> . . . The idea that the community college should offer something for everyone, from the first college experience for beginning students to job retraining for middle-aged and recreational and self-help courses for the elderly is the norm (A. Cohen, 1975:2).

In addressing the issue of site selection, Cohen continued on to say that the "college that purports to offer programs for nearly everyone in the community must be readily accessible"(Cohen, 1975).

Because of the accepted concept of the comprehensive community college and the great importance of adequate facilities to carry out the functions and purposes of this institution, planning for the site selection of such a facility is extremely important. The site can spell the success or failure for such an institution.

III. GROWTH OF THE COMMUNITY COLLEGE

The growth in the number of community college facilities over the past 30 years, as noted previously, has been phenomenal. At the beginning of the century, there were only a few students in two-year colleges referred to as the junior college. Shortly after World War I there were only about 50 community/junior colleges (Schneider, 1967:17). By 1960, however, more than 600,000 students were enrolled in what were generally called junior colleges; and by 1969, according to the Carnegie Commission on Higher Education, the number of students in what were previously known as community colleges has grown to almost two million, including both full-time and part-time students (A Digest of Reports of the Carnegie Commission on Higher Education, 1974:23).

Between 1968 and 1978, 250 new community colleges were established (A. Cohen and J. Lombard, 1979:94). In a report looking

back to what happened to the community colleges in the 1970's, it was stated that:

> Forty-one states showed a net increase, with the greatest expansion occurring both in areas where the community colleges had not been widespread--Arizona, Texas, and Virginia--and in those with mature systems: California, Illinois, and Ohio. Enrollment totals ballooned dramatically. The number of students registered for credit alone more than doubled--from 1.82 million in 1968 to 4.2 million in 1978 (A. Cohen and J. Lombard, 1979).

Adults enrolled as non-credit students outnumbered the credit students by an overwhelming margin. At Florida Junior College in Jacksonville, for example, the non-credit and continuing education students outnumbered the credit students by almost eight to one (McCullough, 1979).

Another report by the Carnegie Commission dealing specifically with community colleges stated that during the 1960's more than 50 new community colleges, averaging about one per week, were established each year, and by 1968 there were 739 of these institutions throughout the country. Further, this report estimated that by 1980 there will be from 3.6 to 4.3 million students enrolled in community colleges, creating the need for more new colleges (Mayhew, 1974). According to the 1974 Carnegie Commission on Higher Education:

> . . . There are now over 1,000 two-year colleges in the United States and there is no doubt that community college enrollment will continue to grow rapidly in the 1970's (A Digest of Reports of the Carnegie Commission on Higher Education, 1974:23).

By 1980, the Community-Junior and Technical College Directory reported 1,044 public community, junior, and technical college facilities in the United States including nine located abroad in United States' territories (Community-Junior, and Technical College Directory, 1980). The Carnegie Commission reported the goal of providing a community college within commuting distance of every potential student should be attained by 1980.

> The Commission estimated that, to achieve this goal, about 230 to 280 new, carefully planned community colleges needed to provide for increased enrollment in the final decade of this century. Much of this increase in enrollment will come from the older and part-time students. Facilities in the 1960's were built to accommodate the young transfer student--demands were great because of low tuition, open door policy, and accessibility. However, into the 1980's and 1990's much of the increase in enrollment will be due to the older part-time student (Schmid, 1980:31).

The annual Directory of Higher Education reported that by the turn of the century the median age in America will be 35, and in fewer than 30 years one person in every five will be over 65. Professor Bernard Luskin of Coastline Community College in California best expressed the impact of this change when he said that "America is experiencing the graying of the nation, and, with it, the graying of the campus" (UNESCO Adult Education, 1980). This means that the great growth in higher education today is in providing for the needs of older, part-time students (Directory of Higher Education, 1978:4).

Cohen has criticized the sites formerly selected for many community colleges. He stated:

> The early community colleges built outside the cities presented difficulties to people who could not afford automobiles, the elderly, the physically handicapped, and indeed those who have been lead to feel subtly unwelcome because the institution was housed in such an unfamiliar setting (A. Cohen, 1975:3).

IV. SITE SELECTION CRITERIA

Most of the early community colleges were rural. These early facilities were increasing at a phenomenal rate in response to the wave of enthusiasm for the low-cost programs, open admission policies and expanded services (A. Cohen and J. Lombard, 1979). Although data show that growth in the number of community colleges over the past 15 years has been significant, many of these facilities were increasing in some states according to a well developed state-wide, long-range plan, and in other apparently without very much thoughtful consideration of planning (Cameron, 1967:76). John Cameron cautions that some of these colleges will close, merge, or stagnate due to poor planning and inadequate location (Cameron, 1967). Cameron also suggested that every state make a careful study of its educational needs and adopt a long-range plan for the development and siting of all its educational institutions with community colleges constituting one very import segment. Such plans need to be based on philosophy, functions, and mission of the institutions. Then plans need to be reviewed frequently and modified to reflect changing conditions that were not anticipated (Cameron, 1967).

In a nationwide geographical study, Rushton discussed the location problem and specifically addressed "the question of optimally locating a set of objects so that some variable or variables will achieve a maximum or a minimum value" (Rushton, 1979:11). Rushton stated that locations in harmony with the overall objectives of the owners should be chosen (Rushton, 1979:11). In the private sector of the economy, locations of facilities are chosen that are in harmony with the overall objectives of the owners (Rushton, 1979:10). In the public sector, intergroup conflicts often develop over location decisions so that the decision finally made represents a compromise between the wishes of the groups, perhpas favoring one or the other group in proportion to the political influence each yields. Many decision makers still fear that a legitimate part of their authority is being taken away from them when a computer is assigned the tasks of developing a location plan for facilities under their jurisdiction. Others realize that the computer is but a task master evaluating data according to a process programmed for it (Rushton, 1979:26).

V. COMMUNITY COLLEGE LOCATIONS OF THE 1980'S

Looking ahead through the 1980's and 1990's, many educators are not optimistic about the future siting of new facilities for higher educational institutions; however, community colleges are relatively well able to respond to the changing educational needs

of the population and industry. The occupational orientation and geographical dispersion of two-year institutions will be an advantage to colleges flexible enough to continue to prosper (Schmid, 1980: 31).

What are the changing conditions of the 1980's and how will it affect the survival and progress of the community college? Forcasting the 1980's and further looking ahead to the 21st century were a few of the topics discussed in a conference held in 1967 on the campus of Michigan State University. Educators met to discuss planning and site selection of community colleges in the next century. In a stimulating prediction paper entitled "Looking Back on Community Colleges in the 1980's, August 1980" James Tschechtelin, acting as though it were the 21st century, summarized the societal trends as he looked back to the 1980's. He predicted a high rate of inflation, slow growth of the economy, high unemployment among young people, increased costs for energy, less affirmative action for blacks, increased porportion of 18-22 year-olds in the population, increased size of government and the influence of regulations, and the reinstatement of the military draft (Tschechtelin, 1967:4). However, according to Tschechtelin, with the decline in the number of high school students, there was a tremendous increase in the rate of college attendance by persons in their 30's and 40's (Tschechtelin, 1967). These trends contributed to the state of stress that the 1980's brought to the community college system but

was met with a variety of reactions in the community college (Tschechtelin, 1967). Some colleges grew; others became stagnant. He concluded that the different outcomes, including the success and growth of the colleges, seemed to have depended upon three major factors, one of which was the location of such facilities (Tschechtelin, 1967). Location, according to Tschechtelin, was a significant factor that determines the success with which community colleges met the challenges of the 1980's (Tschechtelin, 1967).

In another presentation during the 1967 conference, Raymond Schneider offered his forecast for the community-junior colleges in preparation for the 21st century by preparing a case study approach and addressing the solution of finding the proper community-junior colleges sites--a challenge to the Board of Trustees and the administrators for the 21st century. In his article "Setting Your Sites for Century 21," he said:

> Assuming a constant but conservative annual increase between 1970 and 1975 [at which time the Census Bureau predicts a plateau in enrollment], then projecting at a slightly reduced rate until the year 2000, there could be as many as six million students enrolled in the community colleges of this nation (Schneider, 1967:7).

The 1980 Community, Junior, and Technical College Directory reported that the fall 1979 enrollment for community, junior, and technical colleges reached four and one-half million credit students. The enrollment for the 1979 fall figures was up by 4.3 percent (Community, Junior, and Technical College Directory, 1980). The

reported total head count enrollment figures included only those students enrolled in courses or programs for credit. The population for non-credit students was not possible to obtain.

VI. PUBLISHED STATE PLAN CRITERIA

For all states, planning for the location of the community college facilities is essential. Increasing numbers of the 50 states have written master plans for site selection. These plans were written mainly to enable legislators and governing bodies to make decisions concerning community college site selection. To develop a plan for the distribution and location of community colleges on an intrastate basis in order to meet state-wide needs must be based upon logical and relevant criteria about the community college purposes and functions (Cohen, 1975:3). It should be assumed that the community college site will be one for a truly community centered institution with comprehensive programs of high quality to meet a wide range of the needs of the community's youth and adults.

Most of the literature found concerning the planning for site selection of community college facilities came from studies done by a number of state departments of education. Much of it contains information describing rationale and offering lists of specific criteria to be used for the development of a specific site for the state. Many planners and educators suggested the

need to have comprehensive plans for siting community college facilities. However, much of the planning was related to discussing criteria for specific site selections rather than developing a general comprehensive plan to determine the best optimal locations within the state as a whole (a procedure discussed in Chapter III as site analysis).

Many states have master plans. In a state such as Florida, the approval of a community-junior college site is a matter of decision by local community authorities. However, final approval of the site by the state department of education is required (Florida). A data sheet containing a list of criteria is prepared to facilitate selection and approval of sites for community-junior colleges (Florida). The data sheet contains seven points of information concerning site selection that will be useful in evaluating a proposed site. The seven points are legal description of the site, exact location, land contour, availability of water supply, electricity, sewer, and local business and industry. Along with this, there are nine minimum criteria which must be satisfied such as: size, topography, in close proximity to a high school, nearness to center of population, accessibility, availability of fire and police protections, well drained land, adequate zoning regulations, and a rectangular site if possible (Florida).

In another study done by an architect firm for the Delaware Technical and Community College Branch, two sites were discussed

and evaluated. Criteria discussed included location, access, size of land, environment, site character, and utilities availability. Ten potential sites were analyzed using this site selection criteria (Caudill, 1978). A study conducted for the Kansas State Department of Public Instruction, emphasizes the importance of a community college site as an integral part of the total educational environment (Kansas). The study recommended that the decisions regarding selection and development of community colleges be based on criteria fulfilling the educational goals and functions of the institution in the state (Kansas).

However, the state of Kansas suggested the use of more preliminary steps in the planning process before the actual specific site is selected. This included the formation of a college planning committee, a survey to show the present and future need for a college within the area, determining as nearly as possible the programs that are to be offered, determining the size of land, selecting the architect to design the facilities and drawing a preliminary master plan to determine the necessary spaces to house the projected future programs (Kansas). Several important factors should be studied so decisions can be made regarding them before a specific site is selected. Among the most important are the boundaries of the area, land use patterns, convenient access, relationship to industry in the area, drainage, availability of public facilities and fire protection (Kansas).

VII. PREDICTIONS FOR FUTURE COMMUNITY COLLEGE FACILITIES

A community college, like most other facilities, should have a comprehensive plan for site selection and site development. In a study conducted by the United States Office of Education, an analyst advised:

> A space concept of the campus of the year 2000 and beyond should be achieved so that advantage may be taken of any favorable opportunity to acquire suitable space. Neither the year 2000 nor any other selected year is likely to see the end of growth (Schneider, 1967:17).

If between now and the early decades of the next century there may indeed be established another 1,000 facilities. Insights into locational criteria must be gained that will be useful for policy makers. Site selection is a very important part of the process of creating community college facilities. According to Schneider this process is most important. (Schneider, 1967). He views it in a problem solving situation with steps that include recognition of the problem, definition, preparation, analysis, synthesis, evaluation, and presentation. If the problem happens to be the need for a new campus facility, determining its general location and then its specific location is the action mode of the problem solving process (Schneider, 1967:17).

What concerns Raymond Schneider was that one of the greatest natural resources, land, is being used up so rapidly by reckless speculators who tend to consider neither the best interests of the

student nor those of the community. If progress continues, Schneider asks, "Where are we going to find another 1,000 community college sites? The crucial years are now--the time for decisions is now." He suggested that community college planners and decision makers start by setting sites for Century 21.

> The time is right to design and construct community colleges which are neither king-size high schools nor junior editions of four-year colleges; that are, instead, new and unique art forms serving a society which itself is groping for ways to educate not only all of the children of all the people, but all of the people all of the time (Schneider, 1967:7).

VIII. BACKGROUND OF TENNESSEE'S COMMUNITY COLLEGES

The Community College system in Tennessee was developed in an attempt to expand public post-secondary educational opportunities by providing a two-year college program and other post-secondary educational opportunities within commuting distance for most Tennessee residents. The location of the community colleges is of vital importance since their purpose is to have an open door policy which provides educational opportunities accessible to all people in the state.

The Tennessee Higher Education Commission has the responsibility for determining the location of any new institutions of higher education in Tennessee. The service area of each college is usually defined as a 50-mile radius from the college and preferably within a central location of the defined service area.

The community college movement in Tennessee began relatively late. In 1963, the Tennessee General Assembly appropriated $1,000,000 to the State Department of Education for the purpose of planning the establishment of colleges of higher education. Community colleges were not specified in this appropriation. Later, however, recommendations were made to authorize the establishment of the first three community colleges in Cleveland, Jackson, and Columbia (one in East Tennessee, one in West Tennessee, and one in Middle Tennessee). After the general areas were selected, three 100-acre sites were made available as possible locations. A team from the State Department of Education made a visit to the area to evaluate and select the most appropriate property. Along with the 100-acre property, the county in which the community college was selected had to offer the initial $250,000 cost for the establishment of the facility. Thereafter, the state assumed the financial responsibilities. In Tennessee, state support for the operational cost of the community colleges reaches approximately 70 percent. At the present time, Tennessee has 10 operating community colleges, one each in Columbia, Cleveland, Jackson, Dyersburg, Tullahoma, Morristown, Gallatin, Harriman, Memphis, and Chattanooga.

A study made in 1973 identified the factors involved in the location of the first six community colleges in Tennessee (Gould, 1973:2). Based on a series of interviews with Tennessee educational leaders, four primary factors were identified. These

factors included: a desire to make public higher education available within commuting distance for all Tennesseans; the desire to make the community colleges available to the maximum number of people; the availability of strong local support, including local citizens, business and industry, and civic groups; and, for the first three colleges particularly, the desire to recognize the probability of success (Gould, 1977:3).

IX. SUMMARY

This chapter reviewed the literature related to the site selection for community college facilites. The review focused on criteria related to philosophies and functions of the community college, pattern of growth for community college facilities, site selection criteria necessary for planning community college locations of the 1980's, published state plan criteria found in the literature, predictions for future community college facilities, and summary of the background of Tennessee's community colleges.

