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# Predicting Strategic Orientations of Public Research Universities in Economic Development: A Test of the Resource Dependence Model

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PREDICTING STRATEGIC ORIENTATIONS OF  
PUBLIC RESEARCH UNIVERSITIES IN ECONOMIC DEVELOPMENT:  
A TEST OF THE RESOURCE DEPENDENCE MODEL

by

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## ABSTRACT

### PREDICTING STRATEGIC ORIENTATIONS OF PUBLIC RESEARCH UNIVERSITIES IN ECONOMIC DEVELOPMENT: A TEST OF THE RESOURCE DEPENDENCE MODEL

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Old Dominion University, 1995  
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This study is an original application of resource dependence theory to research administration at public universities. It examines the extent to which and under what conditions economic development orientations can be predicted by resource dependence theory. Data analyses concentrate on the combined effects of administrative structure and variations in federal financial support on the economic development orientations of public doctorate-granting universities nationwide.

Data were collected from three sources: (a) published data on the research dollar volume of public universities; (b) higher education personnel directories containing information about research offices; and (c) a mailed survey instrument containing four orientations in economic development. Of 96 universities contacted, usable responses to the survey instrument were received from 80 senior research administrators. A response rate of 83.3 percent was achieved.

Statistical analyses of data from the particular survey instrument employed suggest that resource dependence theory may have limited applicability to the organization and management of research offices at public universities. In addition, the study has three implications for university administrators, policy makers, and management scholars: (a) it demonstrates the feasibility of applying the constructs of resource dependence theory to higher education research administration; (b) it provides new information in the continuing discussion over administrative structure of university research offices; and (c) it suggests that university research administrators attempt to find new sources of funding and reduce their institution's reliance on the federal government.

The study concludes that a standardized rate of growth in federal research funding, in part, influences two orientations of public doctorate-granting universities in economic development: (a) New Business and Technology Development and (b) Capacity Building. On the average, these universities employ strategies more frequently as they encounter adverse policy environments. In closing, this study suggests several avenues for further investigation, including research that ascertains the predictive accuracy of formulae developed herein.

## Dedication

I dedicate this work to Julie, my spouse of over two decades, and our daughter, Deanna. Also, I extend my deepest appreciation to family and friends for their thoughtfulness and relentless support. They have indeed helped me retain a healthy outlook on life. I trust that they will continue to do so in the years that lie ahead.

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## CHAPTER ONE INTRODUCTION

Resource dependence theory (Aldrich & Pfeffer, 1976; Pfeffer, 1987; Pfeffer & Salancik, 1978) addresses the relationship between organizations and their environments, asserting that actions of organizations are related to environmental context and social constraint. According to this perspective, managers are processors of external demands and evaluators of environmental context who facilitate strategies through which their organizations seek survival, growth, and stability.

This study is an original application of resource dependence theory to the research management function at public universities. It will test hypotheses drawn from the resource dependence framework in order to investigate whether particular orientations in economic development, as reported by chief university research officers, can be predicted from recent variations in federal research funding and from current research administrative structures. Specifically, this study examines to what extent public doctorate-granting universities behave as predicted by resource dependence theory.

It is hypothesized that strategic orientations of public research universities in economic development are related to both the context of the policy environment in

which they operate and the constraints of external demands to which they manage. It is assumed that research administrators interpret the policy context and then they act based upon their interpretations of the external environment. In turn, they attempt to transform the current policy context into one which will become more favorable in the future. In essence, their efforts are embodied in the intensity to which public research-oriented universities employ strategies in economic development. As economic development becomes an increasingly important revenue source for urban public universities, some institutions are amending their missions to incorporate these strategies.

#### The Public Policy Context for Public Research Universities

State universities are considered the most responsive units in higher education to the requirements of business, government, and community (Lynton & Elman, 1987). The creation and organization of the National Association of State Universities and Land Grant Colleges, over a century ago, illustrates the distinctive role of state supported higher education in addressing diverse, societal demands (Lynton & Elman, 1987; Osborne, 1987). In short, the delineation of that role can be traced to the founding of the first state university in 1785 and to the ensuing acts of stewardship.

A decade after the American Revolution the state university movement arose, transforming then-elitist higher education. The creation of publicly sponsored state universities was designed to "support the infant republic, help citizens, and promote economic development as well as train minds and improve manners" (Moos, 1981, p. 2) and it eventually resulted in two influential pieces of legislation which remain in effect today.

The formal role of state universities in socio-technological affairs was originally legislated in the Morrill Act of 1862, providing federal grants to states which established state colleges and land grant institutions. This early statute began a long-standing commitment of federal aid to American higher education to foster economic growth and national prosperity. The agricultural extension model, an early product of cooperative federal support, provided a conceptual framework for the education extension movement.

The federal Smith-Lever Act of 1914, a second piece of influential legislation, mandated the consideration and incorporation of public interests into federally funded research projects--a step further than the land grant legislation. It holds the public as the primary beneficiary of such research projects, providing them with agricultural and educational extension services through which they can obtain better access to information derived from the latest

research. In essence, this mandate facilitates an improvement to the Nation's economic growth and social well-being. These two extension models illustrate the long-term, perhaps oft forgotten, policy directions through which federal and state governments encourage interactions between university, industry, government, and community (Moos, 1981; Osborne, 1987).

Geographic location can be an important factor for interaction (AASCU, 1986). Federal programs including Urban Development Action Grants specifically promote metropolitan partnerships (Office of Technology Assessment, 1984). The research of economist David Birch (cited in Toloken, 1994) confirms that technically-oriented firms tend to locate near urban universities.

During the early 1980's state and the federal governments renewed their encouragement of university-assisted technology-based economic development (American Association of State Colleges and Universities ([AASCU], 1986). However, a major change surfaced in the early 1990's resulting from the end of the Cold War and the use of "national security" rationales to support high levels of federal funding for university research. Today, the post-Cold War policy context threatens both to reduce federal funding of what many policy makers refer to as "basic," "defense-related," or "curiosity-driven" research projects, and to augment funding for "development-oriented," "growth-

driven," "applied," or "strategic" research projects (Park, 1994). In essence, this two-fold agenda aims to improve America's scientific and technological competitiveness in a global marketplace (Abelson, 1995). However, recent congressional deliberations portray a policy environment for research and development which poses uncertain implications for global economic competitiveness and social well-being (Cordes & Burd, 1995).

In the new era of resource constraints the civilian (nondefense) research and development budget stands to lose, in real terms, approximately one-third of its current level of support by the year 2002. Current levels of expenditure are in jeopardy as the 104th Congress attempts to balance the federal budget by making significant cuts in federal discretionary spending. Spending cuts in federal research and development appear imminent but the magnitude of those cuts and their impact on research programs at universities cannot now be reliably estimated. Between 1988 and 1993 overall support for research and development remained flat, while the federal government's share fell five percent (see Table 1 below). Future federal budgets will probably continue and accelerate a pattern of reduced federal support for research and development (Cordes & Burd, 1995; Hager, 1995a, 1995b; Hager & Cloud, 1995; Idelson, 1995; Koszczuk & Cloud, 1995; MacIlwain, 1994).

Research universities, in essence, face a public policy context which threatens to destabilize and diminish a principal base of support. This policy environment contains the critical resources upon which research universities are dependent. The data displayed in Table 1 indicate that universities, though still reliant on the federal government for over 50 percent of their funding for research and development, became more diversified in terms of their sources of support for research and development.

Over a period of 20 years the federally funded percentage of academic research and development dollars declined, grew, and then declined again, but the 1993 federal share was the same as it was 15 years earlier in 1978. The rising percentage of dollars which came from institutions themselves may be explained by cost-sharing agreements, matching requirements, and in-kind contributions or other factors which remain unknown to the researcher.

It is also notable that over the twenty-year period from 1973 to 1993 total financial support for research and development grew nationally in constant dollars by \$55 billion while academe grew by approximately \$10 billion; however, only \$4 billion of that \$10 billion in growth came from federal sources. In essence, research universities became less reliant on federal research dollars during the last two decades and they became more diversified in their sources of financial support for research and development.

Diversification of sources of support can be achieved through alternative funding mixes, as depicted below. Resource dependence theory asserts that diversification is a strategy through which organizations attempt to loosen their dependencies (Pfeffer & Salancik, 1978).

TABLE 1  
Support for Research and Development

	1973	1978	1983	1988	1993
Billions of constant 1987 dollars					
US Total, all sources	\$75	\$80	\$102	\$129	\$130
Academe, all sources	7	8	9	13	17
Academe, federal sources	5	5	6	8	9
Sources of Academic R & D dollars					
Federal Government	69%	56%	63%	61%	56%
State & Local Governments	10	9	8	8	9
Industry	3	4	5	7	7
Academic Institutions	11	14	17	18	20
Other	7	8	7	7	8

Note. Source of data is National Science Board (1993) publication Science and Engineering Indicators, p. 333, 389.

Diversification can also be achieved through alternative program-service mixes. Killoren (1994) recognized that research-oriented universities may be diverse in terms of their capacities to conduct research and their preferences for alternative service and program delivery.

Following policy directives set by state and federal governments, institutions of higher education during the early-1980's began exploring alternative economic development strategies including: development of new businesses and technologies (Aldridge, 1986; AASCU, 1986a; Clarke, 1986; Doyle & Brisson, 1985; Peters & Fusfeld, 1983; Souder, 1986); improvements to physical plant and regional participation (White House Science Council [WHSC], 1986); enhancements of outreach services and graduate education (AASCU, 1986; Doyle & Brisson, 1985; Lynton & Elman, 1987; WHSC, 1986); and, advancements in decision-making capacity (Alabama Cooperative Extension Service [ACES], 1987; Moos, 1981; Tornatzky, 1983).

In summary, diversified organizations including public research universities can position themselves strategically as they strive to alleviate resource dependence and attempt to gain control over their external environments. They can engage in strategies which: reduce the proportion of resources exchanged with a particular group; develop reciprocal transaction agreements; exchange personnel; coopt interest groups; and induce governmental action (Pfeffer & Salancik, 1978). This study analyzes the combined influences of variations in federal research support and administrative structure on strategic orientations of public research universities in economic development.



### Significance of Study

This study describes and analyzes research university orientations in economic development. It offers a policy context to view research university involvement in economic development, tests three hypotheses derived from resource dependence theory, and adopts a model of administration developed by Pfeffer and Salancik (1978). In general, the model presented can be used to inform policy makers, public administrators, and management scholars so that they may better understand the externally-focused roles of their organizations. Specifically, the model offers to provide insight into typical roles of research administrators in obtaining alternative sources of funding, achieving resource growth, and stabilizing organizational outcomes. That administrative function can be discerned by analyzing the relationships of a particular strategic orientation of public research universities in economic development to a set of predictor variables which comprise a model of administration.

### Design, Methodology, and Hypotheses

This study employs a cross-sectional design in an effort to predict strategic orientations of American, public research institutions in economic development. The purposes of the study are fourfold:

- develop a better understanding of the joint influences of resource variations and competing demands on public

research universities;

- predict the prevalence of a strategic orientation in economic development based on two measures of recent environmental context and one measure of current organizational structure;
- provide data by which to assess the predictability of higher education's orientation toward economic development; and
- contribute to the building of resource dependence theory by testing its applicability to the practice of research administration in the public sector.

