ABSTRACT

Title: THE ROLE OF ACADEMIC SPACE MANAGEMENT AT RESEARCH UNIVERSITIES AND ACADEMIC MEDICAL CENTERS

Catherine E. Watt, Ph.D., 2008

Directed By: Frank A. Schmidtlein, Associate Professor of Higher Education (Emeritus), Department of Leadership, Higher and International Education

Abstract:

Facilities represent the greatest financial investment for most institutions, yet they remain largely ignored from a management perspective. Improving academic facilities information would provide institutional leaders with an additional tool to improve institutional planning and resource allocations. Academic Space Management (ASM) is a construct that suggests how space management can be more detailed, web-based, and utilized for planning and decision making. This project reports on a case study of three research-focused institutions and the institutions' interest in and use of space information. Results suggest the importance of senior leadership, trust among participants, the practical nature of the space database, and understanding the role that institutional culture plays.

THE ROLE OF ACADEMIC SPACE MANAGEMENT AT RESEARCH UNIVERSITIES AND ACADEMIC MEDICAL CENTERS

By

Catherine E. Watt

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2008

Advisory Committee:
Professor Frank A. Schmidtlein, Chair
Professor Robert O. Berdahl
Jack T. Baker, Ph.D.
Professor Dennis R. Herschbach
Associate Dean Thomas Weible

Dedication

There are many people in my life who made this possible. My parents have always believed in me, even when they never quite understand what I do for a living. I must also thank Jennifer, who made this process so much easier by listening and offering advice and humor when I needed it. Then there's Walter, who helped me through so many years of personal and professional questions. He has put up with me for more years than he cares to remember.

I need to thank my friends and colleagues at Clemson University's Institutional Research office, who endured my insanity and frustration throughout the process. Their faith in me certainly helped get me through some tough months. Many friends at MUSC and USC were always there to answer questions and make sure accurate information was presented.

Lastly, there was my partner, best friend and alter ego who knows that without his care, editing, and harassment this project would never have been imagined, much less completed. Thank you for everything you taught me and for letting me teach you a few things as well.

Acknowledgements

I would be very remiss if I did not thank the deans, department chairs, and other administrators who gave their time and thoughts to this project. Too often the work of these individuals is lost in the vastness of the research university enterprise. None of them are singled out for identification in the text, but their contributions made the entire project possible. Their insights and honesty taught me a great deal beyond the research questions and provided many new questions to answer in the future.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

Nature of the Problem

Space is viewed as the most permanent resource on a research campus and, thus, it requires long-term attention (Montgomery, 1989). This study evaluates the role of Academic Space Management at research intensive institutions and how academic facilities management is an increasing priority for administrators who require new information resources. Academic Space Management (ASM) is an innovative approach for developing criteria for assessment of current space allocation to academic programs, defining benchmarks relative to program needs, and using those benchmarks as a foundation for setting expectations and making management decisions. It involves utilization of a web-based system where authority for space accuracy is delegated down to the colleges and departments, and ASM also suggests using more detailed text-based room descriptors (i.e. Bench Laboratory rather than only Laboratory) as well as assigning individuals to offices and laboratories. The more detailed information can then be used in productivity reporting for research projects, planning for future needs, and contribute to decision-making at the senior management levels. Through discussions with academic deans and department chairs, it was hoped that this project would help bridge the gap between the technical information sources and the information needs of academic leaders. Understanding how administrators could overcome technical and institutional barriers to most effectively utilize space information can assist them in managing their complex

enterprises through today's challenging times of fiscal constraints, concerns for security and increased accountability.

One of the research questions pursued was intended to broaden understanding of current information sources on institutional plant facilities and how they are used by those who need them, recognizing that this is a finite resource requiring careful management. Administrators across all types of institutions have acknowledged this need for at least two decades (Castaldi, 1987; Kaiser, 1989; Ehrenberg, 2000). Unfortunately, the traditional information resource, the typical physical plant generic inventory, seldom is useful for management purposes. The focus of the inventory tends to be on the physical attributes of rooms with references to fixed, overarching function codes. Appendix A highlights a sample facilities inventory from one of the institutions that participated in this study. An inventory's use of codes and its lack of any fields that can be linked with other databases make it of limited utility for those outside of physical plant administration. Lacking sufficient detail of function and assigned faculty, these inventories can rarely be used by the institution's academic administration for immediate management decisions or long-term planning. New or improved tools will be required for academic leadership to answer pressing questions with confidence.

Effective space management requires: 1) current knowledge of how space is assigned, 2) assessments of its use relative to the institution's programs and mission, and 3) understanding how assigned discipline specific space usage compares with that of peer institutions. Armed with this information, institutional leaders can assess methods that allow them to allocate space to those areas most productive. Nowhere is this need for

improved space information more pressing than at research-intensive universities and academic medical centers, primarily because of:

- increases in the number of NIH and NSF sponsored awards,
- added complexity of interdisciplinary research, particularly as it related to research facilities,
- the development of center and institutes housed on campus,
- burgeoning levels of deferred maintenance,
- economic pressures to decrease state appropriations for facilities,
- the increasing role research institutions play in economic development, and
- traditionally long construction periods for new research buildings and renovations.

As research intensive institutions continue to review cost-containment issues, as they become further inundated with compliance mandates, and as they refine accountability standards and performance expectations, their need for more meaningful space information is critical.

In addition to simply supplying data elements, academic leaders must have information that is detailed and up-to-date if timely solutions to pressing issues relating to faculty, research, and space are to be available. The new information requirements for academic leaders will not be stand-alone databases, but a virtual warehouse of information made possible by merging data elements from multiple sources, including sponsored research programs, finance, and personnel data.

Research universities tend to purchase multi-million dollar software packages by companies such as PeopleSoft, Datatel, and others to manage personnel, finance

and student information. Merging data from these systems requires one or more common elements that make linking records possible. Examples would include fields containing Social Security Numbers, room number, employee identifier, among other possibilities. These fields serve as the communication channels to other institutional databases. For administrators, having access to this increasingly complex information becomes even more important as the financial forecasts for public institutions remain pessimistic through 2010 (Boyd, 2002; Jones, 2006).

Strategic planning focuses on the changing conditions of the external environment and assumes that focusing on planning will provide a competitive edge. Administrators concerned with academic strategic planning also require access to facility information that can be compared relative to similar disciplines at other institutions. This requires a level of comfort that comparable metrics are used. Unfortunately, such information remains elusive, and not a single federal or service organization could provide disciplines-specific inter-institutional comparable information regarding space.

Definitions

This project represented an attempt to provide improved academic space information, merging several pieces of institutional information, including facilities data elements too often ignored in strategic academic planning. Throughout this paper, terms are used that are unique to higher education facilities and academic management. These terms are defined as follows:

- **Academic Space Management** – defined as assessment of current space allocation to academic programs, defining benchmarks relative to

program needs, and using those benchmarks as a foundation for setting expectations and making management decisions;

- **Academic Space** – an area assigned for classrooms, office space, research, or research support;
- **Facility Inventory** – a list or schedule of facilities fields with codes and low level of details;
- **Database** – a large body of information stored in a computer, which can be processed and from which particular pieces of information can be retrieved when required;
- **SC Research Institutions** – the three research universities in South Carolina, consisting of Clemson University, the Medical University of South Carolina, and the University of South Carolina Columbia;
- **Academic planning** – Planning related to academic programs and sponsored research;
- **Net Assignable Square Feet (NASF)** – Space assigned to an individual or a program that does not include unusable areas such as hallways; this information usually is provided by a facilities employee who determines the measurement;
- **Research Laboratory** – space in which a faculty member conducts research and may or may not be specially fitted with equipment; and
- **Faculty member or investigator** – a person occupying assigned space for conducting research.

A Proposed New Metric for Academic Space Management

The approach behind Academic Space Management involves developing criteria for assigning space to faculty members and academic units as well as assessing existing assigned space. One of the few common characteristics across multiple science and engineering fields is the use of specialized laboratory space. The costs of using this space are usually not calculated and charged directly to a researcher in the same manner that a person is charged for utilities at a home residence. Without that usual reminder of costs, it can become easy to take this immense resource for granted. The need and use for specialized space, as well as the grants garnered for research, vary significantly across the disciplines. However, all researchers in engineering and science have in common the need for laboratory space and external dollars. Therefore, the integration of institutional research space assignment data with sponsored research data would be a measure of general interest when assessing how effectively this expensive and unique space is being utilized.

A quantitative assessment can be made by integrating data on research funds generated or expended per unit of research-dedicated space. Results typically are expressed in dollars per Net Assignable Square Foot (NASF) of space ($/NASF). Usually, the $/NASF are evaluated initially at the level of individual investigators, but summative information is useful to assess department, college, center or institutional values as well. This measure is an attempt to quantify how effectively a faculty member utilizes his or her assigned space. Effectiveness is defined as utilizing assigned specialized research space in a manner at least as well as one's peers or at a level set through internal standards or expectations, perhaps using a

trend analysis to consider fluctuations over time. An evaluation of a faculty member's ability to garner external awards in a set amount of space assesses the effectiveness with which each uses limited resources and provides a common definition for other comparisons. The resulting "effectiveness metric" ($/NASF) can be used to improve resources allocation across the institution in both personnel time and actual dollars saved. For example, this information can be invaluable for department chairs as they assess space assignment effectiveness, for Deans reviewing departmental space requests, for university officers convincing Boards to approve construction, and for assigning work order priorities to laboratories that generate the most indirect costs.

Administrators at the Medical University of South Carolina (MUSC) created this effectiveness metric when a Dean of the College of Medicine and his Department Chairs needed detailed information because of the competition for federal dollars and the subsequent need for research space. While once used only by the departments within the College of Medicine, the process is now used across the University. The effectiveness metric, along with concurrent research award information, is produced at least annually for use by Department Chairs to demonstrate to their Deans how well their departments are performing compared with a college or University standard. The report details for Chairs an individual's space assignments (Table 1.1), sponsored awards (Table 1.2), and the report to the Dean summarizes each department's space and awards (Table 1.3).

Table1.1 shows an individual faculty member's space assignment, totaled at the bottom. It is important to note that there is no inclusion of technicians or graduate students who may occupy the space. This is because the faculty member is accountable for the

research in that space, and he or she may move graduate students and staff around as needed for the research. In addition, the faculty member's office space is not included in the research space total. For the institutions examined in this project, the philosophy is, that at public institutions, all faculty members are entitled to office space; lab space is not an entitlement.

Table 1.1

Individual Faculty Member's Space Assignments in a Space Database

Faculty Member (Can be Searched)

Name on Award Data
NORRIS, JAMES S.

Name on Space Data
Norris, James S. (PhD)

Assigned Rooms

Building	*Room*	*Center or Shared*	*Dept.*	*Description*	*Area*	*Research Area*
Basic Science	BS203A		Microbiology and	Office, Faculty	190	
Basic Science	BS206C		Microbiology and	Lab, Research Bench	945	945
Basic Science	BS206C1		Microbiology and	Lab, Research Bench	119	119
Basic Science	BS206C2		Microbiology and	Lab, Research Other	110	110
Basic Science	BS206D		Microbiology and	Lab, Research Bench	879	879
Basic Science	BS206D1		Microbiology and	Lab, Research Bench	119	119
Basic Science	BS206D2		Microbiology and	Lab, Research Other	110	110
				Totals:	**3,567**	**2,674**

Table 1.2 shows some of the research awards for the same faculty member as in Table 1.1, again totaled at the bottom. The award dollars have been annualized and broken out into direct award, indirect award, and total award. This is because of the importance that some institutions place on garnering indirect dollars, and the perspective that the direct portion is simply a "pass through," going only to specific costs associated with the research project. At the bottom of the page, the research dollar totals have been

divided by the research space from Table 1.1 to generate the "effectiveness metric" in dollars awarded per square foot of assigned research space.

Table 1.2

Individual Faculty Member's Research Awards Including Funding per Square Foot

Total Awards in Sponsored Programs

Sponsorer	Award No.	Budget Yr. Start / End	Project Start / End	Title	Awarded ($ / Budget Yr.) Direct	Indirect	Total
HEXAL		10/1/1997 3/31/2000	10/1/1997 3/31/2000	RIBOZYME GENE THERAPY	247,301	0	247,301
HEXAL		10/1/1999 9/30/2000	10/1/1997 9/30/2000	RIBOZYME GENE THERAPY	773,046	359,558	1,132,604
NIH/NCI	2R01 CA49949-0	4/1/1999 2/29/2000	9/1/1998 2/28/2002	STEROID MODULATION OF TUMOR CELL GROWTH	196,689	83,363	280,052
NIH/NCI	5R01 CA49949-1	4/1/1999 2/29/2000	9/1/1988 2/28/2002	STEROID MODULATION OF TUMOR CELL GROWTH	194,802	85,713	280,515
NIH/NCI	5R01 CA69598-0	7/1/1999 6/30/2000	9/1/1997 6/30/2002	INDUCTION AND ANALYSIS OF PROSTATE CANCER	166,289	72,776	239,065
				Total :	**1,578,127**	**601,410**	**2,179,537**

Total Funding per Assigned Space

Direct $ / NSF	Indirect $ / NSF	Total $ / NSF
$590	$225	$815

Table 1.3 illustrates what can be summarized for department level analysis and, perhaps, given to a Dean or Provost for assessing the research needs of a department. This type of summary can be useful to Deans and Provosts as they assess needs for a coming year or evaluate institutional emphasis areas for research. A summary of this type also allows administrators to assess internal changes to a department over time, given that it is easier to re-allocate space within a department rather than "take over" space allocated to another department.

Table 1.3

Departmental Summary of Space

Biochemistry and Molecular Biology, College of Medicine - Basic Sciences

	Direct	*Indirect*	*Total*
Total Awards:	4,620,847	1,558,535	6,179,382
Lab-requiring Awards:	4,595,587	1,557,757	6,153,344

Research -dedicated Dept NSF: 24,889

	Direct	*Indirect*	*Rate*	*Total*
Award $ / Research NSF:	$ 184.64	$ 62.59	25.3%	$ 247.23

Biometry and Epidemiology, College of Medicine - Basic Sciences

	Direct	*Indirect*	*Total*
Total Awards:	4,410,514	1,035,782	5,446,296
Lab-requiring Awards:	3,147,193	993,039	4,140,232

Research -dedicated Dept NSF: 4,027

	Direct	*Indirect*	*Rate*	*Total*
Award $ / Research NSF:	$ 781.52	$ 246.60	24.0%	$ 1,028.12

Cell Biology and Anatomy, College of Medicine - Basic Sciences

	Direct	*Indirect*	*Total*
Total Awards:	7,034,476	2,229,128	9,263,604
Lab-requiring Awards:	6,899,681	2,229,128	9,128,809

Research -dedicated Dept NSF: 18,380

	Direct	*Indirect*	*Rate*	*Total*
Award $ / Research NSF:	$ 375.39	$ 121.28	24.4%	$ 496.67

Deans at MUSC use the report when assessing departmental requests for additional space and when presenting their case for additional space to the Provost and President. At another level, a report on how various interdisciplinary units, or centers, are utilizing their space can be used to garner additional external funds. Other academic medical centers utilize similar measures, including the University of Alabama Birmingham (UAB) and Yale University. The Dean of UAB's School of Medicine, Dr. William Deal, stated that he believed the efficiency measure created by dividing sponsored research awards or expenditures by assigned space is essential to institutions that plan to increase their sponsored programs research dollars. In acknowledging that the measure does not pretend to capture student learning outcomes, he states "research is not 'for profit' and cannot take such intangibles into account" (Deal, 2003).

Acquiring new information from space data usually means adopting changes; integrating innovative data techniques and philosophies into the institutional culture. It is the blending of technical methodology with the nuances of organization culture that lead to the holistic Academic Space Management (ASM). The technical portion of ASM is relatively well defined, whereas the factors surrounding its integration (consistent use) into the organization are more difficult to assess and categorize; this proposal will attempt to categorize the multiple factors such as cultural, financial, political and others that affect use of space management information. The need for reliable, data-based ASM is most evident at research intensive institutions, because academic medical centers and research universities garner the majority of federal research funds. Their need to establish accountability standards for the support of investigators is paramount to attracting and retaining the most productive researchers. Although two institutional types, academic medical centers and research universities, may seemingly have different non-research missions, they share in recognizing the importance of good space management practices.

Specifically, this project examined research-intensive universities and academic health centers, specifically the three research institutions in South Carolina: Clemson University; the University of South Carolina; and the Medical University of South Carolina. One of the reasons for including multiple institutions was that discipline-specific comparisons from multiple institutions have an increased value in planning and decision-making. It is difficult to control discipline variation with research dollars, hence the need to compare across specific disciplines.

Background on Academic Facilities at Research Institutions

Academic leaders and governing boards are increasingly aware of the importance and difficulty in managing physical plants as finite resources. In the 1960's, operation and maintenance of facilities represented only three to ten percent of an operating budget, but that percentage jumped to 20 to 30 percent by 1985 (Montgomery, 1989). The finances currently required to renovate or build facilities represent a substantial challenge to institutional leaders. In 2006, colleges and universities spent $15.1 billion on new construction and renovation, with the expenditures varying significantly by state. As an example, the median cost per square foot for a specialized science building was $290 in 2006 (Abramson 2007). The National Science Foundation (2002) suggests that research space will become even more important as institutions are faced with increases coming due in long-deferred maintenance costs. Nowhere is this need more acute than in research intensive universities and academic health centers where the typical facilities inventory falls short of being a reliable and effective space management tool.

Assessment of research space is an increasing need at research-intensive universities and academic health centers as costs rise and demands for accountability increase. The National Science Foundation (NSF) regularly gathers information on facilities in science and engineering fields, and also on research and development expenditures (National Science Foundation, 2002). Longitudinal information found in Table 1.4, which includes stand-alone medical schools, highlights the changes in assignable research space across disciplines. Of particular note is the growth in biological sciences within medical schools. The NSF information provides the

foundation for recognizing that physical plant resources must be analyzed in greater detail if these analyses are to be useful to academic administrators. The NSF data, however, does not enable benchmarking beyond the most general summary by noting where national information suggests a lack of sufficient research space in general program areas. It is at the institution level that the data is most needed, however. Therefore, the summary reports generated from the integrated assessments of assigned research space and sponsored research information are of interest to institutional researchers, deans, and vice presidents for research who want to be aware of national trends in sponsored research. However, this information rarely contains the elements in sufficient detail to be useful in making daily management decisions. In addition, the research and development expenditure data are not aligned with the facilities information to provide the integrated information needed by institutional officers. This project will examine the information institutional leaders need and how they can use Academic Space Management to assess research space.

Table 1.4

National changes in Net Assignable Square Feet by Discipline

National Science Foundation, 2002

Field	Net Assignable Square Feet (in millions) 1988	1990	1992	1994	1996	1998	1999	2001	Percent Change 1999-2001
All Fields	*112*	*116*	*122*	*127*	*136*	*143*	*150*	*155*	***4***
Agicultural sciences	18	21	20	20	22	25	25	27	**7**
Biological sciences	24	27	28	28	30	31	32	33	**4**
Inside all medical schools	8	9	11	11	11	12	13	13	**10**
Outside medical schools	16	18	17	17	19	19	20	20	**0**
Computer sciences	1	1	2	2	2	2	2	2	**-1**
Earth, atmospheric, & ocean sciences	6	6	7	7	7	8	8	8	**2**
Engineering	16	17	18	21	22	23	25	26	**7**
Mathematics	1	1	1	1	1	1	1	1	**0**
Medical sciences	19	20	22	23	25	25	27	28	**4**
Inside all medical schools	14	15	16	17	18	18	19	20	**5**
Outside medical schools	5	5	6	6	7	7	8	8	**-1**
Physical sciences	16	16	16	17	18	18	19	19	**0**
Psychology	3	3	3	3	3	3	4	4	**8**
Social sciences	3	3	3	3	4	5	5	5	**-4**
Other sciences	4	2	2	2	2	3	3	3	**-4**

Research-intensive universities are being driven in many directions by opportunities for sponsored research. Institutions, both medical and traditional, have benefited from significant increases in funding from the National Institutes of Health where funding has now leveled off after significant increases in the 1990s, and from the National Science Foundation, which has seen substantial increases as well (Brainard, 2006). The majority of this research requires specialized facilities. Investing in research requires significant investment in the space, and the return on that investment may not be known for a decade or longer. Institutions may not fully consider the financial investment and risk of taking on longitudinal and specialized

research. Specialized facilities are not easily refitted for another purpose when funding runs out or when the investigator leaves for another institution. Annualized maintenance costs for wet lab research space are approximately $15 to $20 per square foot, compared with only $8 to $10 for dry lab and office space (Clemson internal facilities documentation, 2004). Institutions that are driven by research funding must be able to assess what costs are being "returned" through indirect costs and what other cost factors must be considered institutional investment for future development and prestige.

The Economics of Higher Education Facilities

Research institutions are increasingly thought of as, and called upon to be, sources of economic growth for their states. There are numerous public institutions within each state at the technical and college levels but most states only have two or three public research institutions. While offering undergraduate programs, the unique role and mission of the research sector includes graduate education. At these institutions, academic programs can be thought of as tertiary or as quaternary education, specialized programs that come after an undergraduate degree. This unique aspect of post-baccalaureate education is precisely why these institutions are essential partners with government and business leaders to help achieve state economic goals. These multi-faceted institutions often consume almost 50 percent of a state's total allocation to higher education (Southern Regional Education Board, 2007). In return, faculty conduct research that benefits the state, and the research opportunities offered with these faculty attract graduate students. In addition, graduates from these programs reciprocate by earning more and are often the lead agents for new business initiatives, therein contributing more to the state's tax base.

It is this creation and subsequent sharing of new knowledge that makes these institutions special. Given this unique mission, there is little discussion about the two largest risks taken by institutions, the hiring of research faculty and building research space. Research institutions choose to invest in high cost and high-risk research for the same reasons people take individual risks, the anticipation of large return. However, when individuals invest, the return is easily known, money. The return for a research institution is usually neither immediate nor monetary. Other organizations reap the monetary returns from the knowledge and creations of these institutions. The short-term return on investment in research is primarily reputation, prestige, and opportunities for additional research rather than income (Bowen, 1980).

In 2006, institutions invested over $15 billion in facilities, in new construction and renovations. The expenses represent a 260 percent increase from 1997, and while the costs vary significantly by region and type of facility, specialized science buildings cost an average of over $290 a square foot to build (Abramson, 2007). How institutions acquire the funds to build or renovated has less to do with institutional economics than with prestige. Donors, both individual and corporate, are pleased to see their names given to a facility. Raising funds for a new building offers a set of one-time challenges and an opportunity for donor prestige. Obtaining funds to outfit and maintain space is very challenging because there is little prestige attached for a donor to give for a new heater, and too often cyclical maintenance is deferred until that heater breaks. According to Bowen (1980), one of the unique aspects of American higher education is its continual physical expansion. With few exceptions, institutions want to enroll more students, hire more investigators, and build more facilities. Determining strategic growth, or limiting

growth, is a large challenge for administrators pushed by internal and external constituencies to constantly expand.

One of the primary challenges for private and public research universities and academic medical centers is adjusting to the changes in their financial support structure. Over the past decade, these institutions have been required to adapt to an increased reliance upon the private sector for revenues and partnerships, as well as an increased reliance on student generated tuition and fees. These institutions are realizing that they must change many standard operating processes in order to continue providing an excellent education while serving as a major economic driver for their states. However, these new partnerships are often attached to unfunded reporting mandates, such as conflict of interest reporting, increased audits, and patent considerations. These are all administrative tasks that add to the financial burden borne by institutions.

An additional economic challenge is determining at what level the undergraduate program financially supports the institutional research mission and then articulating the benefits of providing this support. Dollars allocated to facilities and maintenance are usually part of the general institutional fund, and each institution determines the level of support independently. The average percentage of an institutional budget allocated to facilities and maintenance is eight percent (Southern Regional Education Board, 2007), but there is little information available on how this is balanced by the revenues generated through research conducted in these facilities. In addition, recent budget cuts at the state level have increased the backlog of deferred maintenance (Kaiser, 2004). More information is needed as institutional leaders are asked to justify their rising charges to students with solid detail and

objective data. Facilities management is an invaluable resource whose importance should not be overlooked. The proposed study evaluated how facilities management is an increasing priority and how Academic Space Management plays a role for research-focused institutions.

Continued fiscal constraints are forcing higher education to attempt comprehensive changes, but it is unknown whether those changes affect different institutional types equally. Some institutions may have positioned themselves over time, through their internal cultures, to manage in an austere financial environment. State universities and public academic medical centers posed an interesting set of institutions for assessing change strategies in a climate of fiscal constraints. Traditional revenue streams, tuition and state appropriations, that once constituted the overwhelming majority of revenues, no longer exist in the same proportions. Over the past decade years, public institutions in many states have seen their revenue sources shift away from state allocations and more toward revenues from indirect costs, tuition and fees, and auxiliary enterprises. (*Chronicle of Higher Education Almanac*, 2004-05, 2006-07) Many of these institutions are attempting comprehensive changes that will allow them to thrive in twenty-first century conditions.

Academic medical centers could be better positioned to thrive in a severely constrained fiscal environment because these unique institutions have lacked the benefit of the revenue streams such as tuition and state appropriations, which typically make up less than 20 percent of their budgets (Commonwealth Fund Task Force on Academic Health Centers, 2003; Henderson, 1988). Their multiple missions

include education, research, and practice, but their student population is limited for both accreditation and selectivity purposes. Therefore, their revenue from tuition or from a state formula tends to be significantly below the actual cost of instruction and faculty salaries, and there is increased pressure to generate revenue from alternative sources. Research is needed to determine how leaders can use improved space information to prioritize research space needs within their institutions and evaluate how this new information resource can help them adapt to increasing fiscal pressures.

The fiscal pressures on institutions affect their research mission. Research universities and academic health centers are assessed annually by multiple constituencies on their levels of sponsored research and on their research productivity. Only since 2005 are there signs of recovery as tuition and fee increases slow to less than double-digits. According to the College Board, tuition at public four-year colleges rose by 7 percent in 2005-06, the smallest growth in four years, and a significantly lower rate than last year's 10 percent surge (Farrell, 2005). As institutions reach ceilings in tuition and fee charges, they are under pressure, therefore, to garner more sponsored awards because indirect cost revenues represent one of the few flexible funding streams left to institutions.

Traditionally, research space has received little acknowledgement for its importance in allowing institutions to increase their levels of sponsored awards. Much of the literature on facilities management focuses on classroom utilization rates and scheduling (Probasco, 1989; Fink, 2002). The pressure to gather initial construction funds seems to overshadow the long-term funds required for maintenance. Public universities in particular must often rely on state legislatures to

build new facilities or pay for major renovations. The annual survey by the National Science Foundation (NSF) focuses only on space for science and engineering research and does not correlate that with the research awards or expenditures at any group of institutions. The results of the survey are not surprising, noting that most institutions comment on a lack of adequate specialized research space (NSF, 2002). While this information is of interest to administrators who must watch for national trends in research, it is not useful for planning and for convincing others of specific institution needs. A more institution-specific and administratively useful metric is needed to assess how space and funding coexist.