CHAPTER III

DATA ANALYSIS, DEVELOPMENT OF PROPOSED MODEL CRITERIA, AND IMPORTANCE OF PROPOSED MODEL FOR TENNESSEE COMMUNITY COLLEGE PLANNING

I. DATA COLLECTION PROCEDURE

Site selection is one of the most important aspects of planning for a community college facility. Many states have expressed this concern in their state master plans. A review of state plans revealed that it was not unusual to come across a statement such as the following found in the New York plan:

> Site selection is a decision of considerable gravity for it will determine for many years hence the character and nature of the educational opportunities which can be afforded the yough and adults of an area. Considering all available facts, trends, and forecasts of probable development in the foreseeable future, the most judicial decision is one based on sound criteria (New York).

Such a statement gives credence to the need to develop good analytical and sound criteria to be used in the decisions affecting the site selection of any community college facility. Facilities and sites together provide the setting for the development and successful operation of a good educational program. Therefore, the importance of selecting a good site cannot be overestimated.

In an effort to acquire whatever site selection plans were available, letters were sent to all 50 states requesting

information on their site selection guidelines and master plans for the location of community college facilities. Letters were sent to all state administrators as listed in the Community, Junior and Technical College Directory. The letters requested any available information regarding state plans or any other plans for the location of community college facilities (See Appendix A, copy of letter). The first request resulted in responses from 26 states. Letters from 21 states discussed the specific criteria used in their states for the location of community college facilities. Five others indicated that they do not have any guidelines for the location of their community college facilities. Letters from two of the five states where no written plans were available in the state said the reason for their not having any guidelines is that the state does not have a "system of community colleges." Responses from the other three states said that decisions associated with the location of their community college facilities are political and are done by the legislative body and that they do not have any set criteria for the location of community college facilities.

Letters were sent again for the second time to the 24 states that did not respond to the first request. Responses from eight states were received after the second request. Six sent a copy of their guidelines or a letter identifying the

criteria used for the location of their facilities, while two respondents sent a letter indicating that they do not have any known written guidelines. Later, letters were again sent to the remaining 16 states, but no responses were received. This request was followed by phone calls. Those contacted by phone promised to send the requested information. However, two months later no more plans were received. This study, therefore, proceeded with 34 of the 50 states responding with written letters and 16 not replying. Of the 34, 7 seven states wrote to say that they had no systematic plans for providing community college facilities where the need is focused on a state-wide basis (Appendix B). A content analysis was then made of the remaining 27 state plans.

Content analysis was the process used to study and analyze the content of the state plans as well as to summarize, identify and extract the criteria used by each state to locate community college facilities. It became apparent after content analysis that most of the state plans were written merely to enable legislators and governing systems to make general decisions for the siting of community college facilities. Detailed information concerning the initiation and the support for the plan, including evidence for the need to establish a community college facility were always left with the local governing boards.

Given that locational knowledge is important for rational decision making by the policy makers, however, it must be remembered

that those policy makers are responsible to others on whose behalf they are making their locational decisions. One must evaluate the locational policies of those to whom one has consigned the task of locational policy making. Evaluation needs to be carried out not only in terms of the benefit and costs to the state but also in terms of the well being of society as a whole.

The procedure that appeared to be followed in state plans in selecting sites for community college facilities was in accordance with the philosophy of the community college in ensuring accessibility and providing equal educational opportunities to citizens of the surrounding community. The state plans revealed that the burden of providing evidence for the need to have new facilities is placed on an appointed board or committee. Alabama, for instance, appoints a committee whose primary duty is to recommend to the state board of education the areas in which community colleges should be located (Alabama). In states such as Alabama no published site selection plans exists, a state-wide study was recommended to determine the need for post-high school education in that state. Only after the local board established the need and guaranteed the funds, did the coordinating state board consider reviewing the recommended site and making decisions. Existing institutions, acting individually, serve an area usually of their own choosing, and may not consider the needs of an adjacent area. With the present condition of our improved highways, it is possible for

students to commute greater distances, but a more systematic plan for community college location would make such travel distances unnecessary.

II. REVIEW OF STATE PLANS

Each state plan was reviewed independently of the other state plans. A card was used to summarize all the variables that were considered necessary for the establishment of community college facilities in each state. As each of the state plans was examined, the selection criteria used in the plan were noted.

A matrix was constructed with rows representing the criteria found in the state plans. The states were arranged in alphabetical order and were assigned identification numbers. A check was placed under each criterion that was mentioned by the state plan. This process was continued until all 27 state plans were reviewed and summarized with their criteria (see Appendix C). As a result, the following 14 different selection criteria were revealed in order of importance: (1) the number of potential students and enrollment projections; (2) accessibility to the site; (3) land resources as to the availability of a specific parcel of land; (4) financing ability (front money) by local support; (5) location of site near population centers; (6) distance to other two-year and four-year educational institutions, including other community-junior colleges and technical schools; (7) evidence of local interest; (8) cost of

land; (9) availability and cost of utilities; (10) availability and nearness to local industry; (11) demographic analysis or characteristics of the district service area (educational and economical characteristics); (12) environmental factors and aesthetic characteristics; (13) topography and land use; and (14) safety of neighborhood. Criterion 14, safety of neighborhood, was among the few interesting, but unique characteristics that were noted by one or two states. Minor criteria included accreditation from the beginning and water rights for the western states (Appendix C).

In 19 states the number of potential students and the enrollment projections were listed as a very important criterion to be used in siting community college facilities. Seventeen state plans emphasized assessibility to site as an extremely valuable criterion. Ten state plans indicated that evidence of local interest and local revenues necessary for the establishment of facilities are important variables that must be considered before any decisions can be made by the legislative system in the state. However, the state plans did not attempt to further elaborate the specific actions or conditions considered to be sufficient evidence of local interest. Sixteen state plans considered financing ability including local financial support important. Seven state plans stressed the need for the community college facility to be close to local industry. Twelve state plans emphasized the need to consider nearness to other

two-year institutions, both public and private, community, junior, or technical institutions, as well as closeness to four-year colleges and universities. Sixteen state plans indicated that physical characteristics and land availability are extremely important for their state plans. Nearness to population centers was adopted by 15 state master plans. Five respondents felt that demographic analysis of the district is essential to the planning of community college facilities. Cost of land was an important factor for ten states. Availability and nearness of utility facilities as well as low cost of utilities were an important criteria for nine states.

Other variables, such as topography and land shape. visibility, zoning, environmental factors as well as aesthetic factors, were considered by five state plans. The safety of neighborhood was considered by eastern states such as New York and Connecticut while criteria such as water availability and water rights were very important to some western states such as Arizona and Washington.

The content analysis extracted the most important variables used by states to locate their community college facilities. These variables were examined by this researcher to decide on the applicability of each criterion to be used in the determination of the regional configuration of college facilities on a state-wide basis. The applicability of each criterion was based on whether it fit the definition of general site analysis criteria rather than site specific ones.

III. SITE ANALYSIS TECHNIQUE

Siting of community colleges is considered in this study as a two-step approach. The first step is to determine the regional configuration of community college facilities in the state. The second is the choice of a specific site or parcel of land on which the college can be located. Specific sites are selected by availability of land tracts that have certain features deemed necessary for the day-to-day operation of the college. Such features include the availability of utilities, topography, aesthetic characteristics, room to expand, and low land costs. Parcels of land having these features can be found somewhere in most counties.

Determination of the regional configuration of colleges, on the other hand, is thought of as a process of selecting the best general location of the colleges so there is minimal over-lapping of services in any area. Specific sites should be chosen only after the regional configuration is determined; otherwise a maximum number of people would not be served. Colleges that are haphazardly placed lead to an overlapping of service areas, thus costing the state more money.

Since specific sites are readily available in most counties, this study focused on the scanning process to find the counties most in need of community college services. The scanning process was implemented by the use of the general site analysis method. General

site analysis, as used in this study, was defined as the location of a place relative to some other place: its accessibility or its distance or direction from some other place. General site analysis was considered by this researcher as an important first step approach in making initial location decisions, important because in making decisions as to where to locate a community college facility it seems best to try to choose a location that is optimally situated for satisfying identified needs. When looking for a community college site facility, the researcher evaluated this situation in terms of such state plan criteria as: How far will the people in the service area drive to reach it? How accessible is the college? Are there any other similar facilities nearby? Is there any major industry in the service area? What type of industry?

IV. DEVELOPMENT OF CRITERIA

Number of Potential Students and Enrollment Projections

Nineteen states required that the local district and the community college provide some estimate of the number of students who would enroll in the college at the beginning of the first year, then provide minimum enrollment projections for the beginning of the second year, and some projected number for the next five years. As a general standard, it has been the policy in some state plans to require the local district to show that students graduating from its secondary schools will be enough to reach the number as required for minimum college enrollment. The number of potential students

is then used to convince the legislative body or governing body of the state that the number of current high school graduates and the number of interested adults in the area served is sufficient to assume a student body of at least a minimum figure set by the individual state. In some instances, for example Georgia, the plan requires that high schools located within commuting distance (in this case a radius of 30 air miles from the community-junior college site), must have an average of 800 graduates and an average daily attendance of 3,500 students in grades 9-12. There also must be some evidence showing that high school enrollment is growing.

Accessibility

This was found to be a very important criterion in the choice of location for a community college facility in 17 state plans. Accessibility refers to the site's being located on or sufficiently near major highways so that the residents of the region will have easy access to the community college. Along with easy access through roads, numerous public facilities such as: retail stores, gas stations, and resturants and food shops, must be available within the site and should be of benefit to the community college. Growth of these facilities as well as the communities will benefit the college in that the college becomes a significant element in the community rather than an isolated unit outside. If the facility being examined is in a densely populated area, then public transportation facilities should be considered. William Donalson, Director of

Continuing Education at Tallahassee Community College reported in a telephone conversation that older citizens may consider taking a course or two if a bus were available to the college facility. Considering this criterion may contribute a great deal to providing access to potential users.

State plans have shown that the greatest majority of students at the existing community colleges arrive by private car pools (New York, et al.). Therefore, parking spaces should be available and adequate. State plans also indicate that most of the evening class enrollment will drive to the site, no matter how near it is (New York, et al.). Ease of access by automobile from all parts of the service area is, therefore, very important, and the availability of bus services must also be considered.

Site Characteristics

This criterion is extremely important since it addresses the availability of land and land size. From the analysis of data, an important criterion has been the availability of at least 100 usable acres (New York, Tennessee, et al.). In some states, such as New York, this criterion has been so important that state universities will not approve a suburban site of fewer than 100 acres. In other states, such as Florida, in standard urban areas where district-wide planning indicates need for a site in a downtown or

other high density areas, exceptions to minimum size criteria can be considered on an individual basis. In reviewing certain state plans such as New York, it might be concluded that land has become a scarce commodity especially in the densely populated eastern region of the United States.

As a result of land scarcity more and more states are placing availability of land as the number one criterion. Amount of land, as well as availability of parcels of land become extremely important for planning purposes. Size must be sufficient enough to provide enough space for present and future additions, parking, outdoor activities including instruction and recreation, and site beautification and landscaping.

Financing Ability by the Local Community

Sixteen state plans required adequate financial support by the local community. States such as Tennessee require that the district or the county must provide a cash outlay for the initiation of the facility. In Tennessee, the county must provide $250,000 before any consideration can be given to the establishment of a college in the area. In Georgia, political subdivisions must demonstrate adequate bonding and/or taxing ability to satisfactorily discharge their financial obligations without undue hardship (Georgia).

Even though the location of a community college may enhance the economic growth and development of an area, it is necessary

that the potential for growth and development be present. It appears that communities with prosperous economies will have the advantage in being chosen for a community college facility even though community college education may be most urgently needed in communities that have a declining economy (Kentucky).

Location of Site Near Population Centers

Fifteen state plans authorized the additional study of the need for the state to establish community colleges in centers where populations and facilities warrant their establishments. Community colleges should be built to serve most of the people in the state according to the reviewed state plans. Population centers emerge as an important criterion because the college cannot operate successfully without the students. Having the facility in more densely populated areas could contribute to the successful operation and future expansion of the community college. Florida's plan states that location should, as far as it is practicable, be near the center of population of the area to be served with due consideration given to future community developments and, except for the initial site, must be consistent with a district wide plan for providing community college education (Florida).

Availability of Other Educational Opportunities

This criterion refers to nearness of other two or four-year educational institutions and the relationship of new campuses to

existing campuses and service areas. A critical factor in the decision to establish a new campus is the degree to which the service area of the proposed campus will overlap the service area of other existing instructional locations. The purpose of community colleges is to extend educational opportunities to people not now served. comparisons based on this factor include the distance to post-secondary institutions from the center of population of the proposed community college district and the degree to which citizens of the proposed district are enrolled in other post-secondary educational institutions.

Evidence of Local Interest, Revenues, and Local Need

The community college must meet the appropriate educational needs of its service area. Identification of educational needs and development of programs to serve citizens of the community must depend upon adequate available data or surveys as well as upon the involvement of people of the proposed college district. In Arkansas, a steering committee is responsible for finding ways to involve the public in understanding and supporting the community college throughout the development of the proposal. The steering committee is very important, and great care is taken to ensure that its membership is representative of the proposed district. In the Arkansas plan, this is done so that the college will reflect the district's educational needs

and so the college can be interpreted to the citizenry through this committee (Arkansas). In Georgia there must be clear evidence that qualified voters of the political subdivision are enthusiastically in favor of establishing a junior college (community colleges in Georgia are called junior colleges) or providing the support for existing facilities. In Virginia, the plan encourages active participation on the part of local leaders in gaining acceptance for employment of community college graduates and in encouraging present employees in the region to use the community college facility in order to develop additional skills and to keep abreast of changes in technology affecting their jobs (Virginia).

Land Cost

Land values must be established by several professional appraisals. The value should be based upon current market value, the initial utility installation costs, and recurring utility cost/rates. Irregular terrain requires consideration for additional costs of "leveling, grading, drainage, and like factors" (Arizona). Site costs should include: (1) original purchase price; (2) development, including demolition and utilities; and (3) any additional building costs incidental to site conditions. According to New York's master plan, competition, availability, and location are the major differentials in determining the price of land. Sometimes an independent and outside judgment is desirable. At times the cost

of site preparation may be equal to the cost of land as a commodity. Generally, the size and the condition of a parcel of land will eliminate those parcels which impose special costs in the way of site grading and drainage. Other factors that are important in the costs of land preparation are demolition of old existing structures, utility connections, and necessary road connections to link the campus and the community.

Utility Availability and Cost

The site chosen should have all major utilities made available on the site to the point of connection. Utilities include telephone services, fire protection, gas, water, sewer, and electricity. Some of the western states emphasize in their guidelines information regarding water rights including "the possibility of withdrawing, diverting, or making beneficial use of public surface or ground water"(Washington). Other states, Florida for example, require specific information on availability of all utilities including any information such as distance to source of utilities, whether utilities are public or private, or if utilities have been promised but are not currently available (Florida).

Local Industry

Seven state plans stressed the need for community college facilities to be close to local industry. Commercial industrial growth in the proposed area is important, and the opportunity for

work study program relationships would be utilized. The potential for economic and industrial growth of the community can eventually have an impact on the growth of the college as well as on the total area.

Demographic Analysis of the District

When a community college district is planned, a feasibility study is essential to document the educational needs and propose a specific plan for meeting those needs. One of the major factors in the feasibility study to verify an anticipated need for the development of a community college facility is a demographic analysis of the entire district with emphasis upon some specific criteria such as age, sex, and marital status. The demographic analysis criterion can also relate to population centers (current and future) which includes specific economic and educational demographic data, current redirection patterns, and migration of students (Mississippi).