Data on 80 public doctorate-granting universities were gathered from archives such as government documents, university records, and personnel directories and from a mailed survey instrument. The Higher Education Economic Development Survey (HEEDS) instrument (see Appendix A) was employed to measure strategic orientations of public research universities in economic development. Survey respondents were chief research officers at public universities across the United States. Four criterion variables were derived from items contained in the HEEDS.

Those components will be discussed at length in Chapter Three which addresses methodology. After an examination of the reliability and validity of the HEEDS instrument, a central set of three hypotheses will be tested using multiple regression analysis. First, it is hypothesized that a relationship will exist between an economic

development orientation and Administrative Differentiation (defined as the number of offices responsible for research and graduate education). Second, it is hypothesized that a relationship will exist between an economic development orientation and Munificence (defined as a standardized rate of growth in financial support for research). Third, it is hypothesized that a relationship will exist between an economic development orientation and Dynamism (defined as a standardized rate of volatility in research support).<sup>1</sup>

A total of twelve hypotheses will be tested, three for each of four economic development orientations: (a) New Business and Technology Development; (b) Capacity Building; (c) Human Resource Development; and (d) Research, Analysis, and Evaluation. The theoretical constructs, their relationships, and a model of administration--components of the resource dependence framework--will be detailed in Chapter Two. Discussions of research design, sample characteristics, construct measurement, and statistical methods will be described further in Chapter Three and Chapter Four will present the results of statistical analyses. Results suggest that limited empirical support exists for the hypothesized relationships. Finally, Chapter Five presents some limitations of this cross-sectional study and some conclusions based on the empirical evidence and it offers some implications for scholarship and management.

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<sup>1</sup> A glossary which contains the definitions of these and other concepts and variables can be found in Appendix B.

CHAPTER TWO  
LITERATURE REVIEW  
AND HYPOTHESES

This dissertation employs resource dependence theory in a study of the university research management function. Resource dependence theory suggests that managers attend to and interpret--or enact--organizational environments in order to generate additional resources, stabilize organizational outcomes, and satisfy external demands (Pfeffer, 1987; Pfeffer & Salancik, 1978). University research administrators are charged with balancing the constraints of competing demands and knowing the context of policy environment (Merritt, 1993; Scott, 1981).

Two structures for managing research and graduate education functions prevail among American doctorate-granting universities. One administrative structure separates, or differentiates, research and education graduate functions and the other combines them. Furthermore, a continuing debate centers on the appropriate structure of university offices that have responsibility for research administration and graduate education functions (Council of Graduate Schools [CGS], 1986, 1990; Zar, 1992).

Kaplan (1959) asserts that most demands made on research administrators tend to originate from groups "outside of science and outside of research" (p. 42); such

external groups may include regulatory agencies, professional associations, advisory councils, industry leaders, and community groups. Hypothetically, a group which is interested strictly in graduate education affairs has a greater chance to obtain managerial attention under a differentiated administrative structure than under one which combines both research and graduate education functions into one department. For instance, the likelihood of response to an interest group for any given set of demands is one under a differentiated structure whereas it is one-half of that under a combined structure.

Administrative differentiation seeks to alter constraints on the organization which are imposed by external groups making competing demands. Pfeffer and Salancik (1978) suggest that a social constraint exists whenever the probability of an organizational response to one demand is greater, or less, than the probability of response to another demand. In sum, administrative differentiation, as a form of organization structure, is one type of strategy by which organizations attempt to heed competing demands (Pfeffer, 1987; Pfeffer & Salancik, 1978).

Diversification is another type of organizational strategy. Organizations can avoid external control and loosen their dependencies through diversification. The program-service mixes of organizations can be modified and their sources of financial support can become more diverse.

When an organization develops a more diverse set of programs and services, it then has a greater capacity to demonstrate compliance with external demands in some areas and affords it the opportunity to exercise autonomy in other program-service areas. Likewise, when an organization increases its number of suppliers, or achieves growth in its volume of resources, it then has similar capacities and opportunities. Although diversification may loosen an organization's reliance on a particular supplier it can lead to an increase the number of demands overall (Pfeffer & Salancik, 1978).

To summarize, resource dependence theorists argue that managerial efforts to acknowledge external demands, embellish resource flows, and stabilize organizational outcomes are the basic objectives of strategy. Resource dependence can be characterized by (a) importance of the resource for continued operation and survival, (b) interest group discretion over allocation, and (c) number of alternative sources (Pfeffer & Salancik, 1978). It can be argued that research universities via their portrayal of the policy environment will employ strategies which actively seek to loosen their dependency on the federal government, enhance the stability of resource flows, and cope with conflicting demands. The resource dependence framework views organizations as adopting diversification and differentiation strategies to cope with environmental context and social constraint. By extension, strategic

orientations of public research universities in economic development will be determined by recent resource variations and current administrative structure.

The next section of this chapter discusses resource dependence theory. It is followed by sections which contain discussions of diversification and differentiation. The final sections are devoted to a formulation of three primary research hypotheses and an adoption of a model of administration, as adapted from Pfeffer and Salancik (1978).

#### Resource Dependence Theory

Resource dependence theory examines how managers attempt to obtain important resources from their environment -information, money, people, and services. Organizations can adapt their structures in response to the environment, or alter their functions. They can attempt to change the environment by creating demand or seeking government actions that can assist them. In sum, the resource dependence perspective views organizations as adapting to their environments.

The environmental context for research universities throughout this post-World War II era can be characterized as cyclical growth and decline in funding for research and development. These universities continue to operate in a context in which they depend on the federal government for a major, but shrinking, portion of their research funding. In

addition, recent congressional deliberations over tax reduction, deficit elimination, and economic development policies pose a gloomy outlook for university research funding.

As a stream of research, resource dependence theory was generated from studies of managerial action regarding government policy and regulation (Pfeffer, 1972; Salancik, 1976), joint ventures (Pfeffer & Nowak, 1976), and hospital executives (Pfeffer, 1973) and it was employed in a study of university administrative structure (Tolbert, 1985). Tolbert (1985) found that university administrative structure is a function of the number and importance of different interests to be coopted, thus supporting an assertion of the resource dependence theorists regarding administrative differentiation. In addition, Tolbert (1985) points to the need for an investigation of the consequences of administrative differentiation.

Such a structure represents an organizational attempt to satisfy simultaneously the demands made by numerous interest groups. In essence, resource dependence theorists (Pfeffer & Salancik, 1978) assert that administrative differentiation facilitates the acknowledgement of external demands advanced by interest groups, it provides them with a sense of participation, and it offers them alternative courses of appeal. Thompson (1967) suggests that an organization establishes specific departments to deal with



particular aspects of the environment.

Developers of this viewpoint include Hannan and Freeman (1977) who state that "subunits of organizations, usually managers or dominant coalitions, scan the relevant environment for opportunities and threats, formulate strategic responses and adjust organizational structures accordingly" (p. 930). More important, it is Pfeffer and Salancik (1978) who provide the most comprehensive development of resource dependence theory. Pfeffer and Salancik (1978) view organizations as settings wherein individuals and groups with varying interests intermingle and exchange information and other resources and thus they can be considered purposeful coalitions of interest groups.

Organizations require resources from the environment and thus are not internally self sufficient. Consequently, they become interdependent with the organizations in which they exchange resources. "Interdependence exists whenever one actor does not entirely control all of the conditions necessary for the achievement of an action or for obtaining the outcome desired from the action" (Pfeffer & Salancik, 1978, p.40).

The heart of the external perspective is that activities and outcomes are explained by the context in which the organization operates. Evan (1966) coined the term "organization set" to refer to the set of organizations with which a focal organization conducts transactions.

Moreover, relationships between transacting organizations have been cast in terms of power and its inverse, dependence (Emerson, 1962).

Drawing from Emerson's (1962) power-dependence framework, Pfeffer and Salancik (1978) hold three factors as critical determinants of dependence: the importance of the resource for the survival of the organization, the degree to which another has discretion over the allocation and use of the resource, and the degree to which the other has control over the resource. In addition, they outline 10 conditions that will affect how compliant an organization A will be with the external demands D of another actor B: A is aware of D; A gets resources from B; these resources are important for A; A has no alternative sources of the needed resource; A does not control resources needed by B; compliance with D can be assessed by B; compliance with D is not in conflict with compliance to others in A's environment; A does not control the determination, formulation, or expression of D; A can comply with D; and A desires to survive. In the face of demands, often incompatible, from a variety of others, the attempts to satisfy any one are determined by the relative dependence on that one plus the extent to which its demands conflict with those of others (Pfeffer & Salancik, 1978).

Resource dependence theory addresses constraints imposed upon organizations due to conflicting demands. If

demands or constraints originate from less powerful groups, the organization may be able to avoid either the influence or the conditions which demand compliance. To avoid influence, the organization may be able to control information about itself which is available to others. In this way it can balance conflicting demands, lessen aspiration levels for all participants, and play groups against each other (Pfeffer & Salancik, 1978).

Alternatively, the organization may be able to avoid demand situations by influencing the formation or expression of demands or by controlling the definition of satisfaction. Pfeffer and Salancik (1978) elaborate on organizational attempts to manage resource dependencies. In essence, organizations can engage in strategies to alter their dependencies and diminish the necessity of compliance and thus they modify their environments.

Resource dependence theory takes a proactive view of organizations. They can be seen as operative in responding to and altering their environments. Aldrich and Pfeffer (1976) point out that the management of environments may be more important than management of the organization. The outcome of organizational actions is survival, growth, and stability.

Resource dependence theorists (Pfeffer & Salancik, 1978) elaborate the importance of the following: (a) the extent to which managers take into account the

organization's history; (b) how much attention they give to competing demands; (c) the relevance of those demands; and (d) the set of strategies which will balance the demands of competing groups and those which will increase and stabilize the flow of resources from the environment. In essence, the resource dependence model views organizations as dynamic and capable of both responding to and changing their environments (Aldrich & Pfeffer, 1976). According to resource dependence theory, environmental context is both a source and a product of managerial enactment, organizational negotiation, and political action (Pfeffer, 1987; Pfeffer & Salancik, 1978).

Pfeffer (1987) points out that resource dependence theory is conceptually applicable to organizations of any type, but it remains largely underdeveloped with regard the context of public policy and organization political activity. It stands to reason that in the public sector what one organization may gain in financial support another may lose because the total amount of available support for any given year is fixed for a given set of organizations. Given that the total research budget of the federal government is fixed for any given fiscal year, a mutual dependence--or interdependence--exists between and among organizations; for example, the federal government depends upon universities for the results of funded research projects while research universities depend on the overall

size of both the federal research budget and the set of universities in contention for those funds. Basically, interdependence connotes problems of uncertainty or unpredictability in exchange relationships to which organizations can respond via a restructuring of these relationships (Pfeffer & Salancik, 1978).

Pfeffer and Salancik (1978) state that "organization actions can be explained by situations of interdependence, uncertainty, and resource munificence confronting the organization" (p. 222). Interdependence occurs when organizations are heavily reliant upon a critical resource and therefore are dependent upon those who control the resource (Pfeffer & Salancik, 1978). Resource dependence theory can be used to predict what strategies research universities may employ in their efforts to mitigate the impacts of funding environment changes.