An initial attempt to evaluate the perceived importance of academic facilities was conducted by the investigator and colleagues in 2005, in collaboration with the Association of American Medical Colleges (AAMC). A web-based survey was sent to all members of the Group on Institutional Planning, those administrators most often assigned to work with academic space at their institutions. The complete survey can be found in Appendix B, and the responses indicate a strong interest in learning more about how other institutions utilize space. Of the 50 respondents, all agreed that academic space utilization was an increasing priority at their institutions. In addition, the responses suggested that a more standardized method for evaluating the use of space would be of use to them (Watt, Higerd, Tierney & Marriott, 2005). Information gathered during this initial broad survey informed the interview questions.

Purpose of the Study

One area of focus in this research was to evaluate the availability of and attitudes towards quantitative data maintained on an institution's academic facilities.

National standards do not exist to evaluate the influence of academic space on programs or how traditional inventories are very limited tools for academic planning and decision-making. Information about this resource is limited to its physical attributes and not the functional attributes necessary for making program decisions related to mission. In addition to the above-stated interest in availability of space information, this research also sought to evaluate current interest in better space information and share a proposed model that could assist academic leaders in using facilities information for daily decision-making and academic strategic planning. Too often the master planning process that occurs at many institutions may focus on concepts of green space and long-term growth, but academic leaders need a method for making immediate decisions. Inaccurate data regarding current placement of faculty and available space may result in wasted money. If the information flow were improved from the beginning design of the database process then the overall planning process should improve and, hopefully, result in consistent use of the space data by administrators. One of the limitations was that the proposed model has minimal potential for assessing long-term research outcomes such as patent income. However, academic decisions are more often based on immediate financial and personnel needs, rather than long-term monetary potential, and it is those more immediate needs that led to an interest in this project.

One potential outcome of this research was learning how academic leaders are being called upon to use facilities information. The three institutions that participated in this study, Clemson University, the Medical University of South Carolina (MUSC), and the University of South Carolina Columbia (USC) represented

a cross-section of types of public research institutions. These institutions are making efforts to increase non-student-based revenues and to improve their strategic planning efforts. However, only one institution, MUSC, has noted in their strategic plan that space is of primary importance in moving forward. Finally, this research sought to assess what academic space factors and cultural factors allow this Academic Space Management concept (ASM) to be most useful to academic and financial leaders.

MUSC has tracked space carefully for more than five years to assist their academic leaders. This research contributed to their knowledge base by determining the extent to which current deans and department chairs understood and used the resources available to them. It also evaluated any needs the deans and chairs expressed that could improve the MUSC system. Finally, including MUSC in the project allowed for comparisons among institutions at different stages of facilities database development.

Need for This Research

With continued fiscal constraints, increased pressure to garner external funds, recognition of space as a finite resource and because of the complexity of the research university enterprise, empirical research is needed to determine how institutions can improve their management of academic space. Free-standing academic health centers and university colleges of medicine tend to be more advanced than research universities in their coordinated management of space, and they have a strong tradition of interest in assessing its effective use. Schools of medicine and teaching hospitals face a tripartite mission of education, research, and practice that can evolve into competition rather than cooperation. Resolving the balance among the missions

is of primary importance as health care continues to be a priority for many states and the income generated from clinical work competes with other academic interests. Therefore, each unit strives to prove its effective and efficient use of space and those struggles may be won by those with the best quantitative information. While not part of this study, it could be of interest to see if reliance upon effectiveness measures and objective departmental reports encourages peer pressure as departments plan to grow but realize that they must prove their situation quantitatively rather than relying on primarily anecdotal evidence and college politics. Research universities are finding themselves similarly placed with academic medical centers with respect to the need to prove their effectiveness for both internal and external constituencies as they plan for research growth (USC Provost Jerry Odom personal communication, March 27, 2003).

Little literature exists on the ways that strategic management of facilities improves the research enterprise and allows for resource reallocations. Two recent presentations suggest others are aware of the need for improvement. The Federal Demonstration Partnership (FDP) is a consortium of federal agencies and research universities dedicated to improving the research enterprise at several levels, from grant applications to financial audits. At a 2004 meeting, two plenary addresses on assessing the costs of research included several comments on the need to improve space planning. Evaluation and reporting on facilities costs, both for new construction and research in current facilities is needed if an institution is to assess the costs and, subsequently, the benefits of research (Federal Demonstration Partnership, 2004). In addition, a report released in Spring 2004 by the National Academies of Science (NAS) called for the National Science Foundation (NSF) to re-evaluate its

methodology for constructing new research facilities. The preliminary report noted that there is little quantitative information available on exactly how these facilities are being used and the report criticized NSF for not having more information available before committing to a new building. The NAS report called for improved knowledge of research facility activity but did not have a substitute method readily available.

The importance of this research stems from the lack of empirical research into how well universities utilize their research facilities. In *Tuition Rising*, Ehrenberg (2000) notes that several institutions have more invested in their facilities than they hold in their endowments, but their leaders possess little knowledge of how this resource is maintained. The pressure to develop donors tends to focus on endowing departments or entire buildings, but few donors want to give money for new paint. As institutions aspire to move up the Carnegie classification ladder to positions of greater perceived influence, their investment in facilities must increase as well. This need to gain more public recognition has been described as "academic drift" and the "single pyramid of prestige" (Newman, 1987; Berdahl, 2001). Given these circumstances, the need for a measure that combines an institution's largest investment, facilities, with its second largest investment, faculty, would be of interest to both internal and external constituencies.

Research Questions

This study utilized facilities information and interviews with deans and department chairs to examine five primary research questions involving research universities and academic medical centers:

1. What University information on academic space currently exists to serve the needs of deans and department chairs?
2. What access do deans and department chairs have to these information sources and what are their perceptions of their usefulness?
3. What additional information would make their current space information more useful?
4. To what extent would the proposed discipline specific Academic Space Management model provide useful space allocation information for deans and department chairs that is not available from their current space information systems?
5. What factors are likely to affect the implementation and use of the Academic Space Management model?

Setting for the Project and Participating Institutions

The setting for these analyses was the three research universities in South Carolina; Clemson University, the Medical University of South Carolina (MUSC), and the University of South Carolina Columbia (USC). These institutions were chosen for several reasons: 1) the investigator serves as an administrator for Clemson University and has been given access to all three institutions' data; 2) the three institutions work together to respond to the state's accountability system; and 3) the institutions are being asked to bring in substantially more research funding to drive South Carolina's economic development. More importantly, however, the South Carolina institutions served as a sample of research institutions faced with problems

similar to those of other research institutions across the country. Sections later in this chapter and in the methodology will discuss the institutions in greater detail.

The study institutions, Clemson University, the University of South Carolina Columbia, and the Medical University of South Carolina (MUSC) represent institutions with disparate disciplines, cultures, and unique space conditions. Clemson is located in a rural area in a college town that surrounds the university. There is no architectural review of new buildings and land is plentiful. In stark contrast, the Medical University is located in historic Charleston where the city imposes some of the strictest architectural standards on building in the country. Also, MUSC is highly restricted in land availabilty. Finally, USC is located in the center of Columbia where land is already rather highly developed, but growth is not overly restricted with multiple opportunities for renovation and revitalization. These conditions suggest that space would be viewed differently depending on the location of the respondent and his or her role in planning for growth.

Growth has been limited over the past few years because South Carolina public higher education has suffered among the greatest cuts in their appropriations of any state in the country. From fiscal years 2001 to 2004, in constant 2000 dollars, the South Carolina research institutions have had their state allocations cut approximately 30 percent (SC Budget and Control Board, personal data transmission, December 12, 2006*)*. The institutions, therefore, had to rely on increased student fees, institutionally generated funds, and savings realized through internal restructuring. Lottery-funded merit scholarships, touted as helping higher education, do provide state dollars to students, but they place additional burdens on general operating

expenses. Each of the three institutions has addressed the financially challenges of state cuts differently but a consistent theme has been to attract increased amounts of extramural research dollars, therein drawing on the research infrastructure and management to an even greater degree.

Clemson University is the land-grant institution in South Carolina, founded in 1889, with a focus on the engineering and physical and biological sciences, including the support of multiple agricultural experiment stations across the state. Over the past decade, Clemson's research dollars have increased from less than $50 million a year to more than $115 million in fiscal year 2004. From the years 2000 to 2004 state appropriations went from more than 35 percent of Clemson's revenue to less than 25 percent of the total university's budget. With declining interest in agriculture, the leadership has shifted the research focus into biomedical disciplines and automotive engineering. The university's main campus resides on over 1,100 acres in a rural area in the western corner of the state and, unlike the other two study institutions located in urban areas, has lower maintenance costs.

The Medical University of South Carolina (MUSC) is one of about five free-standing academic medical centers in the country. Founded in 1824, the institution has professional programs in medicine, dentistry, nursing, pharmacy and health professions. As with other public academic medical centers, the state's appropriations represent less than six percent of the institution's revenue, a minimal proportion of its $1.4 billion annual budget. As a state agency, MUSC must comply with the state's procurement and business policies and has limited relief from the regulatory burdens imposed on state agencies. One of MUSC's challenges for the

coming decade is facilities growth. The city of Charleston, through its Board of Architectural Review, requires some of the most stringent renovation or construction approvals in the nation. The coastal location also requires that buildings have substantial foundations that increase the cost of any new construction by approximately one-third. MUSC is the leading institution in the state for obtaining extramural funding and its strategic plan calls for increased emphasis on research with the goal of moving up into the top quartile of research grant rankings of medical schools.

The University of South Carolina in Columbia (USC) is the flagship research institution of an eight campus system. USC-Columbia is the only one of its campuses that has a strong research component. Founded in 1801, USC is the traditional public access university in South Carolina, with focus areas in liberal arts, business, and public health. USC enrolls approximately 38,000 students and has approximately 2,000 faculty members at all of its eight campuses. As with the other research institutions, USC-Columbia faces challenges in the coming years, including an increased demand for space in an urban area and a strategic plan that includes greater emphasis on research in community health and primary care medicine. Finally, all three research institutions plan to maintain their current enrollment levels.

One of the interesting features of this cohort of higher education institutions is that they are at different stages of making facilities management a priority. One of the purposes of this study, as covered under Research Question Two, was to assess if and how attention to academic space management improves planning and decision-making. Given the shared goal of increasing research, coupled with the state's fiscal

challenges, Clemson, MUSC, and USC have recognized that their current facilities represent one of their most important resource investments. The challenges presented by this study were two-fold: First, gathering and evaluating the current, but diverse, academic space data at each institution and, secondly, coordinating discussions with leaders of institutions with multiple, complex missions to determine how academic space management could become part of the institutional culture.

Contribution to Research and Practice

The literature on higher education facilities is "geared to looking at the past and trying to figure out how to make the facilities last into the future" (Fink, 1997, p. 338). In both the management literature and the physical plant literature, little attention has been paid to how research facilities are used. There is currently no empirically tested metric for assessing how well a faculty member utilizes the space allocated to him or her by university administrators. The traditional faculty entitlement to laboratory space is giving way to competition for space based on quantitative measures directly related to how a faculty member uses space. As increased pressure is placed on faculty to produce in both the classroom and in the laboratory, the facilities required to support the complex enterprise become more strained and in greater demand. This is occurring with little knowledge or guidelines that could be of assistance to dean and department chairs, the very people who must manage allocation and use on a daily basis.

Middaugh (1996) noted in his work on instructional costs that increasing a faculty member's individual research load and decreasing time in the classroom tends to result in increased costs for institutions, because of increased part-time faculty and

infrastructure. While no mention is made of increased research space costs and facilities support costs, the need for assessing both fall in line with concerns over institutional loyalty and faculty research productivity. Investment in a new faculty member can cost an institution over $1 million for specialized fields such as biomedical research or engineering (Ehrenberg, Rizzo, & Condie, 2003), and part of that investment is in laboratory space. Institutions need to improve how they evaluate the use of space, taking into consideration factors including, but not limited to: infrastructure costs relative to external funding (e.g. high energy expenses but low indirect revenues); specialized equipment that requires renovation; risk of faculty member leaving; and, changes in the discipline that dramatically increase recruiting costs with new faculty members.

Research universities and academic medical centers are assessed extensively on their levels of sponsored research and, therefore, integrating research space assignment data with sponsored research data should be of universal interest. For these institutions, the quality and quantity of laboratory facilities are key determinants underpinning all research programs. Without adequate facilities, faculty and the university can have difficulty fulfilling a sponsor's expectations. In fact, without state-of-the-art facilities it is hard to acquire additional funding and recruit qualified investigators. Research space will become even more important as the value of research clashes with a lack of capital funds. As this resource becomes even more valuable, it is natural to look for a method to assess how well faculty utilize their space, how effectively they manage their lab space related to the sponsored dollars they are awarded. The results that emerged from this case study

could be invaluable for institutional leaders as they face continued financial constraints, increasing construction bids, and rising energy costs.

While this project focused on a single state and its three research institutions, the results of this research would be of use to others who are interested in assessing research space usage. Eventual growth and evolution of ASM at other research universities and academic medical centers would lead to standardized definitions and national comparative measures.

Chapter 2:

Literature Review

Introduction

This project evaluated the role of Academic Space Management at research institutions and assesses how facilities management was an increasing priority for administrators. As defined earlier, Academic Space Management (ASM) is an approach for developing criteria for assigning space to faculty members and academic units as well as assessing existing assigned space. Research on space planning and facilities utilization has sporadically come to the fore in higher education literature. As early as 1968, authors were attempting to suggest methods for comprehensively managing the vast complexes that make up American research universities (Bareither & Schillinger, 1968). In the years since, costs for building research facilities have escalated much faster than inflation (Abramson, 2007), particularly for institutions conducting research in biotechnology and engineering. These escalating costs, combined with the accountability and budget constraints facing most public institutions are once again bringing space planning to the attention of higher education leaders.

Few argue against the unique nature of higher education, particularly those institutions with research missions. The tripartite missions of education, research, and service complicate any attempt to isolate a campus activity into a single category. For example, a doctor doing rounds with residents while visiting indigent patients who are in a National Institutes of Health research project is simultaneously

contributing to all three university missions. The subsequent questions in this example then are: Who should pay her salary? Who should be funding the facilities? These institutional missions serve the public, but as noted by Bowen (1980), the ambitions of these institutions leave little incentive to constrain costs. The beginnings of the twenty-first century, however, suggest that public research institutions face great challenges in balancing costs with revenue sources. Fiscal years 2002 and 2003 had state budget cuts to higher education returning to funding levels equal to that of 1995. When these factors are coupled with limited investment earnings in a poor market, institutions must look to new ways to manage costs.

Bowen (1980) theorized that, in the quest for academic excellence, prestige, and influence, there is no limit to the amount of money an institution can spend. Each institution raises all the money it can and, then spends or re-invests all that it raises. The cumulative effect is toward ever increasing expenditures. Unlike a for-profit business, however, institutions do not have the ability to increase a profit margin. Faculty, staff and students each have high expectations for what support services and products should be provided to them, and these demands contribute to the ever-increasing budgets and demands for resources. Effective management of such complex and expensive institutions requires multiple information resources.

In order to answer the research questions proposed herein, this project was built on a foundation of research related to facilities management, information needs, and change management, subjects that cross higher education and business interests. However, as important as these areas are, there is a lack of empirical research into these areas, particularly related to the area of facilities management. Therefore, this

research project sought to further the literature on space management. Using a traditional case study methodology, the project included an objective assessment of quantitative data and then relied upon discussions with institutional leaders to determine the extent to which facilities management is a priority for them. The discussion in this chapter provides a framework for better understanding the research questions and the challenges presented to institutional leaders seeking to improve their facilities management.

Facilities Information and Its Role at Research Institutions

Middleton (1989) defined facilities management as a triad of functional areas; planning and acquisition, maintenance and operation, and assignment and utilization. He went on to note that underlying each of these areas is the financial need for a fully functioning infrastructure. Increasingly, academic leaders are being asked to take on issues related to facilities planning, and the majority of them question these new responsibilities (Walters & Keim, 2003). Among the challenges of assuming this complex task, good facilities management requires knowledge of the links among the academic priorities, the administrative politics and priorities, and budgetary concerns, as well as how they interact on campus.

For most institutions, traditional facilities inventories are maintained for state reporting, for listing maintenance and renovation orders, for tracking individual classrooms. An inventory is, by definition, simply a listing of items, a catalog. An inventory is not usually designed with either management or decision-making in mind. They serve the purpose of simple reporting to states and federal agencies that then report data related to insurance, room utilization, and overall research capacity.

For research institutions, these inventories can easily include over 15,000 individual rooms, even when excluding dormitories. These isolated inventories often remain the sole responsibility of the physical plant or master planning office, and these offices can tend to be isolated beneath senior leadership. New technology based systems, such as Archibus or BricsNet, can make the information more accessible by those in physical plant and even link architectural drawings to rooms, but the information seems to still be isolated from those who could use it for daily decision-making.

Leaders of complex enterprises require tools that integrate data and allow it to become useful information. Information today must be accessible at a moment's request, and all information must be linkable with other institutional databases such as personnel, finance, and enrollment. Good database design principles require standardized fields for use in merging with other data resources and these fields must have content that can be understood by those who use the database. Designing a database that encompasses an institution's needs is best accomplished by those who need the information. In addition, a database that encourages use by other professionals outside of physical plant tends to increase the accuracy and thoroughness of the data. A database isolated in a single computer does not serve the needs of a research institution or academic medical center. Determining an institution's information system is a primary challenge for today's Presidents, given that technology changes almost daily, concerns about security abound, and costs are added annually. Databases designed to address the personnel, student, and financial needs of a research institution cost millions to purchase, and unknown millions in management and annual fees. Research institutions require massive amounts of

detailed information to manage their complex endeavors, and those requirements are only increasing with demands for compliance, financial accountability, and potential conflicts of interest.

Higher Education Financial Reporting and Improved Information

According to a survey by the National Association of College and University Business Officers (NACUBO), areas of finance and facilities report to the same person at a majority of the public institutions (NACUBO, 2007). This suggests the important link between the two areas. However, perhaps part of the challenge in linking facilities to faculty-sponsored research is that the two areas of research and physical plant are usually not linked organizationally at institutions. This can lead to the challenges of communicating faculty needs for improved research space to administrative leaders who do not have access to detailed information on how that space is being used.

Institutional leaders can rarely separate the utilities used to run an individual research project from that needed to conduct other institutional business, such as administrative office costs or instructional costs. For research institutions, research costs related to facilities and maintenance are supposed to be captured in the indirect cost rate, the rate applied to federal grants in addition to the direct costs of conducting the research. This indirect rate is calculated from a complex formula that splits space into secondary and tertiary uses (i.e., administrative and instructional percentages) if it is documented that any activity other that research occurs. For example, an institution is held responsible for the costs supposedly associated with housing a graduate student in a laboratory, as if that decreases the cost of conducting the

research. Institutions have long noted that the indirect revenues do not fully cover the costs of conducting research (Brainard, 2005; Fossum, Painter, Eiseman, Ettedgui & Adamson, 2004).

The federal government, therefore, relies on the institution to supplement the costs of research, costs that some institutions are better prepared to absorb than others, as suggested by consistent research documenting that the overwhelming majority of federal research funds are awarded to a very limited number of institutions (Brainard, 2001; Fossum, Painter, Eiseman, Ettedgui & Adamson, 2004). Even more surprising is the statistic that approximately 49 percent of the federal research funds go to academic medical centers (Commonwealth Fund, 2003). This partnership, among institutions, researchers, and the federal government, involves the investment of millions of dollars each year and facilities are a vital piece of this endeavor.

As stated by Bowen (1980), institutions invest in research to increase their national reputation, not because they expect to financially profit from research. In addition, institutions are pushed to invest in research to further the economic prosperity of their states and the nation. However, there is little information available regarding the financial investment that individual institutions make in order to garner additional research funds and through this investment, hopefully increasing their national reputations. Institutional leaders should be prepared to assess the gap between their indirect revenues and their internally subsidized research costs and determine if they find the monetary investment level acceptable. Institutions subsidize research in both direct and indirect methods, whether through channeling

indirect costs back to the investigator or by paying temporary faculty to teach courses formerly taught by faculty conducting research. The supplements to conduct research include consideration of annual scheduled plant maintenance, housekeeping, renovation and construction, and basic utilities. The mix of services provided and the difficulties of isolating costs to a lab and, specifically, to a project contribute to the challenge of capturing "true" costs of conducting research.

There is significant literature surrounding the costs of education related to faculty, instruction, and even research. However, only Ehrenberg (2000) refers to the size of the capital investment, while those constructing formulas to assess costs refer to balances of research, undergraduate enrollment, and graduate enrollment (Brinkman, 1981; Brinkman & Leslie, 1986; Cohn, Rhine & Santos, 1989). The pressure to improve the evaluation of facilities use, and the overall management of space, appears to be resurfacing as a topic of institutional interest.

The Fiscal Environment

"There is no such thing as free space in higher education" (Montgomery, 1989, p. 21). Many articles have been written about how higher education spends money. Authors such as Bowen (1980), Ehrenberg (2000), and Keller (1983) have suggested that higher education practice, particularly public higher education, is about more than improving instruction and conducting more research. Higher education is also about spending as much money as is received each year to generate additional prestige and to prevent cuts. Other authors have posited, however, that higher education does manage to do its job with increased efficiency in areas where costs can be controlled (Brinkman, 1981). On both sides, researchers refer to costs of

teaching undergraduates compared with graduate students, of administrative efficiency, of managing endowment income appropriately, of managing shifting proportions of state appropriations and tuition and fee revenue, and even of the costs for conducting research. None of them refer to the costs of maintaining, updating, or building research space. This is in spite of the costs associated with annual expenditures related to the operation and maintenance of physical plant, costs that averaged more than $65 million among a sample of leading research universities (Southern Regional Education Board, 2007). The question then comes as to how the second largest investment made by institutions is left largely undiscussed in the literature on higher education costs and cost containment.

Without much mention of academic space costs or academic space management in the literature, there is the question of how researchers have even tangentially considered facilities costs. It is important to note that this does not pertain to all disciplines, but to those where substantial time in a research laboratory are required. Brinkman (1981) refers to the costs of teaching graduate students as significantly higher than that of teaching undergraduates, and while there is no mention of facilities, one can assume that the costs of teaching graduate students includes more laboratories and an increased number of full-time faculty members. Other research reinforces the theory that those institutions that enroll greater numbers of graduate students tend to have higher instructional costs (Cohn, Rhine, & Santos, 1989), although little if any correlation has been made between those higher instructional costs and increased physical plant costs. Few studies seem to consider

capital outlay as a factor, nor refer to the independent contractor nature of research faculty.

As noted by Birmbaum (1990), the complexity of the research institution enterprise builds upon loosely coupled systems in which there is little organized hierarchy and multiple independent units. Isolating any particular cost to a specific investigator and to a specific grant, and then charging a fee for that use, would result in increased costs with unknown benefits. While these increased costs can be captured in more than one expenditure area, one must consider the infrastructure costs. Cohn, Rhine and Santos (1989) evaluated the relationship between increased costs and research expenditures and found that there were significant economies of scale. They considered multiple variables in their design, yet facilities or plant operations were not in the analysis. Ehrenberg (2000) refers to Cornell University's decision to finally build in annual evaluation of deferred maintenance because of its exponential growth and the tendency for it to be ignored until an emergency arises. The chief business officer at one of the institutions in this study was told that he should "let things break more often" in order to receive more annual funding for infrastructure costs (Anonymous personal communication with senior administrator, Oct. 20, 2004). This suggests a challenge that needs to be addressed in terms of both actual costs and organizational planning.

In academic planning situations, institutional leaders decide how to spend money. Layzell and Caruthers (2002) define opportunity costs as the alternatives that could have been realized by choosing to spend money on something else. Too often the priorities of the institution are those seemingly immediate needs that relate to

limiting tuition increases and appeasing state leaders concerned with fiscal accountability. It can be difficult to convince the external constituent groups that money is needed for basic infrastructure maintenance when money is needed for so many other campus priorities. While Ehrenberg (2000) and Dunn (1989) note that institutions tend to defer plant costs in times of fiscal crisis, public institution leaders may be hard pressed to determine a time that was not a time of fiscal crisis. However, in terms of academic planning, deferring physical plant needs can be viewed only as postponing the inevitable.

The assumptions of this undertaking also included a belief in the integrity of the institutional databases. Each institution in this study must report data related to facilities and faculty each semester to the Commission on Higher Education and that information is audited for accuracy every three years because of the State's performance funding and accountability mandate. The sponsored programs information, particularly projects awarded from federal agencies, is subject to strict reporting and auditing procedures as well in order to appropriately award indirect costs associated with research. Those audits occur usually every three to five years. It is assumed, then, that the information is accurate for each time period.

Evolution of Facilities Information Needs & Technology

The second research question of this project concerned the level of access available to deans and department chairs, assuming that increased access to information would lead to increased use. It was also assumed that opening space information up to multiple audiences would contribute to its increases accuracy. There was no available literature on this concept; no research has been done

comparing the access provided with its actual use. However, because of the relationship between planning and the need for information, a sample of related literature is included to inform the project.

Facilities Planning

It seems natural that planning for space and its use would coincide with planning for the academic priorities of a research institution. For these complex institutions, the amount of specialized space allocated for research now exceeds the amount of space used for classrooms and class laboratories (Fink, 2002). In addition, the amount of deferred maintenance accumulating at many institutions has reached new heights and states are struggling for ways to pay for the increased burden (Cain & Kinnaman, 2004; Fisher, 2006; Kaiser, 2004; Schmidt, 2005). From a theoretical perspective, facilities can be evaluated three ways; technically, functionally, and economically (Ang & Wyatt, 1999; Schodek, 1971). While these perspectives have their home in the civil engineering literature, these perspectives are (or should be) of increasing importance in higher education. Perhaps it is only when the areas of civil engineering, operations and maintenance, and academic administration come together on managing space will institutions improve their overall management of academic space.

The functional perspective on space planning refers to how well a building supports the mission of the institution and serves the purpose for which it was created (Ang & Wyatt, 1999). This may include assessing how accessible the building is to those who need to use it, how well it adapts to changing needs, and if room sizes are appropriate and well organized. For example, traditional lecture halls are being

renovated to better suit students' laptop use during lectures or small group activities. As research and teaching become more susceptible to changes over time, utilizing and evaluating specific function categories with room assignments would be helpful.

From the technical perspective of evaluating facilities, one must consider the actual physical construct of the building, both inside and outside. (Cairns, 2003). Of importance to academic leaders is the evaluation of energy costs, the flexibility of space to be used for other purposes, and its lifespan. It is interesting to note the attention paid to the financial assets of an institution in contrast to the lack of attention paid to facilities information. Planning for a building, the technical perspective, receives much greater attention than its enduring use and management needs. With construction estimates for new buildings often exceeding even the best of state bond plans (Fischer, 2006; Fusco, personal communication, August 2, 2006), financial assets are increasingly devoted to facilities, therefore suggesting that the joining of the two most significant assets of an institution are part of the future.

This joining of financial and facilities management are part of the economic perspective referred to above. In the economic perspective, a building is seen as part of the institutional enterprise and the leadership assesses the return they receive on this investment in space. Unlike simple financial assets, such as endowments or student fees, the return on the investment in space occurs over a period of more than 20 years or longer. There is a need for empirical research into the costs incurred and the revenues earned from facilities, particularly high cost research space.