Environmental Factors

Environmental factors include aesthetics, view to and from site, and impact of the site location on available energy sources. The environment should be quit and conducive to study (Colorado). The environment should be free of undesirable surroundings, high intensity noise, noxious odors, and all other aesthetic factors (Arizona). Other variables such as topography, landscape, visibility, and desirable zoning were mentioned.

V. RECOMMENDED CRITERIA FOR MODEL APPLICATION

Content analysis revealed that many state plans contain information listing specific criteria to be used for the development of a specific site for the state. Although many state plans contained statements encouraging the need to have comprehensive plans for siting community college facilities, much of the planning was related to discussing criteria for specific site selection rather than developing a general comprehensive plan to determine the best optimal location for the state as a whole.

Appendix C contains a list of the 14 criteria mentioned in the 27 state plans. The criteria were divided into two catagories general site analysis criteria and site specific criteria. General site analysis criteria included criteria such as : the number of potential students and enrollment projections, accessibility, location of site near population centers, availability of other educational facilities, and local industry. In the second catagory, site specific criteria included site specific characteristics such as the availability of specific parcels of land, utility availability and cost, land use, topography, land cost, and aesthetic quality.

Content analysis revealed that numerous state plans mixed general site analysis variables with site specific criteria. Site specific criteria are readily available in most counties. Land resources, may be scarce, but specific parcels of land for required number of acres for a community college facility can be found in any county in the state. Availability of land and utilities are important

in the decisions affecting the siting of community college facilities. However, the specific sites should be chosen only after a general planning of the state is determined.

The community college facility is not a separate entity and does not exist in a vacuum. It is a facility that has contacts and relationships with its community, potential clients, and other educational facilities. General site analysis criteria, by definition, indicates the relationship of a facility to its surroundings. The state scanning process based on general site analysis criteria should therefore, be done prior to the selection of a specific site so that maximum benefits can be achieved through the interaction of the proposed community college facility and its surrounding communities.

Based on the content analysis summary of the 27 state plans, five major criteria were recommended for site analysis and used in Chapter IV. These criteria are listed below in order of importance.

1. Number of potential students and enrollment projection.
2. Accessibility--major roads and highways.
3. Location of site near population centers.
4. Nearness to other educational institutions.
5. Major industry in the area.

The model developed in this study focuses on a scanning process using the above criteria to find the counties most in need of community college services in Tennessee. These five criteria applied in the model were all found within existing state plans. Frequency distribution as found by content analysis determined the weight values of the criteria. These five criteria could be

analyzed simultaneously to develop a suitability score for each county in any given state. In Chapter IV, Tennessee will be used as an example of such a process.

VI. IMPORTANCE OF MODEL USE FOR COMMUNITY COLLEGE PLANNING FOR TENNESSEE

The basic concepts involved in the establishment of Tennessee's community colleges were similar to those expressed by other states. If Tennessee is to fulfill the desire to make public higher education available within commuting distance throughout Tennessee and continue to provide educational opportunities for its citizens by making the community college available to the maximum number of people during the 1980's, then planning is essential.

In the 1979-1980 report, Higher Eduation in Tennessee--A Statewide Master Plan, the Tennessee Higher Education Commission (THEC) reported that:

> In the past six years the number of students served by Tennessee's public universities and community colleges has increased by 37 percent, moving from 101,200 to 138,300 students. Much of this growth may be attributed to the development of community colleges (Higher Education in Tennessee--A Statewide Master Plan, Report I, 1979:16).

The study by the Tennessee Higher Education Commission also reported that:

> Tennessee is below the national average in students pursuing post-secondary education. It is likely that the proportion of high school graduates participating in post-secondary education will increase somewhat during the next five years (Higher Education in Tennessee--A Statewide Master Plan, Report I, 1979:67).

Cleveland State Community College reported that one of the major challenges of the future for Cleveland State Community College will be serving a more diverse student population such as the older and the part-time student (Higher Education in Tennessee--A Statewide Master Plan, Report II, 1979:63). The students of the future are more likely to be older individuals who will want to upgrade their occupational skills or prepare for a second career field. The Tennessee Higher Education Commission master plan supports the above argument by reporting that participation rate for older students, part-time students, and work students have increased. The THEC report indicated:

> On of the more dramatic trends over the past five years has been the increased enrollment of part-time students. An accompanying trend, also found regionally and nationally, is the enrollment of older students, many of these enrolling for the first time and many returning for updating skills and developing new ones (Higher Education in Tennessee--A Statewide Master Plan, Report I, 1979:34).

According to a report from Roane State Community College, located in Roane County, Tennessee, the proportion of part-time credit students has increased significantly since 1974, at which time data showed 48 percent of the students attended part-time. Current enrollment reporting for Tennessee reveals that part-time students comprise 61 percent of the total credit enrollment (Higher Education in Tennessee--A Statewide Master Plan, Report II, 1979:75). On the other hand, addressing the older student participation, Volunteer State Community College, Sumner County, Tennessee, reported the following:

> The mean age of current students today is 28.9 years. Only 32.1 percent of the students are under 21 years of age and 23.8 percent are over 35 (Higher Education in Tennessee--A Statewide Master Plan, Report II, 1979:85).

Normally, students served by a community college are, for the most part, persons who have not been served by post-secondary educational opportunities. Volunteer State Community College gave support to the idea that those citizens served by the community college are not the same as those served by state universities, private colleges, or other four-year institutions by reporting the following:

> The great percentage of students are older adults who are primarily occupied with earning a living or making a home. They are individuals who, if not for Volunteer State College's close proximity and low cost, would be unable to attend (Higher Education in Tennessee--A Statewide Master Plan, Report II,

The 1980 preliminary reports of census of pupulations and housing in Tennessee indicated a substantial growth for many of the counties in Tennessee. The rapid growth of certain areas, such as West Knox County, and the tightening of the state budget due to inflation, together with the increasing cost of energy which directly has affected the cost of commuting to the existing facilities, have created a pressing need for a comprehensive and objective method to select potential sites for community colleges in Tennessee.

Planning should not be viewed as a means of preserving the present, but as a way to help in adjusting to the future or perhaps even changing the future itself. A plan that can provide

a logical, orderly, as well as analytical framework provides decision makers with a valuable tool that makes their job much easier. This study could provide Tennessee's decision makers with a procedure to rate the suitability of each alternative site (county) among various counties in Tennessee, using a number of criteria simultaneously and arriving at one simple desirable score per county.

Decision makers in Tennessee, as well as other states, have become more and more concerned with rising costs and duplication efforts as well as the state's ability and need to provide educational opportunities for all citizens who have the ability and interest to attend college. Even if one were to assume that decisions concerning the location of community college facilities are political, there is still a need to provide a firm justification for actions by the decision makers. In this study, such a justification was done by using a type of mathematical modeling technique to ensure an objective and analytical process which, in turn, can provide sound, accurate, and unbiased decisions.

If residents of the state are to receive maximum benefits, it is important that community college facilities be placed in areas where there is a demand for them, that is where population is adequate and likely to grow. For a community college to ensure accessibility and provide equal educational opportunities to citizens of the state, criteria as found in this study, such as population density, accessibility, nearness to other educational

facilities, the number of potential students, and availability of work and industry in the area, could represent usuable and workable variables to be considered when locating a community college facility.

CHAPTER IV

LOCATION MODEL APPLICATION IN TENNESSEE

I. INTRODUCTION

Chapter IV illustrates how to use the variables obtained from content analysis to determine reasonable locations of community colleges in Tennessee. Counties in Tennessee were analyzed to show the use of the locational model. The predetermined set variables from the content analysis are weighted and examined simultaneously in a simple mathematical formulation. The result of this formulation determined the desirability of each county in the State of Tennessee for community colleges.

II. APPLICATION TO TENNESSEE

Criteria applicable to the general site analysis process were drawn from state plans and used in the scanning and model development for Tennessee. Applying the criteria in a locational model resulted in providing a list of suitability scores for all 95 counties. The modet was expressed as:

$$S_j = \sum_{i=1}^{N} (W_i \cdot C_{ij}) \Big/ \sum_{i=1}^{N} W_i .$$

where S_j is the suitability of each county in the state of Tennessee, where $_j$ values range from 1 to 95. The counties were arranged

alphabetically, from Anderson County to Wilson County. C_{ij} is the locational criteria (i) of county (j) given as a standard score. The weights, expressed as W_i in the mathematical expression, contributed to the importance of each criterion in the model. Weights were assigned to each criterion according to the frequency found in content analysis.

The number of potential students and enrollment projections (X_1) criterion was weighted as the most important one. The importance was based on the frequency of mention by state plans. Enrollment projection received the importance weight of 67, indicative of the percentage of times mentioned by the responding states.

Accessibility ranked as second to the number of potential students and enrollment projections. The accessibility (X_2) criterion included measured interstates, highways, and county roads. This criterion received the score of 63.

The third criterion was the population of the counties (X_3) based on the 1980 census data report. Population density had a value of 56. This was followed by the criterion of nearness of the community college facility to other institutions as well as the availability of other educational facilities in the country (X_4). The weight value of the fourth criterion, availability to other educational facilities was 44. The last criterion that was applied in the model tested for Tennessee was the availability of industry in the area (X_5). Availability, which includes both retail establishments as well as manufacturing establishments was assigned a weight value of 26.

Number of Potential Students and Enrollment Projections Criterion

Continuous growth and good services provided for the community are major issues that concern any community facility. Potential student enrollment and enrollment projections are extremely important to the continuous operation and welfare of community colleges. Community colleges serve all adults of the community; it was, therefore, necessary to include all persons 18 years of age and over in each county because they are the potential students of the community college (Table I). This information was available in the census tape reports.

The number of potential students and enrollment projections (X_1) included two categories--A and B. Category A (column two of Table I) represented the 1990 projections for the population age group 15-19 per county in Tennessee. This was the category that was most frequently mentioned by various state plans. This age group, 15-19, was singled out because many community college plans were established in the early 1970's when the transfer function of the community college was still a predominant force in planning. Another reason is that much of the funding is based on full-time student enrollment, and the most pragmatic and assured population for the college to count on for future development is the high school graduates. Therefore, counting the high school age group 15-19 can give the planner some assured projection figures, not more guess work, for future expected college enrollment. The second category (B, column

TABLE I

POTENTIAL STUDENTS AND ENROLLMENT PROJECTIONS FOR TENNESSEE'S COMMUNITY COLLEGES PER COUNTY BY AGE GROUPS, 1980

CO_NAME	POP15[A]	POP20[B]
ANDERSON	5087	53669
BEDFORD	2042	19655
BENTON	976	16264
BLEDSOE	764	6580
BLOUNT	6080	61566
BRADLEY	6204	93199
CAMPBELL	1766	20624
CANNON	671	10914
CARROLL	2153	21113
CARTER	3925	34635
CHEATHAM	1648	14032
CHESTER	1081	9067
CLAIBORNE	1798	17203
CLAY	587	5695
COCKE	2278	23015
COFFEE	2648	25591
CROCKETT	1149	11486
CUMBERLAND	1798	18933
DAVIDSON	38688	389118
DECATUR	778	8416
DEKALB	898	10499
DICKSON	1816	19665
DYER	2513	24023
FAYETTE	2081	15545
FENTRESS	1012	10882
FRANKLIN	2216	21202
GIBSON	3720	72097
GILES	1930	18099
GRAINGER	1324	12992
GREENE	4631	41096
GRUNDY	1019	9573
HAMBLEN	3764	34613
HAMILTON	24590	223828
HANCOCK	562	5180
HARDEMAN	1731	18624
HARDIN	1696	15891
HAWKINS	2938	48731
HAYWOOD	1544	15727
HENDERSON	1549	15715
HENRY	1859	18733
HICKMAN	1069	10206
HOUSTON	615	8350
HUMPHREYS	1225	11943
JACKSON	647	6463
JEFFERSON	2578	22462
JOHNSON	1227	10248
KNOX	24936	246574
LAKE	605	6063
LAUDERDALE	1637	18066
LAWRENCE	2169	23312
LEWIS	612	5825
LINCOLN	1869	19250
LOUDON	2073	21913
MACON	987	10889
MADISON	6309	57805
MARION	2212	16112

TABLE I (Continued)

CO_NAME	POP15[A]	POP20[B]
MARSHALL	1450	15009
MAURY	3597	33893
MCMINN	3367	29478
MCNAIRY	1678	17315
MEIGS	614	4439
MONROE	2029	20090
MONTGOMERY	5842	59718
MOORE	348	2727
MORGAN	1171	10435
OBION	2508	29883
OVERTON	1233	12623
PERRY	442	4232
PICKETT	276	2951
POLK	1137	14828
PUTNAM	3723	34626
RHEA	1647	13958
ROANE	3141	31987
ROBERTSON	2345	24118
RUTHERFORD	5907	66688
SCOTT	1173	12695
SEQUATCHIE	688	5060
SEVIER	2840	28434
SHELBY	67952	601667
SMITH	1053	11219
STEWART	563	6740
SULLIVAN	10791	106498
SUMNER	6512	65879
TIPTON	2485	22239
TROUSDALE	392	4524
UNICOI	1196	12430
UNION	897	7193
VANBUREN	374	3940
WARREN	2429	25208
WASHINGTON	6469	64818
WAYNE	1191	10235
WEAKLEY	3117	23681
WHITE	1318	14346
WILLIAMSON	3882	40143
WILSON	3745	37092

CO_NAME = County names in Tennessee.

POP15[A] = The projections for the population age group 15-19 per county in Tennessee.

POP20[B] = The projections for the population age group 20+ per county in Tennessee.

three of Table I) reflected the 20+ age group adult population per country. This variable was used in the model because ideally the community college's mission is to provide services to all adults of the community. Since one of the major functions of the community college is adult and continuing education, it is necessary to include the adult population as prospective clientele and users of the college facility.

All 95 counties in Tennessee were scaled from a low of one to a high of 100 by using a "rank" procedure of Statistical Analysis System (SAS) program (SAS User's Guide, 1979). The scaling, done by computer, showed the relative positioning of counties to each other in relation to the criterion of projected college populations by age group. For example, Shelby County was scaled as 98 for population category 15-19 years old and also 98 for population 20+. The projected population was also calculated to have the value of 98 (Table II). The "rank" procedure computes ranks for one or more numeric variables in a data set, in this case counties in Tennessee, creating a new data set containing the ranks in place of the original values (SAS User's Guide, 1979). To produce a percentile rank for the 95 counties in Tennessee, a group value of 100 was used.