In summary, diversification and differentiation are two types of collective strategies (Pfeffer & Salancik, 1978) through which research universities attempt to manage external control. Strategic orientations in economic development may afford research universities an opportunity to interact more frequently with and to acquire additional resources from business, industry, and community. The next two sections of this chapter describe how organizations such as research universities can alter their interdependencies. The first section addresses strategies, specifically those

relating to economic development, by which universities may diversify their sources of funding and their deliveries of programs and services. The second section addresses strategies, specifically those relating to administrative structure, by which universities may satisfy the demands and constraints imposed by interest groups. A model of administration, as adapted from Pfeffer and Salancik (1978), and the primary research hypotheses comprising it are presented in the last section of this chapter.

Altering Interdependence:  
Strategic Orientations in Economic Development

Research universities alter their interdependence through resource diversification or growth in their resources. Growth is a means by which an organization increases the amount of resources overall and diversification is one by which it increases the number of alternative resource providers. Both diversification and growth can be accomplished through the formation of new transactions, the advocacy of government actions, and the promotion of cooperative activities (Pfeffer & Salancik, 1978).

Contemporary higher education has been acknowledged as a key player in technology-based economic development strategy (Osborne, 1987). The American Association of State Colleges and Universities ([AASCU], 1986) conducted the first extensive study that identified the various roles of

higher education institutions in economic development. In its survey of 300 or more public institutions, AASCU identified a number of key variables which are reported to influence those roles including resource availability, organizational structure, and institutional characteristics.

The AASCU study was a precursor to the design of the Higher Education Economic Development Survey [HEEDS] (Fitzpatrick, Burkhalter, Hethcox & Wilmouth, in press; Hethcox, 1990). The purpose of the HEEDS instrument is to gauge the prevalence of economic development strategies already implemented at colleges and universities, from the perspectives of research administrators. Utilization of the HEEDS instrument in this study will help discern to what extent public research universities vary their economic development strategies. The next four sections are devoted to describing, in turn, strategies comprising the following four types of strategic orientation in economic development: (a) New Business and Technology Development, (b) Capacity Building, (c) Human Resource Development, and (d) Research, Analysis, and Evaluation.

#### New Business and Technology Development

This orientation, the first of four in the HEEDS instrument, is characterized by strategies employed by universities which "take a direct role in promoting new enterprises that utilize knowledge developed in the university" (AASCU, 1986,

p. 10).

New business and technology development can be facilitated through managerial, technical, and financial services provided to businesses by universities. That assistance can take an educational focus in the form of entrepreneur training programs and course work in business and engineering or it can take a public service focus in the form of providing community access to university research centers and laboratories. Through such arrangements, business and industry can adopt state-of-the-art management concepts and engineering applications by which to expand their product lines, to develop their services, or to improve their operations (Aldridge, 1986; AASCU, 1986; Clarke, 1986; Doyle & Brisson, 1985; Osborne, 1987; Peters & Fusfeld, 1983; Souder, 1986).

These business and technology development arrangements can also be facilitated by university compilation and maintenance of computerized directories which are designed to facilitate information exchange. Such directories can provide immediate referrals to university research centers, faculty expertise areas, and local sources of venture capital. In essence, the outward transfer of knowledge from academe can be facilitated via data bases that provide industry representatives, community groups, and agency personnel with easy access to university researchers, instructional programs, and institutional services (American



Association of State Colleges and Universities [AASCU], 1986; Aldridge, 1986).

Doyle and Brisson (1985) acknowledge that small, especially new, technical-oriented businesses are organizations which were most dependent on assistance from academe. This assistance may include information about technology licensing, the procurement of government grants and contracts, the provision of business development services, and the acquisition of various resources. Furthermore, the implementation of university policies which govern faculty consulting and remuneration, patent and licensing procedures, and conflicts of interest can facilitate additional interactions between and among universities, industries, and financiers (AASCU, 1986; Clarke, 1986; Doyle & Brisson, 1985; Osborne, 1987; Peters & Fusfeld, 1983; Souder, 1986).

#### Capacity Building

This orientation, the second of four in the HEEDS instrument, is characterized by strategies employed by universities which help them replace or upgrade outmoded facilities so that they can expand their technological capacity.

The WHSC (1986, p. 20) proposed that the federal government repair the nation's "most important scientific and technological resource" via tax deductions to industry

which are equal to the full market value of their equipment donations and grants they awarded to higher education institutions.

The capacity for technological growth and development can be enhanced by renovating academic facilities and replacing obsolete equipment. Institutions of higher education can lobby government agencies and others for actions which will facilitate capital improvements. Such actions can include advocating shorter amortization periods, reducing grant restrictions, and providing grants which facilitate university-community cooperatives and joint ventures.

#### Human Resource Development

This orientation, the third of four in the HEEDS instrument, is characterized by strategies employed by universities which can facilitate "education programs to meet the emerging human resource requirements of the new economy" (AASCU, 1986, p. 10).

Economic changes pose new challenges to higher education as new fields emerge that require new skills. The American Association of State Colleges and Universities ([AASCU], 1986) states that "individuals need to receive frequent training in the current environment of rapid technological and informational change" (p. 10). The provision of multidisciplinary, graduate-level problem

solving exercises, by which students (WHSC, 1986) and diverse community groups (AASCU, 1986) can gain multiple perspectives.

Lynton and Elman (1987) point to policies which permit more flexible class schedules and those which reward the public service contributions. Consequently, the general public and policy makers can become better informed about the human resources developed by universities and the contributions of higher education to economic development. In addition, human resource development can be accomplished by equipping communities to understand better their problems.

University involvement in the community helps both parties to meet their regional needs. Conferences and advisory councils are two examples of mechanisms through which universities can educate the general public and policy makers and demonstrate their contribution to the development of human resources (AASCU, 1986; Doyle & Brisson, 1985).

#### Research, Analysis, and Evaluation

This orientation, the last of four in the HEEDS instrument, is characterized by strategies employed by universities which can provide and share information with decision makers from industry, government, and other institutions.

The collection and maintenance of informative data is of paramount importance to the role of higher education in

an information economy (Tornatzky, 1983) as it facilitates an accurate decision making process and a strategic acquisition of scarce resources (Moos, 1981). Data bases are essential to facilitate needs assessment, policy analysis, forecasting, outcome evaluation, and impact prediction (Moos, 1981).

Data which is readily available increases the transmission of information between university and industry, among disciplines, and across industrial sectors (Alabama Cooperative Extension Service, 1987; Moos, 1981). Also it permits comparisons and evaluations for purposes of strategic planning (Moos, 1981) and for formation of strategic alliances (Tornatzky, 1983).

To recap, strategic orientations in economic development function to diversify services, programs, and resource bases so that research universities can diminish their reliance on the federal government and attempt to alleviate external demands. Diversification is one method through which organizations can alter the nature of their interdependence. Universities can attempt to balance and satisfy competing claims for its programs and services via another method of altering interdependence, namely administrative differentiation. It is the topic of discussion contained in the next section.

Altering Interdependence:  
Administrative Differentiation

Pfeffer and Salancik (1978) state "enactment of dependencies, contingencies, and external demands are in part determined by organizational structures..." (p. 260). Administrative differentiation, by extension, then influences how research administrators come to know those situations. Scott (1981) contends that research administrators are employed to keep pace with developments in the policy environment. Furthermore, demands made on research administrators tend to originate from groups "outside of science and outside of research" (Kaplan, 1958, p. 42).

This external focus of research administrators takes into account the demands of customers, suppliers, competitors, and regulators (Valentine, 1994). More importantly, acknowledgement of those constraints can be influenced by administrative structure (Pfeffer, 1987; Pfeffer & Salancik, 1978), which is a subject of recent debate (Council of Graduate Schools [CGS], 1986, 1990; Zar, 1992). One method employed to deal with the host of demands is the differentiated executive position (Pfeffer & Salancik, 1978).

Chief research officers are charged with the management of these constraints by virtue of their position in the organization. University research offices are focal points because they interact with other organizations that provide

resources, make demands, receive services, and issue regulations. In essence, organized research units, by heeding the knowledge needs of external constituencies, can provide universities with access to more resources in the future (Geiger, 1990).

Public research universities obtain the bulk of their operating funds from their host states, yet they receive, on average, 60 percent of their research funding from federal agencies. Furthermore, Tornatzky (1983) stated:

University vice presidents for research are in an experimenting mood...with increasing pressure to replace declining Federal dollars with other sources of research funding. Again, real-time, well-instrumented attempts to systematically intervene in the unstructured, uncertain field of university/industry relations could yield untold beliefs in better harnessing the nation's intellectual capital (p. 9).

The administrative structure of central offices at universities that oversee research and graduate studies has been the topic of recent debate and investigation. Zar (1992) found that slightly less than half (47 percent) of all American doctorate-granting universities separate the responsibilities for research administration and graduate studies. The Council of Graduate Schools ([CGS], 1990), after years of pondering the issue of appropriate

administrative structure, issued a statement of policy on the organization and administration of graduate education. The CGS suggests that managerial responsiveness to competing demands will be greater under a differentiated administrative structure (one which separates the offices of the chief research officer from that of the chief graduate studies officer) than under a dual administrative structure (one which combines the offices).

This researcher did not find an empirical study that examined the consequences of administrative differentiation on university strategy. However, Tolbert (1985) examined the determinants of university administrative differentiation by using a resource dependence perspective, in part, while controlling for institutional type and size. Tolbert found that the size and the type of institution were the strongest predictors of administrative differentiation in public institutions and that the resource environment did not exert a significant influence on administrative structure. Drawing from Tolbert's work, the implication here is that the environment is not expected to influence administrative differentiation but it will be influenced by size. In addition, this study will examine the consequences of administrative differentiation on organizational outcomes.

The influence of administrative structure on actions and outcomes is an "age-old question" (Levine, Peters, &

Thompson, 1990, p. 212) in the field of public management, but it is one that continues to attract the attention of academicians, practitioners, and policy makers alike. In addition, the work of Zar (1992) reminds us that "questions regarding the administrative organization of university research and graduate studies are ongoing across the country" (p. 46).

In summary, administrative differentiation is a function of the number and importance of interests and as a consequence it effects greater organizational responsiveness to external demands (Pfeffer & Salancik, 1978). Zar (1992) points out that the two-person, or differentiated structure, can be criticized for its lack of responsiveness--a criticism that stands in opposition with that of Pfeffer and Salancik (1978) and to that of the Council of Graduate Schools ([CGS], 1990). In essence, university research administrators hypothetically occupy positions which attempt to balance competing demands, loosen resource dependence, and promote outcome stability. The hypothesized effects of environmental context and external constraint on a strategic orientation of public doctorate-granting universities in economic development are outlined in the following section.

### Hypotheses

The nature of university resource dependence may be altered when public research administrators adopt particular



managerial roles. These roles can be discerned through a resource dependence model. A model of administration, drawn from resource dependence theory, contains three primary hypotheses which relate the situations of environmental uncertainty, resource munificence, and administrative differentiation to strategic orientations in economic development.