Facilities and Space Utilization Policy Environment

Most public institutions have been subject to variations in state budgetary priorities over the past four decades, and facilities have tended to suffer in lean times as an area easy to ignore and defer to a time when money becomes more plentiful. In the 1960's, the federal government invested heavily in higher education, building new facilities to house the first generation of students attending colleges after World War II and also to finance research related to the Cold War. The 1970's, however, saw a shift as direct federal support to higher education institutions decreased (and aid was directed to students) and states were pressured to try and compensate for the decrease in funding. Uncertainty also arose because in the 1970s enrollments actually declined at some institutions across several years and there was a surplus of professorial candidates. With shifting monetary priorities, both faculty salaries and money for facilities became scarce (Pickens, 1993). By 1980 the federal government had cut its support of university equipment and facilities by over 80 percent and, as state support increased, federal support continued to decrease (Bok, 1982). The 1980's brought increased funds, because of dramatic tuition increases as well as increased state allocations, enabling administrations to increase faculty salaries after years of neglect (Boyer, 1990; Pickens, 1993). Monies also were used to supply an increasing number of student services. To assess the success of students attending and funding the public institutions, the 1990's became the age of accountability, as approximately 35 states implemented some type of measure to make institutions more responsive to public concerns (Burke & Modarresi, 2000). The new decade since 2000 has not been kind to higher education with respect to state budgets, with the forecast that cuts to compensate for lost revenue will not be regained by 2010 (Boyd, 2002).

Unfortunately, facilities maintenance priorities, while sometimes reported to state coordinating boards, were rarely a priority issue to either legislators or the public. Because of this, many institutions had funds for their deferred maintenance postponed or denied and, therefore, were forced to watch as old buildings fell into disrepair and new ones become a rarity (Pickens, 1993; Ehrenberg, 2000). Renovations or new construction typically require an appeal to a state agency that reviews capital costs; rarely can a public institution rely only on its own funds. Given the increased demands by students for technologically up-to-date campuses, costs for infrastructure have dramatically increased over the past decade and are expected to continue to rise (Fink, 1997). As far back as 1968, Bareither and Schillinger noted the importance of *campus needs* and not departmental needs when they described space planning in terms of a mathematical model. The authors cite the importance of campus planning as a precursor to facilities planning, but this appears to be the kind of long-range planning not always available to public institutions administrators who must take what is available during each budget cycle.

As higher education moves into the 21st century, another debate continues, which is the impact and potential for distance education and the accompanying affect on educational facilities. State plans, such as those for Florida, Maryland, Tennessee, and Virginia address the expanding need for higher education in off-campus locations (Florida Board of Governors, 2007; Maryland Higher Education Commission, 2003; State Council of Higher Education for Virginia, 2007; Tennessee Higher Education Commission, 2004). However, institutions differ widely in their use of this new technology, with most preferring to rely on other institutions, such as for-profit

schools or community colleges, to fill the gap between tradition and innovation. There are conflicting views on the potential for distance education, but some believe as Fink (1997) states, “As advances in technology continue, the campus as a place diminishes in significance as the locus of knowledge” (p. 327). However, actual figures seem to reveal a different tale since the majority of campuses across the country have seen an increase rather than a decrease in on-campus enrollment. Contrary to early beliefs, off-campus instruction has not been less expensive than traditional methods. While the merits of Fink’s assessment are certainly debatable in regards to instructional space, the issue of research space continues to surface, and to surface more often at large institutions, as costs escalate with technological advances.

To assess the impact of research space and its use on research funding, institutions are developing models that can assist them in managing this complex enterprise. The Texas Commission on Higher Education developed a mathematical model by which they can approximate how many square feet of research space is needed to generate $1 million in research. The University of Michigan Medical School utilizes an internal model that not only calculates research dollars per square foot of space, but also breaks out information by senior and junior faculty (Mohr, Offhaus, & Dannemiller, 2005). In this model, academic leaders and faculty can view information on the secured web site, and it is updated regularly throughout the year in order for leaders to assess changes over the previous years. Both Stanford University and the University of North Carolina School of Medicine are among leading institutions that recognize how regularly evaluating space use for research assists in planning and achieving institutional goals (Watt, Higerd, Tierney, &

Marriott, 2005). Other institutions, seeking to increase their research money, are expected to try similar predictors, since both new construction and renovation costs are increasing rapidly.

Competition and Campus Politics

One of the unique characteristics of American higher education is the independence with which departments and faculty operate. Intellectually, faculty members have the freedom to develop their own research and ideas; this freedom is the cornerstone of the American higher education system. Practically, most faculty members are dependent upon the institution to provide structure and support for their research. The university has a commitment towards its faculty and, in order to stay afloat as a center of research and learning, universities must strive to fulfill this commitment.

In *Beyond the Ivory Tower* (1982), Derek Bok notes the conditions that must be present to maintain the highest quality scientific research. Of his six conditions, two relate to space:

- First-rate scientists need proper instrumentation and facilities to permit them to do their best research. Without modern equipment, investigators will not be able to work at the frontiers of science, and the initiative will rapidly shift to other countries where better facilities are available.
- The working environment should be such as to stimulate research of the highest quality…. And since all scientific discoveries build upon existing knowledge, investigators

> must have access to the widest body of scientific work by having excellent library facilities…and maximum freedom to exchange information concerning work in progress. (p. 143)

Being at the forefront of current research means having the necessary facilities and that means being an institution where research gets much more (monetarily) than passing interest. In fact, it almost seems logical to suppose that only the richest institutions can afford to compete for the scientists on the cutting edge of research. An article in *The Chronicle of Higher Education* (Brainard, 2001), detailing the membership of the elite National Academy of Sciences, supports this supposition. The article noted that 56 percent of the 2,285 members of the Academy come from only 30 institutions. These institutions received 40 percent of the federal government's science and engineering funds and possess endowments that are among the largest in the country (Brainard, 2001). Data from fiscal year 1999 revealed that the average endowment for each of these institutions was over $2.5 billion, suggestive of Bok's ideal research environment. It takes more than one or two elite scientists to create a research institution; it takes money, cooperation, and specific intent. At least one of those is often in short supply at public institutions as we enter the 21st century.

Factors Affecting the Adoption of Change in Higher Education

The literature on organizational change is extensive, in higher education and other management arenas. Studies evaluate not only how to implement change, but also the various considerations that make an innovation successful over the long-term. However, the management literature falls short of explaining how higher education is

different from for-profit businesses. There is little agreement of a particular best practice to implement change in an enterprise as complex as higher education. There are multiple factors that can affect the change at any time, whether financial concerns at the beginning, political issues during the process, or overall cultural resistance. Each institution is unique and the factors affecting change will be as well. One of the opportunities presented in this project was to evaluate the change process itself and the factors contributing to a successful implementation in a research environment.

It is assumed from the past experience of the investigator that adopting an innovation is a multi-step process. Bullock and Batten (1985) evaluated how organizations progress through planned change and identified that there is much more to the process than defining goals, activities, and communication methods. They identified four phases that occur during a single process of organizational change: 1) exploration, 2) planning, 3) action, and 4) integration. Subsequently, Timmerman (2003) expanded on the phase theory by proposing different processes that can influence how an organization moves through the phases of planned change. He theorized that the processes vary dependent upon whether the change processes were programmed or not. In a programmed change process, the requirements for change are pre-determined, steps set up without individualization. Planned change processes move along the continuum towards the adaptive end, where the change process is adapted to each organization based on feedback and the needs of the organization. The change processes can be influenced by some external inputs, but the organization must still move through each phase at its own pace.

Because very little empirical research exists regarding facilities management processes or outcomes, this project drew on research from organizational change literature. This literature is appropriate for laying the foundation because institutions seeking to improve their management of academic space must engage in change processes. Change processes for institutions are affected not only by the internal participants but by the methods utilized to implement that change. The change literature refers to two primary methods for implementing change, a planned process or an adaptive process (Schmidtlein, 1973; Mintzberg, 1994). In the planning process, the structure is well-established and is overlaid onto the existing institutional processes with little room for negotiation or alteration of the innovation's construct (Timmerman, 2003). In contrast, an adaptive process encourages, even requires, input and adaptation from those involved in the innovation. This process tries to fit an innovation into an existing culture, rather than forcing the culture to make room for the innovation (Bullock & Batten, 1985; Timmerman, 2003). While most of the organizational literature agrees on these two processes, Timmerman takes it a step further by noting the steps that occur as an organization adopts an innovation (Timmerman, 2003).

Bullock and Batten (1985) evaluated how organizations progress through a planned change implementation and identified that there is much more to the process than defining goals, activities, and communication methods. They identified four phases that occur during a single process of organizational change: 1) exploration, 2) planning, 3) action, and 4) integration. Subsequently, Timmerman (2003) expanded on the phase theory by proposing different processes that can influence how an

organization moves through the phases of planned change. He theorized that the processes vary dependent upon whether the change processes were programmed or were more flexible or adaptive. In a programmed change process, the requirements for change are pre-determined, steps set up without individualization. Change processes move along a continuum from a fully planned effort to an adaptive approach, where the process is adapted to each organization based on feedback and the needs of the organization. Regardless of the anticipated level of adaptation, it cannot be predicted how long each phase will last or the exact factors affecting them.

This research will adapt Timmerman's framework (Figure 2.1) and determine how it can be applied in the unique management environment of higher education. Previous research has determined that, when an innovation is presented to an organization, it will be more integrated into the organization when the process is adapted into the existing structure as much as possible (Marcus, 1988; Gabarro, 1987). Each organization is unique in how its culture and management environment co-exist, and how the senior leadership communicates information. After the initial quantitative assessment of academic space information, the second phase of this project includes discussions with administrative leaders to determine how Academic Space Management fits in with the ideals and management culture of the institution.

Figure 2.1

Conceptualization of implementing an innovation such as Academic Space Management (Timmerman, 2003)

Programmatic Implementation Approach	Adaptive Implementation Approach
Adherence to preplanned, top-down implementation procedures	*Continual modification of implementation procedures based on continual user feedback*
Exploration	
Institution initiated and scans for problem resolution	Institution or implementer initiated and involves collaboration to enhance existing space system.
Planning	
Central decision makers determine direction and implementation plan	Plans and approvals developed by multiple parties developing consensus
Action	
Formally announce implementation from the top	Participative implementation with feedback from all stakeholders; modifications frequent
Integration	
Implementation leads to stable diffusion across institution	Stabilization with continued diffusion of changes to and from the periphery

Cooperation, or a lack thereof, is often cited by faculty, staff members, and administrators as the reason for maintenance of the *status quo* across campuses. Academic departments can be very protective of their space, and have traditionally viewed administrative attempts to assess university space as intrusions upon sovereign territory. Although many would almost certainly say that this departmental protectiveness is not only justified but also necessary, the sometimes contentious climate regarding space has made a comprehensive assessment of university space a task that is difficult at best and acrimonious at worst. To many individual investigators, the administration's role in space management is not to assess space, or even to determine if existing space could be used more efficiently, the administration's role is, quite simply, to provide more space (Fink, 2004). This tradition, which produces its own unique problems, has been symptomatic of a larger

campus attitude concerning space: Should departmental space be controlled and assessed locally? Should a university's overall policy of space management promote local control?

According to Miller (1990), in the "golden age" of the forties and fifties when federal funding for facilities was still plentiful, a hands-off attitude towards space was not only logical but was preferable. Today, however, such an attitude is not possible, and universities can no longer afford to focus only on increasing square footage; the focus should also include evaluating its use.

It would be ideal, of course, if an institution were able to create, and then adhere to, a deferred maintenance plan that anticipated the life cycle of both interiors and exteriors. However, when trying to decide between increasing faculty salaries and updating the air conditioning system, it is difficult to argue against salaries in favor of something that is still in working order. Ehrenberg (2000) believes that this deferment is more hazardous and more costly than keeping up with maintenance needs. Anyone who owns a house knows how much it costs when one waits until a needed element is broken, it costs more and planning becomes less possible. Cornell University is one example where deferred maintenance is now a priority but some at the institution view this as money that could have been spent to keep tuition down or to increase faculty salaries. Cornell has only been successful because its board of trustees continually assesses the progress made and plans for additional maintenance (Ehrenberg, 2000).

Implementing Change in Organizations

When an innovation is initiated, several problems need to be addressed. One challenge to those managing any innovation is determining the correct balance of being proactive while waiting to react to other concerns within the management team. The challenges of managing attention (turf issues), of managing ideas into currency (cultural issues), of managing part-whole relationships (losing sight of the big picture), and of managing institutional leadership (creating an infrastructure conducive to change) must be considered (Van de Ven, 1986). After all, managers can too often feel as though they are continually working on the same intractable issue if there is not an attempt to create an environment open to change and improvement. Managers within an organization tend to have trouble being proactive to external changes and instead are reactive (Dunphy & Stace, 1988). Research universities and academic medical centers are likely to present specific challenges because of the independence with which many colleges and their respective departments operate. An innovation may become part of one college's culture and yet not become integrated into another college in that institution.

Power and Trust in Adopting an Innovation

One of the primary considerations for this research, as stated in Research Question Five, will be assessing the perceptions of leadership and culture related to facilities management on the participating campuses. When senior leadership at a research-focused institution decides to adopt an innovation, they must assess who has the resources to accomplish the task. This requires a discussion of leadership, power, and authority. Power exists in three forms: 1) power over; formal granting of

authority, 2) power to; empowerment, giving others more freedom to act through sharing, and 3) power from; the ability to resist the power of others and fending off demands (Hollader & Offerman, 1990). Power in an organization is earned formally and informally in all three forms. Formal power (authority) gives a person the ability within an organization to make certain decisions. Authority typically has very specific limits, with managers understanding what decisions are within his or her jurisdiction. To the contrary, informal power (influence) can be earned without regard for formal position and may be more highly valued than formal power. Two keys to power that are essential to successful organizational operations are information and access. It is important in evaluating the change process to understand who holds power to affect the change process, and to understand that the person, or people, may not have designated formal power.

Managers and administrators cannot depend on formal power to accomplish goals, however, because authority does not guarantee leadership (Hollander & Offerman, 1990). The process of how someone gains influence over an outcome is not well understood in management (Gabarro, 1987). The use of power to gain improved outcomes can make the user more dependent on others and, therefore, less powerful (Cook & Emerson, 1978). This intuitive sense of transactional equilibrium may make some managers less likely to adopt an innovation because of the fear that they will lose power. Changes tend to redistribute power. However, there is research that suggests influence is won through successful transactions with others because, after the first transaction, people are more likely to continue interactions (Cook & Emerson, 1978). In complex organizations, such as research universities and

academic medical centers, influence remains a topic of interest because formal power changes relatively frequently, and because there is more of a flat hierarchical structure than exists in most private enterprises. One outcome of this project, through Research Question Five, could be information on the path and path elements that teams take through formal and informal power to influence the assimilation of ASM into the culture of an organization. Attention to gender and race differences was perceived as possible important considerations. It was recognized that this investigation could also uncover similar paths managers take to stall or impede the innovation's success.

Trust is highly beneficial to the functioning of an organization, and there are numerous potential benefits of trust (Dirks & Ferrin, 2001). In complex organizations, such as research universities and academic medical centers, the culture can shift towards increased or decreased trust based on changes in administration, changes in funding, or even sub-currents of hidden agendas. Trust is not an all or nothing concept, it occurs along a continuum and combines aspects related to a person's ability, benevolence, and integrity (Mayer, Davis, & Schoorman, 1995). Participants were asked about levels of trust within the department and at the senior administrative levels. Research suggests that increased levels of trust result in more positive attitudes, increased cooperation, and very high levels of performance (Dirks & Ferrin, 2001). Trust helps maintain norms and expectations between leaders and the group (O'Connor, Rice, Peters & Veryzer, 2003). A team is likely to be more efficient if trust exists because of decreased time spent double-checking others'

comments and the increased communication among members (McEvily, Perrone & Zaheer, 2003).

An innovative idea without a champion is doomed to fail. A champion must gather appreciation for the innovation, galvanize new support, and provide emotional meaning and energy to the endeavor (Van de Ven, 1986). In higher education, especially research universities, a leader helps the innovation navigate the complex internal systems, as well as successfully allow for discussion and debate. A leader, or perhaps a shepherd, guides any new process to success. The literature in many disciplines and professional organizations is full of theories regarding what it takes to be a leader. Leadership depends on responsive followers in a process that involves the direction and maintenance of an activity (Hollander & Offerman, 1990). Being named a manager is not synonymous with being a leader and the challenge for an organization is connecting the two concepts and giving these leadership roles the tools to succeed (Dunphy & Stace, 1988).

One challenge noted in the literature is the different qualities required by a leader called in to "transform" an organization, to change rather than maintain the *status quo* (Bensimon, Neumann, & Birnbaum, 1989; Gabarro, 1987). Transformational leaders require time, information, and opportunities to interact with the organization in ways that may be new to the existing administration. This includes stages of "taking hold," "immersion," "reshaping," and "refinement;" stages that allow time for in-depth understanding of the organization and its situation. Leaders chosen from within (as in the case with this project) will most likely require the least time in the first two stages, but may have more challenges in reshaping

because of previous transactions (Gabarro, 1987). It was interesting to note throughout this project the pressures placed on the leaders with regard to institutional type (research university or academic medical center) and comfort with technology.

One leadership challenge unique to higher education is the requirement of leaders to interact well with multiple groups with sometimes competing priorities and personalities. Successful integration of an innovation into one college or discipline does not mean the innovation is used across the institution. Birnbaum (1988) discusses the culture of higher education as one of "loosely coupled" systems. This theory suggests that, in higher education, inputs or changes at one end of the system may or may not be reflected in the outcomes of the institution; change may not become part of a culture simply because of a change in inputs. American higher education is revered as the best in the world and yet also viewed as one that survives with poor management. Birnbaum proposes that perhaps imposing traditional management practices would diminish rather than enhance organizational effectiveness. Echoing these sentiments is O'Connor *et al*. (2003) who note that the academic environment offers even more challenges for multidisciplinary groups because "there is no hierarchical reporting structure and no reward system in place for such risky ventures" (p. 360). Therefore, one of the important questions related to how needing improved information results in actually acquiring new information.

In spite of the unique environment of higher education, universities are still organizations chartered to provide needed products to their constituent groups. Schmidtlein (1977) notes that "information is one source of power" (p. 31), and that the organization can survive only through regularly altering its internal operations to

meet changing needs. Birnbaum (2000) follows this theory in his research related to why and how higher education institutions adopt and then drop management fads in quests to help their organizations thrive rather than merely survive. It is the continual striving for prestige, better cost containment, and overall improved management that perhaps best explains the periodic interest in certain changes in management techniques.

"Restructuring [higher education] has emerged as an imperative at the nexus of resource constraints, market demands, and technological possibilities" (Gumport & Pusser, 1997, p. 453). For higher education to change, the process must allow the fundamental beliefs of the institution to remain intact, or even enhance them, while removing less essential pieces (Chaffee & Jacobson, 1997). Higher education organizations rely on the faculty, often behaving as independent contractors, but who share in the governance of the institution. Governance at institutions exists on two levels, one of more traditional hierarchy within the administration of the institution and one of shared governance as faculty oversee the curriculum and research. Traditional organizational change theory relies on top-down administration hierarchies, but higher education institutions tend to be flat organizations with multiple voices participating in governance. Kabanoff, Waldersee, and Cohen (1995) found that in a collegial environment there was great enthusiasm for change, but also decreased collective satisfaction with the change once it occurred, and they thought more research was needed in the higher education environment. This project attempted to discern trends in perceptions of responsibility for facilities management

(Research Questions One and Two) and if the institutional leadership is meeting those needs (Research Question Five).

Culture and Its Effect on Change in Higher Education

As defined by Peterson and Spencer (1990), culture is "the deeply embedded patterns of organizational behavior and the shared values, assumptions, beliefs, or ideologies that members have about their organization or its work" (p. 4). An institution's culture can be defined as a set of traditions, beliefs, and practices that internal personnel see as what constitutes that institution's specific identity. Culture enables people to explain events better by placing them in a context that members will understand while those outside of the institution may remain uninformed. Because these internal languages and behaviors are unique to each institution, it can be challenging to empirically assess aspects of a culture that "work" better in one place than another and how change affects any institutional culture. There is a dearth of empirical research into the culture of higher education, perhaps understandable given the unique protectiveness many people feel for their institutions and the unique culture each possesses. Most studies are qualitative efforts that merely assess aspects of administrative leadership and interactions with faculty. However, because cultural changes coincide with changes that are inflicted upon institutions, it is important to understand how culture affects an institution trying to adopt an innovation. The ideals of Academic Space Management (ASM) require most institutions to change more than a database structure; it requires changing the culture, the manner in which the administration sets expectations and assesses results.

When coming in from the outside to propose changing an organization, gaining an understanding its culture is of paramount importance. "The planning process that is inconsistent with organizational culture is doomed to fail" (Chaffee & Jacobson, 1997, p. 231). For outsiders coming in to impose an external idea on an established organization, understanding the culture cannot occur within a two-hour meeting or a one-day visit. Given observations such as those above, without considering an institution's culture, a change process will not be successful, no matter how desired by senior management or needed by the organization. Consideration of culture during change requires assessing the path of change, *from* what *to* what (Kabanoff, Waldersee, & Cohen, 1995). In order to do this, however, the literature is inconclusive on specific path elements that contribute to a successful integration. For many leaders, the challenge is in breaking out of one's own framework and leveraging the strength of a group that comes together on a project (O'Connor *et al*, 2003). This project asked Deans and Department Chairs to evaluate how they could use improved facilities information for academic planning. For the institutions that have gone through the adoption of space management, it is of interest to evaluate the cultural elements that served as both barriers and bridges throughout the implementation.

This project's attempt to evaluate the role of Academic Space Management in improving academic planning presented challenges. While there are many individual theories related to facilities management and academic planning, there is a dearth of literature on their interaction. It would seem that in the time of accountability, there would be an increase demand for information on how facilities are used once the plan

is realized. One of the assumptions of this project is that, without exception, administrators realized the need to improve facilities management. It was thought that they simply lacked the tools, or appropriate innovation, to allow them to improve space management. The challenge lay in implementing an innovation into a complex culture and then integrating its use into academic planning processes. The results of Academic Space Management should be improved processes for planning, utilization, and accountability.

Previous research has determined that when an innovation is presented to an organization, it will more likely be more integrated into the organization when the process is adapted into the existing structure as much as possible (Gabarro, 1987; Marcus, 1988). Each organization is unique in how its culture and management environment co-exist and how the senior leadership communicates information. The three participating institutions were expected to each evaluate the value of Academic Space Management implementation with differing levels of guidance from the investigator, and participants across administrative levels will be asked about aspects of the change process.

Summary Regarding Implementation of Change

When an innovation is initiated, several problems need to be addressed. The challenges of managing attention (turf issues), of managing ideas into actual processes (cultural issues), of managing part-whole relationships (losing sight of the big picture), and of managing institutional leadership (creating an infrastructure conducive to change) must be considered (Van de Ven, 1986). The literature has tackled many of the pieces surrounding facilities management. Increasing concerns

about costs, database use, information demands, and factors affecting change contribute to improving the knowledge available to those interesting in academic space management. After all, without creating the environment that can accept and integrate change, managers end up feeling as though they are continually working on the same broken issue. The challenge in this project was discussing the implementation processes, challenges, and overall usefulness of the innovation that must maintain the attention of leaders juggling multiple priorities.

Conclusion

The literature that exists on current facilities information relates more to detailing the inventory systems and classification of space, not how the information is used. In addition, that literature also comes from the facilities maintenance or architecture department of an institution, not from planning or financial administration. Subsequently, information to guide the project's question on access to information was left to rest on literature more related to planning and a more historical perspective on the priorities of research institutions. These two questions related to current processes at the participating institutions and attempted to gather new information that would inform the literature on facilities information and how administrators were given access to the data.

The final three research questions asked deans and department chairs to think about how better facilities information would be useful to them and any barriers to improving space management data. The literature on change management contributed to the interview questions with its foundation on process management and cultural implications. In addition, the literature on the culture of higher education

was helpful because of it reinforced the concept that interviews would reveal internal processes that would not be found in any quantitative analysis. This project represented an innovation in the literature because it attempts to gain insights about implementing facilities management within the culture of a university.

The literature on administrative management of facilities, and possible concerns for the institution as a whole, has existed since the 1960s. Coupled with that, literature on building costs and trends also exists, but tends to be practically focused and aimed towards reports rather than empirical research. Finally, the change management literature is rich with instruction and lessons on how to successfully create change in an organization. The three facets have never been combined to address creating change in facilities management, and the proposed construct of Academic Space Management utilizes information from all three fields of inquiry. This project will rely on a possible renewed interest in administrative oversight of facilities as the lead in learning more about costs and how to guide an institution through the adoption process.

Chapter 3

Research Design and Methodology

Overview

This study was designed to evaluate the role of, and the potential for improvement in, facilities information at research-intensive universities and academic medical centers to determine how academic leaders utilize current information and what information they consider useful. It involved a case study of the three major public research universities in South Carolina. One is a land-grant institution, Clemson University, with more than $114 million in sponsored research awards. One is the state's flagship multi-campus university, the University of South Carolina Columbia (USC), with more than $149 million in sponsored research awards. The third is a free-standing academic medical center, Medical University of South Carolina (MUSC), with more than $180 million in sponsored awards. Confining this project to institutions within one state minimized institutional disparities in funding and capital budgeting practices. This approach should have minimized the variation among state subsidies in increasing research and infrastructure needs, including facilities. The proposed case study included three sequential phases: 1) An initial interview with selected academic deans and department chairs at the three institutions to assess current space processes, information resources, their perceived information needs and the data required to satisfy those needs, 2) a second phase involving a quantitative analysis of current space information from the institutions according to the principles of the Academic Space Management model, and 3) follow up

interviews with the same deans and department chairs to assess how they could use the improved information for academic planning.

This project considered several aspects regarding the management of academic facilities: allocation and accountability policies, the current availability of useful facilities information, how deans and chairs access and use the current information, perceived priority of space information in meeting the needs of the administration, and factors affecting the improvement of data gathering and organization to meet the needs of the academic leaders. To more fully describe the proposed project, this chapter presents: 1) the overarching research design, including the basic assumptions underpinning the research project; 2) the research questions and the data on variables needed to answer the research questions; 3) the proposed methodology including the population, data collection, and the data analysis process; and 4) limitations affecting the research design and methodology.

Research Design

This study attempted to answer the following research questions quantitatively and from a more qualitative grounded theory perspective, obtaining information on the incentives and challenges faced by academic leaders. In examining this complex issue, this study sought answers to five primary research questions:

1. What University information on academic space currently exists to serve the needs of deans and department chairs?
2. What access do deans and department chairs have to these information sources and what are their perceptions of their usefulness?

3. What additional information would make their current space information more useful?
4. To what extent would the proposed discipline specific Academic Space Management model provide useful space allocation information for deans and department chairs that is not available from their current space information systems?
5. What factors are likely to affect the implementation and use of the Academic Space Management model?

The project was structured to answer the five research questions listed above. It was the assumptions and questions that guided the data collecting and collating methods used to gather and analyze space as described in the next chapter.