In comparison to Shelby County, Pickett County was scaled as one for population age group 15-19 and two for population 20+. The total projected enrolment for all age groups relative to Pickett County was scaled to be 1.5. This showed Pickett County as the

TABLE II

THE PERCENTILE RANK OF TENNESSEE COUNTIES BY AGE GROUPS WITH RESPECT TO POTENTIAL STUDENTS AND ENROLLMENT PROJECTIONS, 1980

CO_NAME	POP15[A]	POP20[B]	RPOP15	RPOP20	PROJECT
ANDERSON	5087	53669	86	85	85.5
BEDFORD	2042	19655	57	56	56.5
BENTON	976	16264	20	46	33.0
BLEDSOE	764	6580	16	13	14.5
BLOUNT	6080	61566	89	88	88.5
BRADLEY	6204	93199	90	93	91.5
CAMPBELL	1766	20624	48	59	53.5
CANNON	671	10914	14	28	21.0
CARROLL	2153	21113	60	60	60.0
CARTER	3925	34635	84	80	82.0
CHEATHAM	1648	14032	44	37	40.5
CHESTER	1081	9067	27	18	22.5
CLAIBORNE	1798	17203	50	47	48.5
CLAY	587	5695	8	9	8.5
COCKE	2278	23015	64	65	64.5
COFFEE	2648	25591	71	71	71.0
CROCKETT	1149	11486	29	30	29.5
CUMBERLAND	1798	18933	50	54	52.0
DAVIDSON	38688	389118	97	97	97.0
DECATUR	778	8416	17	17	17.0
DEKALB	898	10499	19	24	21.5
DICKSON	1816	19665	52	57	54.5
DYER	2513	24023	69	68	68.5
FAYETTE	2081	15545	59	41	50.0
FENTRESS	1012	10882	22	26	24.0
FRANKLIN	2216	21202	63	61	62.0
GIBSON	3720	72097	79	92	85.5
GILES	1930	18099	55	51	53.0
GRAINGER	1324	12992	38	35	36.5
GREENE	4631	41096	85	83	84.0
GRUNDY	1019	9573	23	19	21.0
HAMBLEN	3764	34613	82	78	80.0
HAMILTON	24590	223828	95	95	95.0
HANCOCK	562	5180	6	8	7.0
HARDEMAN	1731	18624	47	52	49.5
HARDIN	1696	15891	46	44	45.0
HAWKINS	2938	48731	73	84	78.5
HAYWOOD	1544	15727	40	43	41.5
HENDERSON	1549	15715	41	42	41.5
HENRY	1859	18733	53	53	53.0
HICKMAN	1069	10206	26	20	23.0
HOUSTON	615	8350	12	16	14.0
HUMPHREYS	1225	11943	34	31	32.5
JACKSON	647	6463	13	12	12.5
JEFFERSON	2578	22462	70	64	67.0
JOHNSON	1227	10248	35	22	28.5
KNOX	24936	246574	96	96	96.0
LAKE	605	6063	9	11	10.0
LAUDERDALE	1637	18066	42	49	45.5
LAWRENCE	2169	23312	61	66	63.5
LEWIS	612	5825	10	10	10.0
LINCOLN	1869	19250	54	55	54.5
LOUDON	2073	21913	58	62	60.0
MACON	987	10889	21	27	24.0
MADISON	6309	57805	91	86	88.5
MARION	2212	16112	62	45	53.5

TABLE II (Continued)

CO_NAME	POP15[A]	POP20[B]	RPOP15	RPOP20	PROJECT
MARSHALL	1450	15009	39	40	39.5
MAURY	3597	33893	78	77	77.5
MCMINN	3367	29478	77	73	75.0
MCNAIRY	1678	17315	45	48	46.5
MEIGS	614	4439	11	5	8.0
MONROE	2029	20090	56	58	57.0
MONTGOMERY	5842	59718	87	87	87.0
MOORE	348	2727	2	1	1.5
MORGAN	1171	10435	30	23	26.5
OBION	2508	29883	68	74	71.0
OVERTON	1233	12623	36	33	34.5
PERRY	442	4232	5	4	4.5
PICKETT	276	2951	1	2	1.5
POLK	1137	14828	28	39	33.5
PUTNAM	3723	34626	80	79	79.5
RHEA	1647	13958	43	36	39.5
ROANE	3141	31987	76	76	76.0
ROBERTSON	2345	24118	65	69	67.0
RUTHERFORD	5907	66688	88	91	89.5
SCOTT	1173	12695	31	34	32.5
SEQUATCHIE	688	5060	15	7	11.0
SEVIER	2840	28434	72	72	72.0
SHELBY	67952	601667	98	98	98.0
SMITH	1053	11219	24	29	26.5
STEWART	563	6740	7	14	10.5
SULLIVAN	10791	106498	94	94	94.0
SUMNER	6512	65879	93	90	91.5
TIPTON	2485	22239	67	63	65.0
TROUSDALE	392	4524	4	6	5.0
UNICOI	1196	12430	33	32	32.5
UNION	897	7193	18	15	16.5
VANBUREN	374	3940	3	3	3.0
WARREN	2429	25208	66	70	68.0
WASHINGTON	6469	64818	92	89	90.5
WAYNE	1191	10235	32	21	26.5
WEAKLEY	3117	23681	74	67	70.5
WHITE	1318	14346	37	38	37.5
WILLIAMSON	3882	40143	83	82	82.5
WILSON	3745	37092	81	81	81.0

CO_NAME = County names in Tennessee.

POP15[A] = The projections for the population age group 15-19 per county in Tennessee.

POP20[B] = The projections for the population age 20+ per county in Tennessee.

RPOP15 = Percentile rank for age group 15-19.

RPOP20 = Percentile rank for age group 20+.

PROJECT = Percentile rank for age groups 15-19 and 20+.

smallest among the 95 counties relative to the specific criterion of projected student enrollment. This method of scaling takes into consideration the value differences between the actual numbers of population age groups and not just the ranking in decreasing order independent of the differences between all 95 counties. In other words, if two counties had the same numerical value for the age groups, then the scaling would have the same numerical value. The tied values relieve the mean of the corresponding ranks--that is, the ranks that would have been assigned had the values been slightly different from each other. The mathematical expression used in the model for the number of potential students and enrollment projection criterion was:

$$(R_{pop\ 15} + R_{pop\ 20})$$

Where $R_{pop\ 15}$= pupulation age group 15-19 in each county and,

$R_{pop\ 20}$= population age group 20 and over.

Accessibility Criterion

The second criterion was accessibility. To determine the accessibility (meaning ease of reaching each site) of each county in Tennessee, the number of highways and roads of each county was determined. Since interstates, paved roads, and four-lane highways do provide easier and more desirable means of travel, it was important to assign different weights to the types of roads in each county. The

more desirable roads because of good road conditions and ease of travel were assigned the highest numerical value. Interstates were assigned a weight of three, while United States Highways and roads were assigned a weight of two, and county roads a weight of one. A large map of Tennessee highways, 1979-1980, was obtained from the Tennessee Highway Department. All Tennessee highways and roads were shown on the map. Using the large scale map, a count was made of the number of interstates transversing the county. This was followed by counting the number of United States Highways followed by county roads. This process was repeated for each of the 95 counties in Tennessee (Table III). For example, access in Anderson County was measured by multiplying the number of interstates times three added to the number of United States Highways multiplied by two added to the number of state highways multiplied by one. The 95 counties were scaled according to the number of major highways and roads. Using the scaling value of 1 to 100, Davidson County received the highest scale value of 98 and Pickett in contrast received the scaling value of 1 (Table IV). The mathematical expression used in the model was as follows:

$$\text{Access} = (I \times 3) + (U \times 2) + (S \times 1)$$

where I = number of interstates in the county, U = number of all United States Highways in the county, and S = number of all state and county roads in the county.

TABLE III

THE NUMBER OF INTERSTATES, U.S. HIGHWAYS, AND COUNTY ROADS TRANSVERSING TENNESSEE'S COUNTIES, 1981

CO_NAME	INTER	US	STHWY
ANDERSON	1	2	3
BEDFORD	0	2	3
BENTON	1	2	1
BLEDSOE	0	1	2
BLOUNT	0	2	4
BRADLEY	1	2	3
CAMPBELL	1	1	2
CANNON	0	1	4
CARROLL	0	2	4
CARTER	0	2	4
CHEATHAM	2	2	2
CHESTER	0	1	2
CLAIBORNE	0	1	4
CLAY	0	0	4
COCKE	1	3	4
COFFEE	1	2	3
CROCKETT	0	1	5
CUMBERLAND	1	3	2
DAVIDSON	3	7	3
DECATUR	1	1	3
DEKALB	0	1	4
DICKSON	1	1	5
DYER	1	1	6
FAYETTE	1	2	3
FENTRESS	0	1	4
FRANKLIN	0	2	6
GIBSON	0	3	6
GILES	1	3	3
GRAINGER	0	2	3
GREENE	1	2	3
GRUNDY	1	1	3
HAMBLEN	1	2	3
HAMILTON	2	4	7
HANCOCK	0	0	4
HARDEMAN	0	1	5
HARDIN	0	1	6
HAWKINS	0	1	5
HAYWOOD	1	1	4
HENDERSON	1	0	3
HENRY	0	2	5
HICKMAN	1	0	4
HOUSTON	0	0	4
HUMPHREYS	1	1	1
JACKSON	0	0	5
JEFFERSON	2	3	3
JOHNSON	0	2	5
KNOX	2	6	4
LAKE	0	0	4
LAUDERDALE	0	1	3
LAWRENCE	0	2	1
LEWIS	0	0	4
LINCOLN	0	3	4
LOUDON	2	2	2
MACON	0	0	4
MADISON	1	2	3
MARION	1	2	6

TABLE III (Continued)

CO_NAME	INTER	US	STHWY
MARSHALL	1	2	5
MAURY	1	2	4
MCMINN	1	2	4
MCNAIRY	0	2	4
MEIGS	0	0	4
MONROE	1	2	2
MONTGOMERY	1	1	5
MOORE	0	0	4
MORGAN	0	1	3
OBION	1	1	5
OVERTON	0	0	6
PERRY	0	0	4
PICKETT	0	0	3
POLK	0	2	4
PUTNAM	1	1	8
RHEA	0	1	3
ROANE	1	2	5
ROBERTSON	2	2	5
RUTHERFORD	1	4	2
SCOTT	0	1	2
SEQUATCHIE	0	1	2
SEVIER	1	3	3
SHELBY	2	3	3
SMITH	1	1	5
STEWART	0	1	2
SULLIVAN	1	5	4
SUMNER	0	1	4
TIPTON	0	1	3
TROUSDALE	0	1	3
UNICOI	0	2	3
UNION	0	0	4
VANBUREN	0	1	2
WARREN	0	1	5
WASHINGTON	1	3	5
WAYNE	0	1	3
WEAKLEY	0	1	5
WHITE	0	2	2
WILLIAMSON	2	3	3
WILSON	1	4	5

CO_NAME = County names in Tennessee.

INTER = The number of Interstates.

US = The number of United States highways.

STHWY = The number of state highways and roads.

TABLE IV

THE PERCENTILE RANK FOR ACCESS, DETERMINED BY THE NUMBER OF ROADWAYS PER COUNTY IN TENNESSEE, 1981

CO_NAME	INTER	US	STHWY	ACCESS	RACCESS
ANDERSON	1	2	3	10	66
BEDFORD	0	2	3	7	41
BENTON	1	2	1	8	51
BLEDSOE	0	1	2	4	9
BLOUNT	0	2	4	8	51
BRADLEY	1	2	3	10	66
CAMPBELL	1	1	2	7	41
CANNON	0	1	4	6	31
CARROLL	0	2	4	8	51
CARTER	0	2	4	8	51
CHEATHAM	2	2	2	12	81
CHESTER	0	1	2	4	9
CLAIBORNE	0	1	4	6	31
CLAY	0	0	4	4	9
COCKE	1	3	4	13	86
COFFEE	1	2	3	10	66
CROCKETT	0	1	5	7	41
CUMBERLAND	1	3	2	11	75
DAVIDSON	3	7	3	26	98
DECATUR	1	1	3	8	51
DEKALB	0	1	4	6	31
DICKSON	1	1	5	10	66
DYER	1	1	6	11	75
FAYETTE	1	2	3	10	66
FENTRESS	0	1	4	6	31
FRANKLIN	0	2	6	10	66
GIBSON	0	3	6	12	81
GILES	1	3	3	12	81
GRAINGER	0	2	3	7	41
GREENE	1	2	3	10	66
GRUNDY	1	1	3	8	51
HAMBLEN	1	2	3	10	66
HAMILTON	2	4	7	21	96
HANCOCK	0	0	4	4	9
HARDEMAN	0	1	5	7	41
HARDIN	0	1	6	8	51
HAWKINS	0	1	5	7	41
HAYWOOD	1	1	4	9	57
HENDERSON	1	0	3	6	31
HENRY	0	2	5	9	57
HICKMAN	1	0	4	7	41
HOUSTON	0	0	4	4	9
HUMPHREYS	1	1	1	6	31
JACKSON	0	0	5	5	22
JEFFERSON	2	3	3	15	92
JOHNSON	0	2	5	9	57
KNOX	2	6	4	22	97
LAKE	0	0	4	4	9
LAUDERDALE	0	1	3	5	22
LAWRENCE	0	2	1	5	22
LEWIS	0	0	4	4	9
LINCOLN	0	3	4	10	66
LOUDON	2	2	2	12	81
MACON	0	0	4	4	9
MADISON	1	2	3	10	66
MARION	1	2	6	13	86

TABLE IV (Continued)

CO_NAME	INTER	US	STHWY	ACCESS	RACCESS
MARSHALL	1	2	5	12	81
MAURY	1	2	4	11	75
MCMINN	1	2	4	11	75
MCNAIRY	0	2	4	8	51
MEIGS	0	0	4	4	9
MONROE	1	2	2	9	57
MONTGOMERY	1	1	5	10	66
MOORE	0	0	4	4	9
MORGAN	0	1	3	5	22
OBION	1	1	5	10	66
OVERTON	0	0	6	6	31
PERRY	0	0	4	4	9
PICKETT	0	0	3	3	1
POLK	0	2	4	8	51
PUTNAM	1	1	8	13	86
RHEA	0	1	3	5	22
ROANE	1	2	5	12	81
ROBERTSON	2	2	5	15	92
RUTHERFORD	1	4	2	13	86
SCOTT	0	1	2	4	9
SEQUATCHIE	0	1	2	4	9
SEVIER	1	3	3	12	81
SHELBY	2	3	3	15	92
SMITH	1	1	5	10	66
STEWART	0	1	2	4	9
SULLIVAN	1	5	4	17	95
SUMNER	0	1	4	6	31
TIPTON	0	1	3	5	22
TROUSDALE	0	1	3	5	22
UNICOI	0	2	3	7	41
UNION	0	0	4	4	9
VANBUREN	0	1	2	4	9
WARREN	0	1	5	7	41
WASHINGTON	1	3	5	14	89
WAYNE	0	1	3	5	22
WEAKLEY	0	1	5	7	41
WHITE	0	2	2	6	31
WILLIAMSON	2	3	3	15	92
WILSON	1	4	5	16	94

CO_NAME = County names in Tennessee.

INTER = The number of Interstates.

US = The number of United States highways.

STHWY = The number of state highways and roads.

ACCESS = (Number of Interstates x 3) + (number of U.S. roads x 2) + (number of state and county roads x 1).

RACESS = Percentile rank for ACCESS.

Population Density Criterion

The criterion of the location of sites near population centers could not be used unless population data of each Tennessee county was gathered from the 1980 Federal Census report in the ORNL computer data files (Table V). Clustering of populations in a state can increase the need to provide additional educational facilities as well as possibly the need to place some facilities in areas that are experiencing the greatest population growth. Such an area presents a strong potential for growth and success of the community college.