**It is hypothesized that a positive relationship will exist between an economic development orientation and administrative structure, or Administrative Differentiation (Hypothesis One).** Organizations with differentiated administrative structures are more effective in the acknowledgment of external demands than organizations with simpler, combined administrative structures. Furthermore, acknowledgement of competing demands may be greater for organizations with a differentiated structures than for those without such a structure; the greater the level of acknowledgement, the more prevalent is an economic development orientation.

**It is hypothesized that a negative relationship will exist between an economic development orientation and a standardized rate of growth, or Munificence (Hypothesis Two).** Organizations with a rate of growth in their financial support which is larger than the rate experienced by comparable organizations will vary strategic orientations less frequently. Conversely, organizations that have

experienced a comparatively smaller rate of growth will be expected to vary strategic orientations more frequently than those that have experienced a large rate of growth; the smaller the rate of growth, the more prevalent is an economic development orientation.

**It is hypothesized that a positive relationship will exist between an economic development orientation and a standardized rate of instability, or Dynamism (Hypothesis Three).** Organizations which have experienced a rate of instability in their financial support which is smaller than the rate experienced by comparable organizations will vary their strategic orientations less frequently than those that have experienced a comparatively larger rate of instability. Conversely, organizations that have experienced a larger rate of instability will vary their strategic orientations more frequently than those that have experienced a small rate of growth; the larger the rate of instability, the more prevalent is an economic development orientation.

The external control model advanced by resource dependence theorists (Pfeffer & Salancik, 1978), adapted herein, argues that environmental context influences organizational actions and, in turn, those actions are strategic in the sense that they attempt to transform the current context in a more favorable one in the future. By extension, the ability of public research universities to orient themselves strategically requires the acuity of

administrators toward both the context of the policy environment and the constraints imposed by the competing demands of organizations and individuals in that environment. In the next section, the reader's attention is turned toward three hypothetical relationships that comprise the administrative model.

#### Model of Administration

The model of administration, as posited by Pfeffer and Salancik (1978), relates the strategic orientation to environmental context (Munificence and Dynamism) and to social constraint (Administrative Differentiation). That model can help describe the typical managerial role of the public university research administrator in facilitating organizational altering of interdependence. Pfeffer and Salancik (1978) outlined three possible managerial roles--the symbolic, the responsive, and the discretionary--in their administrative model.

Resource dependence theory suggests that research administrators exercise a discretionary role in the management of external control. In this mode, organizational action focuses on altering the system of constraints and dependencies. The discretionary role can be observed when a particular orientation is related significantly to both the environmental context (Munificence and/or Dynamism) and the social constraint (Administrative

Differentiation).

In this study, it is expected that an economic development orientation (as calculated from the survey responses of senior research administrators) will correlate significantly with constraint and context. In essence, this implies that research administrators pay attention to policy developments, acknowledge demands of competing groups, and then respond by taking discretionary actions to loosen future dependencies and reduce external control. Therefore, it can be concluded that administrative enactment of environmental context is fairly accurate and the administrator acknowledges the constraints of groups which are imposing competing demands.

TABLE 2  
Characteristics of An Administrative Model

Variable	Role		
	Symbolic	Responsive	Discretionary
Munificence	S	I	S
Dynamism	S	I	S
Administrative Differentiation	I	S	S

Notes. Adapted from Pfeffer and Salancik (1978).  
S = significant relationship. I = insignificant relationship.

The responsive role can be observed when a particular orientation is significantly related to Administrative Differentiation, but not to Munificence nor Dynamism. In other words, the economic development orientation, as reported by the research administrator, correlates solely with administrative structure (Administrative Differentiation). In essence, research administrators can be considered responsive to social constraints. In this mode, as organizational managers assess the context, determine the method of adaptation to that context and implement the adaptation, they decide which demands to heed or which to reject. Therefore, it can be concluded that the administrator responsively acknowledges competing demands.

The symbolic role can be observed when a particular orientation is significantly related to Munificence and Dynamism and not related to Administrative Differentiation. In essence, the administrator pays attention to policy developments but fails to be responsive to the demands of competing groups. Therefore, it can be concluded that the frequency of employment for an economic development orientation corresponds highly with managerial interpretations. Table 2 above summarizes the model of administration, as adapted from Pfeffer and Salancik (1978). Table 3 below summarizes the component variables, their definitions, and their predicted effects on a strategic orientation.

TABLE 3  
Definitions of Variables and Their Predicted Signs

Variable	Definition	Prediction
Strategic orientation: <sup>a</sup> NBTB CB HRD RAE	Mean weighted <sup>b</sup> response to items contained within section of HEEDS for any given institution	Criterion variable
Munificence	Standardized rate of growth in federal research funding for any given institution	-
Dynamism	Standardized rate of volatility in federal research funding for any given institution	+
Administrative differentiation	Dummy variable set to one if research and graduate studies are administered from separate offices, zero otherwise, for any given institution	+
Log of size	Natural logarithm of student headcount enrollment at any given institution	No prediction

<sup>a</sup>Each of four dependent variables are from the Higher Education Economic Development Survey (HEEDS), which contains the following sections: New Business and Technology Development (NBTB); Capacity Building (CB); Human Resource Development (HRD); and Research, Analysis, and Evaluation (RAE).

<sup>b</sup>Items weighted by factor loadings and used in the calculation mean responses for each of the four sections of HEEDS.

This study tests three primary hypotheses in order to discern the predominant role of the research administrator for a given economic development orientation. For example, the discretionary role in the orientation New Business and Technology Development can be observed when it has a high statistical correspondence with all three predictor variables (Munificence, Dynamism, and Administrative Differentiation). University research offices have varied administrative structures and the administrators holding positions within such structures can play various managerial roles. Their roles can be discerned by testing the three primary hypotheses that comprise the model of administration and then examining the results therefrom.

In summary, this chapter discussed three primary hypotheses suggested by resource dependence theory and organizational alteration of the nature of its interdependence according to that theoretical framework. Resource dependence theory takes a proactive view of organizations. It asserts that they are capable of both adaptation to and manipulation of environmental context and social constraint. We now turn to Chapter Three; it describes the research methodology.

### CHAPTER THREE RESEARCH METHODOLOGY

The first section of this chapter presents the research hypotheses. The second section describes the study's research design. The third section describes the study's sample. The fourth section discusses measurement and statistical control. The fifth section covers statistical procedures relevant to the analysis of data.

#### Hypotheses

The model of administration, adapted from Pfeffer and Salancik (1978), relates four strategic orientations in economic development individually to a set of three central predictor variables and one control variable. A total of 12 hypotheses, three primary for each orientation, which were derived from resource dependence theory will be tested in this study. The twelve hypotheses are stated below:

Hypothesis 1a: New Business and Technology Development will be negatively related to Munificence when holding constant Dynamism and Administrative Differentiation and controlling for Size.

Hypothesis 1b: Capacity Building will be negatively related to Munificence when holding constant Dynamism and Administrative Differentiation and controlling for Size.

Hypothesis 1c: Human Resource Development will be negatively related to Munificence when holding constant Dynamism and Administrative Differentiation and controlling for Size.



- Hypothesis 1d: Research, Analysis, and Evaluation will be negatively related to Munificence when holding constant Dynamism and Administrative Differentiation and controlling for Size.
- Hypothesis 2a: New Business and Technology Development will be positively related to Dynamism when holding constant Munificence and Administrative Differentiation and controlling for Size.
- Hypothesis 2b: Capacity Building will be positively related to Dynamism when holding constant Munificence and Administrative Differentiation and controlling for Size.
- Hypothesis 2c: Human Resource Development will be positively related to Dynamism when holding constant Munificence and Administrative Differentiation and controlling for Size.
- Hypothesis 2d: Research, Analysis, and Evaluation will be positively related to Dynamism when holding constant Munificence and Administrative Differentiation and controlling for Size.
- Hypothesis 3a: New Business and Technology Development will be positively related to Administrative Differentiation when holding constant Munificence and Dynamism and controlling for Size.
- Hypothesis 3b: Capacity Building will be positively related to Administrative Differentiation when holding constant Munificence and Dynamism and controlling for Size.
- Hypothesis 3c: Human Resource Development will be positively related to Administrative Differentiation when holding constant Munificence and Dynamism and controlling for Size.
- Hypothesis 3d: Research, Analysis, and Evaluation will be positively related to Administrative Differentiation when holding constant Munificence and Dynamism and controlling for Size.

### Research Design

This study employed a cross-sectional design in an effort to develop results that can be used to predict strategic orientations of research institutions in economic development. The sample consisted of a national cross-section of 80 public doctorate-granting universities in the United States. Survey and archival data were collected from a sample of institutions selected using a simple random sampling procedure.

### Sample

Archival data were collected from government publications, personnel directories, and university records. Survey data was collected via the Higher Education Economic Development Survey; it was employed to gather data on the strategic orientations of those universities in economic development. Survey respondents were chief research officers at public universities across the United States.

The survey was administered using a three-wave method designed to achieve high response rates (Cote, Grinnell, & Tompkins, 1986) to senior research administrators who were (a) received by mail the Higher Education Economic Development Survey (HEEDS) and (b) then contacted by telephone and e-mail to obtain data on federal research dollars awarded for fiscal years 1993 and 1994. This contact was initiated only after (a) the completed

instrument was received by the researcher or (b) the researcher was told that a response to the survey was not forthcoming.

The respondents were senior research administrators who are employed at the sample of public doctorate-granting institutions. The names, position titles, addresses and telephone numbers of senior research administrators are listed in one or more directories including the Council of Graduate Schools' (CGS) 1994 Membership Directory, the Society of Research Administrators' (SRA) Membership Directory 1994, and the Higher Education Publications (HEP), Incorporated '94 Higher Education Directory.

Other sources of data include government documents and the Carnegie Foundation for the Advancement of Teaching ([CFAT], 1987) publication A Classification of Institutions of Higher Education. That listing is compiled approximately every seven years after CFAT classifies institutions of higher education. Private and public institutions are listed separately and individually in that classification directory.<sup>1</sup>

CFAT classifies American institutions according to: 1) the annual number of doctorate degrees conferred; 2) the number of disciplines represented by those doctorate

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<sup>1</sup>Only public doctorate-granting institutions are of interest to the researcher due to doctoral program requirements and the nature of this study.

degrees; and 3) the annual dollar volume of federally-sponsored research. The sample of public institutions was drawn from the population using a simple random sampling technique with the aid of a random number table.

TABLE 4  
Carnegie Classifications of Public Institutions

Classification	Population		Sample	
	N	Pct.	n	Pct.
RESEARCH	71	53%	39	49%
Research I	45	34	22	28
Research II	26	19	17	21
DOCTORATE	63	47%	41	51%
Doctorate I	30	22	18	23
Doctorate II	33	25	23	29
TOTAL	134		80	

Note. Source of data reported above is the Carnegie Foundation for the Advancement of Teaching (1987) A Classification of Institutions of Higher Education.

Table 4 shows that 53 percent of the population of 134 institutions are classified "Research I" or "Research II" according to CFAT. In contrast, 49 percent of the sample are similarly classified "Research" institutions (see Table 4 above). Analyses which will be presented in Chapter Four indicate that such differences are negligible and affirm that the sample is representative of the population.