Table 3.1

Assumptions, Research Questions, Variables, & Data

Assumption	Research Question	Variables	Data Source
Managers of existing facilities information at institutions tends to ignore the needs of those outside of the physical plant offices.	What university information sources currently exist to serve the needs of academic deans and department chairs?	Basis for allocating space? Existence of space policy? Process for acquiring space? Knowledge of current productivity of space? What information sources currently exist?	Interviews with physical plant officers, deans, and department chairs
The reason space information is not used is that most people do not have access to it.	What access do deans and department chairs have to these information sources and what are their perceptions of their usefulness?	Who is authenticated source for information? Who allocates space to your faculty (and how)? Strengths & weaknesses of current system? Use of system? Maintenance of shadow databases? Factors that contribute to use (or not) of the system?	Previous and current space databases; Interviews

If institutional leaders had better facilities information, they could use this information to improve planning and decision-making.	What additional information would make their current space information more useful?	Additional needed information? Use of information from other institutions? Use of information with chairs / individuals?	Interviews; Institutional planning and administrative reports
Leaders do not utilize facilities information for planning because most inventories do not contain the information they need.	To what extent would the proposed discipline specific Academic Space Management model provide useful space allocation information that is not available from current space information systems?	Trust level in current system? Do you have enough space now to conduct your research? How much space would be adequate? Is there a "space crunch" at your institution? How would you assess the value of additional space (the return on investment)?	Interviews; Institutional planning and administrative reports
The data or technology does not keep people from using the new facilities information; political, economic, social, and cultural constraints must be overcome.	What factors are likely to affect the implementation and use of the Academic Space Management model?	How does acquisition of space work? If current system isn't trusted, why? Do you keep shadow databases? How do your responsibilities differ from that of others?	Interviews

Assumptions

Academic Space Management (ASM) offers institutions a data collection and analysis model from which space policies can be formulated and tools can be adopted for improving an institution's internal management of academic space. To establish a space management system, academic leadership (provosts, college deans, and department chairs) ideally should appreciate the importance of space management and the need to effectively manage space. In addition, leaders must act as change agents to incorporate the space management concepts into the institutional culture and to use the concepts in decision-making. Questions posed to deans and department chairs in the first phase asked them to articulate their current knowledge of institutional space allocation and management processes, their academic space needs, the available information to assess these needs, and their ability overall comfort with

facilities information. The second phase utilized the quantitative facilities information available from each institution to create summary reports in both traditional inventory style and the proposed ASM construct model. These sample reports were given to participants in phase three to assist leaders in assessing the factors perceived by the leaders as incentives or barriers to utilizing a proposed Academic Space Management system.

An important assumption of this research project was that the current data, as they relate to basic space elements, provided by the institution, are valid. Facilities inventories and additional related databases will be gathered by the investigator and the initial analyses will be shared with the appropriate institution administrators to evaluate any anomalies. In addition, efforts were made to validate institution-specific information with random building walk-throughs, but it was assumed that the data fields were correctly noted and maintained throughout the study period. This assumption was tested as the institutional data was merged with that from the other participating institutions for discipline-specific comparisons, which was expected to reveal some inconsistencies in both field names and elements within fields. This analysis and suggested improvements in data elements served to guide future studies, to assist institutions in focusing on areas needing data improvements, and to help make improvements on an evolving national model for Academic Space Management.

This assumption lead to the question regarding the specific information sources that existed at the participating institutions that served the needs of deans and department chairs. Participants were asked what information sources were available,

how they used these resources, the policies that existed at their institutions, and if they had enough space to run their programs effectively. There seemed to be no accepted standard procedure for gathering and utilizing facilities information, and it was of interest to note how different administrators choose to use that information, and for what purpose, with their faculty members. During the initial interviews, it was possible that additional variables would come to light, but the primary variables included the following:

- Current information resources available
- Current space allocation processes and policies
- Academic space as a priority at the institution
- Assignable square footage for discipline
- Justification process for acquiring additional space
- Strengths and weaknesses of current institutional space data
- Strengths and weakness of current administration in space management

The current accuracy of space information from the participating institutions was unknown and random checks were made to estimate the accuracy of the information in order to proceed with analyzing the space information.

Another assumption underpinning the first question of this project was that deans, department chairs, and other senior leadership recognized that they should know more about the use of their academic space and that improved information would help them better manage this valuable resource. As discussed earlier, it is well established that the costs of building new facilities and renovating current ones weigh heavily on institutional budgets (Abramson, 2007; Fink, 2004). Given the costs,

researchers should also have recognized that research institutions should seek methods through which they can evaluate the effective use of research related space. Perhaps those in institutional leadership, at the dean and chair levels, are more prepared now than in the past to recognize the need for a robust Academic Space Management system, one that includes multiple quantifiable methods for aligning academic space information with the strategic objectives of their institutions.

Another assumption was that isolation and lack of communication between physical plant administrators and academic leaders was the reason facilities information is not well used. Physical plant administrators tend to focus on maintaining the operational aspects of institutional space, with little concern for who is in that space and for what purpose. Other databases at institutions are often used in decision making, including student information systems, financial resources, and even personnel systems. The complexity of today's research institutions, more like a corporate enterprise, requires the use of accurate and detailed information. However, while facilities represent a large investment for institutions, the databases are too often not accessible by academic leaders such as deans and department chairs. At best, it is accessible in pieces and only through individual efforts, leaving the information isolated.

To evaluate the access that leaders have to space information, questions to the participants focused on their familiarity and use of the institution's information resources. Not only were they asked what resources exist, but more importantly, they were asked to comment on how useful the information was to them. After all, if

information is not perceived to be useful, no level of access will make leaders use it. The interview questions related to this assumption included:

- Who is the authenticated source for facilities information
- Current processes for allocating space to faculty
- Strengths and weaknesses of the current space information system
- The administrators' use of the system
- Others' use of the institutional space system and for what purpose
- Maintenance and use of shadow databases
- Institutional requests for facilities information

Additional information of interest might come to light because the details regarding space use and access at each of the institutions was not fully known.

Even as leaders may recognize that they should know more about space, it was assumed in this project that space information tends to be isolated and poorly utilized at most institutions. Those who manage the facilities information tend to ignore the needs of those outside the traditional physical plant offices. The rationale for this assumption was that there is only one federal report that requires facilities data, the National Science Foundation Survey of Science and Engineering Research Facilities. This report focuses solely on a listing of very generic research space codes without regard to research programs or investigators, and while this is important data, the report makes no attempt to integrate the space data with either personnel data or sponsored research information. In addition, there is no state (as of 2005) that requires space reporting beyond that of classroom utilization. Since there is little or

no incentive to review data for accuracy, facilities databases can become isolated and inaccurate simply from a lack of attention.

If it were determined that the current space information is isolated and not well utilized, then it was assumed that if the information were improved, it could be used by institutional leaders to improve decision making and academic planning. New information needs could include additional detail regarding laboratory equipment as research programs move past requirements such as simple hoods to more complex laboratory tools. A good space database must include what data is needed, be trusted by internal constituent groups for its accuracy and timeliness, as well as being easily accessible to those who need the information. With institutions facing fiscal constraints and concerns over increasing costs, leaders need to be able to access as many information resources as possible with which to make decisions. Space information can become another objective and reliable database similar to that of finance and enrollment, both often used to manage institutional resources.

This assumption lead to the questions posed to deans and department chairs as to what information they need to improve space management and, therefore, create a useful data resource. Research Question Three asked what information would make their current system more useful, with the assumptions stated above related to reliability, access, and current structure. Through these interview questions, information related to the institutions' needs were obtained. Variables of interest included the following:

- Institutional policies for allocating space
- Individual's involvement in space management

- Individual's awareness of a discipline's priority at the institution
- Institution's current space data construct
- Individual's comments on unavailable information

The initial interviews with academic leaders from the participating institutions focused on current space processes and information sources. Sharing the information across institutions regarding processes that exist would hopefully contribute to stimulating ideas that contributed to this project's outcomes.

Because one of the anticipated outcomes of this study was for institutional leaders to make increased use of space information, it was thought that the Academic Space Management model provided something that was missing from the traditional space inventories. As discussed earlier, traditional inventories lack fields useful for planning and decision making, whereas the proposed model includes fields useful to academic administrators. The useful fields include linking fields that allow for space information to be merged with other databases such as personnel, enrollment, and sponsored research. Leaders must find the fields applicable to their needs and relevant to their daily concerns.

Therefore, it was important to evaluate the extent to which the Academic Space Management model, and its usual fields, would be useful to deans and department chairs. Leaders must have the information they need, not simply additional fields. For academic buildings, the median cost per square foot for new construction reached $206 in 2006 and for science buildings the 2006 cost reached $290 per square foot (Abramson, 2007). Therefore, it was thought to be important to assess the database fields that yield useable information to evaluate how these

building are actually used. Data gathered from the institutions space systems and from the interviews was expected to reveal substantial differences in both what is provided and what is needed. Variables of interest included the following:

- Fields in existing space systems
- Individual's basis for allocating space
- Satisfaction with current space processes at institution
- Basis for requesting additional space at institution
- Individual's comments on unavailable information
- Dissemination process of space information to faculty
- Comments on information tools that would be most helpful in managing space

Interviews with the deans and department chairs were also expected to suggest specific items in each space system that should be reviewed carefully for their usefulness.

It was assumed that there were incentives as well as barriers to adopting improved academic space management processes. There are financial constraints on many institutions, and the technology needed can cost millions. In addition, the time required to adopt an innovation can appear overwhelming. Finally, among these considerations is the interaction of culture with other factors. Culture is "the deeply embedded patterns of organizational behavior and the shared values, assumptions, beliefs, or ideologies that members have about their organization or its work" (Peterson and Spencer, 1990 p. 4), and it was of interest to elicit the leaders' opinions regarding the impact culture has on change. The institutional culture can be defined

as a set of traditions, beliefs, and practices that internal personnel see as constituting that institution's specific identity. Institutions vary as far as how each factor interacts with others to promote or deter adoption of change.

Most institutions are accustomed to utilizing complex databases to gather, maintain, and use information, and this is particularly true for research-focused universities. Then it seems to follow that it is not the data or technology that is a barrier to improving space management, but the time and effort that is required to integrate the concept into the institution's administrative practices. For higher education to adopt a change, a new process must allow the fundamental interests and beliefs of institutional members to remain intact, or even enhance them, while eliminating dysfunctional practices (Chaffee & Jacobson, 1997). This change process suggests that leaders must be proactive in utilizing more effective systems and that the loosely coupled structures of higher education do not respond as quickly as other systems (Birnbaum, 1988). In spite of this unique environment, universities are still organizations chartered to provide needed benefits to their constituent groups.

Considering these assumptions and the corresponding research questions, this research project attempted to evaluate attitudes towards, and quantitative data maintained related to, an institution's research facilities. The final interviews with the participating deans and department chairs were expected to yield interesting themes that supplemented the variables. Leaders were asked questions that would open up a discussion as to how the institution's culture allows or affects the adoption of a new process such as Academic Space Management. Variables of interest included the following:

- Individual's use of current space information
- Barriers to using space information effectively
- Facilities-related themes from institution strategic plans
- Individual's involvement in space management
- Individual's comments on information needs
- Individual's support of sharing comparable space data
- Comments on current and potential uses of space data

Observations and discussions with leaders could yield additional variables related to specific institutional factors and their effect on implementing change.

Research Methodology

Grounded Theory Case Study

There is no similar study found in the facilities management literature that could have served as a foundation for this study. Given the lack of research examining the need for and subsequent use of facilities information, as well as the need for fuller, more descriptive and comprehensive data in this area, a qualitative design was incorporated in the present study. Large facilities surveys, such as the ones conducted by the National Science Foundation, the Society for College and University Planning, or the Association of American Medical Colleges do little more than request an inventory of space at an institution. These studies assume two things. First, they assume that the institutional data is accurate. Second, the surveys assume that the information has meaning to those using it at the institution level. Academic space management is an emerging area, and this project represented a unique attempt to gather multi-institutional space data in a comparable format. It is hoped that this first attempt to

evaluate both data integrity and its perceived usefulness will be replicated by other states to generate further interest in creating national definitions for academic space information.

A challenge for this project was that no other study like this had occurred. Research on facilities tends to be more "lessons learned" practical advice from a specific institution. As covered in Chapter 2, the literature available on space management is slim and, therefore, the project was conceived based only on the literature noting the increasing construction and renovation costs, the historical literature referring mostly to classroom utilization, and change management literature. However, the investigator perceived the need for the project based on her professional experience and from comments made by the administrators from the participating institutions.

Grounded theory methodology focuses on understanding how people interpret their own experiences. The subject matter, and its various facets, are determined from the participants' perspectives, rather than forced onto the research by the investigator (Charmaz, 2000). In some ways, the idea is that there are no wrong answers, for each person's experience is considered a valid contribution to the project. The responses from interviews and discussions guide the investigator. In addition, each perspective assists in guiding the investigator to the literature that further informs the project.

Because a project, such as this one on space management, had not occurred previously, grounded theory was thought to be a way of allowing the priorities about space to emerge from interviews. A unique aspect of space management is that it

crosses many administrative units rather than only involving the facilities manager and different perspectives were certain to emerge. In addition to the classic academic units of the colleges and departments that are part of this study, good institution-wide space management should include support services provided by the Office of Sponsored Programs, the offices of Finance and Budgeting, Enrollment Services, and others. This complexity, of working at the interface of facilities with the research and educational enterprise, required that this project include both quantitative and qualitative aspects to present a more comprehensive model.

The methods pursued in this project, while uniquely applied to space information, followed traditional case study procedures. Case study methodology has researchers look for systematic connections among the observable behaviors, speculations, causes, and treatments (Stake, 1995). General comparisons were made among institutions and, where possible, more specific comparisons were made among disciplines. It is thought that multi-institutional comparisons of academic space information, most notably research space, will assist institutions in planning for growth and improve the understanding of space usage as a productivity measure.

This project did not presume that the cultures and needs of these three institutions would be a representative sample of the population of research institutions. Instead, the methodology was intended to provide a conceptual structure around which an understanding of space management priorities could be better understood. The culture of an institution was difficult to ascertain in the short study period, but the comments made through the initial interviews and follow-up

discussions were expected to provide a good foundation for answering the research questions.

The Case Study Participants

Research universities are complex enterprises, comprising the central academic core of undergraduate students as well as graduate students who are really apprentices in their chosen fields, faculty members who conduct research, auxiliary enterprises that support the campus. Each of these pieces takes up space on campus but it is the research conducted by faculty that requires specialized high-cost space. The deans are responsible for the work conducted within their colleges and their department chairs must balance the workloads of teaching and research within the confines of their assigned space. Therefore, these administrators were the people most affected by space constraints and most familiar with the demands of those above them in the administration and the individual faculty conducting research.

For Clemson and MUSC, their deans were the ones who had to manage the space within their college confines. What differentiated their role from that of USC was that their Provosts also asked them about space and had shifted space around as needed. Both institutions had required reports of space use, but MUSC's deans had utilized them for several years. Clemson was only on the second full year of reporting. It was of interest in the project to evaluate the amount of time the deans spent on space issues, their concerns related to space, and how they felt the senior administration was managing the resource.

At USC, the interest in interviewing the deans was similar to that with the other schools. USC has many colleges, 14 at the time of this project, and as the

flagship research university, the colleges ranged from Education to Medicine to Law. Most colleges are contained within their own individual buildings and, as mentioned earlier, the institution is expanding. However, because USC does not have a space management system, there was interest in determining how their concerns about space differed from their counterparts.

Department chairs at research institutions must usually balance difficult priorities between those of the administration and those of the faculty. While many chair responsibilities vary based on the size of the department, they are still accountable to their deans for administrative requirements. Chairs are expected to guide their new faculty, assign offices, manage schedules, and manage administrative offices. They are often the first to hear demands by faculty members for more space as well as being the first to hear about space constraints from their deans. Therefore, their opinions about the interest in space and their perceptions of senior administrators' dedication to its effective use were of high interest.

The participating institutions had different areas of research specialty. All academic deans were sent letters requesting interviews because these administrators bear such responsibility for the success of their institutions. They must balance the interests of their own departments with the larger interests of the Provost and President. Because the research focused on high cost research space, such as bench laboratories, the researcher focused on departments that met one of two criteria, use of specialized laboratory space or high research dollar awards. These criteria were adhered to in most cases.

Data Collection Schedule and Processes

The three phases of this research project included a survey of the department chairs and deans, quantitative analysis of the academic space for each institution, and follow-up interviews with the same chairs and deans. The time frame for conducting the study was as follows:

Fall 2005:

1) A meeting with each participating Provost or his or her designee took place to establish the institution compatible procedures for the research project and assess any unique or special considerations. During this meeting, questions were asked regarding the facilities management philosophy for his or her institution and to describe his or her academic space management needs.

2) A list of department chairs and deans were obtained from the participating institutions. The information included name, department, number of full-time faculty members in the department, and contact information.

3) A letter of introduction for the study was sent to all academic deans and selected department chairs at the three participating institutions, noting that participation is voluntary. The letter included the informed consent form, general questions that would be asked and contact information if there were questions.

4) A follow-up phone call or email was made to determine an appropriate time to conduct the initial interview. Participants were reminded that the process was voluntary and that information would be kept confidential.

5) Concurrent with planning the initial interviews, the facilities data from the participating institutions was gathered. The facilities data was organized and analyzed over the course of the study.

6) The purpose of organizing and analyzing the institutional information was to determine its utility as a full-service database, noting the presence or absence of elements described by the department chairs and deans.

Winter 2005 – Spring 2006:

1) The individual department facilities data were summarized summary tables. The room data for each department was organized by its function and use, with particular attention paid to

identifying the occupant of the space. In collaboration with institutional personnel, random checks were made to evaluate accuracy of information.

2) The participants from the initial interviews were contacted to set up individual interviews. Contact was made by email and through phone calls.

Summer – Fall 2006:

1) The follow-up interviews focused on the usefulness of the new information and how it could be used to guide academic planning. Constraints affecting the use of space information were also covered.

2) Summary reports were presented to the deans and Provosts, with opportunities for them to ask questions or offer comments.

Data Analysis Processes

The structure for the case study was somewhat limited by the voluntary participation in the process. All academic deans and research-centered department chairs were sent the initial letter informing them of the study and requesting their participation. Every effort was made to encourage participation through letters and follow up e-mails, and participation rates were carefully watched. The following table shows the population for each group for each institution:

Table 3.2

Total Deans and Department Chairs by Institution

	Clemson	**MUSC**	**USC**	**TOTAL**
Deans	5	5	11	21
Department Chairs	45	29	61	135
Total	**50**	**34**	**72**	**156**

The incentives for participation included the verification of data for a department or college, the possibility to obtain comparative information from the other institutions (where disciplines were similar), and the opportunity to discuss space as an institutional priority. The triangulation of surveys, objective data analysis, and interviews provided a firm foundation for answering the research questions.

Quantitative Analyses

The initial research question related directly to the quantitative data available and the analysis of this data underpins the other research questions. This required the assessment of the academic facilities databases from Clemson, MUSC, and USC. There were similarities in their information because of annual reports required by the South Carolina Commission on Higher Education and the insurance assessments completed by the state's Budget and Control Board. The institutional information was analyzed for strengths and weaknesses based on whether or not the information contains sufficient integrity and content for use as a metric of assessing productivity or planning.

Analysis related to the question on accuracy and maintenance allowed the investigator to determine the strengths and weaknesses of each institution's database. The initial data integrity analyses included edit checks related to the over-arching categories of academic space and the field elements in each database. The data was also analyzed for size relationships relative to room use. Simple analyses of room size variation, either by discipline or by faculty member, permitted a cursory assessment so that gross data errors can be corrected. Room summaries for each department participating in this project were prepared that included comments for

where improvements could be made to improve its usefulness. These summaries were shared with participating department chairs during the final interviews.

Institutions that desire to adopt academic space management, or even simply to improve their facilities management, require the kind of practical suggestions contained in the summaries, particularly related to:

- identifying data content needs,
- merging the data from disparate databases,
- timeliness of data,
- focusing on data roll-ups (ensuring detail merges into more general fields appropriately) into meaning summary terms,
- providing proper access to the data for viewing, downloading and editing, via the web, and
- providing information in ways that best serve the constituent groups.

The combination of in-depth interviews, quantitative analyses and follow-up discussions provided the answer to the proposed research questions but also lead to additional change opportunities for the participating institutions.

Qualitative Processes

In conjunction with an assessment of the quantitative space data, interviews with institutional personnel were critical to understanding the needs that drive improving facilities management and how this new information would be used across the institution. One of the hypotheses of improved academic space management is that resource allocation changes emerge through altering how personnel spend their time more so than perhaps than through dollars saved. The academic leaders were

questioned on issues related to their perception of the importance of academic space management, the utility of a web-based space database system, and how the information could be better utilized at the institution. The investigator expected that leaders at the institutions are the primary drivers of improved space management, and that organizational change is not led from the facilities personnel.

The first phase interviews served the purpose of gauging the knowledge and interest of the deans and department chairs, both by their willingness to participate and their responses to the questions. Once the department information was summarized and, where possible, merged with that from other institutions, leaders were asked how they would use the new information to assist in planning and in evaluating the productivity of departments and individual faculty investigators.

Results from this study were expected to include a set of implementation suggestions that other institutions could utilize in improving their management of research space. Because the three South Carolina institutions participating in this study have individual concerns and areas of focus, they were at different stages of facilities management. Through these analyses, other institutions can adopt more appropriate methods for improving management of research space and assess how this information can be utilized for their own institutional decision-making.

Multi-Institutional Comparisons by Discipline

The impetus for this project stemmed from increased efforts at the three South Carolina research institutions to better demonstrate their commitment both to public accountability and to the economic development of the state. The Medical University of South Carolina (MUSC) created a web-based space management system in the

early 1990's in an effort to improve data management in the College of Medicine. Over time the system became part of the institutional culture and the system's use of open source software meant that it could be adopted for little or no cost. Therefore, when space management became a topic of interest at the other two research universities, the adoption of the MUSC system became a topic of interest. Comparing disciplines based on common field definitions and the inclusion of award dollars would lead to an increased ability to communicate needs and strategic planning efforts with external audiences.

This project focused on faculty research at three institutions, permitting a more detailed examination of discipline-specific characteristics affecting space utilization. No claim was made about the level that is appropriate to a discipline; those standards will only emerge over time and with national space utilization data. The investigator hoped that this project allowed insights that could then be applied to other institutions. For the purposes of this research, research space was defined as specialized laboratory space assigned to a full-time faculty member. Sponsored programs awards were defined as external awards made to a faculty member. To that end, this project attempted to assess how well an effectiveness measure for use of specialized research space could be utilized by academic administrators.

Space is of interest because constructing specialized space represents a significant investment for institutions, an investment that may take decades to recoup. An assessment of institution management of research space is necessary for both immediate cost containment and for long-term planning. For public institutions, the forecast for state allocations suggests continued significant constraints. For academic

medical centers, it is important to assess how the space is being used in garnering 49 percent of the grant dollars from the National Institutes of Health and NSF (Commonwealth Fund, 2003). In addition, the use of objective space utilization information provides institutional leaders with a new measure of accountability for internal and external constituencies. However, a purely quantitative analysis of the usefulness of academic space management is not significant unless it can be determined how administrators and other institutional leader will use the measure in planning. It is the triangulation of surveys, data analysis, and interviews that are needed to provide a more complete picture.

Limitations

This study was limited to only three institutions, and it was likely that these institutions were not representative of all public research-focused institutions. This limits how much the results could be generalized for others to utilize. However, it could provide useful information for the three participating institutions, and then would allow other institutions to use the results for their own space management improvements.

An additional limitation was the self-selecting nature of the project. The initial approach for the interviews was to all deans and research-centered department chairs, but participation was voluntary. It was possible that those who responded were the academic leaders who have the greatest needs, while those who have not yet recognized the importance of good space information failed to participate. As needed, efforts were made to evaluate the disciplines participating compared with those that did not.

As the project progressed to the data gathering and analysis phases, additional limitations were expected to come to light and would be noted in the findings.

Chapter 4

Results and Analysis

Overview

The purpose of this study was to examine the availability and use of space information at research universities and academic medical centers in South Carolina and to determine how improving space information would be of use to academic deans and department chairs. These academic leaders were interviewed to assess their current use of space data, their reasons for using it or not, and then the policies and priorities at their institutions related to space. Quantitative information from the three participating institutions was gathered, summarized, and analyzed for comparative assessments and then this information was used in follow-up interviews with the same deans and chairs to determine possible uses of improved space management information.

This chapter consists of three parts: the first includes a description of the study population, the second describes the interview and data analysis findings, and the last summarizes the findings for each research question.

Description of the Study Population

The deans selected to participate in this study were the leaders of academic colleges at Clemson University (five), the Medical University of South Carolina (five), and the University of South Carolina Columbia (eleven). Deans of undergraduate studies, graduate schools, or libraries were not included in the study population. Each participant was sent a letter describing the study, requesting their

participating, and an informed consent form was also included. Follow-up telephone calls were used to schedule interviews and to answer any preliminary questions about the study's intent. All five academic deans at Clemson and the five academic deans at MUSC participated. Of the 11 academic deans at the University of South Carolina, four deans did not participate as a result of scheduling problems and retirements. All participants were interviewed at their respective offices and the initial interviews varied from approximately 25 minutes to more than 90 minutes. The follow-up interviews lasted no more than 30 minutes for almost all participants.

In addition to the deans, department chairs responsible for disciplines with significant levels of research dollars were invited to participate with the same interview protocol as the deans. For Clemson, 20 were invited to participate and 12 completed the interviews; for MUSC, 11 were invited and nine participated; and at USC, 25 were invited to be interviewed with 12 participating (Table 4.1). No demographic data was gathered, but information on each person's length of time in the position and their specific discipline area were noted in order to evaluate any themes that emerged by discipline.

Table 4.1

Number of Study Participants by Group

	Deans Participating	Rate	Department Chairs Participating	Rate
Clemson University	5	100%	15	42%
Medical University of South Carolina	5	100%	10	27%
University of South Carolina Columbia	7	54%	12	25%

The deans interviewed represented a variety of disciplines but a majority of them represented areas of physical and biological sciences, health sciences, and engineering. Comments later in this chapter will note some response similarities within disciplines. Table 4.2 summarizes the deans' demographics. There was an overall average time in positions of 5.3 years, with a standard deviation of 2.4 years.

Table 4.2

Participating Deans by Discipline Area

Participating Dean Units	Count of Deans
Agriculture & Life Sciences	2
Arts & Humanities	2
Behavioral Sciences	2
Engineering & Physical Sciences	3
Health Professions	2
Education & Human Development	1
Medicine	2
Nursing	2
Pharmacy	1

Similarly, the department chairs had commonalities by general discipline families, as noted in Table 4.3. For the chairs, the average number of years in their position was 7.5, with a standard deviation of only two years. Because the study was conducted within a single state, many of the participants were familiar with their respective colleagues, and perhaps this contributed to their willingness to participate.

Table 4.3

Participating Department Chairs by Discipline Area

Participating Department Chairs	Count of Chairs
Life Sciences	5
Humanities	0
Business	0
Social Sciences	2
Physical Sciences	6
Engineering	10
Health Professions	14

As noted with the deans, the department chairs were selected from disciplines with substantial external funding or those disciplines where space was perceived as an issue.

The Interview Process

The initial interviews took place with the assumption that there would be substantial differences among respondents regarding both knowledge of and priority placed on academic space. The priorities and needs, hopefully, would emerge from the different perspectives of the deans and chairs. In the interviews, participants were asked how long they had been in their dean or department chair positions and how many department chairs or faculty members they supervised. The initial interview questions were designed to elicit detailed responses and, when necessary, prompting or follow-up questions were asked to ensure the most relevant information possible was gathered. These interviews provided a lens through which the quantitative data could be analyzed, and the follow-up interviews were intended to gauge interest in improving or maintaining space information as an institutional priority. Each

research question was analyzed using the data gathered in each of the three project phases.