The third criterion, population density per county, was also scaled based on the relative positioning of each county population in relation to others in Tennessee. After scaling was completed, Shelby County received the value of 98 while Pickett was given the value of 1 (Table VI). The mathematical expression used in the model was referred to as $R_{pop\ 80}$, where $R_{pop\ 80}$ = population of counties in Tennessee based on the 1980 census data reports.

Availability of Educational Facilities Criterion

Duplication has been a major issue discussed among not only college and university administrations, but also among state agencies and legislative bodies, especially because of today's inflation and high cost of operation. It is important as well as appropriate to eliminate those areas that are already being served in the state. Duplication then was calculated in the formula by measuring the

TABLE V

POPULATION COUNT FOR TENNESSEE BY COUNTIES, 1980

CO_NAME	POP_80
ANDERSON	66878
BEDFORD	27759
BENTON	14762
BLEDSOE	9197
BLOUNT	78022
BRADLEY	66619
CAMPBELL	34433
CANNON	10236
CARROLL	28223
CARTER	50079
CHEATHAM	21560
CHESTER	12702
CLAIBORNE	24565
CLAY	7419
COCKE	28720
COFFEE	38179
CROCKETT	14823
CUMBERLAND	28305
DAVIDSON	460268
DECATUR	10802
DEKALB	13549
DICKSON	29974
DYER	34409
FAYETTE	25030
FENTRESS	14757
FRANKLIN	32083
GIBSON	49276
GILES	24646
GRAINGER	16697
GREENE	54209
GRUNDY	13559
HAMBLEN	49167
HAMILTON	282563
HANCOCK	6873
HARDEMAN	23708
HARDIN	22401
HAWKINS	43669
HAYWOOD	20185
HENDERSON	21391
HENRY	28578
HICKMAN	15106
HOUSTON	5879
HUMPHREYS	16004
JACKSON	9178
JEFFERSON	31189
JOHNSON	13753
KNOX	318539
LAKE	7280
LAUDERDALE	24112
LAWRENCE	33251
LEWIS	8756
LINCOLN	26372
LOUDON	28421
MACON	15604
MADISON	74585
MARION	23695

TABLE V (Continued)

CO_NAME	POP_80
MARSHALL	19589
MAURY	50981
MCMINN	41622
MCNAIRY	22451
MEIGS	7432
MONROE	28585
MONTGOMERY	83066
MOORE	4519
MORGAN	16829
OBION	32634
OVERTON	17546
PERRY	6095
PICKETT	4332
POLK	13525
PUTNAM	46846
RHEA	24111
ROANE	47715
ROBERTSON	36128
RUTHERFORD	84020
SCOTT	19268
SEQUATCHIE	8432
SEVIER	41376
SHELBY	774381
SMITH	14562
STEWART	8680
SULLIVAN	143858
SUMNER	84643
TIPTON	32253
TROUSDALE	6042
UNICOI	16341
UNION	11670
VANBUREN	4696
WARREN	32480
WASHINGTON	88743
WAYNE	13924
WEAKLEY	32747
WHITE	19422
WILLIAMSON	57858
WILSON	54089

CO_NAME = County names in Tennessee.

POP_80 = The 1980 population count for Tennessee Counties.

TABLE VI

PERCENTILE RANK FOR TENNESSEE'S
POPULATION BY COUNTIES,
1980

CO_NAME	POP_80	RPOP_80
ANDERSON	66878	87
BEDFORD	27759	54
BENTON	14762	28
BLEDSOE	9197	15
BLOUNT	78022	89
BRADLEY	66619	86
CAMPBELL	34433	70
CANNON	10236	16
CARROLL	28223	55
CARTER	50079	81
CHEATHAM	21560	42
CHESTER	12702	19
CLAIBORNE	24565	49
CLAY	7419	9
COCKE	28720	60
COFFEE	38179	72
CROCKETT	14823	29
CUMBERLAND	28305	56
DAVIDSON	460268	97
DECATUR	10802	17
DEKALB	13549	21
DICKSON	29974	61
DYER	34409	69
FAYETTE	25030	52
FENTRESS	14757	27
FRANKLIN	32083	63
GIBSON	49276	80
GILES	24646	51
GRAINGER	16697	34
GREENE	54209	84
GRUNDY	13559	22
HAMBLEN	49167	79
HAMILTON	282563	95
HANCOCK	6873	7
HARDEMAN	23708	46
HARDIN	22401	43
HAWKINS	43669	76
HAYWOOD	20185	40
HENDERSON	21391	41
HENRY	28578	58
HICKMAN	15106	30
HOUSTON	5879	4
HUMPHREYS	16004	32
JACKSON	9178	14
JEFFERSON	31189	62
JOHNSON	13753	23
KNOX	318539	96
LAKE	7280	8
LAUDERDALE	24112	48
LAWRENCE	33251	68
LEWIS	8756	13
LINCOLN	26372	53
LOUDON	28421	57
MACON	15604	31
MADISON	74585	88
MARION	23695	45

TABLE VI (Continued)

CO_NAME	POP_80	RPOP_80
MARSHALL	19589	39
MAURY	50981	82
MCMINN	41622	74
MCNAIRY	22451	44
MEIGS	7432	10
MONROE	28585	59
MONTGOMERY	83066	90
MOORE	4519	2
MORGAN	16829	35
OBION	32634	66
OVERTON	17546	36
PERRY	6095	6
PICKETT	4332	1
POLK	13525	20
PUTNAM	46846	77
RHEA	24111	47
ROANE	47715	78
ROBERTSON	36128	71
RUTHERFORD	84020	91
SCOTT	19268	37
SEQUATCHIE	8432	11
SEVIER	41376	73
SHELBY	774381	98
SMITH	14562	26
STEWART	8680	12
SULLIVAN	143858	94
SUMNER	84643	92
TIPTON	32253	64
TROUSDALE	6042	5
UNICOI	16341	33
UNION	11670	18
VANBUREN	4696	3
WARREN	32480	65
WASHINGTON	88743	93
WAYNE	13924	24
WEAKLEY	32747	67
WHITE	19422	38
WILLIAMSON	57858	85
WILSON	54089	83

CO_NAME = County names in Tennessee.

POP_80 = The 1980 population count for Tennessee counties.

RPOP_80 = Percentile rank for population 1980.

distance between the community college nearest to the county and the center of population. Since there was no adequate way to actually find the center of population of each county, the county seat was used as a starting point for membership. In the case where a community college facility was in existence in the county, a zero value was assigned to the distance measured indicating that it would be undesirable to locate another community college within that county. The distance between county seats per county and the nearest community college was reported in Table VII. Measurement reflected the shortest travel distance in miles using the most direct highway or road.

Colleges, universities, junior colleges, and the technical institutions cannot be ignored in this study because they do provide similar services to the community. Therefore, a count was made of all post-secondary educational facilities in each county (Table VIII). However, different weights were assigned to different types of educational institutions. Although colleges, universities, junior colleges, technical institutes, and independent colleges all provide educational programs, they do not necessarily duplicate efforts of community colleges since they typically serve specific rather than general clientele. However, colleges and universities with continuing education functions attract a clientele somewhat similar to the community college, while junior colleges and some private colleges are only interested in a special age group, and therefore,

TABLE VII

THE DISTANCE BETWEEN COUNTY SEATS PER COUNTY IN TENNESSEE AND THE NEAREST COMMUNITY COLLEGE FACILITY, 1981

County Name	Center of County	*Distance in Inches	Distance in Miles	Community College Services
Anderson	Clinton	4.0	32.0	Roane
Bedford	Shelbyville	2.5	20.0	Motlow
Benton	Camden	7.0	56.0	Jackson
Bledsoe	Pikeville	6.0	48.0	Roane
Blount	Maryville	6.5	52.0	Roane
Bradley	Cleveland	0.0	00.0	Cleveland
Campbell	Jackson	6.0	48.0	Roane
Cannon	Woodbury	4.5	36.0	Motlow
Carroll	Huntington	4.0	32.0	Jackson
Carter	Elizabethton	8.0	64.0	Walter
Cheatam	Ashland City	5.5	44.0	Volunteer
Chester	Henderson	2.5	20.0	Jackson
Clairbourne	Tazewell	3.5	28.0	Walter
Clay	Celina	8.0	64.0	Volunteer
Cocke	Newport	2.0	16.0	Walter
Coffee	Manchester	1.5	12.0	Motlow
Crockett	Alamo	3.0	24.0	Jackson
Cumberland	Crossville	3.0	24.0	Roane
Davidson	Nashville	3.0	24.0	Volunteer
Decatur	Decaturville	5.0	40.0	Jackson

TABLE VII (Continued)

County Name	Center of County	*Distance in Inches	Distance in Miles	Community College Services
DeKalb	Smithville	6.5	52.0	Volunteer
Dickson	Charlotte	6.5	52.0	Volunteer
Dyer	Dyersburg	0.0	00.0	Dyersburg
Fayette	Somerville	4.5	36.0	Shelby
Fentress	Jamestown	6.5	52.0	Roane
Franklin	Winchester	2.0	16.0	Motlow
Gibson	Trenton	3.5	28.0	Jackson
Giles	Pulaski	3.5	28.0	Columbia
Grainger	Rutledge	3.5	28.0	Walter
Greene	Greeneville	3.0	24.0	Walter
Grundy	Altamont	5.0	40.0	Motlow
Hamblen	Morristown	0.0	00.0	Walter
Hamilton	Chattanooga	0.0	00.0	Chattanooga
Hancock	Sneedville	4.0	32.0	Walter
Hardeman	Bolivar	4.0	32.0	Jackson
Hardin	Savannah	7.0	56.0	Jackson
Hawkins	Rogersville	3.5	28.0	Walter
Haywood	Brownsville	3.5	28.0	Jackson
Henderson	Lexington	2.5	20.0	Jackson
Henry	Paris	8.0	64.0	Jackson
Hickman	Centerville	3.5	28.0	Columbia
Houston	Erin	9.5	76.0	Volunteer

TABLE VII (Continued)

County Name	Center of County	*Distance in Inches	Distance in Miles	Community College Services
Humphreys	Waverly	8.0	64.0	Jackson
Jackson	Gainsboro	6.5	52.0	Volunteer
Jefferson	Dandridge	2.0	16.0	Walter
Johnson	Mountain City	10.5	84.0	Walter
Knox	Knoxville	5.0	40.0	Roane
Lake	Tiptonville	3.0	24.0	Dyersburg
Lauderdale	Ripley	3.0	24.0	Dyersburg
Lawrence	Lawrenceburg	4.0	32.0	Columbia
Lewis	Hohenwald	3.5	28.0	Columbia
Lincoln	Fayetteville	2.5	32.0	Volunteer
Loudon	Loudon	3.5	28.0	Roane
Macon	Lafayette	4.0	32.0	Volunteer
Madison	Jackson	0.0	00.0	Jackson
Marion	Jasper	3.5	36.0	Jackson
Marshall	Lewisburg	2.5	20.0	Columbia
Maury	Columbia	0.0	00.0	Columbia
McMinn	Athens	3.0	24.0	Cleveland
McNairy	Selmen	4.5	36.0	Jackson
Meigs	Decatur	4.0	32.0	Cleveland
Monroe	Madisonville	5.0	40.0	Cleveland
Montgomery	Clarksville	8.0	64.0	Volunteer
Moore	Lynchburg	0.0	00.0	Motlow

TABLE VII (Continued)

County Name	Center of County	*Distance in Inches	Distance in Miles	Community College Services
Morgan	Wartburg	3.0	24.0	Roane
Obion	Union City	4.5	36.0	Dyersburg
Overton	Livingston	7.5	60.0	Roane
Perry	Linden	5.5	44.0	Chattanooga
Pickett	Byrdştown	9.5	76.0	Roane
Polk	Benton	1.5	12.0	Cleveland
Putnam	Cookeville	7.5	60.0	Volunteer
Rhea	Dayton	4.5	36.0	Roane
Roane	Kingston	0.0	00.0	Roane
Robertson	Springfiled	4.0	32.0	Volunteer
Rutherford	Murfreesboro	4.5	36.0	Motlow
Scott	Huntsville	6.5	52.0	Roane
Sequachie	Dunlap	5.5	44.0	Chattanooga
Sevier	Sevierville	4.5	36.0	Walter
Shelby	Memphis	0.0	00.0	Shelby
Smith	Carthage	5.0	40.0	Volunteer
Sterwart	Dover	10.5	84.0	Volunteer
Sullivan	Blountville	7.5	60.0	Walter
Sumner	Gallatin	0.0	00.0	Volunteer
Tipton	Covington	4.5	36.0	Shelby or Dyersburg
Trousdale	Hartsville	2.0	16.0	Volunteer

TABLE VII (Continued)

County Name	Center of County	*Distance in Inches	Distance in Miles	Community College Services
Unicoi	Erwin	6.5	52.0	Walter
Union	Maynardville	5.0	40.0	Walter
Van Buren	Spencer	6.5	52.0	Roane
Warren	McMinnville	5.0	40.0	Motlow
Washington	Jonesboro	6.5	52.0	Walter
Wayne	Waynesboro	7.0	56.0	Columbia
Weakley	Dresden	6.0	48.0	Dyersburg
White	Sparta	6.0	48.0	Roane
Williamson	Franklin	3.0	24.0	Columbia
Wilson	Lebanon	2.5	20.0	Volunteer

*Scale: 2.5 inches = 20 miles.