### Measurement and Variables

The research design relates measures of economic development orientation to two measures of the environment, one measure of administrative structure, and one control variable. The control variable size was employed after taking its log transformation. The three predictor variables are Munificence and Dynamism which serve as measures of environmental context and Administrative Differentiation which serves as a measure of social constraint.

The criterion variable, **Economic Development Strategic Orientation** (EDSO), was measured using the Higher Education Economic Development Survey (HEEDS) as validated by Fitzpatrick, Burkhalter, Hethcox, & Wilmouth (in press). It contains items designed to measure four factors, which are: New Business and Technology Development; Capacity Building; Human Resource Development; and Research, Analysis, and Evaluation.

The HEEDS can be deemed a useful instrument after this researcher conducted two additional analyses. First, it has Cronbach alpha coefficients which exceed .70 (see end of Table 5 for values), the minimum value necessary for an indication of internal reliability. An alpha coefficient "provides a conservative estimate of a measure's reliability" when it exceeds 0.70 (Carmines & Zeller, 1979, p. 45).

Second, principal components analysis with orthogonal rotation was also performed by this researcher and it revealed that four factors accounted for approximately 62 percent of the instrument's total variance; items retained had loadings greater than .40, also presented in Table 5 below.

HEEDS contains a uniform six-point response scale to record the frequency to which universities employ a given strategy (see Appendix A). In addition, HEEDS contains a "Don't Know" (DK) response option was included "to screen out respondents who do not have any knowledge of an activity and thus increase the accuracy of other responses" (Hethcox, 1990, p. 33). The original scale of the HEEDS instrument was reversed to one in which a "1" equates to "Never" and a "6" equates to "Always." This was done to simplify presentations of data.

A weighted mean item response was calculated by weighting the non-DK responses by their respective factor loadings and then calculating an arithmetic average based on items answered by respondents for given section, or EDSO. The proportion of all responses which were either answered with a DK or left blank amounted to less than two percent. These weighted responses were then regressed individually on the set of predictor and control variables. Four separate models, one for each EDSO, were produced as a result.

TABLE 5  
Factor Analysis of HEEDS Items

Items	Factors and Loadings <sup>a</sup>			
	NBTD	CB	HRD	RAE
2-1 Develop linkage mechanisms between venture capital networks and entrepreneurs	<u>54</u>	8	38	25
2-2 Provide management and technical assistance to potential entrepreneurs	<u>87</u>	7	10	6
2-3 Provide entrepreneurial assistance programs with emphasis on new business development, i.e., evaluation of technical feasibility, market evaluation, production costs, financial viability, and general business and management advice	<u>75</u>	1	19	21
2-5 Develop mechanisms that stimulate new business development, e.g., incubators, research centers, entrepreneurial training programs, and innovation centers	<u>70</u>	7	15	11
2-7 Set measurable goals for data analysis and evaluation of institutional programs promoting new businesses for economic development	<u>69</u>	4	24	27
2-8 Maintain a computer data base inventory of faculty research	<u>58</u>	7	11	2

TABLE 5 (continued)  
Factor Analysis of HEEDS Items

Items	Factors and Loadings			
	NBTD	CB	HRD	RAE
2-9 Provide industries and appropriate government agencies access to relevant faculty research activities specifically for aiding economic development	<u>53</u>	16	27	17
3-2 Promote shortened period of amortization on new academic facilities from 50 years to 20 years	9	<u>89</u>	27	13
3-5 Advocate greater flexibility of federal funding that allows investigators discretionary use of up to 10 percent of research monies	20	<u>91</u>	12	15
3-7 Advocate federally funded block grants that encourage multidisciplinary and regional university cooperation	2	<u>69</u>	9	6
3-9 Advocate establishment of a tax deduction equal to the full market value of industrially contributed equipment	26	<u>77</u>	3	25
4-1 Recognize public service contributions that promote economic development activities in an instructional reward system in addition to the traditional scholarly engagements	35	18	<u>47</u>	3



TABLE 5 (continued)  
Factor Analysis of HEEDS Items

Items	Factors and Loadings			
	NBTD	CB	HRD	RAE
4-2 Offer appropriate instruction at flexible times to meet the unique needs of industry, community, and state/local government in planning for economic development	18	20	<u>70</u>	18
4-6 Encourage academic policy that requires multidisciplinary graduate study with the framework of traditional departments	12	8	<u>63</u>	32
4-7 Establish advisory councils and other linkage mechanisms to keep in touch with community needs	5	25	<u>86</u>	12
4-8 Build capacity to address economic development priorities through symposia and conferences involving diverse community groups including business, local labor and governmental leaders and faculty	30	2	<u>85</u>	9
4-9 Educate policy makers and the general public about university resources that could promote economic development	12	13	<u>84</u>	6
4-10 Develop centers for excellence that focus on existing service areas in which the institution has expertise	1	11	<u>60</u>	2

TABLE 5 (continued)  
Factor Analysis of HEEDS Items

Items	Factors and Loadings			
	NBTD	CB	HRD	RAE
5-1 Maintain a management information system within an office of institutional research to diagnose problems and to analyze alternatives in policy analysis, needs assessment, forecasting, impact predictions, strategic planning, and economic development	5	7	15	<u>75</u>
5-4 Establish guidelines to transform institutional research into a management information system	20	10	37	<u>70</u>
5-5 Provide cooperative extension networks with access to on-campus data bases to diagnose problems and to analyze alternative economic development strategies	18	24	13	<u>87</u>
5-7 Maintain an empirical data base for comparison and evaluation of innovation processes among university, industry, community, and state and local governments	16	18	11	<u>63</u>
Factor Eigenvalue <sup>b</sup>	3.69	3.01	4.28	2.69
Cronbach's Alpha for Factor <sup>c</sup>	.72	.86	.83	.76

Notes. Results are from this study; n = 80; only loadings > .40 are presented in table and reported as rounded absolute values which were multiplied by 100.

<sup>a</sup>Four factors explain 62% of the total variance.

<sup>b</sup>Cronbach's Alpha coefficient is .89 overall for all items combined in HEEDS instrument.

Environment

Aldrich (1979) identified six dimensions of the environment which were subsequently reduced to a parsimonious set of three by Dess and Beard (1984); their correspondence follows:

<u>Aldrich</u>	<u>Dess and Beard</u>
Capacity	Munificence
Stability-Instability	Dynamism
Homogeneity-Heterogeneity	Complexity
Concentration-Dispersion	

Dess and Beard's (1984) set of dimensions received consequential support through a confirmatory factor analysis (Rasheed & Prescott, 1992), which reported that a three-factor structure explained 94 percent of variance in their data and coefficient alphas were in excess of 0.80. Single indicators were selected from that analysis to represent the munificence and dynamism dimensions.

**Munificence** is defined as the standardized rate of growth, or decline, in an institution's federal-dollar volume of research. Munificence was calculated using an institution's annual change in its dollar volume of research awards over a period divided by the average volume for that span of time (Dess & Beard, 1984). It is the standardized slope coefficient resulting from a regression model that uses a five-year window.

**Dynamism** is defined as the standardized rate of volatility in an institution's federal-dollar volume of research. Dynamism was calculated using an institution's

annual fluctuation in its dollar volume of research awards over a period divided by average volume for that span of time (Dess & Beard, 1984). It is the standard error of the slope estimate which resulted from the same regression model used to calculate Munificence. Five fiscal years, 1990 through 1994, were used to calculate the values of the variables Munificence and Dynamism.

A number of potential problems may exist when using archival measures of the environment (Boyd, Dess, & Rasheed, 1993). One problem of which is the possibility that managers give more weight to recent events than to those in the immediate past. Wholey and Brittain (1989) pointed out that the most recent data may not affect administrator perceptions when systematic variation exists over a period of time. Therefore, an analysis of the autoregressive nature of the data was performed and it revealed that significant variation exists on a year-to-year.

The one- and two-period lags indicated the need to collect the most recent data on research and development dollars: obligations lagged on itself one year explains approximately 75 percent of variation and when lagged on itself two years R-square drops to approximately to 52 percent. These results suggest that administrators would mostly likely pay attention, and that organizations would most likely respond, to the most recent resource variations. Thus, the researcher decided to use the most recent data.

Two sources of data, therefore, were used for the measurement of Munificence and Dynamism: (a) the National Science Foundation (NSF) which compiles and publishes each institution's annual dollarwise award volume of federally-funded research in Federal Support to Universities, Colleges, and Nonprofit Institutions for fiscal years 1990, 1991, 1992, and 1993; and (b) the last year of data, fiscal year 1994, was gathered by contacting offices of research administration. It is possible that the likelihood of error in the measurement of Munificence and Dynamism was increased as a result of using archival award data in conjunction with data self-reported by the institutions.

#### Administrative Differentiation

**Administrative Differentiation** was measured by the considering the number of top-level administrative offices (Pfeffer & Salancik, 1978; Tolbert, 1985) that directly oversee an institution's research and graduate studies functions (Zar, 1992). For institutions where independent offices administer research and graduate studies, as indicated by the CRO's position title and by the name of the administrative office, this variable is coded with a "1;" otherwise, it is coded with a "0." As noted below at the bottom of Table 6, the sources of data for measurement of administrative differentiation are CGS' Directory, Society of Research Administrators' SRA Membership Directory, 1994,

and the Higher Education Publications' hep Higher Education Directory 1994.

Most of the sample institutions had offices which administer both functions, research and graduate studies, whereas it was just the opposite for the population. However, that difference is negligible in the sense of representativeness as indicated by the results from a difference-of-proportions test.

TABLE 6  
Administrative Structure  
of University Research Offices

Administrative Structure	Population		Sample	
	N	Pct.	n	Pct.
Differentiated	71	53%	35	44%
Combined	63	47	45	56
TOTAL	134		80	

Note. Sources of data reported above include: Council of Graduate Schools' Directory; Society of Research Administrators' SRA Membership Directory, 1994; and Higher Education Publications' hep Higher Education Directory 1994.

#### Statistical Control

The scale of an institution's operation can affect its capacity to garner resources and its ability to orient itself towards one or more economic development orientations; a large institution, as opposed to a small one, may be better equipped to acquire a larger amount of

resources and maintain a more diverse set of orientations.

Carnegie classifications are widely used in research on higher education as a variable for scale (Phalunas, 1991). However, supplemental analyses (not reported here) confirmed that the ordinal Carnegie classes were strongly and significantly associated with the variable Size. Consequently, this researcher chose to use a ratio-level versus an ordinal-level variable.

**Institution size** was measured by taking a logarithm of total student headcount enrollment as reported in the 1994 Higher Education Directory. Size is commonly used as a statistical control in studies of the organization-environment relations because it exerts a confounding influence on the discretion and capacity of institutions to respond to the resource environment and to pursue organizational activity. For example, the amount of resources that an institution receives from state government for its operations are derived, in part, from enrollment. Therefore, for purposes of control and replication, a log transformation of the variable Size was employed in this study. Table 7 below presents a recap of the variables and the type of data source from which they were gathered.