In scheduling the initial interviews, letters were sent to the deans and department chairs informing them of the study's purpose, an informed consent form that included a sample of questions, and a possible schedule for the interview. The Provosts of Clemson and MUSC allowed the investigator to include a cover letter in the invitation package from each of them endorsing the study but the USC administration did not endorse the project. The initial and follow-up interviews occurred at the participants' offices at times scheduled for their convenience. While official lengths of time were not maintained, the initial interviews lasted approximately 45 minutes, with several lasting more than an hour. The initial interviews, while consistent in their questions (see Appendix C for protocol), varied in the level of detail the investigator was required to provide as supplements to the questions because the participants varied significantly in their familiarity with space information.

A second set of interviews with the same participants took place approximately six to eight months after the initial interviews. The intent of the follow-up discussions was to ascertain if the participants had incorporated any of the space management concepts or if any changes in space had occurred at their institutions. The follow-up interviews proved challenging at all three institutions, primarily because of a lack of administrative change in space management over the study period. None of the participating institutions had created or requested any new space reports since the initial interviews. Most participants commented that more

time was needed to see if space management became, or was maintained as, an institutional priority. Some commented that it takes a crisis, funding or personnel related, for space to become a topic of conversation on campus. In addition, others were concerned that additional management of space would take more money for personnel and databases. Comments from the follow-up interviews did not appear to add much to answering the research questions, and the approximate average time for these discussions was 30 minutes.

Overall themes that emerged from the interviews helped to answer the research questions posed in Chapter One. Responses related to each research question are grouped by institution and by the deans and department chairs. It is important to note that characterization of subjects' responses, as noted for each research question, may not appear consistent across questions because some participants' responses evolved as the interviews continued. For example, as questions were asked, participants tended to become more comfortable discussing the issue of space and were more able to express their opinions. There were important differences among the institutional responses as well as by the position held. Themes that emerged from each research question are described at the end of the section.

Answering the Research Questions

The following sections describe the results of the interviews and quantitative analysis of space data and are divided into the responses related to each of the research questions. The first descriptive research question for this study was:

> What University information on academic space currently exists to serve the needs of deans and department chairs?

Thus, in the first part of each section the participants' responses and data analysis is related to what types of space data were available and if that information met the needs of those interviewed. Information was also gathered to determine what access deans and department chairs had to space information and if they found that access useful. The second descriptive research question is:

> What access do deans and department chairs have to these information sources and what are their perceptions of their usefulness?

To answer this question, the second part of each section examines subjects' responses about how they actually are *using* the information that was available and corresponding quantitative analyses. In relation to the question on use, the third descriptive research question is:

> What additional information would make their current space information more useful?

Participants' were asked to consider the strengths and weaknesses of their existing system and, through examination of existing databases, comment on possible improvements.

The final two analytical research questions asked participants to consider the possibilities for improving their space information:

> To what extent would the proposed discipline specific Academic Space Management model provide useful space allocation information for deans and department chairs that is not available from their current space information systems?
>
> What factors are likely to affect the implementation and use of the Academic Space Management model?

To answer these questions, the responses to the interview questions, as well as analysis of existing databases, were used to comment on possibilities for

improvement. Participants' opinions as well as specific comments on the existing reliability of space information were used to evaluate how space information could become a more effective decision-making tool.

The findings for each question contain a summary of how the literature reviewed relates to the information gathered by this study. Examples of participants' responses are provided throughout the findings for each research question, with brackets [] used where needed to replace personal information or names of individuals. Because of the conversational style of the interviews, responses may appear as incomplete sentences or thoughts. To display natural pauses, semicolons are used, and ellipses are used to indicate when different portions of the same subject's response were combined to respond to the same issue.

Responses by Research Question

Research Question 1: What University information on academic space currently exists to serve the needs of deans and department chairs?

Information related to this question was gathered from searching the institutions' web site and analyzing existing space data from the three participating institutions as well as from answers to interview questions. Interview questions related to this research section included how space was allocated on their campuses; if there was a space policy in effect; was space a priority for their senior leadership; and the information sources that existed at their institutions. For example, it could be considered a contradiction if space were stated as an institutional priority, but there was no information readily available.

In addition to the interviews, space data from the institutions was gathered in spring 2006, and each inventory was summarized and randomly checked for accuracy. For MUSC and Clemson, the information was accessible from the web; data from USC was received from the University Architect's office. Summary statistics totaled as follows:

Table 4.4

Summary of Institutional Space Data

Institution	Total Assignable Square Feet	Number of Buildings	Number of Offices	Number of Laboratories
Clemson University	3,148,719	144	3245	872
Medical University of SC	1,294,831	63	1373	1327
University of SC	5,145,993	151	4874	523

The research question asked what, if any, information was available from the institutions. To determine if the information's structure made the data more or less useful to the average user, a faculty member or dean for example, the differences among the three space information sources were noted. A set of fields deemed useful and appropriate for decision-making was selected, then it was noted if the information was available from each institution and, if so, in what form. The variable name was also noted and if some information was available in the background, meaning that it may not be part of the observable data but was known to be a hidden field.

Table 4.5

Field Names and Data Types in Institutional Space Information

	Clemson University		Medical University of SC		University of SC Columbia	
Field	*variable*	*type*	*variable*	*type*	*variable*	*type*
Building Name	Building	text	Building name	text	Bldnam	text
Building Number	n/a	in background	Bldg Number	number	Bldnum	number
Room Number	Room	number	Room Number	number	Rmnum	number
Unit in charge of room	n/a		Administrative Unit	text	n/a	
Centers or Institutes	n/a		Centers Institutes Etc	text	n/a	
Department ID	Department	number	Dept	number	Dept	number
Department Name	Department	text	Department	text	Deptds	text
Division or College	n/a	in background	Division	text	n/a	
Room Function	Room Function	text + number	n/a	in background	Funcus	code
Room Use	Room Use	text + number	n/a	in background	Rmtype	code
Room Use Descriptor	Room Use	text + number	Room Use Descriptor	text	Rtypds	code
State reporting	CHEMIS	code	CHEMIS	code	n/a	in background
Room Loaned From	n/a		Loaned From	text	n/a	
Room Square footage	Assignable area	number	Area Sq Ft	number	Nsqft	number
Room Review Date	Comments	date	Review Date	date	Svdte	date
Data Modified Date	Modified Date	date	Mod Date	date	n/a	
Occupant Identifier	n/a	in background	n/a		n/a	
Faculty in charge	Employee	text	Faculty in charge	text	n/a	
Faculty Rank	n/a	in background	Faculty rank	text	n/a	

NOTE: "n/a" is defined as not available.

The information in the Clemson and MUSC databases are relatively consistent, which is appropriate because Clemson adopted its system from MUSC. In contrast, however, the USC information system only has 10 of the 19 fields available. Also, the field names within the USC system are not easily translated by those unfamiliar

with the specific system. As stated earlier, the USC data was not readily available from a web site or from the colleges; it was maintained exclusively within the University Architect's office. Professionals within that office were familiar with the field names and with the data contained within the inventory.

The lack of consistent information in the data summaries exemplified some of the initial challenges in obtaining and comparing space information across institutions. For example, only the most general academic space terms could be used, i.e. "office" or "laboratory" because that is as specific as the University of South Carolina inventory allows. There is no information in the USC-Columbia inventory about who is housed in those offices, whether occupants are graduate students, faculty members, or deans. Both Clemson and MUSC's databases had more detailed descriptors that would have allowed for a better descriptive summary. This could be a problem because not knowing even what type of employees are located where could affect an administrator's ability to plan on where to place a new faculty member.

Data Availability and Accuracy

The Medical University had the best set of data available on the University intranet, and it was found to be very accurate, with a random check locating only three errors in space assignment, and no errors found in room description or size. The database contained detailed descriptors on the type of space (i.e. Laboratory, Bench or Office, Chair), and was the only institution to also include information on if a room was "on loan from" another department temporarily. MUSC also had a regular update schedule and established reports. Clemson University's relatively new system was very accurate for description and size but, of the approximate 40 offices checked,

there were ten errors. Finally, for USC there was a space inventory maintained by the University Architect in MS Access. Their database was not accessible on a web site; to obtain information, one had to make a request to the Architect's office and only an administrator's own department or college data would be released. USC's system did not maintain occupant information or detailed room descriptions, but the function and descriptions were approximately 70 percent accurate for the 80 rooms checked.

For both Clemson and MUSC the space management system was maintained within the Office of Institutional Research. These offices were responsible for almost all federal and state reporting, as well as responding to national surveys, discipline accreditation, and other quantitative reports. Institutional research professionals are accustomed to working with multiple institutional databases and, therefore, placing space data within these offices provides them with another resource to use when responding to questions by administrators and faculty members. In contrast, the space inventory at USC was maintained in the University Architect's office.

The facilities data from Clemson, MUSC, and USC were examined to evaluate the types of variables, the methods for updating information, and the constructs for linking space information with other institutional databases. In addition, attention was paid to the field names used to describe the facilities and the perceived usefulness of the field names. Comments from participants suggested that one way to make space information more useful is to utilize meaningful text database field names rather than traditional maintenance codes. For example, instead of using the code "310" for a classroom, administrators find it more meaningful to use "classroom, technology." In addition, perhaps through the addition of more detail

when appropriate, the database's perceived usefulness is increased. The use of descriptive text enables users outside of a facilities maintenance office to understand and utilize the space information. Each of the participating institutions had a field called "room use descriptor" which defined the type of room. The options within this field name varied among the participating institutions and provided insight into the database's overall usefulness. USC had only a limited number of room use descriptors. They included office, laboratory, storage, and classroom. In addition, within the USC data, these are actually codes that must be translated. In contrast, the room use descriptor variable within MUSC's database, which includes but is not limited to, the following descriptors: office, faculty; office, department chair; laboratory, bench; laboratory, dry; laboratory, other; and classroom, technology. The additional detail was reported to make the information more useful to decision makers and other interested personnel.

The Clemson space database was derived from the database used at MUSC, and many of the variables and field names within each variable were the same. The database had a comprehensive set of consistently formatted text fields, including the assignment of labs and offices to faculty members. Staff members, such as secretaries or analysts, were not assigned to space, nor were graduate assistants. Deans appointed one or two people in their colleges to edit space information as needed, but no less than twice a year for the Provost's reports. Upon random checks, 90 to 95 percent of the information was correct.

At Clemson, four of the five deans knew that a web-based space database existed and that there had been steps taken to improve space management. The other

dean knew that there was a space database but she was unaware that it was web-based and did not know which university office maintained the information. The Clemson deans had mixed comments regarding their knowledge of the database, with comments such as:

> Oh, I know it's there and the University needs it but I don't worry about space much and I've never looked at the web system…. My faculty are pretty settled and if I need more [space] I know that some faculty are retiring soon….When things change I'll have to look to see what's out there.
>
> I'm glad you all have paid more attention to space….I think it [the database] has everything I need. It's important to the institution to have a handle on who's where. This way I have more ammunition when I go to an agency for money or to the Provost for more space. We have a place to go for good information, and space is becoming more of a priority.

The deans who stated that they had actually used the web-based database were in the engineering and science areas, including health and social sciences. Each of these discipline families reflects a research growth area for the University.

All five academic deans at MUSC were aware of the web-based space system in place at their institution and they mentioned several processes were in place to maintain accurate space information. The Dean of the College of Medicine stated that he utilized the database regularly and he uses it in the annual performance evaluations of his department chairs. The deans differed somewhat in their level of use, noting, as one dean did, that "My space is set within this building; I have to fit everything in here for now." Four out of the five endorsed the database as accurate, with the one who did not saying that she had not looked at the database in "quite a while." While all agreed that space was a priority for the institution, they differed on comments related to the types of data in the system. Three of the five asked to have

grant information tied to the system all the time rather than only making the connection in special reports. Only one dean asked to have graphics attached and he said that "it would be nice but I know it's not necessary." In summary, most deans appeared pleased with the space system and understood that space was a priority for the institution.

In contrast to Clemson and MUSC, USC did not possess a space database useful for the needs of deans, department chairs, or other academic leadership. Maintained by the University Architect's office, the data fields were primarily codes used by facilities workers who maintain the space. Some of the flaws noted in comparing USC's database with Clemson and MUSC's systems included:

- USC did not have any data on people placed in space, either for offices or for laboratories, leaving no ability to link with personnel systems data;
- USC did not delineate space beyond "office" or "laboratory," which means that there was no ability to determine if space was occupied by a graduate student, an administrative assistant, or a full professor;
- There was no field to note if a space was occupied, leaving senior administrators unaware of potential free space within a college or department; and,
- The USC space inventory system was maintained and kept within the University Architect's office. No one else was able to view the fields without a request to that office. Copies must be made of the files and sent to the requesting office.

A random check of USC's space fields also found that approximately 20 percent of the information was out of date, although a full audit of academic space was being initiated for a federal and administrative audit of research space. Thus, it was impossible to compare this inventory appropriately with the databases of Clemson and MUSC because of dissimilarities in design and content.

To supplement interviews with deans and chairs, discussions with the personnel who oversee the space databases took place, and these people provided demonstrations of summaries or reports that could be created upon request. A senior statistician for Clemson University stated, "With the employee ID [identifier] saying who's in an office or a lab, I can tell you just about anything you want to know." Example of reports he has created for the University's Provost include office and laboratory space of faculty members who are about to retire, space assigned to researchers who are not generating indirect costs with their grants, and unassigned laboratories.

For MUSC, the Associate Provost in charge of the space database noted that each year there was a new consideration, a new way to sort the data to make it meaningful. At one time, MUSC only listed either bench (wet) labs or dry labs; currently there were specialty labs to accommodate changes in research demands. MUSC had also made changes in how they analyzed space used for clinical trials, noting those awards separately from sponsored research awards. Both institutions used their databases and share the information with senior leadership for decision making, reinforcing the need for integrity within the system.

Research Question 2: What access do deans and department chairs have to these information sources and what are their perceptions of their usefulness?

It was important to evaluate not only the academic leaders' knowledge of what existed, but also how and to whom access to space information was granted to encourage use of the system. Data hidden beneath layers of passwords and shared on a limited basis cannot then be perceived as useful by the university community. In addition, questions regarding the usefulness of the data were important because if information is not perceived as useful, it will not be referred to often for decision making. The cycle of use, and inherent risk, is that increasing the accessibility of a new space system risks more individuals finding errors in the data that must be corrected if it going to be perceived as having integrity. If personnel believe a system is accurate and relevant, they are more likely to use it. This research question implies that increased access to space information leads to the data being used more often, evaluated and corrected for accuracy and, finally, used more for decision making.

Interview responses from across all three institutions repeatedly referred to the amount of trust that the participating deans and department chairs had in the accuracy of the space information related to their colleges. The investigator's own experience with space data inspired the questions related to the issue of trust, understanding that extremely high levels of accuracy must be maintained if others are going to use the information. The smallest percentages of inaccuracy will most likely cause long-term delays in persuading others to fully utilize the system. An analysis of the institutions' space data reinforced the differences in database maturity and the level of attention received among the three institutions.

The participating institutions were at different stages of space management, which allowed for multiple contrasts among the information provided in the initial interviews and follow-up discussions. One of the interesting facets of the Academic Space Management concept is that providing increased access to space information improves its accuracy and increases the chances that it will be used in decision making. However, this construct can be in opposition to the increased security placed on other types of information, such as personnel data or even sponsored research awards. It was interesting to note the different perceptions of opening information to multiple internal audiences.

The deans at Clemson had access to space information via a password-protected web site that had existed for approximately three years. When the system was introduced to the institution, as one that would allow anyone with a University faculty or staff member password to access all space on campus, there was some resistance. The deans were asked about how that initial concern about access had changed over time.

> I was worried about allowing access to everybody but I think all it does is get more people to use it. And I don't have to worry about permissions and levels when I ask my assistant to go look at data.

> We had initial misgivings because it was an unknown, something we didn't know how it was going to be used. But now I know that, when the Provost talks about space, we're all working from the same data.

> Overall, I'm for it…but you should know what I don't like is that this means my faculty can look for new space they want and come to me. So I can be dealing with space at any time…no, not that often, but I think we need a little more time.

Overall, the deans voiced some limited concerns, but believed that their initial concerns over inappropriate access or editing had proven unwarranted. A repeated comment was that having the space system ensured all groups were using the same data and that was considered a valuable positive.

The MUSC space system had slightly different access levels. The Associate Provost for Institutional Research and Assessment allowed access to either view or edit mode based on individual requests. No request for view level access had been denied to any University employee but edit access was limited to one or two people per college. Because their space system, and access levels, had existed for more than seven years, few comments were made opposing increased access to space information.

> Other medical schools use space data so of course we do. Our faculty expect to have access to the information because they know I use it in their evaluations.
>
> We've never had any problems with access. The people who want to look at the system can and, as long as they can't change my data, that's fine with me.
>
> At least I know that when the Provost says he's getting ready to do a space report, I know, and my faculty knows, the data he's working from.

Similar to Clemson's deans, a recurring comment was that opening a space system contributes to its perceived reliability because all participants are using the same data. In addition, two MUSC deans, especially the Dean of the College of Medicine, commented that their colleagues at other institutions utilized space information.

Finally, the deans at USC voiced the greatest concerns with sharing space information among internal personnel. Noting that they had little space information

from central administration to share, none of the deans thought that anyone but other deans should be able to see any space information and even then there was concern.

> Would we have to allow others access to our information? Why should anyone else know what I have? I don't know what my chairs would think.
>
> What purpose does it serve? I don't know…we don't have anything like that here. Access to information is very limited…we're careful.

Only three of the nine deans interviewed saw value in sharing access to space information. As one commented, "You know, I'd like to see what the others have. That could help us as our college grows." It appeared that the institution did not have a culture of open information and the leadership did not perceive its value.

The comments regarding access to information varied more among department chairs at Clemson. Responses followed discipline lines, with the engineering and physical science chairs being more receptive to open information. As one chair commented, "It's all the Provost's space anyway. We *should* be able to see what space the University has." Those chairs in non-laboratory oriented space did not have many comments in common, most likely because they had already stated that they used the space system only rarely and some had not used it at all.

The MUSC department chairs considered themselves on the "front lines" for space management and were strongly supportive of sharing access across the University. All of the chairs had the ability to edit information, although all of them asked that their budget managers also have edit access. One chair commented that, "it will be interesting to see if there are any access issues now that the Provost is

really implementing the new space policy." Overall, however, there was confidence in the access process.

> We have an open policy here that goes over well with the faculty. Faculty know what we do with the information, we know what the deans do with it, and so on.
>
> Granting access is done within the Provost's office and we've never had a problem. We have enough edit checks in place, and it fits within our culture.

After seven years with a space management system, it appeared that the culture had come to fully accept shared access to University space data. Reliability and use of the system led to trust, which created a cycle of accuracy and use throughout the University.

The department chairs at USC continued to be more amenable to the idea of space management and they thought that access within a department would work. "I think I would share the space information with my faculty and maybe with some close departments…." However, the majority of the chairs thought that it was those above them in the leadership who would have the greatest problems. The concern was about access to others' space as well as who would manage any space system to detect errors.

> I worry that there's no oversight of the system or changes. If someone made changes how would I know? I don't have the time to keep checking for accuracy or correcting errors.
>
> We don't have open access to other departments' information…and I'm not sure my dean would go for it. He likes to keep information to himself for when he needs it to make a point.
>
> I'm not sure why any of us would need access to all the University space. Wouldn't that mean other people could make

> changes? My dean wouldn't like that and it could mean that my space information might not be accurate.

Overall, it was interesting to note that the concept of open access was not part of the USC culture and neither the deans nor the department chairs perceived much value in access to space information.

At Clemson and at MUSC access to the web-based space system was given to all who requested it; as noted, USC does not have a system to use space data. Perceptions of space data's usefulness were highly related to the access provided to the system and, especially, to how access allowed for consistency in data used by senior administrators. The Provost's office at MUSC regularly asked for reports, the Provost at Clemson was starting to ask for information and, the leadership at USC did not ask deans or chairs for any space information. As discussed earlier, the role of senior leadership is an important factor in determining if a space management system is used and to what extent.

Lines of Authority for Decisions on Space

Following the emerging theme of increasing access to a space system through the internet, shorter comments made throughout the discussions related to the line of authority related to space. The theory of Academic Space Management holds that space is "given" to those who are accountable for it, usually from deans to department chairs and then to individual faculty members. It is this line of authority that assigns faculty members to space, even if there are graduate students in the lab. If a faculty member loses awards that give him or her use of a specific lab, then the graduate student will not be in there. The faculty member is responsible for the work that goes on in that lab. Few questions were asked that directly related to this line of authority

but comments made, especially by the department chairs, referred to accountability and authority rather regularly.

The interviews and follow-up talks with Clemson deans held that the line of authority was generally direct down from the Provost. The Provost still held the final authority and, as noted earlier by one dean, "the Provost can take any space when she wants to." In addition, the new space system had provided a new tool for delegating responsibility and that seemed to be the primary focus for deans. One dean noted that "the system means that I can have other people worry about space" and another said, "it means I can have my chairs manage what is really theirs to manage."

At MUSC, all five of the deans stated that they had authority to allocate space to their chairs who then allocated it to their faculty members. The line of authority went up to the Provost but all thought the system was fully decentralized. "I can't imagine that the Provost would just come in and 'take' space," one dean commented. "We are even allowed to loan space to other departments and those loans are in the database." Perhaps because space was acknowledged as an institutional priority, there was acceptance of accountability. A dean of a smaller college noted, "I hold my chairs accountable for space because I know that there isn't any more available. The Provost gives me a certain amount and I do the same (allocate space to faculty). We're all in the same boat."

The deans at USC did not have many comments on this line of authority, except that about half of the deans consistently referred to "my space," "my college," or "my labs." These phrases suggest a sense of ownership but no comment was made regarding who was finally accountable for the activities that went on in the

laboratories. Four deans made comments that the growth of the institution enabled more colleges to stand alone in single buildings which could contribute to the limited interest in what other deans or department chairs were doing in their own space. One dean commented that the University "was becoming more like several small colleges" under an umbrella. In conclusion, there was a sense that approximately half of the deans believed they controlled their space and the other half were more likely to acknowledge that the space "belonged" to the Provost. For USC deans the lines of authority were different than those at either Clemson or MUSC.

With respect to authority over space, and accountability for its use, some of the most interesting comments were made by the Clemson and MUSC department chairs. At Clemson, they remained very supportive of the space system but felt the pressure of being in the middle of the accountability line. "We've become the 'go-to' people on space," one chair commented. Another chair echoed the sentiment saying, "the Dean is asking me about space now and I have faculty members asking about their space. I think we're getting it from both sides." As was the trend, those chairs in engineering and science felt the pressure more acutely with one chair noting, "I know my dean is getting bugged about space from both the Provost and the Research office. But they forget that we have other responsibilities." The chairs felt both the pressure of being accountable for their faculty members' use of space and the pressure of not having substantial authority.

As with the chairs at MUSC, the USC chairs stated that they felt more pressure from their faculty members and from their deans but, again, most were not certain that a space management system would be useful. In agreement with their

deans, the chairs commented that they believed that their deans kept track of space and would be the primary ones asking any questions. "We're all in one pretty new building so my dean knows what's going on," one social science chair commented. However, as with the Clemson chairs, more USC chairs in engineering saw worth in the line of authority and, therefore, it appeared, saw worth in being more "in charge" of their own laboratories and what occurred in them.

No system solves all problems. Throughout the discussions with deans and department chairs there were comments about favoritism, perceptions that one department or one faculty member received special consideration. There was always the comment that accepted lines of authority may be bypassed for a highly recruited faculty member or for a large new grant. With all three institutions making efforts to increase their research dollars, this bypass of normal practice was accepted by about 70 percent of the participants.

One advantage of a space management system appeared to be that it enabled delegation of responsibility away from a single centralized source to the department chairs. Keeping with the construct of Academic Space Management, this allowed for increased accuracy because it is those administrators closest to the lab space and office space who are aware of changes as soon as they happen. Consistent with the other emerging themes, senior leadership roles and use of the space system increase the importance of a clear authority line.

Existence of a Space Policy

Space management too often is an ignored investment at research universities, as noted from the lack of empirical research on space use or management. Therefore,

this research project offered an initial attempt to learn how institutions managed their space resources. The question was asked during the interviews and follow-up discussions if a space policy existed and, if so, how it was implemented across the institution. The purpose of the question was to evaluate how structured the management of space was and if that structure was followed. The existence of policies also relates to Question 3 about the need for additional information. However, the investigator perceived that having a policy was related to space data use and delegation of its maintenance downward into the colleges and thus viewed the theme as part of an access issue.

Clemson University did not have a policy regarding space at any level, whether for assignment, maintenance, or management. All of the deans knew that there was no official policy governing space but, as one dean stated, "We don't have many policies at all." During a discussion with the Senior Statistician, who oversaw the space database, he stated that the University would never implement a space policy because flexibility in space management was more of a priority than accountability. He stated, "If we had a policy and strict procedures, then the administration couldn't do things when it needed to." At the time of this research, there were no plans to create a space policy.

According to the new MUSC space policy (Appendix D), requests for additional space were supposed to be made based on significant changes in research funding. The policy calls for regular reports on space utilization by faculty members, and the policy specifically stated that the MySpace system will be the authenticated

source for all space allocation data. The deans were interested to see how the new policy would work in practice:

> We have a new space policy that will tell us just how serious the administration is about space management. Everyone has seen the system but not everyone has used the system.
>
> I know there's the space system but my space is pretty self-contained in a single building. We'll have to see if we're affected but I'm not worried about it.
>
> I don't look at the system but a couple of times a year. The new policy could have us using the system more often, especially my chairs.

The policy was seen as the "teeth" behind the reports that the Provost had been using for several years. The deans were interested to see how it was actually used and no changes had been made at the time of this research.

In contrast to comments at MUSC, the responses from the deans at USC were congruent with the fact that the institution has no web-based system and limited data availability. There was no institutional policy on space management, similar to Clemson, the deans did not foresee one in the future for several reasons.

> I don't have access to any space data. I don't know where the University keeps it or for what and I'm sure we won't have any kind of policy to oversee what we do.
>
> We don't have a policy, probably because we don't have many policies at all. Yes, we should have good space information but we don't. It should be a priority but I don't think it is.
>
> What data I've seen is basic. I know what I have, or I think I know. It would be good to have some kind of policy telling us what governs space issues but I don't think it'll happen around here.

There was a perception that it was difficult for the deans at USC to think about a University policy that would govern a resource that had received very little attention.

The deans continued to state that they did not see any similar policy in their future, even when they were shown the MUSC space policy during the follow-up discussions.

The department chairs at Clemson agreed with their deans that there was no policy that governed management of space and eight department chairs acknowledged that the Provost's office could still dictate any change they wished for in departmental space. The same eight chairs were also the ones who had accessed the web system more than once over the past year. The following responses were representative of the chairs' comments:

> I know about the space system and I've used it. But I still know that [the Provost] can move people where she wants them.
>
> I'm glad we have the space system, really. But we still don't have any policy or procedures for monitoring its use, or assignment, and that makes any system kind of meaningless.
>
> We would never have a policy like that here … it wouldn't work … but we don't have a policy for anything and we do ok.

Three chairs, all in engineering disciplines, had appointed their administrative assistants as the primary people charged with accessing the system. Finally, the above-mentioned eight chairs knew that individual faculty members could also access the space system with their University identifier but none of the chairs were aware if any of their faculty members had done so. Overall, the usefulness of the space system for Clemson was still being tested; additional efforts from senior leadership were needed to build on the system's founding goals. However, a University policy did not appear to be in its future.