TABLE VIII

THE DISTANCE BETWEEN COUNTY SEATS PER COUNTY IN TENNESSEE TO THE NEAREST COMMUNITY COLLEGE AND THE NUMBER OF OTHER EDUCATIONAL FACILITIES IN THE COUNTY, 1980

CO_NAME	DISTANCE[A]	Total Number of Educational Facilities[B]				
		CC	UNIVER	TECH	JUNOIR	OTHER
ANDERSON	4.0	0	0	0	0	0
BEDFORD	2.5	0	0	0	0	0
BENTON	7.0	0	0	0	0	0
BLEDSOE	6.0	0	0	0	0	0
BLOUNT	7.0	0	0	0	0	1
BRADLEY	0.0	1	0	0	1	1
CAMPBELL	6.0	0	0	0	0	0
CANNON	4.5	0	0	0	0	0
CARROLL	4.0	0	0	0	0	1
CARTER	8.0	0	0	0	0	1
CHEATHAM	5.5	0	0	0	0	0
CHESTER	2.5	0	0	0	0	1
CLAIBORNE	3.5	0	0	0	0	1
CLAY	8.0	0	0	0	0	0
COCKE	2.0	0	0	0	0	0
COFFEE	1.5	0	0	0	0	0
CROCKETT	3.0	0	0	0	0	0
CUMBERLAND	3.0	0	0	0	0	0
DAVIDSON	3.0	0	1	1	1	1
DECATUR	5.0	0	0	0	0	0
DEKALB	6.5	0	0	0	0	0
DICKSON	6.5	0	0	0	0	0
DYER	0.0	1	0	0	0	0
FAYETTE	4.5	0	0	0	0	0
FENTRESS	6.5	0	0	0	0	0
FRANKLIN	2.0	0	0	0	0	1
GIBSON	3.5	0	0	0	0	0
GILES	3.5	0	0	0	1	0
GRAINGER	3.5	0	0	0	0	0
GREENE	3.0	0	0	0	0	1
GRUNDY	5.0	0	0	0	0	0
HAMBLEN	0.0	1	0	0	1	0
HAMILTON	0.0	1	1	0	0	1
HANCOCK	4.0	0	0	0	0	0
HARDEMAN	4.0	0	0	0	0	0
HARDIN	7.0	0	0	0	0	0
HAWKINS	3.5	0	0	0	0	0
HAYWOOD	3.5	0	0	0	0	0
HENDERSON	2.5	0	0	0	0	0
HENRY	8.0	0	0	0	0	0
HICKMAN	3.5	0	0	0	0	0
HOUSTON	9.5	0	0	0	0	0
HUMPHREYS	8.0	0	0	0	0	0
JACKSON	6.5	0	0	0	0	0
JEFFERSON	2.0	0	0	0	0	1
JOHNSON	10.5	0	0	0	0	0
KNOX	5.0	0	1	1	0	1
LAKE	3.0	0	0	0	0	0
LAUDERDALE	3.0	0	0	0	0	0
LAWRENCE	4.0	0	0	0	0	0
LEWIS	3.5	0	0	0	0	0
LINCOLN	2.5	0	0	0	0	0
LOUDON	3.5	0	0	0	0	0
MACON	4.0	0	0	0	0	0
MADISON	0.0	1	0	0	0	3
MARION	3.5	0	0	0	0	0

TABLE VIII (Continued)

CO_NAME	DISTANCE[A]	Total Number of Educational Facilities[B]				
		CC	UNIVER	TECH	JUNOIR	OTHER
MARSHALL	2.5	0	0	0	0	0
MAURY	0.0	1	0	0	0	0
MCMINN	3.0	0	0	0	0	1
MCNAIRY	4.5	0	0	0	0	0
MEIGS	4.0	0	0	0	0	0
MONROE	5.0	0	0	0	1	0
MONTGOMERY	8.0	0	1	0	0	0
MOORE	0.0	1	0	0	0	0
MORGAN	3.0	0	0	0	0	0
OBION	4.5	0	0	0	0	0
OVERTON	7.5	0	0	0	0	0
PERRY	5.5	0	0	0	0	0
PICKETT	9.5	0	0	0	0	0
POLK	1.5	0	0	0	0	0
PUTNAM	7.5	0	1	0	0	0
RHEA	4.5	0	0	0	0	1
ROANE	0.0	1	0	0	0	0
ROBERTSON	4.0	0	0	0	0	0
RUTHERFORD	4.5	0	1	0	0	0
SCOTT	6.5	0	0	0	0	0
SEQUATCHIE	5.5	0	0	0	0	0
SEVIER	4.5	0	0	0	0	0
SHELBY	0.0	1	2	1	0	5
SMITH	5.0	0	0	0	0	0
STEWART	10.5	0	0	0	0	0
SULLIVAN	7.5	0	0	1	0	1
SUMNER	0.0	1	0	0	0	0
TIPTON	4.5	0	0	0	0	0
TROUSDALE	2.0	0	0	0	0	0
UNICOI	6.5	0	0	0	0	0
UNION	5.0	0	0	0	0	0
VANBUREN	6.5	0	0	0	0	0
WARREN	5.0	0	0	0	0	0
WASHINGTON	6.5	0	1	0	0	0
WAYNE	7.0	0	0	0	0	0
WEAKLEY	6.0	0	1	0	0	0
WHITE	6.0	0	0	0	0	0
WILLIAMSON	3.0	0	0	0	0	0
WILSON	2.5	0	0	0	1	0

CO_NAME = County names in Tennessee.

DISTANCE[A] = Traveled distances from the county seat to the nearest community college measured in inches.

CC = Number of community colleges.

UNIVER = Number of universities.

TECH = Number of technical institutions.

JUNIOR = Number of junior colleges.

OTHER = Number of independent institutions without continuing education functions.

Total Number of Educational Facilities[B] = Combined total of community colleges, universities, technical institutions, junior colleges, and independent institutions without continuing education functions.

their mere presence in a county does not mean that all residents of the county have the opportunity of being served. A weight of five was assigned to those counties with a community college facility. Because colleges and universities with a continuing education function might be more likely to duplicate efforts of the community college facility, a weight of four was assigned to those facilities found in each county. A weight of three was assigned to technical institutions. A two was assigned to all junior colleges because they might also provide some services similar to those of the community college. One was assigned to independent colleges without continuing education functions because they reach highly specific clientele. The Statistical Abstract of Tennessee Higher Education, 1977-1978, was used to provide a count of all types of facilities per county (Statistical Abstract of Tennessee Higher Education, 1978:vii).

The fourth criterion, emphasizing the desire to reduce duplication and provide measures to the nearness to other educational institutions, included two categories, A and B variables. Category A was the traveled measured distance of existing community college facilities to the nearest county seat (Table VII, page 75). Category B included the number and type of other educational facilities in each county in Tennessee (Table VIII, page 80, columns 2, 3, 4, 5, and 6). The expression calculated for the availability of community college facilities in a county as well as the availability of other educational facilities was (X_4).

Category A in (X_4) (column two of Table VIII, page 80) measured the distance of existing community college facilities to the nearest county seat per county in Tennessee. A value of 0.0 was assigned to the ten counties in Tennessee where there is already an existing community college facility. In the model, those distances as shown in Table VII, page 75, were given the expression R-Dist. The variable R-Dist for all 95 counties was scaled, and those counties that have a community college received the lowest score (Table IX). For example Bradley, Dyer, Hamblen, Hamilton, Madison, Maury, Moore, Roane, Shelby, and Sumner Counties were scaled to receive the value of five, lowest among all counties in the state, while Johnson and Stewart Counties received a high scale of 98. This meant if one was to make a decision based on this criterion alone, that it would be more desirable to locate a community college facility in Johnson County over any other county in Tennessee, holding all other factors constant.

The second category (Category B) of the (X_4) (columns 3, 4, 5, 6, and 7 of Table VIII, page 80) included the availability of other educational institutions per county. It calculated an expression (prox) to equal the number of community colleges multiplied by five added to the number of universities providing continuing education services multiplied by four added to the number of technical institutions multiplied by three added to the number of junior colleges by two added to the number of other independent

TABLE IX

PERCENTILE RANK OF AVAILABILITY OF EDUCATIONAL FACILITIES
PER COUNTY IN TENNESSEE, 1978

CO_NAME	DISTANCE[A]	PDIST	Total Number of Educational Facilities[B] CC	UNIVER	TECH	JUNOIR	OTHER	R100	VAR4
ANDERSON	4.0	47	0	0	0	0	0	67	57.0
BEDFORD	2.5	20	0	0	0	0	0	67	43.5
BENTON	7.0	84	0	0	0	0	0	67	75.5
BLEDSOE	6.0	72	0	0	0	0	0	67	69.5
BLOUNT	7.0	84	0	0	0	0	1	28	56.0
BRADLEY	0.0	5	1	0	0	1	1	6	5.5
CAMPBELL	6.0	72	0	0	0	0	0	67	69.5
CANNON	4.5	55	0	0	0	0	0	67	61.0
CARROLL	4.0	47	0	0	0	0	1	28	37.5
CARTER	8.0	92	0	0	0	0	1	28	60.0
CHEATHAM	5.5	68	0	0	0	0	0	67	67.5
CHESTER	2.5	20	0	0	0	0	1	28	24.0
CLAIBORNE	3.5	38	0	0	0	0	1	28	33.0
CLAY	8.0	92	0	0	0	0	0	67	79.5
COCKE	2.0	15	0	0	0	0	0	67	41.0
COFFEE	1.5	11	0	0	0	0	0	67	39.0
CROCKETT	3.0	28	0	0	0	0	0	67	47.5
CUMBERLAND	3.0	28	0	0	0	0	0	67	47.5
DAVIDSON	3.0	28	0	1	1	1	1	3	15.5
DECATUR	5.0	63	0	0	0	0	0	67	65.0
DEKALB	6.5	78	0	0	0	0	0	67	72.5
DICKSON	6.5	78	0	0	0	0	0	67	72.5
DYER	0.0	5	1	0	0	0	0	11	8.0
FAYETTE	4.5	55	0	0	0	0	0	67	61.0
FENTRESS	6.5	78	0	0	0	0	0	67	72.5
FRANKLIN	2.0	15	0	0	0	0	1	28	21.5
GIBSON	3.5	38	0	0	0	0	0	67	52.5
GILES	3.5	38	0	0	0	1	0	21	29.5
GRAINGER	3.5	38	0	0	0	0	0	67	52.5
GREENE	3.0	28	0	0	0	0	1	28	28.0
GRUNDY	5.0	63	0	0	0	0	0	67	65.0
HAMBLEN	0.0	5	1	0	0	1	0	8	6.5
HAMILTON	0.0	5	1	1	0	0	1	3	4.0
HANCOCK	4.0	47	0	0	0	0	0	67	57.0
HARDEMAN	4.0	47	0	0	0	0	0	67	57.0
HARDIN	7.0	84	0	0	0	0	0	67	75.5
HAWKINS	3.5	38	0	0	0	0	0	67	52.5
HAYWOOD	3.5	38	0	0	0	0	0	67	52.5
HENDERSON	2.5	20	0	0	0	0	0	67	43.5
HENRY	8.0	92	0	0	0	0	0	67	79.5
HICKMAN	3.5	38	0	0	0	0	0	67	52.5
HOUSTON	9.5	96	0	0	0	0	0	67	81.5
HUMPHREYS	8.0	92	0	0	0	0	0	67	79.5
JACKSON	6.5	78	0	0	0	0	0	67	72.5
JEFFERSON	2.0	15	0	0	0	0	1	28	21.5
JOHNSON	10.5	98	0	0	0	0	0	67	82.5
KNOX	5.0	63	0	1	1	0	1	6	34.5
LAKE	3.0	28	0	0	0	0	0	67	47.5
LAUDERDALE	3.0	28	0	0	0	0	0	67	47.5
LAWRENCE	4.0	47	0	0	0	0	0	67	57.0
LEWIS	3.5	38	0	0	0	0	0	67	52.5
LINCOLN	2.5	20	0	0	0	0	0	67	43.5
LOUDON	3.5	38	0	0	0	0	0	67	52.5
MACON	4.0	47	0	0	0	0	0	67	57.0
MADISON	0.0	5	1	0	0	0	3	6	5.5
MARION	3.5	38	0	0	0	0	0	67	52.5

TABLE IX (Continued)

CO_NAME	DISTANCE[A]	RDIST	Total Number of Educational Facilities[B]					R100	VAR4
			CC	UNIVER	TECH	JUNIOR	OTHER		
MARSHALL	2.5	20	0	0	0	0	0	67	43.5
MAURY	0.0	5	1	0	0	0	0	11	8.0
MCMINN	3.0	28	0	0	0	0	1	28	28.0
MCNAIRY	4.5	55	0	0	0	0	0	67	61.0
MEIGS	4.0	47	0	0	0	0	0	67	57.0
MONROE	5.0	63	0	0	0	1	0	21	42.0
MONTGOMERY	8.0	92	0	1	0	0	0	17	54.5
MOORE	0.0	5	1	0	0	0	0	11	8.0
MORGAN	3.0	28	0	0	0	0	0	67	47.5
OBION	4.5	55	0	0	0	0	0	67	61.0
OVERTON	7.5	88	0	0	0	0	0	67	77.5
PERRY	5.5	68	0	0	0	0	0	67	67.5
PICKETT	9.5	96	0	0	0	0	0	67	81.5
POLK	1.5	11	0	0	0	0	0	67	39.0
PUTNAM	7.5	88	0	1	0	0	0	17	52.5
RHEA	4.5	55	0	0	0	0	1	28	41.5
ROANE	0.0	5	1	0	0	0	0	11	8.0
ROBERTSON	4.0	47	0	0	0	0	0	67	57.0
RUTHERFORD	4.5	55	0	1	0	0	0	17	36.0
SCOTT	6.5	78	0	0	0	0	0	67	72.5
SEQUATCHIE	5.5	68	0	0	0	0	0	67	67.5
SEVIER	4.5	55	0	0	0	0	0	67	61.0
SHELBY	0.0	5	1	2	1	0	5	2	3.5
SMITH	5.0	63	0	0	0	0	0	67	65.0
STEWART	10.5	98	0	0	0	0	0	67	82.5
SULLIVAN	7.5	88	0	0	1	0	1	17	52.5
SUMNER	0.0	5	1	0	0	0	0	11	8.0
TIPTON	4.5	55	0	0	0	0	0	67	61.0
TROUSDALE	2.0	15	0	0	0	0	0	67	41.0
UNICOI	6.5	78	0	0	0	0	0	67	72.5
UNION	5.0	63	0	0	0	0	0	67	65.0
VANBUREN	6.5	78	0	0	0	0	0	67	72.5
WARREN	5.0	63	0	0	0	0	0	67	65.0
WASHINGTON	6.5	78	0	1	0	0	0	17	47.5
WAYNE	7.0	84	0	0	0	0	0	67	75.5
WEAKLEY	6.0	72	0	1	0	0	0	17	44.5
WHITE	6.0	72	0	0	0	0	0	67	69.5
WILLIAMSON	3.0	28	0	0	0	0	0	67	47.5
WILSON	2.5	20	0	0	0	1	0	21	20.5

CO_NAME = County names in Tennessee.

DISTANCE[A] = Traveled distances from the county seat to the nearest community college measured in inches.

RDIST = Percentile rank of distances between county seat and nearest community college.

CC = Number of community colleges.

UNIVER = Number of universities.

TECH = Number of technical institutions.

JUNIOR = Number of junior colleges.

OTHER = Number of independent institutions without continuing education functions.

R100 = Percentile rank of the number of institutions per county.

VAR4 = Percentile rank of number of institutions per county and the distance to the nearest college facility.

Total Number of Educational Facilities[B] = Combined total of community colleges, universities, technical institutions, junior colleges, and independent institutions without continuing education functions.

four-year colleges without any continuing education by one. The mathematical expression was as follows:

prox = (CC x 5) + (Univer x 4) + (Tech x 3) + (Junior x 2) + (other x 1).

The prox was then subtracted from 100, a constant, allowing those counties with many educational facilities as well as community colleges to receive a lower score and, therefore, become less desirable for the location of another similar facility. This addresses the concern that many states have had with duplication of services in any one area and gives high weighted values to those areas without any educational services. Variable (X_4) was then calculated by adding R-Dist to prox subtracted from 100 then the expression divided by two. Mathematical expression was as follows:

$$X_4 = \frac{(\text{R-Dist} + (100 - \text{prox}))}{2}$$

(X_4) was scaled according to the SAS "Rank" procedure program discussed earlier in the chapter. The counties with community colleges and other types of educational institutions received a lower score from those counties without any services. For example, Shelby County was scaled to receive a value to 3.5 and Roane County a score of 8.0, while Knox County received the value of 34.5, Pickett received a high score of 81.5, and Stewart County was scaled a very high score of 82.5 (Table IX, page 84, column 10).

Availability of Industry Criterion

Availability of industry in the area of the proposed community college facility is essential to the work-study function relationship between the college and the community that it serves. Also students who are enrolled at the community college are usually those residing in the community, and the training and education they receive at the college should help them either obtain jobs or move into better jobs that are available in the area. The community college plays an important role in training business employees as well as in providing continuing education to the residents of its service area. Thus, the number of manufacturing establishments as well as the number of retail establishments were obtained from the city-county directory for each county in Tennessee (Table X).