TABLE 7  
Study Variables and Data Source Types

Variable	Type
<b>Criterion:</b>	
New Business and Technology Development	Survey
Capacity Building	Survey
Human Resource Development	Survey
Research, Analysis, and Evaluation	Survey
<b>Predictor:</b>	
Munificence	Archival
Dynamism	Archival
Administrative Differentiation	Archival
<b>Control:</b>	
Log of Institution Size	Archival

#### Methods of Statistical Analysis

Methods of statistical analysis, in general, include secondary methods such as principal components analysis, univariate analysis, correlation analysis, one-way analysis of variance (ANOVA) or t-tests, and correlation analysis. The primary method of statistical analysis was multiple regression analysis. The hypotheses contained within the model of administration will be tested using multiple regression analysis.



The results from the regression analysis procedure were tested using a .05 level of significance for a one-tail test; a subsidiary correlation matrix is located in Appendix C for readers interested in bivariate relationships rather than partial relationships. In addition, univariate analysis was used to calculate descriptive statistics on the responses to the survey items and the strategic orientations. Chapter Four presents the results from the various statistical tests including univariate tests for representativeness of the sample and normality of the frequency distributions.

## CHAPTER FOUR RESULTS

The first section of this chapter discusses briefly the results of t-tests which were performed to detect any possible differences between the sample and the population on archival variables. The second section describes selected characteristics of the sample institutions. The third section presents the results of multiple regression analysis. Although the response rate achieved in this study exceeds 83 percent the researcher examines the extent to which the sample is representative of the population.

### Sample Characteristics

Archival data were collected on variables from the population of 134 institutions. T-tests were performed to compare each variable's mean for the 80 sample institutions against those of the population. These variables and the corresponding  $t$  values (placed within parentheses) are as follows: munificence (1.10); dynamism (1.09); administrative differentiation (0.36); size (0.37) and log of size (0.30); federal percentage of research dollars (0.00); Carnegie classification of institutions (0.86). None of these variables was found to vary significantly at the .05 significance level. Results indicate that the sample archival data is representative of the population.

TABLE 8  
 Characteristics of Sample Institutions<sup>a</sup>

Variables	Mean	s.d.	Range	
			Low	High
New Business & Technology Development	3.45	0.87	1.60	5.67
Capacity Building <sup>b</sup>	2.86	1.26	1.00	6.00
Human Resource Development	3.55	0.84	1.86	6.00
Research, Analysis, & Evaluation <sup>c</sup>	2.54	1.08	1.00	6.00
Munificence	0.18	0.17	-0.25	0.81
Dynamism	0.10	0.11	0.01	0.57
Administrative Differentiation	0.44	0.50	0.00	1.00
Log of Size <sup>d</sup>	9.80	0.58	7.51	10.68
Federal Percentage of Total Research Dollars	61.00	14.50	25.00	84.00

Notes. Data as calculated by author. Data reported above on the four economic development orientations are not weighted by their respective factor loadings in order to simply their presentation. The frequency scale was reversed in order from that shown on the HEEDS instrument. That six-point scale, as converted, is as follows: 1 = Never; 2 = Seldom; 3 = Sometimes; 4 = Fairly often; 5 = Frequently; and 6 = Always.

<sup>a</sup> n = 80, except where noted below.

<sup>b</sup> n = 73;

<sup>c</sup> n = 76;

<sup>d</sup> Mean size is 20,636 with a standard deviation of 9,807 and a range of 1,844 to 43,635; it was placed here to improve table appearance.

### Univariate Analysis

The results of univariate analysis are summarized in Table 8 above. The sample institutions reported that the federal government provides, on average, 61 percent of their funding for research and development as shown near the bottom of Table 8. Descriptive statistics for the criterion variables are presented near the top portion.

The sample institutions employ Human Resource Development strategies, on average, more frequently than any other strategy of the HEEDS schema. It received an average (unweighted) response value of 3.55 on a six-point response scale ranging from 1 to 6. The frequency to which they employ Human Resource Development strategies can be described as "Fairly Often," according to the (reversed) scale of the Higher Education Economic Development Survey (see Appendix A). In addition, the sample institutions employ Research, Analysis, and Evaluation strategies less frequently than any other; it can be described as being employed on a "Seldom" basis, as indicated by the value of 2.54.

The next three variables presented in Table 8 are the variables Munificence, Dynamism, and Administrative Differentiation. The average Munificence, or standardized rate of growth, is 0.18 and the average Dynamism, or standardized rate of volatility, is 0.10, an indication that funding pattern is almost as volatile as it is generous.

### Multiple Regression Analysis

The primary method of statistical analysis was multiple regression analysis. The unstandardized regression coefficients and their accompanying standard errors are presented below in Table 9. Note that, as indicated by probability notes, two relationships are statistically significant at  $p < .05$ .

The resultant directions of regression coefficients for Munificence and Dynamism across orientations are consistent with the hypotheses, with the exception of Human Resource Development. Munificence is statistically significant for the orientations New Business and Technology Development (NBTD) and Capacity Building (CB) and it has a greater effect on the latter, as noted by the -2.02 value of the regression coefficient. It is also noteworthy that the effect of Administrative Differentiation is almost nil across all four orientations.

The R-squared value indicates that six percent of the variance for the New Business and Technology Development orientation, or regression model, can be explained by the combined influences of predictor variables Munificence, Dynamism, and Administrative Differentiation and the control variable Log of Size. Likewise, those four variables explain five percent of the variance in Capacity Building model. Furthermore, these two and other models are not significant as indicated by the resultant F-statistic.

TABLE 9  
Regression Results for Strategic Orientations

	NBTD	CB	HRD	RAE
Munificence	-0.77* (0.45)	-2.02* (1.07)	-0.19 (0.48)	-0.33 (0.72)
Dynamism	0.25 (0.67)	1.61 (1.51)	-0.29 (0.71)	0.42 (1.21)
Administrative Differentiation	-0.04 (0.13)	-0.10 (0.25)	0.00 (0.14)	-0.05 (0.21)
Log of size	0.11 (0.12)	0.01 (0.23)	0.15 (0.13)	0.13 (0.18)
Constant	1.29 (1.25)	2.49 (2.34)	1.11 (1.32)	0.63 (1.86)
R <sup>2</sup>	.06	.05	.03	.01
<u>F</u>	1.26	0.95	0.68	0.25
<u>n</u>	80	73	80	76

Notes. Standard errors are in parentheses. Criterion variables are weighted mean responses to the Higher Education Economic Development Survey (HEEDS); key noted as follows: NBTD = New Business and Technology Development  
CB = Capacity Building  
HRD = Human Resource Development  
RAE = Research, Analysis, and Evaluation

\* $p < .05$ , one-tailed.

These results prompted further investigation by researcher via stepwise removal of each predictor and control variable from the model and its subsequent addition back into it. The correlation matrix (see Appendix C) indicates that a statistically significant correlation of .41 exists between Munificence and Dynamism. However, when Dynamism was removed from the regression model the statistical results did not improve. The mean square error, the R-square and the F-statistic for each of the four regression models did not show any improvement through manipulation of the variables in the model nor through logarithm transformations which were performed on those variables, an indication that the models shown in Table 9 are more efficient and less biased than other models.

In summary, two of twelve directional research hypotheses tested in this study were found statistically significant; the orientation New Business and Technology Development and the orientation Capacity Building were found significantly related to Munificence. Model manipulations variable transformations did not improve the results. Statistical power, defined as the likelihood of a correct rejection of the null hypothesis, is approximately 77 percent for tests of correlation between variables and 30 percent for tests of difference in characteristics. Alternative explanations for the lack of statistical correspondence are discussed in Chapter Five.

## CHAPTER FIVE CONCLUSIONS AND IMPLICATIONS

This final chapter offers some conclusions and discusses some implications for resource dependence theory, administrative practice, and future research. This study explored the applicability of resource dependence theory to the research management function at public doctorate-granting universities. The goal of this study was to ascertain to what degree and under what conditions can resource dependence theory predict public research university orientations.

This study provides new information for the purpose of gaining a better understanding of how public research universities deal with resource dependence and environmental uncertainty. It suggests that public research universities vary in the frequency to which they pursue strategic orientations in economic development. In addition, this study is the first to test hypotheses derived from resource dependence theory against an organizational context managed by senior research administrators. Sample data was collected from a nationwide cross-section of 80 public doctorate-granting universities.



### Significant Findings

The data was analyzed to test hypotheses that the frequency to which research universities employ strategic orientations in economic development is related (a) negatively to a standardized rate of growth (Munificence) in federal research dollars, (b) positively to a standardized rate of volatility (Dynamism), and (c) positively to the organizational structure (Administrative Differentiation) of university research offices. These hypotheses were tested using multiple regression, in which one-tail tests of significance were set at the .05 level. Support was found, at the .05 level of significance, for two out of 12 hypotheses tested in the study (see Table 10).

TABLE 10  
Degree of Support for  
Hypotheses in Model of Administration

Predictor Variables	Economic Development Orientation <sup>a</sup>			
	NBTB	CB	HRD	RAE
Munificence	Support	Support	No Support	No Support
Dynamism	No Support	No Support	No Support	No Support
Administrative differentiation	No Support	No Support	No Support	No Support

Notes. Results from a one-tailed  $p$  value set at .05 level of statistical significance; control variable Log of Size not shown in table and not statistically significant.

<sup>a</sup>Key: NBTB = New Business and Technology Development  
CB = Capacity Building  
HRD = Human Resource Development  
RAE = Research, Analysis, and Evaluation

Support was found for the research hypothesis that a linear, negative relationship exists between a strategic orientation and Munificence. The evidence, though somewhat limited, bears out that Munificence affects the frequency to which research universities orient themselves in New Business and Technology Development strategies and likewise for Capacity Building strategies. For example, institutions with standardized rates of growth (decline) in their federally-funded research volume comparatively lower than similar institutions, employ New Business and Technology Development and Capacity Building strategies more (less) frequently, and vice versa. According to resource dependence theorists (Aldrich & Pfeffer, 1976; Pfeffer, 1987; Pfeffer & Salancik, 1978), organizations are expected to employ strategies which will promote growth, stabilize outcomes, and maintain survival. In sum, the predictive power of resource dependence theory is not determined in this study given the limited findings.

#### Alternative Explanations for Limited Findings

The statistical data analysis is limited in that it produced very little in terms of meaningful results. This section offers some explanations for such limitations. Factors other than those included in the model of administration most likely have influenced the results of this cross-sectional study, as indicated in the resultant r-

square values. Six possible explanations are offered below.

First, this study examined the effects of variations in total, federal research support. It remains plausible, however, that historical differences exist in resource variations across federal agencies. For example, grant awards received from one federal agency such as the National Institutes of Health, one of the largest financiers of university research and development, may vary quite differently over time from that received in aggregate from other federal agencies.

Second, it is possible that some respondents in this study may have already been exposed to HEEDS or received it previously during the course of Hethcox's work, in the 1988-89 time frame. However, the analyses indicate that number of years in the present position, at the same institution, does not correlate with the survey responses. Further, this finding bears up under scrutiny, in an analysis that isolates the 59 respondents who have held the same position at the same institution for the past five years from those who have not. Nonetheless, it is likely that bias exists which may stem from the nature of the survey process itself including, but not limited to, the organization and the wording of its contents.