Department chairs from MUSC were detailed in their responses, perhaps because, as stated by a participant: "We're the ones on the front lines and are the one who hear the complaints." Most allocated space to their faculty only on an "as needed" basis, meaning that only when complaints surfaced was space addressed. All chairs, regardless of how often they used the space system, agreed that the new space policy could yield important changes in how space was evaluated and that they, as chairs, could be held more accountable for its use. As with the deans, about half of the chairs did not believe much would change:

> I use the system occasionally when I know the Provost has asked for a report. But my dean knows that we're pretty stable … so any new policy is going to affect other colleges more.
>
> The space policy is really on the Provost to back up what he says. He's put a lot of his credibility on the line saying that space is a priority, that it can be managed by numbers, in reports, and linked to our budgets. I'll just wait and see what happens.
>
> The Provost has been saying for a while that space is important but now this policy is what we've needed….Of course I'll look at the system more often if I know that someone else is really looking at what I do.

Most agreed that the new space policy, as an institution-wide policy, could affect change, but there was uncertainty as to how much follow-through the Provost's office really would do. To that end, MUSC hired a new Associate Provost for Research, who is charged with implementing, evaluating, and coordinating space use and research projects. As of this writing, he has been in office less than six months and was starting to request the first space reports.

The USC department chairs reiterated their deans' statements regarding the lack of a space policy, or the potential for one, at their institution. As with the other

chairs, they also believed they were "closer to the action," as one chair stated. The comments on the appropriateness of a policy, however, suggested that they felt the strong role played by the senior administration.

> I can't think that our research people or Provost's office would go for a space policy. I doubt my dean would approach them with the idea even though we could use more information about space.
>
> We're not going to have a space policy here. …we won't pay attention to space until it's a problem.
>
> I could see maybe my dean asking us to track space within the college but as long as we're building and growing we won't have anything University-wide.
>
> Even the state doesn't ask us for space information. I think someone reports classroom use but that's all. I don't think we're going to volunteer for another kind of accountability report.

In the discussions, the chairs were adamant that there was no interest at the senior administrative level in instituting a space policy.

Because of the relatively short time period between the initial interviews and the follow-up discussions, there had been no change in space management in the interim. As Clemson moves forward in their space management database, a space policy may be a next step. However, neither Clemson nor USC participants thought that a space policy was in the foreseeable future. Clemson did not have many policies governing the management of the institution. USC did not express an interest in space and did not foresee any policy regulating its management. Only MUSC, with its more data-driven senior management, had a new policy and procedures that contributed to space management.

Awareness of and Familiarity with Space Databases

During the interviews, questions were asked to determine if the deans and chairs were familiar with information related to space, the format in which data were maintained, and how access was granted to others within the college or across the institution. The researcher thought that there would be a relationship between how accessible space information was on a campus and the adoption of a comprehensive space database. Therefore, it was possible that increased access to a space system would be needed if the senior leadership made space information a priority for planning and reporting.

Overall, Clemson deans were familiar with the new space system, although their levels of use varied based on the number of laboratories and research in their colleges. The four deans at Clemson who were aware of the space database knew that they could obtain information, either upon request or from the password protected web site. The following responses were typical:

> You all [Office of Institutional Research] really did a good job making the information easy to get to but I just don't need it very often.
>
> It's taken a while for all of us to get used to having space data. I've called Institutional Research a couple of times for help and they've offered to train anyone on my staff. But it really is user-friendly.
>
> What I like is that you don't use those codes that I don't understand. Seems every time we have a space audit I had to learn codes that no one else ever understood. You all used text and some detail to make it better.

Only two deans stated that they had gone onto the web site more than once to query the system for information on their colleges. One of them stated, "You know, I like being able to check out space. Really I like being able to see what else is out there

when I think there might be a change." The other two deans had appointed personnel to manage space information and to ensure that the data was updated as needed, usually as requests were made by senior University leaders. All five deans had also given authority for daily management of space to their chairs.

MUSC's space system had been in place for approximately seven years, and all five deans were aware of its structure and how access was provided to University personnel. The deans had all accessed the system even if only for the reports to the Provost. It was clear that these reports were taken seriously, as was space overall.

> I know that we have open access to the space database and that used to bother me. But I don't know that anyone has ever misused it. We are all accountable to the Provost.
>
> Every year it's a little different and I guess we need to make sure the Provost has the information in the format at the time he wants it. But there's no problem with access or with anyone understanding the information in there (the database).
>
> My college is contained in this building so I don't need the space system like others do. I know that my chairs use it more than I do and I review the reports from the Provost's office to see how my college is doing.

Unlike either Clemson or USC, space management at MUSC was ingrained into the culture as a priority and the institution provided the tools that enabled the deans to respond appropriately.

The responses from the deans at USC varied significantly from those received at Clemson and at MUSC. Only two deans, out of the seven deans interviewed at USC, knew that there was any space maintained at the University and they were aware of it only for calculating the federal indirect cost rate. The rest of the deans did not know how space information was kept and none of the deans knew how current

the information was. Two of USC's deans kept their own shadow information that was, in the words of one dean, "a way for me to keep track of what I want to and I've been doing it a long time." The deans who did not keep track of space or know how it was maintained typically responded as follows:

> Oh, I think you mean maintenance. We have a way to report problems with rooms…But I don't know that the University tracks space the way you're describing.
>
> If you mean other than reporting problems to physical plant, then yeah, I suppose we should make space more of a priority, but with funding cuts and so many other priorities, space hasn't been addressed in any objective way.

It was interesting to note the complete lack of an edited space system at the institution, given the size and broad scope of the University's research. The urban campus has expanded and yet it places space management in the hands of a central University Architect's office.

The majority (10 of 15) of Clemson department chairs who were interviewed knew that there was a space database but only seven of the ten knew that the system was accessible on the University web site. Most of them were aware of the system because each receives a report on their particular department each fall. As one chair said, "I like that I receive a report each fall and that I can make corrections. But since space isn't high on the priority list, I don't look at the system much beyond that." That kind of comment was typical from the Clemson chairs. Of the chairs who did not know of the space database, the following comments were typical:

> Well, I guess other departments need it [the database] more than I do. We don't have much research going on so I don't have more than some classrooms and offices.

> Space? I don't have enough to worry about. But maybe I could look at the web site and see what's there.

Of those who were not aware of the existing Clemson space database, the consistent response was that they had no need to learn more about their space.

The MUSC chairs were even more involved in the space management system than their deans. Their comments, considered separately from their concerns about implementation of senior leadership's space policy, were overall very positive.

> I've found that [the Associate Provost] is very open to suggestions that can make the database better. We've seen changes in the types of labs we have so that the old bench lab category isn't enough. I don't know how it all rolls up for the Provost but we can use terms that mean something.

> The space system is friendly even though I only use it when the Provost asks for something. It's reliable and I know exactly who to call if there's a problem…very user friendly.

> I came from a medical school where I had to learn codes, had to call someone in facilities if I wanted to know anything. The formatting and access in our system is so much better.

From the discussions with the deans, the Provost's office staff does not simply ask for reports; the Associate Provost reinforces the space priority with technical assistance and database adaptations as needed. Reports to department chairs are followed by reports from the Associate Provost on annual productivity changes and shifts in space allocations. MUSC demonstrates that effective space management is a matter of access to information, adaptation of information, and use of that information.

The department chairs from USC responded similarly to their deans regarding the lack of access to useful space information. Three exceptions to the commonality between deans and chairs came from chairs at USC who stated that they kept their

own spreadsheets in order to try and keep up with their space. One such chair stated the following:

> Faculty ask me for space. The Dean asks me for space. I have to know what's going on in my department. We need to do a better job of knowing what we have. It always seems like we're, you know, on the verge of doing something, but then we get distracted by something else. You know, space isn't what makes newspapers – it just isn't that interesting to most people.

It is worth noting that the chairs who are keeping their own detailed spreadsheets are in large research departments with bench and special laboratories. During the follow-up interviews, when asked to comment on creating such a system with University-wide access, most of the chairs continued to hesitate on the usefulness of space information. In addition, they questioned the worth of allowing access to such information across more than a very limited group. One chair stated, "You mean other chairs could see what was mine? That means they could go out and see what space they wanted and find a way to take it." The importance of making space, and access to space information, part of the institutional culture will be discussed in a later section.

Question 1 attempted to determine the types of data deans and department chairs would find useful and if they were aware of the elements currently available at their respective institutions. Question 2 followed by determining the level of access deans and department chairs had to this information and the perceived usefulness of this information. The answers were somewhat intertwined. Clemson and MUSC have space systems that the majority of their deans and department chairs are aware of and have used at least occasionally. The majority of those interviewed thought the information was kept current and recognized that it could be useful when needed.

Only the senior administration at MUSC makes regular use of the space system in evaluating use of laboratory space by faculty. Clemson academic leaders are aware of the space system, but have yet to use it regularly for any regular reporting. They do use it as needed for specific reports and questions that arise. In contrast, USC does not have a space database; their inventory tends to lack reliability and is not useful to deans or department chairs in managing their resources. None of the USC personnel interviewed viewed the current inventory as a useful tool. Overall, it appeared that while space management was not a priority for many of the participants, those who had the database appreciated its capabilities.

Research Question #3: What additional information would make their current space information more useful?

One important goal of this project was to ascertain the ability of the deans and department chairs to think beyond the information currently available to them and start to think about their actual information needs. As noted earlier, Clemson's space system was based on the system utilized at MUSC, meaning that variables and many field names within the variables were the same. However, a comparison of those data with the data from USC led to the belief that the participants from USC should be able to recognize the weaknesses of their current space knowledge base and see possibilities from sample reports. The goal was to ask participants to start analyzing the strengths and weaknesses of the space information they had available. Questions were asked during both the initial interviews and in the follow-up discussions, but sample reports were only provided to USC during the follow-up discussions.

The Relationship between Disciplines and the Perceived Usefulness of a Space Management System

The deans at Clemson had all been in their positions during the implementation of the space management system in 2003. Holding their positions throughout the institution's space evolution gave them an excellent perspective for evaluating strengths of the system as well as potential needs. At the time of the initial interviews, all deans could access space information via the web-based management system and they could edit certain fields in this system themselves or have staff members edit the information. When asked what to evaluate the strengths and weaknesses of the system, there were some specific suggestions, including the following:

> I would like to see more information about their research grants in the database, at least make the data more accessible.
>
> …more about contents in the lab space. Maybe how current the equipment is, the hoods, the water, the storage.
>
> I like what's there. You know, though, the question is always about the one thing that's *not* in there. I get questions sometimes about the physical set up but that's hard to put into a database.
>
> … nice to have the links to the drawings of the rooms…No, I don't know if I would use the system more but I would like the visual connection.

It was interesting to note that the deans who had earlier stated that they did not use the space system did have requests for additional information. There was no commonality among the requests by the deans but, as talks continued with deans at other institutions, similarities emerged by discipline.

The deans at MUSC report on space to the Provost two or three times each year. Deans are responsible for ensuring the accuracy of the data, in cooperation with the Associate Provost for Institutional Research and Assessment. These reports regularly list summary space information as well as linking each faculty member's space with his or her research award dollars. MUSC was the only participating institution that has used such space reports for more than five years and most medical centers utilize space data in annual departmental reports. When asked what additional information would be useful to them, none of the deans had more than a couple of suggestions, most related to knowing what their peers were doing at other institutions. For example, the Dean of the College of Dental Medicine stated that it would be helpful to know if his productivity, given his space constraints, was comparable to other colleges of dental medicine. It should be noted that MUSC has had several years to test and clarify the information included in space reports.

The USC deans expressed a diverse range of responses to the question of what additional space information resources would be useful to them. During the initial interviews many of the comments appeared disjointed and inconsistent, and five of the deans acknowledged that they did not know what was possible and that they had very limited experience working with space information. Specifically, four of the five deans referred to space management only in terms of traditional *facilities maintenance*, and only two comments mentioned operational planning. During the follow-up interviews, approximately six months after the initial talks, a few of the deans in the sciences and engineering had ideas about information they could use, most likely stemming from the information provided in the sample reports.

> This would be great, now that I've seen what it could do. I don't know day to day how much I would use it but we [USC] need to pay more attention to space.
>
> I still want to know how I would use this information. I like it and I would be happy if it were accurate. I would like my chairs to have this too.
>
> I could use this in so many ways….getting grants, hiring faculty. I could show others what we have and make a case for what we need.

All of the deans were interested in how the other institutions in this study were using space data. In summary, it appeared that the USC deans thought that the information could be useful although there was still uncertainty on specifics of its use to the overall University.

In contrast to the deans, most of the department chairs at Clemson did not have additional requests for information. Even those who did not regularly use the space system stated it was not the lack of information that kept them from using it. As one chair stated, "I don't use it because I don't need the information, not because of what's there. Space isn't something I worry about." During the follow-up interviews, reports similar to those distributed annually were shown to the chairs and the question was asked if there were anything missing that would make the reports more useful. Again, most did not find fault with the amount of information provided and only a few suggestions were offered:

> Could you include data on how many students they advise or how many theses they supervise? That way, I could know more about their space related to student visits.
>
> I'd like to see something about the quality of the space…maybe when the space was last renovated.

> It depends on what the Provost wants us to keep track of…and that changes you know. She's always asking for data on changes so maybe include the history, like the last time he got new space.

Several chairs commented that they were still getting accustomed to receiving any space information and they were pleased with the current level of data available.

Given the deans' responses, it was not surprising that the MUSC chairs had similar comments. More than 75 percent of them were pleased with the amount of information given in the MUSC space reports and there were only a few suggestions for other fields. The comments by the minority of chairs included:

> It would be nice to see what my peer departments are doing at other institutions. It may be hard to get, but it would be helpful.

> The information I get is fine. If we added anything, it would be to include the graphics for the buildings.

These statements echoed the comments by the deans and that was expected given that there is greater accountability from the Provost's office to the deans and down to the chairs. Perhaps because space was part of the institutional culture, the follow-up interviews yielded no additional responses.

The department chairs at USC responded similarly to their deans in the potential for the space reports. As noted earlier, they stated that they felt more pressure from their faculty members and, therefore, needed to have information more readily available. Their comments reflect the diversity of their disciplines and the range of interests they have in pursuing space data.

> The lab reports are interesting although I don't know if this is accurate. We'd have a lot of work to do to see what's correct, and I don't know if we'd use it more than once a year.

> This would be a detailed way to keep track of who is where. I would like to have something like this – can this really work? I'd need to work with my dean to make sure he agreed with what we were doing.
>
> I don't have too many labs but what about classrooms? I would like to know where my faculty were teaching, who was using the technology classrooms…. I suppose the office information would be useful…we have so many graduate students that it would be nice to separate their space from the faculty members.
>
> I like the reports…can't think of what else I could use… but I don't know if the University will adopt this.

As expected, the science and engineering chairs were more interested in laboratory assessments while a few other chairs commented on classroom utilization. Eight of 12 specifically commented that the University would need to adopt space as a priority for the reports to have any meaning. It was interesting to note that none of the USC chairs believed they could take on the space initiative in a way that could encourage others within their institution to do the same.

What emerged from this question was the theme that requests for additional information had more commonality by discipline family than by institution. Those in engineering requested more detail about the types of specialized lab space, noting that "we have more than the traditional bench labs in our college." For example, each engineering school had a specialized space for virtual reality research. The Clemson system was able to utilize a specific room use descriptor of "specialized laboratory," and also partition ownership of the space among the five faculty members who worked in the lab space. There was no way to determine from USC data where the different types of laboratories were located. Finally, engineers were also more likely

to mention the desire to learn what other institutions were doing with space management.

Similar to their engineering colleagues, deans and department chairs in the physical and life sciences had greater overall interest in space data. Some chairs commented that space was becoming more important because of substantial increases in federal funding in these disciplines at the participating institutions. The science requests for more information were related to federal reporting requirements, particularly with more data on graduate students in laboratories and assigning specific grants to space. Only the USC scientists did not have substantial comments related to space information.

In contrast, all three institutions had nursing administrators who participated, and none of them stated that they needed more data. In all cases, their college or department was contained within a single building. Responses to this particular research question, when analyzed by discipline, supported the original theory that there would be common levels of interest by discipline. More research is needed to evaluate if this trend continues with institutions outside of South Carolina.

In conclusion, Clemson and MUSC participants had limited suggestions on expansion of the current reports, most likely because the data and reports were in use. The comments made had more in common by discipline than by institution. There had been opportunities at their institutions to make adaptations and to discover what information was truly useful. The USC deans and chairs, however, had little comment upon the initial interviews. The follow-up discussions, where sample reports were presented, stimulated more useful discussions related to space

management. It was in those later interviews that the USC personnel were more able to assess the potential value of space information although they continued to have a limited number of suggestions.

Flexibility of Database Development and Links to other Institutional Databases

Deans at Clemson commented that they liked how the space system information could be linked with other institutional databases and three of the five deans perceived this as the greatest strength of the space system. Other comments included the following:

> I wish I could make the database links myself and maybe you could put in an automatic link on the web site.
>
> I don't like that I have to go through IR (Institutional Research) to get merged reports but at least I can get them. It's good that we can check the data with sponsored programs.
>
> We need to learn how to download the information so we can play with it ourselves. …can't we do that? …if we could learn to use the information when we need it that could be good.

In some cases, the deans had to be reminded that the system had capabilities that may not have been apparent to them. The investigator thought that this was perhaps because most deans had admitted rarely accessing the system themselves.

The deans at MUSC had participated in the changes that had already occurred with their space system. Four of the deans specifically noted that, over time, "the Provost's Office had been responsive to requests for change." When asked what changes had occurred, and what they needed from the system, the responses were very positive:

> They've done things for us like making sure small conference rooms and supply rooms are classified correctly. That has helped me find rooms for small lectures and groups.

> One of the things I've asked for is to split out labs for more than one faculty member. We're not there yet, but maybe we'll get there.
>
> I think I said before that we need more types of laboratory categories and I think [the Provost's office] is listening. It'll be nice to have a couple more options.

It was determined from the discussions that one of the reasons for the long-term use of MUSC's space system was that the administration who managed the system listened to the concerns of those who used the system. The deans' comments regarding the changes that had been made, coupled with their overall support for the system, reinforced the importance of maintaining flexibility in the database over time.

Because USC did not have a space management system, the questions about links with other systems and future possibilities occurred during the follow-up discussions. The results of these talks were more about opening up possibilities to the deans, although they did have comments about possible needs.

> I could see where linking it with HR (Human Resources) would be useful. It's hard to think about all the possibilities….
>
> …maybe use it with classroom utilization to get a better handle on the types of setups. But yes, what we use it for would probably change over time.
>
> It would take a lot of time to get all of our lab space in here and it would be hard to think of everything at once. We would have to be able to change fields when we needed to….

Three deans did not see how a space system would add value to their work and, therefore, did not have any comments on database needs.

The Clemson department chairs were among those who saw the value in being able to adapt the database over time and seemed more willing to allow the system to evolve.

> …already there have been changes. When the system was being developed we were able to make suggestions and include things that we needed. I'm sure that will continue with other departments.
>
> … I like the reports with HR and I'm sure there's more we can do, we just have to learn over time.
>
> I can think of a few things I'd like to see, maybe noting where graduate students are…we get more of them, we could track where they are.
>
> … we could change some of the classroom categories, and if we add more technology or special equipment, I hope you would be willing to do that.

The Clemson chairs were still becoming familiar with the potential of space information and its relationship with other institutional databases. There was consistent interest in flexibility that crossed disciplines, although the social science chairs expressed more interest in classrooms and offices, while the science and engineering chairs had more interest in lab space.

The MUSC chairs were quick to point out ways that their suggestions had been incorporated into their system over time. Two of the chairs noted that it was their suggestion to incorporate research awards into annual reports and another chair noted that the recent hiring of an Associate Provost for Research was his idea. Most chairs, though, expressed the importance of having the system be adaptable over time.

> I see that one day, when we get a better finance system, that it would be able to link with grant expenditures by lab instead of just awards.

> … need to be flexible so that as we grow the system still works.
>
> If we can't make changes when we need to, as my department grows, and as my labs change, the Provost's questions won't be answered.

As occurred repeatedly in conversations at MUSC, concern for the senior administration's use was a common theme. Like the Clemson chairs, there were similar comments across all the disciplines and the MUSC chairs could point to specific changes made based on their requests.

The USC chairs did not have many comments regarding what they would see as long-term possibilities for a space system. As one chair said when asked about additional information needs, "We haven't even thought about tracking space. It's hard to think about what the possibilities are." When shown the different space reports that used space data merged with personnel or research data it was still difficult for most chairs to articulate what would be needed in a USC system over time.

Overall, the comments regarding the importance of database flexibility were made in relation to the overall demands that would be placed on a system. This theme is important for others interested in space management because it reminds all affiliated with such a project that space, and its uses, are not static; that as research evolves, and as classroom technologies evolve, a good system will need to consider those changes. Just as the basic federal classroom classification of "310" for any classroom no longer is appropriate for the myriad classroom constructs, a database must change as needed.

Research Question 4: To what extent would the proposed discipline specific Academic Space Management model provide useful space allocation information for deans and department chairs that is not available from their current space information systems?

The intent of this series of questions was to ascertain from the deans and department chairs their opinions on the overall usefulness of a comprehensive space management system. Coupled with their earlier responses, analysis of the currently available space information lent more substance to the interview responses. Did these academic leaders see value in assessing and tracking space in a way that may encourage their senior leadership, and even other institutions, to emulate? The researcher also wanted to determine the balance of interest among laboratories versus classrooms versus office space. As reported previously, for Clemson and MUSC, the initial interviews revealed much more than the follow-up interviews; the USC initial discussions yielded little information but the follow-up talks, with the sample reports, were more productive.

The Trust Senior Administrators have in the System

Institutions spend millions of dollars implementing large-scale systems to manage finance, human resources, and enrollment, among other things. These systems have in common the fact that use of these systems is required for conducting daily institutional business. A space management system is more optional and, therefore, keeping the system in use as an authenticated resource for space information is more challenging.

The Clemson University deans were still becoming accustomed to having a space management system, with their new system only in place for about two years. During the initial interviews, three of the five deans stated that they had trust in the new system although some voiced concerns about maintaining it over a long period of time.

> I know you all spent time setting it up but how are you going to keep it going? Is [the Provost] committed to this long-term?
>
> … we've found some errors. That means some people won't use the system and I have to double-check data. Unless I know it's right we won't use it.
>
> If there are errors we won't use the system. ..but yes, if we do the reports and use the system, there's a greater chance of the information being correct.

Over the one-year full installation period, the Clemson space information had been updated. However, the deans' comments highlighted the challenge of building confidence in a new system, as well as the challenge in shifting accountability for accuracy away from a central office to each department.

The trust in MUSC's system was directly linked with its use as an accountability measure, especially for the colleges with high levels of research dollars. The deans were very honest in their recommendations that trust in a space system was established over time.

> Our data isn't perfect, never has been. But we work hard to keep it pretty accurate because we know the Provost is going to use it.
>
> We're the ones held accountable and if the data's not right it's on us… or on my departments. …how the system works has built up over time and there's trust in the administration and their trust in us… it works both ways to make it all work better.

> …you know, it's about our relationships with the administration and how they've used the information over time. They've been open with us and that isn't found everywhere.

When errors were caught in the data they were fixed as soon as possible. During the study period, there were updates and edits made to the system because errors had been caught in a recent report. The Provost's office participated in the edit process, working with the departments to run edit checks with new faculty member assignments and retirements. It was the collaboration among the department chairs, deans, and Provost's office that reinforced the trust in the data and how it would be used.

The USC deans offered little information about the management of a space system but there were comments about their trust in the University's information. During the follow-up discussions, the deans were shown information pulled from the USC space data and, as expected, the deans were not able to comment fully on the accuracy of the data. They did, however, inform the theory about trust in institutional data:

> I wouldn't know how much of this was accurate…I guess most of it is. Since no one I know ever looks at this does it matter?
>
> I don't worry about what the Architect's office says my space is, and I don't know if it's correct. We don't work together and we don't report our space to them.
>
> My information in my office is correct. I work with my chairs to move people around if we need to and I don't report that to anyone.

There was difficulty in discerning what came first for the deans, their lack of trust in sharing information across colleges or that each college seemed isolated and operated

as an independent unit. There was little sharing of information across colleges at USC and few deans seemed interested in doing so.

The department chairs at Clemson, like the deans, had mixed feelings about the accuracy and, therefore, the trust they had in the space system. As the ones on the front lines, the end users of the information, the department chairs had been the first ones to see the space system and how it would be constructed. The initial data checks for accuracy had been done in collaboration with them, which suggested to the investigator that they would understand the challenges of maintaining accurate information. Overall, the collaborative relationship showed through in their responses.

> I'm sure there are still some errors but we like the system. It's still better than what we had before. I know that if something seems off I can call….
>
> We're learning how to make changes and we're learning when reports will be due. That means that trust in the system and how it will be used is getting better.
>
> I'm still waiting to see how the system is really used. I want to make sure that we aren't going to be hit up for space without warning…so I guess the trust is still building.

The space system was in its third year of use and the chairs had received approximately four reports that used the database. In all cases, there were only a few questions, the investigator was not certain if the lack of questions were because the information was known to be accurate or because the reports were not carefully reviewed.

The concerns among the MUSC chairs were more limited. The chairs supported the work of the senior administration and that support translated into

mutual trust, trust in the senior administration by the chairs, and trust in the chairs by the President and Provost's offices. The trust was conveyed in their comments:

> I don't worry about the data, even if it's not perfect. We have advanced notice of when reports are being run, we have the ability to edit data, and we receive copies of the reports.
>
> I update the system as I need to when the reports are being created but as long as the reports are correct, that's what's important
>
> The system isn't perfect and we aren't perfect at keeping up with it. …know that the reports will be used well, shared with us, and changes made if we need to make them.

The trust was also apparent because the chairs knew that the information in the system would actually be used. Their work did not sit idle in an unused database. Fair use of a system by senior administrators increased trust in the system, which seemed to increase its upkeep and accuracy. This positive cycle could serve as a guide for other institutions installing a space management system.

Finally, the USC chairs were aware that their deans and senior administrators did not use space information. When the chairs were shown sample reports from their own data and then USC data compared with another institution's comparable information, they expressed concern for their own information and how it would be used.

> I could use a report like this, but … I don't know what's in our system. …I would have to do it myself.
>
> How would central administration use this? What if they took space away if there was an error? It's too much for us to keep up with….
>
> Who would have access to this? The report would be useful [to me], but I don't know how my dean or the Provost would use it.

> We'd have to do so much work to get our data in order, it would take forever. And who would get to see it? Someone to ask more questions and ask for another report…

The comments from USC department chairs suggested both the concerns with accuracy and concerns with sharing information. The culture of the institution was not ready for sharing information and trust did not appear to be present among most of the chairs or among their deans.

The theme of trust was about more than accuracy within the database, it must include trust in those accessing and using the information. It's about more than data or creating a space management system for personnel to utilize. Time is needed to build a culture of system use and trust, and investment is required across academic levels, from faculty through the Provost's office. Suggestions for improving this relationship included regular use of the space system, communication about reports generated from the system, and a lack of penalty for data errors. The deans and department chairs at Clemson provide the best opportunity for evaluating future change as their space system continues to mature.