The fifth criterion (X_5) used in the model was the number of manufacturing and retail establishments per county (Table X). Manufacturing establishments were scaled and again Shelby County received the highest score values at 98 and Moore received the value of 1. In retail establishments larger counties such as Shelby and Davidson received higher scores than Van Buren and Pickett. The Estab variable in the model was expressed as follows:

$$X_5 = \frac{(\text{Manufacturing} + \text{Retail})}{5}$$

The X_5 variable was scaled for all 95 counties. Results showed that

TABLE X

THE NUMBER OF MANUFACTURING AND RETAIL ESTABLISHMENTS PER COUNTY IN TENNESSEE, 1977*

CO_NAME	MAN_EST	RET_EST
ANDERSON	60	495
BEDFORD	59	274
BENTON	11	145
BLEDSOE	15	66
BLOUNT	44	527
BRADLEY	107	537
CAMPBELL	37	262
CANNON	13	75
CARROLL	28	305
CARTER	34	349
CHEATHAM	14	106
CHESTER	10	122
CLAIBORNE	18	194
CLAY	10	76
COCKE	38	258
COFFEE	63	393
CROCKETT	11	172
CUMBERLAND	42	229
DAVIDSON	766	4136
DECATUR	23	141
DEKALB	18	132
DICKSON	42	230
DYER	38	384
FAYETTE	11	174
FENTRESS	23	124
FRANKLIN	28	333
GIBSON	65	565
GILES	34	278
GRAINGER	19	113
GREENE	61	423
GRUNDY	23	107
HAMBLEN	83	419
HAMILTON	485	2553
HANCOCK	4	59
HARDEMAN	29	239
HARDIN	37	207
HAWKINS	14	334
HAYWOOD	21	200
HENDERSON	26	234
HENRY	35	289
HICKMAN	15	133
HOUSTON	14	57
HUMPHREYS	20	158
JACKSON	6	59
JEFFERSON	29	207
JOHNSON	15	96
KNOX	352	2632
LAKE	8	109
LAUDERDALE	28	269
LAWRENCE	38	358
LEWIS	16	87
LINCOLN	35	262
LOUDON	30	261
MACON	29	130
MADISON	103	693
MARION	26	218

TABLE X (Continued)

CO_NAME	MAN_EST	RET_EST
MARSHALL	42	215
MAURY	56	492
MCMINN	95	407
MCNAIRY	32	231
MEIGS	10	49
MONROE	50	291
MONTGOMERY	57	556
MOORE	4	25
MORGAN	18	106
OBION	35	366
OVERTON	26	141
PERRY	22	69
PICKETT	6	38
POLK	20	133
PUTNAM	89	480
RHEA	41	217
ROANE	30	476
ROBERTSON	43	222
RUTHERFORD	86	552
SCOTT	25	176
SEQUATCHIE	15	78
SEVIER	40	435
SHELBY	937	5577
SMITH	12	131
STEWART	11	65
SULLIVAN	108	1085
SUMNER	71	545
TIPTON	26	254
TROUSDALE	9	64
UNICOI	24	129
UNION	7	63
VANBUREN	7	36
WARREN	43	337
WASHINGTON	89	814
WAYNE	22	149
WEAKLEY	46	344
WHITE	28	200
WILLIAMSON	45	372
WILSON	57	409

*Only available information was 1977 county and city data book.

CO_NAME = County names in Tennessee.

MAN_EST = The number of manufacturing establishments.

RET_EST = The number of retail establishments.

Moore received a value of 1 and Shelby County a value of 98 on a scale of 1 to 100 (Table XI).

III. RESULTS

A computer run was made using the mathematical expression:

$$\text{Score} = \frac{(67 \times \text{project} + 63 \times \text{Raccess} + 56 \times R_{\text{pop-80}} + 44(X_4) + 26 \times \text{Estab})}{(67 + 63 + 56 + 44 + 26)}$$

Results show the higher the score for the county, the more desirable it is to locate a community college facility.

The first computer analysis was obtained by including all five criteria: Project, Raccess, $R_{\text{pop-80}}$, VAR4, and Estab. Results showed the following in order of desirability from the top 17 counties:

1. Sullivan County
2. Knox County
3. Washington County
4. Davidson County
5. Shelby County
6. Hamilton County
7. Rutherford County
8. Williamson County
9. Gibson County
10. Montgomery County
11. Putnam County
12. Anderson County
13. Blount County

TABLE XI

THE PERCENTILE RANK OF THE NUMBER OF MANUFACTURING AND RETAIL ESTABLISHMENTS PER COUNTY IN TENNESSEE, 1981

CO_NAME	MAN_EST	RET_EST	RMAN_EST	RRET_EST	ESTAB
ANDERSON	60	495	82	85	83.5
BEDFORD	59	274	81	61	71.0
BENTON	11	145	14	34	24.0
BLEDSOE	15	66	23	11	17.0
BLOUNT	44	527	73	86	79.5
BRADLEY	107	537	93	87	90.0
CAMPBELL	37	262	61	58	59.5
CANNON	13	75	17	13	15.0
CARROLL	28	305	47	65	56.0
CARTER	34	349	56	70	63.0
CHEATHAM	14	106	19	19	19.0
CHESTER	10	122	10	23	16.5
CLAIBORNE	18	194	28	40	34.0
CLAY	10	76	10	14	12.0
COCKE	38	258	64	56	60.0
COFFEE	63	393	84	76	80.0
CROCKETT	11	172	14	37	25.5
CUMBERLAND	42	229	69	49	59.0
DAVIDSON	766	4136	97	97	97.0
DECATUR	23	141	37	32	34.5
DEKALB	18	132	28	29	28.5
DICKSON	42	230	69	51	60.0
DYER	38	384	64	74	69.0
FAYETTE	11	174	14	38	26.0
FENTRESS	23	124	37	24	30.5
FRANKLIN	28	333	47	66	56.5
GIBSON	65	565	85	91	88.0
GILES	34	278	56	62	59.0
GRAINGER	19	113	30	22	26.0
GREENE	61	423	83	80	81.5
GRUNDY	23	107	37	20	28.5
HAMBLEN	83	419	87	79	83.0
HAMILTON	485	2553	96	95	95.5
HANCOCK	4	59	1	6	3.5
HARDEMAN	29	239	51	54	52.5
HARDIN	37	207	61	44	52.5
HAWKINS	14	334	19	67	43.0
HAYWOOD	21	200	33	42	37.5
HENDERSON	26	234	43	53	48.0
HENRY	35	289	59	63	61.0
HICKMAN	15	133	23	30	26.5
HOUSTON	14	57	19	5	12.0
HUMPHREYS	20	158	31	36	33.5
JACKSON	6	59	3	6	4.5
JEFFERSON	29	207	51	44	47.5
JOHNSON	15	96	23	17	20.0
KNOX	352	2632	95	96	95.5
LAKE	8	109	7	21	14.0
LAUDERDALE	28	269	47	60	53.5
LAWRENCE	38	358	64	71	67.5
LEWIS	16	87	26	16	21.0
LINCOLN	35	262	59	58	58.5
LOUDON	30	261	53	57	55.0
MACON	29	130	51	27	39.0
MADISON	103	693	92	92	92.0
MARION	26	218	43	47	45.0

TABLE XI (Continued)

CO_NAME	MAN_EST	RET_EST	RMAN_EST	RRET_EST	ESTAB
MARSHALL	42	215	69	45	57.0
MAURY	56	492	78	84	81.0
MCMINN	95	407	91	77	84.0
MCNAIRY	32	231	55	52	53.5
MEIGS	10	49	10	4	7.0
MONROE	50	291	77	64	70.5
MONTGOMERY	57	556	79	90	84.5
MOORE	4	25	1	1	1.0
MORGAN	18	106	28	19	23.5
OBION	35	366	59	72	65.5
OVERTON	26	141	43	32	37.5
PERRY	22	69	34	12	23.0
PICKETT	6	38	3	3	3.0
POLK	20	133	31	30	30.5
PUTNAM	89	480	90	83	86.5
RHEA	41	217	67	46	56.5
ROANE	30	476	53	82	67.5
ROBERTSON	43	222	72	48	60.0
RUTHERFORD	86	552	88	89	88.5
SCOTT	25	176	40	39	39.5
SEQUATCHIE	15	78	23	15	19.0
SEVIER	40	435	66	81	73.5
SHELBY	937	5577	98	98	98.0
SMITH	12	131	16	28	22.0
STEWART	11	65	14	10	12.0
SULLIVAN	108	1085	94	94	94.0
SUMNER	71	545	86	88	87.0
TIPTON	26	254	43	55	49.0
TROUSDALE	9	64	8	9	8.5
UNICOI	24	129	39	26	32.5
UNION	7	63	5	8	6.5
VANBUREN	7	36	5	2	3.5
WARREN	43	337	72	68	70.0
WASHINGTON	89	814	90	93	91.5
WAYNE	22	149	34	35	34.5
WEAKLEY	46	344	76	69	72.5
WHITE	26	200	47	42	44.5
WILLIAMSON	45	372	74	73	73.5
WILSON	57	409	79	78	78.5

CO_NAME = County names in Tennessee.

MAN_EST = The number of manufacturing establishments.

RET_EST = The number of retail establishments.

RMAN_EST = Percentile rank of manufacturing establishments.

RRET_EST = Percentile rank of retail establishments.

ESTAB = Percentile rank of both manufacturing and retail establishments.

14. Sevier County
15. Wilson County
16. Robertson County
17. Greene County

Since weights were higher for the criteria reflecting population projections as well as population density, results heavily favor populated areas. There also appears to be a direct correlation between population density, population projections, and retail and manufacturing establishments. Therefore, results again favored more densely populated centers. The reason Shelby County did not receive the highest score was due to the availability of numerous educational facilities (X_4). The (X_4) criterion had a negative effect on Shelby County, since Shelby had a community college as well as other colleges and universities. A second run was made eliminating criterion (X_4). In other words, checking to see where one might best locate a community college in Tennessee without giving any consideration to existing community colleges. Results for the top 20 counties are as follows:

1. Davidson County
2. Knox County
3. Shelby County
4. Hamilton County
5. Sullivan County
6. Washington County
7. Rutherford County

8. Wilson County
9. Williamson County
10. Gibson County
11. Bradley County
12. Madison County
13. Putnam County
14. Montgomery County
15. Maury County
16. Greene County
17. Roane County
18. Glount County
19. Hamblen County
20. McMinn County

It was interesting to note that out of the top 20 counties, only 7 have existing community colleges. They are Shelby, Hamilton, Madison, Bradley, Maury, Roane, and Hamblen.

A third run was made including only projected high school age enrollment. Rpop15 was used in criterion X_1 and excluded the age group 20+. Results changed very slightly. A shifting occurred between Montgomery and Williamson and Putnam Counties. The remaining counties kept their original positions. Both Williamson and Putnam Counties have a slightly larger group of 20+ population, while the age group 15-19 was close between all three counties.

Results of this analysis favors larger populated areas, where growth is to be expected. Based on this analysis, the three most

desirable counties in Tennessee for the location of a community college facility in order of importance are: Sullivan County, followed by Knox County and Washington County.

VI. SUMMARY EXAMPLE

One county in Tennessee, Sullivan County was used in this summary example to provide a clear understanding of the steps used in the location model application for community college facilities in Tennessee. The first criterion, potential and projected student enrollment for Sullivan County, included two categories (A and B). Category A represented the population age group 15-19 in Sullivan County, which was equivalent to 10,791 students (Table 1, column 2, page 58). Category B was the population age group 20 and over in Sullivan County, which reached 106,498 people (Table I, column 3, page 58).

As all 95 counties in Tennessee were scaled from a low of one to a high of 100, run by computer, using a "rank" procedure of Statistical Analysis System (SAS) program, Sullivan County was scaled as 94 for both categories of age groups 15-19 and 20+ (Table II, Columns 3 and 4, page 61). The 94 percentile rank of Sullivan County showed the relative positioning of Sullivan to the remaining counties in Tennessee with respect to the criterion of projected college populations by age groups.

The second criterion, accessibility, was determined by counting the number of highways and roads of each county in the state of Tennessee. Highways were divided into three categories based on good road conditions and ease of travel. The three categories included interstates, United States highways, and state and county roads. In Sullivan County interstate 81, five United States highways, and four state roads transversed the county (Table III, page 65). Access for Sullivan County was calculated by multiplying the number of interstates by three added to the number of United States highway multiplied by two added to the number of state highways multiplied by one. Access for Sullivan County was calculated as follows (Table IV, column 5, page 67):

Access (Sullivan) = (1 x 3) + (5 x 2) + (4 x 1) = 17

Using the scaling value of 1 to 100 according to the SAS "rank" procedure program discussed earlier, Sullivan County received the scaled value of 95 (Table IV, column 6, page 67). The 95 percentile rank of Sullivan County is indicative of the position of Sullivan to the other counties in Tennessee in relation to the accessibility criterion. The scaled value of 95 ascertained that Sullivan County is the fourth most accessible county in Tennessee proceeded by Davidson (98), Knox (97), and Hamilton (96) Counties (Table IV, column 6, page 67).

The third criterion, population density per county in Tennessee, was obtained from the 1980 Federal Census report. Sullivan County

reported a population of 143,858 in the 1980 Federal Census report (Table V, page 70). Pupulation density criterion was scaled for all 95 counties and Sullivan County received the value of 94 (Table VI, column 3, page 72).

The fourth criterion, emphasizing the desire to reduce duplication and provide measures to the nearness to other educational institutions included two categories. The first category (A) calculated the traveled distances between each county seat and the nearest community college facility. In the case of Sullivan County, the traveled distance from the county seat, Blountville, to the nearest community college facility (Walter State Community College) was measured 7.5 inches on the map. Using the scale of 2.5 inches = 20 miles, the 7.5 inches was converted to 60 miles of traveled distance (Table VII, page 75).

The second category (B) included the number of other educational facilities in Sullivan County (Table VIII, columns 3, 4, 5, 6, and 7, page 80). The Tri-Cities State Technical Institute was designated as Technical Institute July 1, 1978 (Table VIII, column 5, page 80) (Higher Education in Tennessee: A Statewide Master Plan, Volumn I, 1979). Category B calculated the expression prox to equal the number of community colleges in Sullivan County multiplied by five added to the number of universities providing continuing education services multiplied by four added to the number of technical institutes multiplied by three added to the number of junior colleges

by two added to the number of other independent four-year colleges without any continuing education by one. The mathematical calculation for Sullivan County was as follows:

$$\text{prox (Sullivan)} = (0 \times 5) + (0 \times 4) + (1 \times 3) + (0 \times 2) + (1 \times 1)$$
$$= 4$$

The value four was then subtracted from 100, a constant, allowing those counties with many educational facilities to receive a lower score and, therefore, become less desirable for the location of another similar educational facility. Both the distances of community college facility to the county seat and the number of other educational facilities in Sullivan County were scaled according to the SAS "rank" procedure. The scaled value for category A (distance) received a score of 88 (Table XI, column 3, page 84) while the combined value of the number of educational facilities received the score of 17 (Table XI, column 9, page 84). The scaled value of variable (X_4) was then calculated as follows:

$$X_4 \text{ (Sullivan)} = \frac{(88 + 17)}{2}$$
$$= 52.5$$

The fifth criterion (X_5) used in the model was the number of manufacturing and retail establishments. Table X, page 88, shows that Sullivan County has 108 manufacturing establishments (column 2) and 1,085 retail establishments (column 3). After scaling the manufacturing and retail establishments Sullivan County received the

value of 94 for both categories (Table XI, columns 4 and 5, page 91). Thus the (X_5) value for Sullivan County was also 94 (Table XI, column 6, page 91).

$$X_5 \text{ (Sullivan)} = \frac{(94 = 94)}{2}$$

$$= 94$$

When the computer run was made for Sullivan County, the score for the desirability of a community college facility in Sullivan County was high. The higher the score the more desirable it is to locate a community college facility.