Third, it plausible that certain responses may have been evoked from either the researcher's verbal request to respondents for their participation in this study or the

content of the cover letter that accompanied the survey (see Appendix A). It would be very difficult to discern the effect of this threat to validity.

Fourth, it is not determined whether respondents have backgrounds or institutions have characteristics which differ significantly from nonrespondents or that respondents answered the items differently than nonrespondents would have answered them. The survey's 83 percent response rate indicates that the possible differential is not overly burdensome. Nonetheless, a difference-of-means test was performed by this researcher. The t-test results for respondent and nonrespondent groupings on the archival data indicate that no differences exist at the .05 level of significance.

In terms of generalizability, the effects of setting and unique features remain another plausible explanation for which there has been no elimination. Fifth, the focus of this study is the unique context of research administration in public doctorate-granting institutions. Furthermore, the media often report on Congressional deliberations over national science and technology policy formation. Consequently, it is possible that the impact of those deliberations made respondents to HEEDS unusually receptive, due to the recent conditions in the policy environment. Lastly, and perhaps most important, the validity of the Higher Education Economic Development Survey is suspect and

it requires further analyses which seek to confirm or deny the meaningfulness of its contents. In sum, all rival and plausible hypotheses cannot be ruled out, due to the nature and design of this study. Nonetheless, this study uncovered relationships and variables which are worthy of further examination.

### Implications

The study has implications for resource dependence theory, university administrative practice, and future research; each of which will be discussed in this order. It has four implications for resource dependence theory. First, it is not determined whether the failure to support 10 of the 12 research hypotheses is indicative of an inaccurate enactment of the environment. Perhaps most research administrators are oriented internally in their focus rather than externally as suggested by theory. The theoretical expectation is that research administrators interpret and orient their organizations to the external environment. This raises the question: Are university research administrators focused externally?

Second, it is possible that failure to support the research hypotheses stems from organizational effectiveness in diversification and differentiation strategies which permit research universities and their research officers to avoid external control in certain orientations. Resource

dependence theory suggests a deliberate avoidance through strategy. This raises the question: Are economic development orientations undertaken for the purpose of exercising avoidance?

Third, it is possible that some roles of institutions enable them to ignore, either in part or completely, aspects of the environment in their economic development orientations. The expectation is that a set of strategies are employed so that an organization can readily demonstrate its compliance with external demands in one area and simultaneously achieve noncompliance in another area. This raises the question: Does an institution attempt to demonstrate partial compliance?

Finally, the failure of the data to support the research hypotheses may simply stem from imitation among institutions. Resource dependence theory suggests that alternative funding sources are sought and alternative program-service mixes are delivered for via collective activity among various organizations. This raises the question: Do institutions imitate each other's strategy?

The study also has three implications for practice. First, the evidence suggests that universities should seek out new sources of financial support for research and/or engage more frequently in economic development strategies, namely the promotion of new business and the renovation of academic facilities. Second, the administrative model,

posited by the theory, frames the typical roles of the research administrator in the management of external control. The evidence suggests that the typical managerial role of research administrators is largely symbolic. For example, the variable Munificence was significant in its explanation of two orientations whereas the variables Dynamism and Administrative Differentiation were not significant explanations. Third, the study offers no evidence to resolve an ongoing debate over the administrative structure of university offices that oversee research and graduate studies. It is not yet determined which mode of organization is the most responsive to social constraints. Furthermore, after years of inquiry little is known about the causes and consequences of administrative structure. In summary, this study sets the stage for an assessment of the environment in which public research universities operate.

This draws attention to the important connections between federally-sponsored research and the policy directions of public research-oriented universities in economic development. This study also has four implications for future research. First, a more accurate measurement of the environmental dimensions must wait until the National Science Foundation publishes the pertinent data for fiscal year 1994.

Second, the influence of prevalent strategic orientations on prospective organizational outcomes, namely new contexts, requires further study. Resource dependence theory asserts that growth and diversification can alter the nature of interdependence and thereby diminish dependence (Pfeffer & Salancik, 1978). Basically, further research should be undertaken which seeks to answer the question: Do strategic orientations of public research universities orientations in economic development contribute to resource growth and organizational stability? Toward that end, additional data will have to be collected on university research dollars, federal and otherwise, to examine the effect of these orientations on prospective funding mixes, resource variations, and administrative structures.

Third, the results of this study require cross validation using other samples of data in order to assess the practical worthiness of the results from the administrative model. Such research could evaluate the degree of shrinkage by comparing the predictions made herein with data collected on future strategic orientations. Cross validation could be accomplished by computing the predicted frequencies using results from the regression models developed herein and then conducting correlation analysis. Lastly, the author welcomes future inquiry challenging the assumptions of this research.



In conclusion, the behavior of organizations reflects both their constant struggle for autonomy and discretion and their perpetual confrontation with constraint and external control. A major implication of this study for public policy or public management is that external directives often constrain organizational freedom. An understanding of such directives can be gained by placing them into a historical context. The overall significance of the study can be underscored by the statement "to understand organization behavior, one must understand how the environment relates to other social actors in its environment" (Pfeffer & Salancik, 1978, p. 257). In closing, this study demonstrates that resource scarcity influences two strategic orientations of public research-oriented universities in economic development, namely New Business and Technology Development and Capacity Building.

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Appendix A:  
Higher Education Economic Development Survey

## Script

Hello \_\_\_\_\_,

My name is Steve Hoagland, Research Administrator at Old Dominion University's Office of Research and Graduate Studies. As part my dissertation research project, I'm conducting a mailed survey of chief research officers. It requests information about your institution's involvement in activities thought conducive to economic development and it will take approximately 20-to-25 minutes of your time for its completion.

I request your voluntary participation in this project. Your responses will be held confidentially. Would you like to participate? Do you have any questions or comments at this time?

I will mail a cover letter along with the Higher Education Economic Development Survey next week. The mail packet contains information should you desire to contact me. Thank you for your time and consideration.

Bye.

**STEVEN R. HOAGLAND**

Ph. D. Candidate, Old Dominion University  
Research Administrator, Old Dominion University

< Home Street Address >

< City, State, and Zip >

Office telephone: (804) 683-3460

E-mail: srh300u@oduvm or srh300U@oduvm.cc.odu.edu

Dear Chief Research Officer:

As you may recall, I contacted you recently to request your participation in my dissertation research. Thank you for agreeing to complete the **Higher Education Economic Development Survey (HEEDS)**, which is attached. That Survey seeks the perspectives of chief research officers/administrators regarding institutional involvement in economic development activities, both in terms of what is presently occurring and what you believe should be occurring.

Your responses are a rich source of data, especially in these times of defense conversion and national policy formation. Please note that your responses will be handled in a confidential manner. To ensure such confidentiality, a code number was assigned to your institution and is stamped on the first page of the instrument.

HEEDS contains 46 response items that are grouped under four headings: New Business and Technology Development; Capacity Building; Human Resource Development; and Research, Analysis, and Evaluation. The survey will take an estimated twenty to twenty-five minutes to complete. Please return, at your earliest convenience, the completed HEEDS using the attached, pre-addressed and hand-stamped, TYVEK (tm) envelope.

If you have any questions or comments please do not hesitate to contact me via the telephone number above between 8:30am and 5:00pm EST or via e-mail. If you desire to obtain a copy of the results please check the blank which follows the last item of the survey. Thank you for your attention and your invaluable responses.

Sincerely,

Steven R. Hoagland  
Fellow Research Administrator  
and Ph. D. Candidate

# Higher Education Economic Development Survey

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## Section I: Demographics

---

1. Respondent's Title (please check):

Dean of Graduate Studies/School/College

Associate Vice President for Research and Graduate Studies

Director/Administrator

Other (please note) \_\_\_\_\_

Institution Code

2. Highest Degree Obtained (please check):

Doctorate       Masters       Other (please note) \_\_\_\_\_

3. Area of Study for Highest Degree (please check):

Biological Sciences       Engineering       Humanities

Mathematical Sciences       Social Sciences       Education

Physical Sciences       Other (please note) \_\_\_\_\_

4. Years of Experience (please specify):

This institution (present position)       Other institutions (similar position)

5. Age (please check):

Under 30       31-35       36-40       41-45

46-50       51-55       56-60       61-65

66 plus

6. Gender (please check):

Female       Male

This survey contains 46 items organized into four dimensions of higher education thought important to economic development. Rate each item according to the amount of involvement *presently occurring* at your institution and to what extent you believe the activity *should be occurring*. If you have no knowledge of the activity *presently occurring* please circle the response marked "?", but remember to circle a response on the *should be occurring* scale. All responses will be treated confidentially.

## Section II: New Business and Technology Development

### Scale:

- 1 = Always; 100% of the time  
 2 = Frequently, if not always; 75-99%  
 3 = Fairly often; 50-74%  
 4 = Sometimes; 25-49%  
 5 = Seldom; 1-24%  
 6 = Never; 0% of the time

	<u>Presently Occurring</u>						<u>Should Be Occurring</u>						
Develop linkage mechanisms between venture capital networks and entrepreneurs (2-1)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide management and technical assistance to potential entrepreneurs (2-2)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide entrepreneurial assistance programs with emphasis on new business development, i.e., evaluation of technical feasibility, market evaluation, production costs, financial viability, and general business and management advice (2-5)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide industrial extension agents who will work specifically with new and small businesses in market identification, management training, computer use, exporting, procurement assistance, patent and licensing arrangements (2-4)	?	1	2	3	4	5	6	1	2	3	4	5	6
Develop mechanisms that stimulate new business development, e.g., incubators, research centers, entrepreneurial training programs, and innovation centers (2-5)	?	1	2	3	4	5	6	1	2	3	4	5	6
Negotiate, prior to actual involvement, expected financial benefits (i.e., royalties, rents, equity ownership) in return for institutional seed money, use of faculty consulting services, office space, and laboratory equipment (2-6)	?	1	2	3	4	5	6	1	2	3	4	5	6
Set measurable goals for data analysis and evaluation of institutional programs promoting new businesses for economic development (2-7)	?	1	2	3	4	5	6	1	2	3	4	5	6

**Scale:**

- 1 = Always; 100% of the time
- 2 = Frequently, if not always; 75-99%
- 3 = Fairly often; 50-74%
- 4 = Sometimes; 25-49%
- 5 = Seldom; 1-24%
- 6 = Never; 0% of the time

	<u>Presently Occuring</u>						<u>Should Be Occuring</u>						
Maintain a computer data base inventory of faculty research (2-8)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide industries and appropriate government agencies access to relevant faculty research activities specifically for aiding economic development (2-9)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide a directory of institutional services that might facilitate product or process technology transfer to businesses, state/local governments, and communities (2-10)	?	1	2	3	4	5	6	1	2	3	4	5	6
Develop a specific program for diffusion of university technological products and processes for economic development (2-11)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide knowledge transfer mechanisms that support industrial, professional and community economic development needs (2-12)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide campus-wide interactive data base inventory of faculty research (2-13)	?	1	2	3	4	5	6	1	2	3	4	5	6
Promote faculty sabbaticals in laboratory settings, e.g., industry, economic development agencies, federal laboratories (2-14)	?	1	2	3	4	5	6	1	2	3	4	5	6
Encourage faculty access to industrial and federal laboratories through personnel exchanges that allow laboratory scientists to teach in classrooms for one term (2-15)	?	1	2	3	4	5	6	1	2	3	4	5	6
Provide equitable compensation for faculty consulting and reward public service contributions that contribute to economic development (2-16)	?	1	2	3	4	5	6	1	2	3	4	5	6
Develop mechanisms to encourage product commercialization through patent filing, patent management, and patent licensing (2-17)	?	1	2	3	4	5	6	1	2	3	4	5	6