The Effects of an Institution's Location, Real Estate Availability, and Construction Costs on the Implementation and Use of a Space Management System

The idea of Academic Space Management (ASM) rests on a foundation of open data, linked information, and delegation of authority to colleges and departments. Therefore, it was of interest to learn what made one institution more concerned about space than another institution. Perhaps ASM was more attractive to a particular type of institution based on more than its research. How do institutions

become interested in evaluating how their space is assigned or used? The three participating institutions were located in very different areas of the state and the investigator wanted to know how location related to space management.

At Clemson, all deans agreed that there was not a current "space crunch," and all commented that they were fortunate to have the space that they did.

> The new system we have is useful to my colleagues, I'm sure, and I've heard some of my chairs like it. I'm lucky that I don't have to worry about it [space] too much.
>
> I don't know if other institutions could use this…maybe if they were in a city or someplace where they couldn't expand.
>
> We have space that needs renovating… but we also have new space and we have room for new buildings. Other campuses I've visited aren't as fortunate as we are with space.

There were limited comments about needs and the politics of getting space but, overall, the deans were pleased with their space system and with their space. Only the Dean of the College of Engineering and Sciences articulated a concern that "good, updated lab space was running out" as he his college continued to expand, both in faculty numbers and in research awards.

The Clemson department chairs appeared very candid in their responses. Like their deans, 11 of the 15 stated that there was not a shortage of space. One chair mentioned, "Well, of course, we could do a better job with what we have, but Clemson's lucky to have room." In addition, half of them referred directly to the Provost's "Academic Road Map" (http://www.clemson.edu/provost/docs/road_to_top_20.pdf), which includes managing space for increasing research and hiring new faculty members. While there seemed to be agreement that space was important, only three of the 15 chairs thought

space management should be used as an accountability measure with faculty, or as part of their own evaluation as chairs. Responses were based not on trust, it seemed, but on the fear that it would be too easy to take space away from someone based on a single assessment that may not occur within the same calendar periods as the grant award periods. The lack of a "space crunch" at the University led to a tradition of keeping space even when no grant awards had been made to a faculty member. In one college, it was noted that there were more than 15 faculty members who had no active grants or active proposals but still had bench labs assigned to them. Neither the department chairs nor their dean believed this was a serious concern.

The MUSC chairs had slightly different opinions than their deans and, as the administrators closest to the data, they commented more on possible problems. Six of the nine chairs interviewed trusted that the system data was correct, as one chair stated, "It's up to us to keep it correct. It's my responsibility." It was interesting to note that all of the chairs agreed that space was a priority although chairs felt varying levels of pressure for their individual departments, with three chairs noting space was not a serious concern. Again, there was variation among the responses related to the effective use measure, dollars per square foot, with approximately half of the chairs fully endorsing the measure as an appropriate way to evaluate use of space. Six of the nine chairs agreed that it was useful as a guide for finding space and gathering information about the work their faculty were conducting, noting that "the Provost hasn't misused the space data. I work with my dean and we move people if we need to." Overall, they believed that their system provided them with useful, accurate information that was use appropriately by their senior administrators.

Accountability for Space

Because all deans agreed that space was a concern and a priority for their institution, there seemed to be a willingness to be held accountable for its use. No dean stated that it was inappropriate to use the "effective use" measure of research dollars divided by assigned square foot of lab space. One dean summarized it in the following manner: "It's [the dollars per square foot evaluation] been used fairly and not as often as it would seem on the surface. My chairs are accountable to me and I'm accountable to the Provost. It's *one* measure, not the only measure." The deans were split on their belief that their faculty had enough space to conduct research, with one dean having an increased dollar per square foot figure in mind for his college, while other deans were more general in saying that they could "always use more space."

For MUSC, it was important to note one specific area of disagreement that occurred among and within the groups of chairs, deans, and senior administration. The assignment of space in two new buildings was continually raised by groups in two colleges, Medicine and Pharmacy, as contentious. One building, the Children's Research Institute, had recently opened and faculty members were supposed to be granted space in that building based on high levels of research productivity and, as a condition of moving, were supposed to surrender half of their old space so it could be re-assigned. Interviews revealed that there was disagreement on how space was actually assigned and who did not give up any previous space. As one chair said, "We were told it would be a strict criteria, based on dollars per square foot and that we could re-assign other space. Neither of those things has happened." Senior

administrators believed that the building was assigned properly, commenting that "We had an obligation to put our best researchers in the space but we also had to consider how to encourage collaboration. In a *Children's* Research Institute, it makes sense that there should be plenty of opportunities for those who work with children." Another new building, a Drug Discovery Center, was being planned and three chairs as well as one dean voiced concern that space in that building had been determined already, with little discussion. From this issue, it could be hypothesized that one of the possible drawbacks to an open space management system could be that it holds senior administrators just as accountable for using the quantitative information, leaving them open to criticism when procedures are not followed.

Usefulness of Space Management Systems Data

As mentioned earlier, the initial interviews with the USC deans on questions related to the usefulness of a space management system yielded few results. Upon review of the university's quantitative information, the researcher assumed that little information about space was shared with the deans and department chairs because of the use only of codes with no available translation table. It was much more useful to the discussions to present space data first with only their codes and secondly as information with text fields similar to those used by Clemson and MUSC. Where possible, comparison data was utilized, placing data side by side from Clemson or MUSC, to encourage the deans to think about way to use space data [please see Appendix E for sample report]. Most of the deans included the following concerns in their comments: establishing trust in a system, insufficient personnel to manage a

space database, inattention by senior leadership that space should be better managed, and uncertainty as to a space system's use at their institution.

The USC department chairs were not as vocal in their comments related to the concerns they had in a space management system. The initial interviews yielded very little in their responses as to how better space information could be used by USC; follow-up discussions did not go much better. From their views of the space inventory, and accompanying sample reports, the chairs had a tendency to focus on what was wrong in the system, where errors existed, or where they disagreed with a categorization, rather than being able to extrapolate from what was available to what was possible. This was in contrast to earlier comments and responses when some chairs had stated that there would be benefits to creating a space management system. The three chairs who maintained their own spreadsheets still did not believe that a space management system would be useful to the entire University. Because of the similarities in comments, the investigator believed that there was a great deal of mistrust in how the institution would or could use such a system to increase accountability among faculty members. Similar to earlier comments on trust, one chair commented that "What would happen if others could see my space? You mean it would be open to anyone? I don't think I want that." Regardless of the temporary interest in the space reports, there did not appear to be an interest in adopting a space management system. The primary reasons mentioned were similar to the deans, related to investing in personnel to build and maintain the system and belief that the system would be built and subsequently not used appropriately.

Summarizing the responses revealed that belief in the value of a space management system was directly related to the existence and use of a space management system. The endorsement of the system's value may also be related to trust in senior institutional management. Trust in, and subsequent endorsement of, a system was greatest at MUSC where the system had been in place, was open to those who requested access, and was utilized by senior leadership in a judicious manner. At Clemson, where the system had only been in place for approximately three years, trust was still being established, not as much in the data itself, but in the system's long-term usefulness and use by senior leaders in making decisions. Finally, the USC participants ended up with little interest in initiating a space management system across their institution, noting trust and personnel time as the primary concerns. This did not follow the hypothesis that the participants' recognition of the value in a space system would be positively related to the identification of a "space crunch" at an institution. The fear of inappropriate decisions by senior officials, and pressures by peers to use the system to justify taking away space, have some currency if there was insensitive central leadership. The investigator was not able to ascertain how other centralized systems had been used by senior leadership. USC and MUSC interviewees consistently agreed that space was, or should be, a priority; yet the USC group was not prepared to recognize the value of a space management system even though a majority of them had stated earlier that space was a concern on their campus.

As expected and noted earlier, there were some commonalities by discipline. Among social sciences and education there was substantial variance in responses but

those in health, engineering, and sciences were significantly more likely (20 of 26) to endorse a space system as useful for evaluating effective use of lab space. For USC, this did not mean they believed the system would work for the university as a whole, but that they found it useful internally. The issue of trust and accurate data was expressed several times by the USC personnel. Even at MUSC, trust issues arose not in the data itself, but in the belief that senior leadership is committed to using the information to make decisions. However, all of the science and health disciplines at MUSC were in line with believing that there had to be some way to evaluate how space was being utilized, where at Clemson, with a greater variety of disciplines, there was more variation in response. The breadth of responses, as well as the lack of consistency, were surprising and suggested the need for additional research.

Research Question 5: What factors are likely to affect the implementation and use of the Academic Space Management model?

One of the theories to be examined through this project was if institutional culture was the primary factor affecting adoption of an academic space management model. The culture of an institution, often understood only by those inside the university, can determine whether new processes are either successful or fail (Kuh & Whitt, 1988). Those within the organization may not be aware of the specific term, "culture," and refer more to terms such as "procedures," "tradition," and "politics." Culture may be one reason that managers within an organization have trouble proactively responding to external changes and instead become reactive (Dunphy & Stace 1988). Belief that an innovation would disrupt the culture could lead to a "wait and see" attitude by those not in senior leadership roles. Consideration of culture

during change requires assessing the path of change, *from* what *to* what (Kabanoff, Waldersee, & Cohen 1995). Therefore, this research question was, in some ways, the most important because it would reveal more about what would be required for almost any innovation to succeed in an institutional environment.

Leadership Role of Senior Administrators

Because facility costs are incurred primarily at the institutional level, worries regarding how to plan and pay for new buildings or renovations do not traditionally affect individual faculty members. This can be especially true of faculty members who do not need specialized research space to conduct their work. Even those faculty members in bench labs traditionally use grants only to fund special equipment or renovations. It is the role of senior leadership, therefore, to convey the reasons for improving space information, whether for planning or for accountability. Their consistent use of the information plays a direct role in how deans and department chairs use their own specific college information.

At Clemson, deans referred directly to the roles of the Provost and the Vice President for Research and Economic Development in supporting the new web-based space system. Comments were made that each senior leader has his or her own purposes for wanting more information but their overall leadership was important as noted in the comments:

> Well, the Provost has used the system, as you know, for some planning purposes. I know she has asked for a report that documents who is planning to retire and their offices. That's a new use for space information.

> You know that [VP for Research] has taken some labs back because they were not assigned to people in your database. We'll have to see what happens – that was a first.

> No one has asked me for much on my space, but I know I don't have any labs. It seems that's what they (the leadership) are interested in.
>
> I think that [VP for Research] has really taken to this space project. I haven't heard anything from [the President], but [the Provost] and [VP for Research] seem to like it.

Throughout the interviews, there were references to the political nature of the space process and how the drive of two vice presidents made the space system more than a one-time project for the University.

Similar to the responses by the Clemson deans, the deans at MUSC were very familiar with the Provost's demands for space accountability. Their space system and reporting had been in place for more than seven years and the all of the deans participated in the process. Respect and support for the President and Provost were evident in all of their responses:

> We all know that space is a priority, just look around. We have to be careful of how we use what we have because there's no room to grow. [The President] and [Provost] have to find ways to pay for the changes we're making.
>
> Our President's Cabinet group knows that space has to be a priority. Reporting on space isn't about productivity as much as it's about overall accountability.
>
> Even though my college is small, I know that space matters; it matters to the Provost and he has to be accountable to the President and to the Board. But he's fair and he does the best he can. The new space policy will determine what we really do with space information.

Throughout the discussions at MUSC, the deans' support of the President and Provost, the University's strategic plan, and the master plan for the institution's future were very positive. The support for the senior leadership was believed to be one of

the reasons that space management was so successful and accepted across the campus.

Finally, the deans at USC expressed strong support for their senior leadership, but admitted that space was not a priority for them. There was more conflict among their responses, with some deans commenting that "space should be more of an issue on campus" but that there was substantial growth occurring that took priority over facilities planning. Overall, the comments reflected that senior leadership had not made space information a priority.

> The President's Council talks about space every once in a while…seems to be when someone wants to take over someone else's space. But the Provost seems happy with the information he has, and he doesn't ask us for anything on it unless it's time for the federal F&A study.
>
> We don't have to worry about space in my college. We have our building and it's all ours. Why would anyone else need to know about it? The Provost knows where we are, and he knows what research we do. I'm accountable to him and if he wants to know about our space he'll ask.
>
> It (space) isn't a priority for our administration, not tracking it anyway. We've increased our research, increased our faculty numbers, and grown our facilities. Right now everyone is happy with that.

There were only two deans who stated that they disagreed with senior leadership's perspective on space management. One of the deans stated that his colleagues at other institutions were tracking space. The deans had their own priorities such as managing an increasing enrollment, growing the campus, and maintaining a budget under stagnant state support.

The department chairs had less to say about the role of senior leadership, although their comments were in line with those of their deans. At Clemson, there

was some discussion that the space system helped the chairs have information they had not possessed previously.

> This way, when the Provost asks about space, we're both working off the same data. But she wants it and believes that this makes all departments more equal. Over time, we'll see what happens, if it stays used.
>
> I like being able to get my own space reports. I know that it's what the Provost and [VP for Research] want, and I guess it's what the President wants, but I like having it all on the web.
>
> My department has some changes going on, and I know that the dean and Provost like checking up on what we're doing. Space is becoming more of an issue as our college grows, and I guess that means being more careful with what we have.

The department chairs at Clemson seemed pleased with the progress that had been made on the space system, even though it had only been in place for a few years. To them, it seemed that the role of senior leadership affected them less than the interests of their deans.

Similar to the deans' responses, all department chairs at MUSC were aware of the space database and seven of the nine chairs interviewed agreed that space was a priority for the University. The level to which department chairs kept up with their space was almost always directly related to the amount of research conducted in the departments. At MUSC, where most chairs interviewed used the space database at least twice a year, their comments included the following:

> I'm careful with tracking my space because there's never enough, and we've always been that way. Space is definitely a commodity here.
>
> The Provost hasn't held everyone accountable, and I'm waiting to see what happens with the new space policy. We have a database, we have a committee, but still a lot is done by politics rather than hard numbers.

> When my faculty get new grants, I use the database so I can ask for more space. I have hard numbers on where my guys are and my dean knows what they're doing. If we win awards, we get space.

Overall, the department chairs at MUSC knew what space each had under his or her purview, and they were pleased with the type of information included in the database.

It was interesting to note the consistent reference to senior leadership across all institutions, with only a rare few tracking space when their institutions were not. Even for USC, the largest participating institution, the priorities of senior leadership directly dictated any space data -related tasks of the department chairs. The investigator anticipated that the three participating institutions would have varied responses given the different stages of their overall space information but all institutions equally emphasized the leadership required by senior administrators. MUSC, with its established database, and Clemson with its relatively new system, had deans who were knowledgeable about space information. USC, with no space system, had deans who did not use or have knowledge of any institutional space information. Most of the chairs at Clemson and at MUSC were aware that space is an important part of their institution and they knew that their leaders were very interested in space usage within their departments.

Regarding the *types* of data already maintained in, or requested by, deans and department chairs, there appears to be a positive relationship between the time a space system has been in place and administrators' belief in and use of the system. Across the three institutions there was an awareness of the information that existed, or did not exist. For deans and chairs at Clemson and MUSC, there was a belief that space

was rather important, even if space was not an immediate issue for the participant's direct area. One note of importance is the statements of strong leadership present at both Clemson and MUSC and well-received institutional visions at the institutions. Participants from MUSC especially mentioned the strong leadership provided by the President and Provost. At Clemson, participants more often mentioned the Provost and the Vice President for Research as the two who were making space a priority. Finally, at USC, there were references by only seven of 19 participants that space should be more of a priority, but no particular senior leader was named who could address the need. Leadership at the senior level was paramount not only to making space a priority for an institution but also, as described below, in integrating the process into the institution's culture.

Questions to the Clemson deans revealed some uncertainty about what makes a new process more successful than another. The investigator found it difficult to discern the reasons for their hesitancy in commenting but statements repeatedly referred to the President and Provost:

> I think it has to do with how much the President and Provost want something done. With FAS [Faculty Activity System], it didn't take off until the Provost really started using is…and letting people know she was using it. If people think leadership is ignoring a system then it's ok for them to ignore it.
>
> What keeps things from being successful? It's just hard to get people doing something new….the people who have been here for decades aren't interested in doing anything new. Only if the Provost pushes it will anything new happen.
>
> If you can convince the President it will help with his vision, help achieve one of his goals, then he'll make it happen. …not about the vision, then it won't become part of what we do.

One common thread was that if a process were used by senior leaders, it will be used by others. The senior leadership of the institution, President, Provost, and several Vice Presidents were internal promotions and most had worked at the institution for more than 20 years. Therefore, it was thought that part of the institutional culture at Clemson was the authority of the senior leadership to "make or break" an innovation. The unspoken language was that if the President or Provost liked something, those under them would make room for it. The politics of the institution appeared to be more of a top-down approach than one of building innovations up from the faculty. According to the deans, the two factors affecting a project's success were both the endorsement of a project by senior leadership and then for the leadership to regularly ask for reports that utilized the innovation.

The investigator expected that deans and department chairs at the Medical University of South Carolina would have the best insight about how the space management system succeeds. Only two of the five deans were at MUSC (not in their current positions) when the MySpace system was introduced, but overall, the space system had been in use for more than seven years. When the deans were asked what made the space management system successful, their responses were slightly different from their Clemson counterparts.

> It's just something we do as part of our processes and I know how important space is to the Provost. …I guess if they didn't use it we wouldn't either but since they do we keep it up.
>
> Space is important around here and we all know it. When I got here I learned how the reports are done and now I use the system. But we trust each other and I support what [the President] and [Provost] want to do.

> …space is important, and the Provost says we need to keep track of it… and it's not a perfect system but it works for what we need.

For MUSC, the role of senior leadership appeared to be less of an enforcer and more of a partner because the repeated theme of supporting the work of the President and Provost. Creating a partnership builds a foundation of trust. The deans saw that the space system was important to the leadership, used by them, and that made space management part of the MUSC culture.

The USC deans were asked what would lead to the successful implementation and use of a space management system or any system that was new to the institution. Four deans first commented that they did not see a space management system in their future but, after that, noted the importance of senior leadership's endorsement in getting a system to be adopted and integrated in the institution's management. As one dean commented, "The Provost is a strong leader, as is [the Vice President for Research]. Without them saying that a project will be done it won't be." When asked if they could initiate and run a space management process within their own colleges, all said that they could but noted "why would we? We don't have to report what we do in our labs to anyone." From the deans' comments, the move to space management would have to be initiated, fully endorsed, and pushed by the senior leadership.

The Clemson department chairs, similar to their deans, also referred regularly to the leadership above them as vital to any program's success. Of the 15 participating chairs from Clemson, ten referred first to the endorsement by the President, Provost, or other senior leader as vital to a new process' success.

> If we weren't told to do it (track space), then no, we wouldn't. I don't need something else to do. But the Provost says it's a new system, so we do it.
>
> I think tracking space is a good idea and we should be doing something to know who's where… but it helps that the Provost says she's going to use the information.
>
> You know how it is, if the President doesn't like something it doesn't happen. Our administrative council has to like something and usually that means it makes us look good.
>
> I guess we could track space within our college, if we wanted to, but it helps more that it has support from Sikes (the administration building).

For the participants at Clemson, the culture of senior leadership approval was very strong, perhaps most notably because the majority of academic leadership positions, including deans and chairs, were internal promotions. Each has a great deal invested in the continued success of the institution, and most seemed unwilling to venture far from the established culture. Additional research into MUSC's space system could include evaluating how the space system's use expands or decreases over time, as senior leadership changes.

Throughout the interviews and talks with the MUSC chairs, they had expressed strong support for the administration, but they also expressed some frustration at being the ones who were held most accountable for space. Seven of the nine participants expressed positive interest in the space policy and stated that any frustrations they had did not diminish their support for the space system or what made it work:

> I know it's not a perfect system but, it works and I trust that the reports are right. The Provost's office uses it as a data tool, not to punish us.

> There was a saying by the former dean that "facts win." That's how we work around here. If I provide good information to my dean, he has more data to take to the Provost when we want something.
>
> We don't get to whine around here…that's not who we are. The Provosts trusts each college to run its own ship, but we still think about what is best for the University. …and in turn, the Provost gets a lot of support from us.

All of the chairs mentioned the President and the Provost several times, whether directly supporting the space policy or supporting the University's strategic plan.

The University of South Carolina department chairs had few comments about what it would take to make an innovation successful. Nine of the chairs stated that most databases were for required processes, like human resources, and as one chair stated, "getting those computer programs up and running were enough trouble." However, there were some references to the importance of senior leadership:

> … if they (the President and Provost) said we would do it then we would. It takes something to get a project done around here.
>
> I guess this would have to have the support of the Vice President for Research and other leadership. No one would just do it on their own.

The department chairs did not have much interest in evaluating possibilities for success and the responses to these questions were not lengthy.

The participants at both Clemson and MUSC referred regularly to the implementation support received from senior administration as vital to the project's success. The contrast was that at MUSC where the support for senior leadership was an issue of mutual trust in implementation and reliable use; at Clemson, it was about

the leadership's ability to "make or break" any new project. Even at USC, with limited experience on any innovation, there were comments about the importance of senior leadership.

An Innovation, to become Fully Integrated into Institutional Practices, must provide Practical, Reliable Information in a user-friendly Manner

Within the past eight years, Clemson had adopted a new software package to manage all of its financial and personnel operations while it also continued to expand use of a web-based faculty workload program. For the financial software, implementation and use was not an option; use of the system was the only way to conduct business. The initiation and expansion of the Faculty Activity System (FAS) had taken more than seven years and was a web-based database in which faculty members entered their effort and productivity information. Through these two processes, plus the space management system, it was thought that the deans would have insight about the factors that lead to successful integration of the space system in regular use. When asked, the following were typical responses:

> You know, it's much easier when there's no choice. Peoplesoft [the finance system] wasn't easy, but we had to do it. The space project is interesting but it just doesn't have the same everyday use so it's harder to get people talking about it.
>
> For me to use something it has to be practical, tell me something that nothing else can. And of course, it has to be easy to use….
>
> To become part of my routine, it has to be easy to use, make sense, and answer my questions.
>
> …you want me to use something, then I need a reason to use it.

As one dean commented, "I have enough to do. Something new has to make my life easier." If an institution makes space a priority, then providing tools that are helpful to those accountable for space must also occur.

All of the MUSC deans stated that space management was a priority for the institution and all agreed that it had to be. According to them, the space management system was successful for two reasons; it was used appropriately by the leadership and it was a practical solution to address the stated priority. Three of the deans added that there were other facets of the system that contributed to its success:

> …it also helps that, in one way or another, we've kept at it. We've used the space information pretty consistently…it's been used by the Provosts, …, and we keep trying to make it better.
>
> I need it to keep up with my faculty …. I have too much space, too much money, tied up in my buildings to not track space. It's good for us that the system is easy to use *and* it meets our needs.
>
> The Provosts have used it, not always in the same way…but still they have continued to track space and hold us accountable for it. But the system still has to be pretty easy to use and be practical for all of us….

These responses suggested that the system was also perceived as useful to them in their specific positions, not only because the senior administration demands it. The system was created to answer a question for the University and it was viewed as practical and reliable by those required to use it.

The USC deans did not view a space management system as practical for their institution as a whole and did not believe that it would be adopted across the colleges. When asked about innovations in general and what made them successful, only three deans referred to the practical side of a project. One dean stated, "Most projects are

about getting us to take on more work. If something were to really work, it should make something less work." The other two related comments echoed comments made by MUSC deans, referring to an innovation not adding to their workload, but making that workload easier.

A minority of Clemson department chairs, only five, referred to the practicality of an innovation:

> For something new to be successful, it has to be useful to me and my staff. If it's a better way and gives me better information, then I'll use it.
>
> Too often what something new does is make a process more complicated than it needs to be. But if you've got a more efficient way to help me do something I have to do anyway, that's great.
>
> The goal is to give everyone more time to do what they need to do. …If you want me to do something for you, I want to know what's in it for me… how will it help me.

The combination of responses almost always revolved around the two themes of senior leadership endorsement and practicality for the department chairs. The idea of practicality may not have been raised in the interviews because that theme had been stated as the primary reason for instituting a space management system at the institution over the initiation period.

MUSC department chairs appeared to take the practical nature of the space system for granted. Five of the nine chairs referred specifically to practicality but the comments were made in passing, mostly as part of answers to other questions about making a project successful:

> …I like that the system is easy to use, practical….
>
> The system meets a need for us and is easy to use….

> The Provost's system works well and makes it pretty easy to report on space.
>
> It works well… it's understandable…

One of the recurring themes within MUSC was the lack of bureaucracy, a flat organizational structure. The reports required were made as easy as possible by the Provost's office and, in return, the chairs and deans were kept informed of how the information was used.

Finally, the majority of chairs at USC, seven of 12, referred to practicality but they did not perceive a space management system to be a practical solution for their institution.

> …for something to work, it has to be useful to me …answer questions where I need answers.
>
> We don't need to answer questions about space but a system would have to be easy to use, manageable to really work.
>
> …something has to be really useful, make my life easier, but we don't need space data right now.

In the discussions with the USC chairs the investigator inferred that the chairs recognized how an innovation would have to be practical, but they also had difficulties seeing past the initial discussion related to space management.

The Time required for Academic Space Management to become Part of an Institution's Culture.

An institution's culture is not immediately apparent to those outside of the institution; the language of an institution is spoken only by insiders. During the interviews, careful attention was paid to the references participants made to "institutional politics," "how things get done around here," or directly to the culture

of the institution. The various stages of space management among the participating institutions were thought to add additional useful information on the effects of institutional culture. Comments regarding how an innovation such as space management becomes part of everyday language and regular use at an institution could provide useful information for those seeking to implement such a project.

The deans at Clemson referred often to the Provost and "how she gets things done." Three of the five deans commented specifically that regardless of any space database, the Provost would do what she wanted with space. From a certain perspective, this revealed that the deans did not view the space as "theirs," but as the institution's space. In addition, the deans referred to several other aspects of Clemson's culture:

> …we don't do things here with policies and procedures. If the Provost wants to get something done, she does it. You know how it is…same goes for getting almost anything done.
>
> With so many people here for so many years, you learn how to get things done if you want anything. You can't just ask for something; you have to work all those unspoken rules, through all the right people.

Overall, comments reflected that the institution did not have many formal policies or procedures for its practices, they evolved over time from a faculty and staff who had been at the institution for decades. At the time of the project, several of the senior leadership positions were held by those promoted from within the institution: President, Provost, Vice President for Research and Economic Development, Vice President for Student Affairs, Vice President for Public Service Activities, and Interim Chief Financial Officer. Each of the aforementioned senior staff had worked

their way up the leadership ladder at Clemson, reinforcing the culture that developed over decades.

The deans of MUSC also referred to their culture, but the cultural theme was one of change and moving forward. The support and respect for the President and Provost, as well as for their strategic plan, was apparent throughout the interviews. The limited concerns were that, over the short-term, the University would be stretched financially. "We don't have the money to pay for the space we have now," as one dean stated. The culture of fact-based decision making was apparent in the following comments:

> We have a flat structure…lots of freedom to improve our own colleges. We have to make our changes based on facts, on objectivity, but that's what most of us are about anyway.
>
> I know the priorities of the Provost and if I want to do something I can do it. …about culture here…if I can save money and further our research or service goals, then I can create change, with space or with anything else.
>
> We have a culture of mutual respect. Most of us believe in the work that the others are doing and we know that right now money is tight. We all have to work together and we all believe in what [the President] is accomplishing.