Score for Sullivan County =

$$\frac{\left((67 \times 94) + (63 \times 95) + (56 \times 94) + (44 \times 52.5) + (26 \times 94)\right)}{(67 + 63 + 56 + 44 + 26)}$$

$$\frac{(6,298 + 5,985 + 5,264 + 2,310 + 2,444)}{256}$$

$$\frac{22,301}{56} = 87.113$$

The score of 87.113 was the highest among the 95 county scores for Tennessee. Therefore, Sullivan County is considered to be the most desirable county for the location of community college facility followed by Knox County and closely tied with Washington and Davidson Counties.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS OF THE STUDY

I. INTRODUCTION

The purpose of this chapter is to summarize the present study and to report its findings. Conclusions effecting the future siting of community college facilities reached as a result of the findings are drawn and summarized. Finally, recommendations for possible future locations of community college facilities in Tennessee are suggested along with recommendations made for future study.

II. SUMMARY

The purpose of this study was to examine the set of criteria used for the development of community college facilities and to develop appropriate guidelines for selecting possible locations for the development of future facilities. In addition, Tennessee was used as an example to illustrate how the guidelines for selecting possible locations can easily be used in a mathematical model.

In order to gather the necessary information to achieve the purpose of the study, letters were sent to community college governing agencies of all 50 states requesting state plans for

the establishment and location of community college facilities. From 50 states, 34 agencies responded. Of the 34, seven agencies replied that they have no systematic plans for providing community college facilities where the need is focused on a statewide basis.

The existing 27 community college location plans in the United States were analyzed in order to secure relevant criteria amenable to future community college site selection. Then criteria developed as a result of content analysis were applied to the mathematical model. An example of the use of the model was illustrated by using Tennessee.

III. FINDINGS

1. Most state plans were written to enable legislators and governing systems to make decisions for the siting of educational facilities. However, the initiation and the support, including the gathering of evidence for the need to establish a community college facility were always left with the local boards of education. The local board was asked to provide adequate evidence to document local interest, revenues, and local need.

2. Some states were divided into community college districts, and the burden of providing evidence for the need to have new facilities was placed on the appointed committee of that district. Also evidence showing adequate financial support was required by the local community.

3. The most often mentioned criterion in planning for community college facility was the number of potential students and enrollment projections. As a general standard, it was the policy in many state plans to require the local district to show that students graduating from its secondary schools will be adequate to reach the minimum required for potential enrollment in the community college.

4. Accessibility was a very important criterion in the choosing of a site for a community college facility. Community colleges were established as non-resident commuter institutions and, therefore, road accessibility became a critical factor in the siting of community college facilities.

5. A critical factor in the decision to establish a new community college facility was the degree to which the service area of the proposed new campus facility would overlap the service area of other existing educational facilities.

6. Commercial industrial growth in the proposed area was very important in many state plans because of the opportunity for work study program relationships as well as the potential for economic and industrial growth of the community, growth which could eventually have an impact on the college.

7. Many state plans authorized additional study of the need for the state to establish community colleges in centers

where populations and facilities warranted their establishment and future growth.

8. Site specific characteristics were heavily considered in many state plans. The site specific characteristics included land availability, irregular terrain, land size, availability of utilities and cost. Some western states included information regarding water rights in their consideration of utility availability.

9. Some state plans encouraged the state to do a feasibility study to identify the educational needs and to propose a plan for meeting those needs. One of the major factors in the feasibility study to verify an anticipated need for the development of a community college facility was the demographic analysis of the entire district or service area.

10. Environmental factors including aesthetics were considered in five state plans (Arkansas, Arizona, et al.). Also variables such as topography, landscape, noise potential, and pleasing surroundings with desirable zoning were found useful.

11. Safety of neighborhood was considered important in the eastern region where larger cosmopolitan centers of population prevailed.

12. Availability of land resource was extremely important for the eastern region where land has become a scarce resource.

13. Water availability was a crucial factor in determining the actual physical location of community college facilities in the western states.

14. Cost and ability of local financing was repeatedly mentioned by southern states.

15. Sullivan County followed by Knox, Washington, and Davidson Counties were the most desirable counties for the future locations of community college facilities in Tennessee.

IV. CONCLUSIONS

The following conclusions were drawn from the analysis of the study.

1. Most state plans contain numerous variables that are relevant only to a few specific counties. Too often, then, data collection and decisions pertaining to the actual site location of community college facilities in one area of the state are preceded by insufficient forethought and analysis for statewide interests.

2. Modeling technique is a useful tool for statewide screening for the purpose of choosing a suitable community college site that is cost effective to the state. Because of the lack of planning on a statewide basis, college facilities have been placed sometimes seemingly haphazardly, leading to overlapping of service areas, thus costing the state more money; scanning the state as a

whole should always precede any decision pertaining to the specific site location of community college facilities.

3. An automated statewide scanning system is important in that the decision maker is able to cast aside his or her own biases and apply the criteria in an unbiased manner.

4. By using multiple sets of criteria in a computerized form, allowance can be made for incooperating differing opinions and perspectives on community college facility siting. Most existing procedures use a single set of criteria that are determined by designers who may or may not have practical experiences in facility siting. In order to correct this shortcoming, the model was designed to accept numerous sets of criteria from many disparate groups with different siting objectives and, therefore, make a decision by simultaneously evaluating all criteria.

5. The study and the procedures have repeatedly selected sizable concentrations of high scores in the population areas of the state. It appears that community college facilities of the future will shift nearer population centers. With inflation, energy costs, loss of travel time it becomes a negative factor if one were to spend more than 30 minutes driving to a college facility. Since the majority of community college clientele are adults having both jobs and families, college facilities will have to be closer to large population centers in order for their services to be cost effective to both the state, the community, and their clientele.

6. Because of public awareness, the issue of the justification of a proposed new community college facility in terms of political influence has become a significant issue. The question of whether a proposed facility will, in fact, serve to meet demands in the service area is being asked with increasing frequency. Using the modeling technique developed in this study would lend credibility to the proposed candidate areas as well as those areas already chosen.

7. Most state plans dealt with the physical attributes rather than the need of the clientele. Siting criteria must be determined in the context of "people's need." Most state plans set criteria for a local area emphasizing water, land, and availability of utilities. In the beginning many state plans assumed the establishment of nearly unlimited community college growth, thus not giving much consideration to all parts of the state. State plans did not emphasize the exclusiveness of a service area.

8. A major deficiency in the design of most state plan procedures was that too little attention was given to the definition of siting criteria. There is no systematic approach on the state level for implementation; therefore, the plans are not workable for the state. The criteria are rather arbitrary and seem to be written to satisfy legislators and governing bodies because there is no indication of how the criteria are to be

used and evaluated. Therefore, proper implementation of the state plans is not possible.

9. The state plans reviewed in this study did not differentiate between general site analysis and specific site location, two different concepts, as indicated in this study. These concepts do not appear to be of general knowledge to state plan developers.

10. A clear definition of siting criteria, including the importance of each variable, indicating the critical categories, leads to efficient collection of useful information in the proper form for application.

11. While the study is limited to community college siting, there is no reason why this approach cannot be adapted to another type of educational facility merely by changing the criteria matrix and perhaps adding or deleting variables to fit the character of the facility.

V. RECOMMENDATIONS

1. The modeling technique used in this study is particularly useful early in the selection process when the state is being screened to identify candidate areas for community college facilities. Therefore, this process should be used as a first cut approach in deciding the best general area in a state for the location of additional facilities.

2. The same model may be used by existing community colleges after setting what they consider is their criteria to provide services to certain areas in their geographical area. The criteria can be made highly specific to fit a particular type of facility while the automated portion of the model will be simple to use and operate with minimum use of time and money.

3. In spite of the fact that many argue that enrollment will decrease due to the decline in 18 to 24 year olds, this forecast will not affect the community college since it will be offset by the increasing enrollment of older students and part-time students. The trend is already in progress. Therefore, community college plans must emphasize the function of adult and continuing education as an important criterion in the decisions affecting the location of such facilities. For example, the age population 20 and over must be considered as a major criterion in determining the best possible location for community college facilities in the defined area.

4. Decisíon makers would spend their time more productively if they were to define more carefully the criteria that the location pattern should meet and leave to the computer the job of finding the best location patterns that meet those identified needs.

5. The rural nature of some areas or counties is a constant challenge for community college administrators. Delivery of services to these areas is expensive, time-consuming, and

difficult due to the relatively small number served. However, existing community colleges may adopt a system and a modeling technique such as the one applied in this study after identifying specific criteria relevant to the needs of the rural areas so that an objective determination can be made as to where the college can best concentrate its efforts.

6. The most pressing need for future research is in the development of siting factors to be used by community colleges. Future research should include a stratified sample of experts to identify those criteria that most describe the philosophies and functions of the community college in the state. Those identified criteria should be used in future siting models. The role of knowledgeable people is extremely useful and can result in defining various sets of siting criteria. The experts may include administrators of community colleges, university professors that have community college experience, State Department personnel as well as representatives of the American Association of Community-Junior Colleges.

7. Assuming that the development of community college centers are the trend of the future, the researcher suggests that future studies can be directed toward defining criteria necessary for these centers and applying the defined criteria in a model structure such as the one suggested by this study. College centers should complement and supplement existing community college facilities and should not duplicate whatever exists.

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APPENDIXES

APPENDIX A

LETTER REQUESTING AVAILABLE INFORMATION REGARDING STATE PLANS FOR SITING OF COMMUNITY COLLEGE FACILITIES

Dear

I am working with Dr. Ken McCullough of the University of Tennessee, Knoxville on a nationwide survey of states regarding their site selection plans and policies for community colleges. We are attempting to obtain site selection plans, procedures, and policies used by your state to determine where to locate community colleges. Accordingly, we would greatly appreciate any information you could provide. Please send to:

Dr. Ken McCullough
15 Henson Hall
Department of Continuing and
Higher Education
The University of Tennessee
Knoxville, TN 37916

Your cooperation and prompt reply is appreciated.

Sincerely,

Fadia Alvic

FA/mw

P.S. If you would like a copy of our results, please attach a note to your reply. We will be glad to send you a summary as soon as we have it completed.

APPENDIX B

STATE RESPONSES TO THE REQUEST FOR COMMUNITY COLLEGE PLANS PERTAINING TO THE LOCATION AND SITING OF FACILITIES

State Name	Not Responding	No Plan	Letter with Plan	Copy of Plan	Refer to Other Documents	Personal Contact
Alabama				x		
Alaska	x					
Arizona				x		
Arkansas				x		
California	x					x
Colorado				x		
Connecticut				x		
Delaware	x					
Florida				x		
Georgia				x		
Hawaii		x			x	
Idaho	x					
Illinois				x		
Indiana		x				
Iowa				x		
Kansas				x		
Kentuky				x		
Louisiana	x					

State Name	Not Responding	No Plan	Letter with Plan	Copy of Plan	Refer to Other Documents	Personal Contact
Maine		x				
Maryland	x					
Massachusetts	x					
Michigan		x				
Minnesota		x				
Mississippi				x		
Missouri				x		
Montana				x		
Nebraska		x				
Nevada				x		
New Hampshire				x		
New Jersey	x					
New Mexico				x		
New York				x		
North Carolina	x					
North Dakota	x					
Ohio				x		
Oklahoma				x		
Oregon				x		
Pennsylvania	x					
Rhode Island	x					

State Name	Not Reponding	No Plan	Letter with Plan	Copy of Plan	Refer to Other Documents	Personal Contact
South Carolina				x		
South Dakota		x				
Tennessee				x		x
Texas			x			
Utah	x					
Vermont	x					
Virginia				x		
Washington				x		
West Virginia	x					
Wisconsin			x			
Wyoming	x					

APPENDIX C

CRITERIA IN STATE PLANS

State Names	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
Alabama	X	X		X			X							
Arizona	X	X	X		X			X	X			X	X	
Arkansas	X	X	X	X	X	X		X	X		X	X	X	
Colorado		X	X		X			X	X	X		X	X	
Connecticut	X	X		X	X	X		X	X		X			X
Florida		X	X	X	X			X	X	X				
Georgia	X		X	X	X	X	X							
Illinois	X	X		X			X	X		X			X	
Iowa		X	X		X				X					
Kansas							X							
Kentucky	X	X	X	X	X	X	X		X		X			
Mississippi	X			X	X	X		X			X			
Missouri	X	X	X	X		X	X			X				
Montana	X							X						
Nevada	x				x									
New Hampshire	X	X	X		X				X	X		X	X	
New Mexico	X	X	X	X				X						
New York		X	X	X		X								X
Ohio	X													
Oklahoma				X	X	X	X							
Oregon	X		X	X		X	X							
South Carolina	X			X	X	X				X				
Tennessee	X	X	X	X										
Texas				X	X		X							
Virginia	X	X	X			X	X			X	X			
Washington	X	X	X		X	X								
Wisconsin		X	X					X	X			X		
Total	19	17	16	16	15	12	10	10	9	7	5	5	5	2

I = Number of potential students and enrollment projections.

II = Accessibility.

III = Site characteristics--availability of land.

IV = Finance ability by the local community.

V = Location of site near population centers.

VI = Availability of other educational opportunities.

VII = Evidence of local interest, revenue and local need.

VIII = Land cost.

IX = Utility availability and cost.

X = Local industry.

XI = Demographic analysis of the district.

XII = Environmental factors and aesthetic quality.

XIII = Land use, shape, visibility, topography and desirable zoning.

XIV = Safety of neighborhood.

VITA

Fadia M. Alvic was born in Baghdad, Iraq, where she was graduated from The American High School in May 1962. She was awarded a Rotary International exchange student scholarship to attend Meredith College in Raleigh, North Carolina. She received a Bachelor of Arts degree in chemistry and mathematics from Hastings College, Hastings, Nebraska, in May 1967.

In August 1967, she married Donald Alvic of Chicago, Illinois, and accepted a position of an analytical chemist at Commercial Solvent Corporation, Terre Haute, Indiana. In the fall of 1973, she was employed as an adult education teacher at Knox County Schools, Knoxville. She entered graduate school at The University of Tennessee, Knoxville, in September 1974, and received the Master of Science degree in Adult Education in December 1975. During that year, she worked as an intern from The University of Tennessee, Knoxville, in the Office of Continuing Education at Volunteer State Community College. She also worked as Professional Associate in the Office of Continuing Education at Cleveland State Community College.

The Doctor of Education degree in Administration of Higher Education was completed in August 1981. As a research associate consultant with The University of Tennessee, Knoxville, she is currently working as a regional coordinator with the National Abandoned Mine Lands Inventory, Oak Ridge, Tennessee. She is a member of the Adult Education Association and Tennessee Adult Education Association.

She is married to Don Alvic and has two children, Philip, 10; and Donia Lesley, 8.