**Scale:**

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	<u>Presently Occurring</u>	<u>Should Be Occurring</u>
Advocate a facilities fund dispersed through a National Science Foundation peer review process (50-50 matching) over a 10-year period to bring academic infrastructure up to acceptable research standards (3-1)	? 1 2 3 4 5 6	1 2 3 4 5 6
Promote shortened period of amortization on new academic facilities from 50 years to 20 years (3-2)	? 1 2 3 4 5 6	1 2 3 4 5 6
Promote reduced period on depreciation of equipment from 15 years to between 10 and 15 years depending upon the nature of the equipment involved (3-3)	? 1 2 3 4 5 6	1 2 3 4 5 6
Encourage allocation of federally funded research grants for at least three to five years (3-4)	? 1 2 3 4 5 6	1 2 3 4 5 6
Advocate greater flexibility of federal funding that allows investigators discretionary use of up to 10 percent of research monies (3-5)	? 1 2 3 4 5 6	1 2 3 4 5 6
Encourage high-risk research by investigators with proven track record (3-6)	? 1 2 3 4 5 6	1 2 3 4 5 6
Advocate federally funded block grants that encourage multidisciplinary and regional university cooperation (3-7)	? 1 2 3 4 5 6	1 2 3 4 5 6
Advocate a 25 percent full tax credit for industrial funding of academic based research (3-8)	? 1 2 3 4 5 6	1 2 3 4 5 6
Advocate establishment of a tax deduction equal to the full market value of industrially contributed equipment (3-9)	? 1 2 3 4 5 6	1 2 3 4 5 6
Promote tax credit for industry supported maintenance and servicing of donated research equipment (3-10)	? 1 2 3 4 5 6	1 2 3 4 5 6
Provide mechanisms to encourage faculty assistance to small- and medium-size firms (3-11)	? 1 2 3 4 5 6	1 2 3 4 5 6



### Section III: Capacity Building (continued)

#### Scale:

- 1 = Always; 100% of the time**  
**2 = Frequently, if not always; 75-99%**  
**3 = Fairly often; 50-74%**  
**4 = Sometimes; 25-49%**  
**5 = Seldom; 1-24%**  
**6 = Never; 0% of the time**

	<u>Presently Occurring</u>						<u>Should Be Occurring</u>						
Advocate full, portable, merit-based scholarships to the most intellectually-able one percent of entering college freshmen (3-12)	?	1	2	3	4	5	6	1	2	3	4	5	6

### Section IV: Human Resource Development

Recognize public service contributions that promote economic development activities in an instructional reward system in addition to the traditional scholarly engagements (4-1)	?	1	2	3	4	5	6	1	2	3	4	5	6
Offer appropriate instruction at flexible times to meet the unique needs of industry, community, and state/local government in planning for economic development (4-2)	?	1	2	3	4	5	6	1	2	3	4	5	6
Promote international studies that enhance knowledge of other cultures as a core requirement for undergraduate curricula (4-3)	?	1	2	3	4	5	6	1	2	3	4	5	6
Encourage undergraduate interdepartmental studies (4-4)	?	1	2	3	4	5	6	1	2	3	4	5	6
Devise instructional methodologies across curricula that utilizes case studies in combination with problem-solving simulations (4-5)	?	1	2	3	4	5	6	1	2	3	4	5	6
Encourage academic policy that requires multidisciplinary graduate study with the framework of traditional departments (4-6)	?	1	2	3	4	5	6	1	2	3	4	5	6
Establish advisory councils and other linkage mechanisms to keep in touch with community needs (4-7)	?	1	2	3	4	5	6	1	2	3	4	5	6
Build capacity to address economic development priorities through symposia and conferences involving diverse community groups including business, local labor and governmental leaders and faculty (4-8)	?	1	2	3	4	5	6	1	2	3	4	5	6

Scale:

- 1 = Always; 100% of the time
- 2 = Frequently, if not always; 75-99%
- 3 = Fairly often; 50-74%
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- 6 = Never; 0% of the time

	<u>Presently Occurring</u>	<u>Should Be Occurring</u>
Educate policy makers and the general public about university resources that could promote economic development (4-9)	? 1 2 3 4 5 6	1 2 3 4 5 6
Develop centers for excellence that focus on existing service areas in which the institution has expertise (4-10)	? 1 2 3 4 5 6	1 2 3 4 5 6

Section V: Research Analysis and Evaluation

Maintain a management information system within an office of institutional research to diagnose problems and to analyze alternatives in policy analysis, needs assessment, forecasting, impact predictions, strategic planning, and economic development (5-1)	? 1 2 3 4 5 6	1 2 3 4 5 6
Evaluate the institutional data base requirements of personnel throughout the organization who need to access information for decisionmaking (5-2)	? 1 2 3 4 5 6	1 2 3 4 5 6
Establish policies that reflect the needs of personnel affected by or involved in access to information for decision making (5-3)	? 1 2 3 4 5 6	1 2 3 4 5 6
Establish guidelines to transform institutional research into a management information system (5-4)	? 1 2 3 4 5 6	1 2 3 4 5 6
Provide cooperative extension networks with access to on-campus data bases to diagnose problems and to analyze alternative economic development strategies (5-5)	? 1 2 3 4 5 6	1 2 3 4 5 6
Maintain a data base of university-industry interaction for longitudinal trend analysis (5-6)	? 1 2 3 4 5 6	1 2 3 4 5 6
Maintain an empirical data base for comparison and evaluation of innovation processes among university, industry, community, and state and local governments (5-7)	? 1 2 3 4 5 6	1 2 3 4 5 6

Appendix B:  
Glossary

## Glossary

**Administrative Differentiation:** a measure of the top-level administrative structure of university offices which oversee research and graduate functions. When separate offices are maintained, as indicated by the position title of the senior research administrator, for each function then administrative structure is considered differentiated; taken in this study as a dummy variable.

**Capacity Building:** assisting a wide variety of community organizations in developing the capacity to participate more effectively in economic development.

**Dependence:** characterized by importance of the resource for continued organizational operation and survival, interest group discretion over allocation of the resource, and the number of alternative sources.

**Development:** use of knowledge gained from inquiry, directed toward construction of useful materials, devices, systems or methods, including the design and refinement of models.

**Dynamism:** extent of (in)stability in an environment; a standardized rate of volatility, or stability, in an institution's federal-dollar volume of research. It was calculated using an institution's annual fluctuation in its dollar volume of research awards from 1990 through 1994 divided by the average volume for that period; a standard error of the slope coefficient, from a regression model in which research volume was regressed against time, divided by the average award volume for that five-year period. It was calculated using the standard error of the slope estimate which resulted from the same regression model used to calculate Munificence.

**Economic Development:** a general improvement in the overall well-being of society.

**Environmental Enactment:** a mental image of the environment in which a manager operates.

**Human Resource Development:** tailoring education programs to meet the emerging human resource requirements of the economy.

**Interdependence:** dependence among a set of organizations having similar needs and facing similar demands; exists whenever one actor cannot control the conditions necessary to achieve an action or obtain a desirable outcome from such action.

**Munificence:** capacity of the environment to support growth; a standardized rate of growth, or decline, in an institution's federal-dollar volume of research. It was calculated using an institution's annual change in its dollar volume of research awards from 1990 through 1994 divided by the average volume for that period; a slope coefficient, from a regression model in which research volume was regressed against time, divided by the average award volume for that five-year period.

**New Business and Technology Development:** applying existing knowledge to help firms learn about and adopt effective management and engineering concepts; promoting new enterprises that utilize knowledge developed in the university; the overall process of invention, innovation, and diffusion of new knowledge throughout society.

**Research:** basic and applied work to produce new knowledge that can result in new products and services or new forms of production.

**Research, Analysis, and Evaluation:** providing objective information and new knowledge to public and private decision makers about the economy and its requirements.

**Research-oriented institutions:** institutions which confer doctorate degrees and classified by the Carnegie Foundation as "Doctorate-Granting" or "Research" universities.

**Social Constraint:** a constraint that exists if the hypothetical probability of an organizational response to one group is greater than it is for another; for instance, a 50 percent probability exists for an organizational response to a group that is interested specifically in graduate affairs under an administrative structure which is not differentiated whereas it is 100 percent under a differentiated structure.

**Strategic Orientation in Economic Development:** strategies and processes through which an economy achieves long-run economic growth; involves capital formation, market development, productivity growth, and improvements in entrepreneurial ability and labor skills; each of four dimensions contained in Higher Education Economic Development Survey (HEEDS).

Appendix C:  
Correlation Matrix

Descriptive Statistics and Correlations  
for Variables Used in Study

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Variables	Means	d.	1	2	3	4	5	6	7
1. NBTB <sup>a</sup>	2.270	.60							
2. CB <sup>b</sup>	2.331	.05	.39**						
3. HRD	2.560	.64	.45**	.41**					
4. RAE <sup>c</sup>	1.930	.89	.45**	.44**	.40**				
5. Muni- ficence	0.180	.17-	.23**	-.21*	-.12-	.08			
6. Dynamism	0.100	.11-	.07-	.03-	.12-	.02	.41**		
7. Admin- istrative Differ- entiation	0.440	.50-	.03-	.04-	.03-	.05-	.01	.06	
8. Log of Size	9.800	.58	.16	.01	.12	.04-	.29#	-.26#	-.05

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Note. Criterion variables from HEEDS and key is as follows:  
 NBTB = New Business and Technology Development;  
 CB = Capacity Building;  
 HRD = Human Resource Development;  
 RAE = Research, Analysis, and Evaluation.

<sup>a</sup>n = 80 for NBTB and HRD. <sup>b</sup>n = 73. <sup>c</sup>n = 76.

\*p < .05, one-tailed. \*\*p < .01, one-tailed. #p < .01, two-tailed.

### Autobiographical Statement

Steven Rae Hoagland was born in Alexandria, Virginia on 29 July 1954. The author earned the following diplomas: an Associate in Applied Science degree from Tidewater Community College (June, 1982); a Bachelor of Arts in economics from Old Dominion University (December, 1985); a Master of Arts in economics from Old Dominion University (May, 1988).

This author began his employment in public higher education in 1988 at Old Dominion University. Currently, he holds an administrative position as a Research Administrator in the Office of Research and Graduate Studies and prior to that he was a Research Associate in the Office of Institution Research and Planning. As an adjunct faculty member he has taught classes in economics at Tidewater Community College and Old Dominion University.

He was recently inducted into the National Honor Society for Public Affairs and Administration. He is also a member of Omicron Delta Epsilon International Honor Society in Economics.