There was little concern for permission or the need to work projects through administrative layers to implement a new process or change in procedure. The culture was one of open communication, limited administrative oversight, and support for the institution's mission and goals.

The deans' statements at USC were consistent with their other comments about space. Because space had not been tracked or shared with the deans, their comments were very limited and most said that they did not know how "something

like space management" could be forced from the colleges up through senior administration.

The department chairs at Clemson had fewer years at the institution, but they were aware of how their deans could get things done or not. Within the colleges of Engineering and Science and Agriculture and Life Sciences the drive was for increasing research. Any change process had to revolve around research. Several of the chairs commented that change was slow to become integrated:

> Maybe it's because our culture is so home grown that we take things for granted. Still, I think it takes reminding people again and again, making sure a process appears in annual reports, maybe is made part of FAS (the internal faculty productivity system).

> You know, the Provost's academic road map was a good example. She presented it, then went around to all departments and got buy-in, then continued to present the road map and progress on it for a couple of years until we all got used to seeing it.

Another comment from the chairs was that for an innovation to be successful it had a time-saving element. The practicality of a new process had a significant effect on how well the chairs adopted or ignored it.

The chairs from MUSC were more diverse in their responses than their deans, although still supportive of the University's leadership and plans. The primary criticism was that the Provost's requests for space reports had not been followed through with noticeable change in space allocation although no chair produced data that supported these statements. As one chair said, "If space is so important then, when we have a new building, strict criteria should be followed and I know too many

things are just *status quo*." Overall, however, the comments echoed the data-driven decision making comments of their deans:

> I have to prove that my faculty are productive; that's the bottom line around here. Our culture and leadership are built around using information for decision making.
>
> We have some committees within the college but we don't have to go outside…or to the President's office… to make changes. We have the authority, or power, or whatever, to run our shops.

All of the chairs acknowledged that it had taken some time for space to become a regular report, but all of them saw that the information was directly tied to the challenges and goals for the institution, primarily managing limited space with limited funding.

Finally, the USC department chairs had interesting comments on their culture in general, although they did not comment on space specifically because space management was not part of their language. They appeared to be more forthcoming than their deans in discussing the cultural aspects that affect the integration of an innovation.

> The culture here is one of administrative meetings, of several layers of associate someones, or of writing memos. It takes a lot to get something changed around here, especially outside your immediate area.
>
> We're getting so big that it's changing our culture I think. It's hard to get out and gain perspective on the campus, there's so much growth, so many priorities. We kind of create our own culture within our college but that doesn't mean it could get anything done at the University level.
>
> The only way a new idea or project becomes part of our culture is if it comes from the top. If the President buys in then it's done. If he doesn't, then forget it. You won't ever hear about it again.

The reference to layers of administrative oversight, coupled with institutional growth, provided frustration for some of the chairs. Others saw the size as an opportunity to build more within a college rather than worrying about the entire campus.

Overall, comments about culture made it easier to understand why an innovation such as space management could be more successful at one institution than at another. Those who wish to implement a new concept or project at an institution must consider how data oriented the leadership is, what policies and procedures already exist, and even the relationships within senior leadership. An innovation is successful because it fits the needs and interests of a specific group, not simply because it could benefit the institution.

Summary of Findings:

There were several themes that emerged from the initial interviews where the questions focused on the current state of space information, its availability, and institutional policies governing space. Similarities were noted between Clemson and MUSC, both with web-based space systems. The institution without any space system, USC, stood out in contrast, as the responses to the interview questions and the quantitative analysis suggested a real need to address the issue of space better over time. The themes, by research question, were summarized as follows:

Research Question 1: What University information on academic space currently exists to serve the needs of deans and department chairs?

- Both Clemson and MUSC have web-based space databases open to all deans and department chairs. The databases may be linked with other

systems, queried for specific information, and downloaded for easier use. USC had a traditional inventory maintained within the office of the University Architect with coded information available only upon request and only for the requestor's specific area of control.

- If information is to meet the needs of deans and department chairs a space management system must have accurate, relevant, and useful information in text that is easily understood.

Research Question 2: What access do deans and department chairs have to these information sources and what are their perceptions of their usefulness?

- Providing access to more personnel is related to improved perceptions of a space system's usefulness.
- Allowing access to a space management system from central administration to deans and to chairs improves the information's accuracy and usefulness.
- Creation and implementation of a space allocation policy is challenging because of the complexities surrounding space at research institutions and academic medical centers.
- If space is to be perceived as important on a campus, academic leaders must have access to data, formats must be understandable, and leaders must have reasons to become familiar with the system.

Research Question #3: What additional information would make their current space information more useful?

- Information perceived as useful within a space management system differs across discipline areas.
- A space system should be flexible so that it can expand or change over time, as well as be linked with other institutional databases.

Research Question 4: To what extent would the proposed discipline specific Academic Space Management model provide useful space allocation information for deans and department chairs that is not available from their current space information systems?

- Use of a space system and interest in it is highly related to trust senior administrators have in the system.
- An institution's location, overall real estate availability, and location construction costs directly affect the implementation and use of a space management system.

Research Question 5: What factors are likely to affect the implementation and use of the Academic Space Management model?

- The leadership role of senior administrators is vital in making space information a priority.
- The role of senior leadership in endorsing and using an innovation is paramount to its successful integration into an institution's processes.

- For an innovation to become fully integrated into institutional practices, it must provide practical, reliable information in a user-friendly manner.
- It takes substantial time for Academic Space Management to become part of an institution's culture.

The participants in basic sciences and engineering noted the importance of research space and they said that an increasing challenge was obtaining money to renovate bench laboratories. A theme that emerged among the chairs was substantial interest in how their colleagues at other institutions and in other colleges allocated space. The investigator determined that there was recognition that space either was already, or would become, more of a priority at USC. One important note was that department chairs at MUSC were almost always recruited from other institutions, negotiated for space in their initial contracts, and tended to bring in other researchers with them. While the average service time for the chairs interviewed was approximately five years, no information was gathered on what they may have negotiated in their contracts.

Chapter 5:

Conclusions

In Chapter 4 the emergent themes were presented for each of the study's five research questions related to academic space management at research universities and academic medical centers. The interviews, quantitative analysis, and follow-up discussions were evaluated for commonalities and differences. Chapter 5 begins with a discussion of the results of the study and general observations and conclusions that can be drawn based on these findings. It continues with an analysis of major implications of the study, both in terms of theory and practice. Implications for key stakeholder groups that are affected by these policy decisions are also examined. The chapter concludes with a summary of recommendations for future research on this topic.

Discussion of the Findings

The findings from this research project could serve as the first guidelines for successfully implementing a space management system at an institution. One of the goals of the research project was to evaluate the understanding of current information sources on institutional plant facilities and how they are used by those who need them, recognizing that this is a finite resource requiring careful management. The initial interviews and follow-up discussions yielded some interesting results, with commonalities emerging by institution and by discipline area. These findings suggest that effective space management requires: 1) current knowledge of how space is assigned, 2) assessments of its use relative to the institution's programs and mission,

and 3) understanding how assigned discipline specific space usage compares with that of peer institutions.

Importance of Senior Leadership

The investigator noted themes related to each research question, however, the most important theme appeared to be the importance of senior leadership's participation in the space management endeavor, from implementation through its regular use at the institution. In her opinion, the participants referred most often to the use, or lack thereof, of space information by the leaders as being of primary importance in responding to the remaining interview questions. In most cases, an entire group of people were not needed to lead the support, but that at least one person needs to be perceived as the catalyst, the one who defends the process when required and believes the most in its possibilities. At Clemson, it was the Vice President for Research, who had taken back a number of laboratories that remained unassigned in the space database, even though the Provost's initial support contributed significantly to its creation. For MUSC, the Provost and his staff were the primary people who requested space reports, facilitated system upgrades and changes, and utilized the space information. Although USC did not have an interest in adopting a space management system, the senior leadership's position on space management obviously determined the attention paid to it by the deans and department chairs.

The role of senior leadership was not surprising to the investigator because the literature available on both leadership and change refers to the importance of a champion, an individual who serves as a catalyst for change and as a cheerleader for

an innovation such as space management. A champion must gather appreciation for the innovation, galvanize new support, and provide emotional meaning and energy to the endeavor (Van de Ven, 1986). The process of how someone gains influence over an outcome is not well understood in management (Gabarro, 1987) but, as this project found, the value of this influence cannot be understated. A corollary to identifying a champion is the establishment and maintenance of trust within the organization. All three participating institutions exhibited strong trust in their senior leadership, perhaps more than the investigator expected. Research correlates with trust both to increase the effectiveness of the organization and a willingness to take on new tasks (Mayer, Davis, & Schoorman, 1995). The support of leaders relates to their ability to recognize the complexities of the organizations they govern. In higher education that means recognizing the collegial, the political, and the symbolic processes involved in achieving change (Bensimon, Neumann, & Birnbaum, 1989).

The investigator was interested to observe how the leadership theme emerged in the conversations because of her knowledge of the three institutions that had evolved over her eight years in South Carolina higher education. The leadership at each institution is unique but each is a strong presence with strong, consistent support by the faculty and staff. Over the past ten years, the three institutions have substantially increased their national reputations and much credit has been given to the Presidents and Provosts. MUSC had changed its culture regarding space over a seven year period. Clemson was still undergoing a space management change even after having a system in place for three years. Finally, USC neither tracked nor required reporting on academic space throughout their institution, even though it is by

far the largest institution in South Carolina. Creating change at a large institution can be compared to steering a battleship; creating large shifts in culture can appear intimidating and seems to be a long-term process.

Data Systems Must Serve Practical Ends

Another theme that crossed research questions and institutions was that an innovation such as space management had to be practical, created and utilized in a way that made the users' tasks easier. For research institutions and academic medical centers that have faced dramatic increases in federal research reporting requirements, more stringent institutional review boards, and increased conflict of interest concerns, any new database or report must be viewed by the users as having a positive impact on workload. Part of the rationale for selecting deans and department chairs to serve as the primary contacts for this project was that they are typically seen as the ones in "middle management." Deans and chairs work with individual faculty members to complete reports and also work with senior leadership to meet institution goals. Their roles at the institutions made them excellent candidates to evaluate how a new process would work and what it would take to make it part of the institutional culture. Therefore, their comments on the need for practicality and ease of use resonated as a likely lesson for those wishing to implement Academic Space Management at another institution.

The research available on change and innovation implementation reinforces the idea of practicality when trying to successfully implement a change process. Within higher education, the idea of facilitating changes in the loosely coupled systems means that there tends to be greater emphasis on thoroughness and

deliberation, that many options to solving a problem would be explored (Birnbaum, 1988). When implementing change, this means that the process of exploration itself is important. Research universities, with faculty members accustomed to exploring new ideas and concepts, may have a culture that requires more time and testing before an innovation is integrated into regular practice. Marcus (1988) concluded in his study of change processes that "implementation is likely to be more effective when policy implementors are free to design and determine the specifics," (p. 251) creating ownership specific to their needs. Space management appears to be no different in its requirements for successful implementation.

Fear of Uninformed Central Decision-making

In the investigator's opinion the lack of endorsement or enthusiasm from the deans and chairs at USC, where there was not a space database of any kind in use, was surprising. The investigator had theorized that the participants from USC would become enthusiasts for adoption of a space system that would improve access, accuracy, and use of space data at the largest institution in the state. With the other two research institutions investing time and priority to space, there was a theory that USC would begin to perceive space as worth tracking, detailing, and reporting. Throughout the interviews and follow-up discussions, only a few participants believed that space management was a worthwhile endeavor for the University. More participants, approximately 30 percent of them, believed that space information could be useful within a single college, but not across the entire University. The investigator theorized that very large institutions would not see the value in space management because the colleges were run as independent units and little

coordination occurred among colleges to the central administration level. Data is power and when central figures gain access to data it erodes the power of those who had exclusive access. Lower level officials also fear central decision makers will ignore many of the local complexities that affect decisions and that are apparent to those organizationally closer to the scene. Perhaps centralizing decision-making on space would jeopardize the traditional autonomy of the departments and colleges. Additional research would be needed at other institutions of similar size to evaluate this theory.

Lack of Comments on Costs of Construction

There was little discussion related to the costs associated with construction, however, none of the research questions specifically referred to building costs. The investigator surmised that this was partially the result of the focus on space use, but she did not receive any comments from those at USC about the cost of implementing a space system. There had not been a bond bill passed in South Carolina since 2000, but the research institutions had received other special funds to help with construction of research facilities. The Research University Infrastructure Bond Act of 2004 authorized $250 million for higher education. Thirty million dollars was deferred maintenance for non-research universities and $220 million was for the three major research universities to promote research and the growth of the state's economy.

Time Required to Integrate into Institutional Culture

Finally, a theme emerged across research questions about the time it takes before an innovation becomes integrated into an institution's culture. This theme of timing and integration was anticipated because of the variance among the three

participating institutions related to interest in and adoption of space management. As noted earlier, MUSC's space system had been in place for approximately seven years and, across all colleges, the deans and department chairs accepted space management as an institutional priority. There were discussions of improving some management areas, and there were limited areas where space information was not accessed more than required by the Provost. However, it was an accepted practice. Clemson deans and department chairs had been part of a space management improvement process for approximately three years and there were still some deans and chairs who had not accessed the web-based system. Those who endorsed its use tended to be those in large engineering and science departments and those with bench or specialty laboratory space. Two colleges, with little or no laboratory space, did not articulate many reasons at all to use the system unless preparing for a requested report. The space management system was still in the integration process for Clemson. Finally, USC did not have a space management system and it not perceived as a priority by most of their deans and department chairs. Over the eight month project period, few changes in the participants' perspectives was noted, with only a small percentage believing that space management would work even at the college level.

Empirical research on the culture of higher education institutions is limited, most literature on the subject is more qualitative and commentary. The culture of an institution is usually only known to those on the inside and can be difficult to describe objectively to an outsider. Therefore, comparisons over time and across institutions are hard to make because changes in leadership and changes in institutional goals can change a culture (and *vice versa*). Managing the meaning of an innovation is the

responsibility of leaders and goals of a new project cannot seriously conflict with an institution's culture (Kuh & Whitt, 1988). For example, implementing a space management system that would hold faculty members accountable for their productivity within a space will not be quickly or easily adapted into a culture where faculty currently haves freedom to work in any assigned office or laboratory space without accountability. As noted by Cohen and March (1986), a university system suffers from "high inertia." High energy is required to start something new and also a coordinated effort is required to stop a process once it is in motion. For an innovation such as space management, once it becomes part of the administrative culture, stopping that process is extremely challenging. As experienced with Clemson, it is the initial push to start the space management process that takes the greatest energy.

In the investigator's opinion, even the state culture had an effect on the responses. South Carolina has a history of implementing new programs, such as performance funding, requiring reports for several years and then abandoning them in favor of the newest fad. Some leaders had expressed concern about starting something new that simply could be forgotten in the next budget cycle or with the next Provost. Overcoming the inertia and cynicism that stems from too much reporting could be a significant obstacle to initiating a space management system.

The cultures of the three participating institutions were unique in certain ways. The common thread that emerged was that discussed earlier, the strong senior leadership at each institution. However, the investigator believed that the commonality ended there. In her opinion, the leadership at each institution chose to cultivate the institutional culture in different ways, along a continuum from allowing

substantial autonomy to exercising more comprehensive control. At MUSC, while it appeared that the administration required detailed accountability on their faculty members, the organization structure was very flat, with few administrative layers. Faculty members, department chairs, and others had access to the senior administration and were able to implement changes on their own; in brief, there was professional respect and freedom across all levels. For Clemson, allegiance to the President's mission was paramount but within those confines, faculty members and department chairs could initiate change. Over the course of the investigative period, there were several administrators hired between the deans and Provost, increasing the layers and, perhaps, making change more challenging. Finally, USC had several layers of Associate and Assistant Provosts, Associate and Assistant Deans, and other administrators who appeared to serve as gatekeepers to the senior staff. In this role, the faculty members and department chairs appeared isolated from others outside of their colleges which contributed to the interview responses, noting that it was the college unit that was important, not the University as an entity. The investigator was not granted interviews with the Provost's office to discuss space management or the current space information at USC.

In conclusion, there was a great deal to learn about leadership in this project. The role of senior leadership in facilitating change, in encouraging the new system, and in reinforcing it through regular use was vital to its adoption at MUSC and at Clemson. Similarly, the lack of interest from the leadership at USC regarding tracking space, or creating reports based on space, meant that even the basic data was not maintained accurately. Leadership and culture crossed in the discussions many

times and more research is needed to evaluate the evolution of space management at Clemson and at USC. Finally, there was the continual reference to the practical nature of space management, how any innovation must be practical, that it must work as part of the institution's overall goals. As occurs in higher education, particularly at the complex enterprise of a research university, placing a process into the environment does not mean it will be used, it must be given time and respond to an observed need.

Perceived Advantages and Disadvantages to Academic Space Management

Results from discussions with deans and department chairs at Clemson, MUSC, and USC revealed that Academic Space Management was still considered a unique concept that did not capture everyone's attention. Some of the perceived disadvantages could be noted: 1) database does not contain enough information of interest, such as the quality of the space or graphics; 2) the potential long-term outcomes of research performed in the space not captured in a square footage use measure, 3) the concurrent issues of faculty work and graduate student efforts that may conflict with straight analysis of space use and, 4) the lack of comparable information from other institutions to encourage use of the system. However, for those institutions willing to attempt this innovation, overall results suggest that advantages to adopting a space management system include: 1) a new information resource that can justify additional construction or renovation; 2) a tool that facilitates completion of federal research audit processes; 3) adding a system that could decrease department and college workload by standardizing required reports; and 4) a method for administrators to improve planning and placement of new faculty or new grants.

Perceived Disadvantages

Responses related to Question 1, the University information on academic space that currently exists to serve the needs of deans and department chairs, included some comments that a space database should include data related to the quality of space. Some participants commented that the current systems at Clemson and MUSC did not contain any such information. Some of the expensive commercially available space packages allow for graphics of the room design and setup to be included. For Clemson, at least, the costs associated with such a system outweighed the possible benefits of have graphics attached to the database. It would be interesting to pilot test some qualitative comments about quality, but there are concerns that each researcher would have independent assessments of what is acceptable space. Perhaps limiting it to choices, such as "acceptable," "needs equipment repair," and "needs significant renovation" would serve as an appropriate compromise.

There was a perceived disadvantage that was not accurately reflected in any of the research questions, that of a space database not capturing the potential financial benefit resulting from research occurring in the laboratory. The investigator could not determine any method by which the potential of research revenues could be measured and used in an evaluation of space use. The concept of Academic Space Management could consider long-term awards from federal agencies such as the National Institutes of Health and, perhaps, points could be given for patents awarded. A challenge exists because of the long-term process involved in actually achieving the outcomes of research. Publications, for example, can take a year to be published; patents take even longer. It is important to remember that Academic Space

Management still allows academic leaders to consider other factors, with dollars awarded or expended per square foot serving as only one measure of effectiveness.

Of course, faculty members do more than work in laboratories and conduct research. Most teach, advise students, serve on committees, and assist with graduate laboratory experiences. For a faculty member conducting research, additional space may be needed to provide graduate students with work space. Teaching and research can easily co-exist in the same space. These special needs can be challenging to capture in a database and, without this knowledge, it could appear that a faculty member has an over-sized lab for his or her research. One possibility would be to include a field for "graduate students" or "additional personnel" to account for persons also in that space.

A final disadvantage was noted by those at Clemson and MUSC who are trying to use space information, and that was the difficulty of obtaining any benchmarks or comparable data from other institutions. The Association of American Medical Colleges (AAMC) has a sub-group called the Group on Institutional Planning (GIP), and their annual conference usually includes at least one presentation on using space information. However, those processes are still internal within individual institutions and, to the investigator's knowledge, no multi-institution comparisons on space use are available. The Association of Physical Plant Administrators (APPA) has a web site and journal that detail facility construction and renovation costs but, it contains no information on how the space is used once it is built. The facilities officers turn the space over to the academic side of the institution and typically forego additional responsibility for its use. There is no other group

involved in the use of space from an institutional perspective. This leaves institutions that implement space management somewhat isolated in finding comparative information that can validate their efforts.

Disadvantages, perhaps more optimistically stated as challenges, to implementing and using a space management system were noted among project participants at all three institutions. As useful as detailed space information can be to deans and provosts, the challenge lies in creating a culture where department chairs and their designees regularly update data. Findings suggested that there must be evidence that the system will not create more workload and vice presidents must be able to assure deans and chairs that they will not use the data to make decisions that ignore local realities that may not be apparent from the data. It has taken time at the institutions for faculty members and department chairs to become accustomed to updating space data as soon as a faculty member changes offices or labs. Using MUSC as an example of what works well for space management, it seems to take regular use by senior administrations and a longer than anticipated period of time to get a space system into the culture. MUSC's system has been in place for more than seven years and still there are department chairs who only access the system a couple of times a year. Clemson's space system had been in place for approximately three years, and on average, half of the deans and department chairs understood how to use the system. Both senior administrators and deans were still adjusting to using this information resource, and perhaps continued use of space reports across the campus will assist in the system's evolution.

The investigator did not note any additional disadvantages from the discussions, aside from the concern that maintaining a space database would be an additional burden on the administrators' time. There was mention of "turf," of the trouble that could come from having an open database, but that concern was only mentioned by USC, which does not have a space database. If Clemson or MUSC administrators had those concerns, they seemed to have been allayed over time. In the opinion of the investigator, this fear was one that most likely all administrators had initially. Consistent use by senior administrators was needed to encourage the open system.

Perceived Advantages

One of the goals of Academic Space Management is to provide leaders with a new tool to assist with decision-making. Public institutions must find new ways to finance the construction and major renovation projects needed on their campuses. States are increasingly concerned about taking on large bond debts as they continue to face tight budgets and calls for tax cuts. In addition, the traditionally long period between planning, construction, and utilization can frustrate planners at both the institution and state levels. Constructions costs have not decreased and, therefore, one advantage of a space management system lies in being able to present detailed information on how space is being fully utilized. Administrators can make a fact-based case for expansion with specific assignment and utilization data, even planning for how the new space will be used. Too often higher education is criticized for simply asking their state legislatures or parents for additional funds without being held accountable for why the funds are needed. Academic Space Management

provides institutional leaders with an accountability measure that readily demonstrates how an institution is using its valuable space resources.

Research institutions must go through federal audits of space that determine the percentage of indirect expenditures that will be allowed on federal grants, focusing on research space only. This audit process, called an "F&A" audit because institutions can charge indirect expenses on grants for "facilities and administrative" overhead, requires institutions to produce detailed reports, down to the level of the specific federal grants a researcher is working on in a specific lab. Institutions must also break a room's use into percentages, including the percentage used for instruction, research, or office space. For example, a bench lab where a faculty member conducts research with graduate assistants is not only a research laboratory, but also instructional space. If the faculty member's office is in that same space, then administrative space must also be a percentage. When institutions go through this process approximately once every five years, those that do not have a space management system must usually start from scratch and devote a great deal of time to the process. An Academic Space Management system allows institutions to have a "head start" on the audit process and make a detailed case to the federal auditors.

Finally, a space management process provides a tool for planning, both strategic and operational, at a time when most institutions are facing a generational turnover of faculty. As faculty plan to retire, it is important that the administration be able to plan for where space will be vacant, where laboratories will still be in use, and where space may need to be renovated before it is ready for new occupants. Senior faculty members usually occupy prime space within a department and, once they

retire, decisions must be made about how to best use that space. Also, institutional priorities may be evolving with the hiring of new faculty and space may be needed to be reconfigured or held for a different use. Without a reliable space database that assigns individual faculty members to offices, administrators may not know what is available while they're recruiting new junior faculty. There was an instance at Clemson where a long-deceased faculty member was still assigned a specific office; no one had bothered to change the data and the office remained vacant. An accessible space database can keep deans and department chairs honest about space, which can be important as institutions evolve. As found in the project, consistent use of the system through standardized reports is also very important to planning.

Finally, the investigator believes that there is a challenge for administrators to determine exactly how to use space information within the institution. Clemson has used the tool for planning and as a method for summarizing the types of space available within departments and colleges. The calculation of research dollars expended per square foot of assigned lab space for individual researchers has been calculated but no space changed hands because of the measure. At present, it has been used to determine any baselines for future accountability and to evaluate how junior faculty members change their space use as they mature into senior researchers. The Provost's perception was that, while junior faculty members may be listed as co-investigators on grants, there should be a progression until they are the primary investigators. MUSC follows a similar program, noting changes over time in grant awards. MUSC creates a department summary of dollars awarded per square foot and then also creates a University ratio. Evaluations of departments that fall below the

University ratio are made college by college. A dean, or the Associate Provost, may review a faculty member's pending awards, proposals submitted, or other documentation before noting a problem with space use. Changes in space assignments are left up to the individual deans and, to the investigator's knowledge, the Provost's office has never taken space away from a college. Shifts have occurred within colleges as department research has increased or decreased and deans have appropriately made changes to balance the needs of their chairs to the Provost's satisfaction.

The perceived advantages and challenges to an Academic Space Management system will vary across institutions and over time. Thorough planning, a willingness to made modifications, and detailed discussions as the implementation progresses will mediate some of the challenges, such as developing trust in how the information will be used. For example, it was made clear to the deans and department chairs at Clemson that there would not be a University-wide standard for dollars expended per square foot of assigned space. At a land-grant institution like Clemson or USC there was too much variation in types of awards and space needed to conduct research. Pitting departments against each other would be inappropriate. Building trust and establishing space management as a collaborative innovation will assist in diminishing the challenges and enhancing the advantages.

Limitations on Interpreting Findings and Conclusions

With regard to the findings from this project, there are reservations to consider. The investigator did not participate in meetings among deans and department chairs within the individual institutions, meetings that may have lent more

substance to the underlying cultures of the institutions. Perhaps there is a reason that USC-Columbia does not focus on accurate space data or make space management a priority, but it would have taken a substantial amount of inclusion in discussions and permission from the senior leadership to ascertain a more detailed conclusion. Similarly, the investigator's inclusion in several MUSC meetings, as well as more time on the campus, probably yielded additional clues as to what makes their space system successful. Certainly, her position within the Clemson administration contributed significantly to her understanding of the needs, uses, and culture of the institution. Conducting interviews and discussions with individuals may have yielded different responses than if small focus groups had been conducted in a setting that allowed participants to play off of others' responses.

The complete study period was approximately six to eight months between the initial interviews and the follow-up discussions, which did not appear to be enough time for any changes to occur. There was limited information available on other institutional priorities that may have taken the focus away from space management, but it is important to note that South Carolina requires their public institutions to complete several accountability reports each year in addition to the standard federal reports. Space utilization is not required reporting at the state or federal level. Also, Clemson had recently completed a federal indirect cost audit, suggesting that the administrators believed the data had been sufficiently updated and analyzed in the previous year. Institutions wishing to initiate a space management system must realize that it will take time to implement and researchers studying the process must devote sufficient time to determine how long it takes for changes to occur in an

institution's culture. Time was also needed to evaluate how the benefits of space management are shown to outweigh the perceived costs in time, resources and loss of local control.

There was the concern that the investigator's position at Clemson limited the responses of some of the participants. The paradox was that being part of the culture can assist in understanding why an innovation succeeds or fails but it can also limit how other participants respond to questions. Analyzing what makes something work in higher education is made possible by being part of the process, one of the insiders. For example, the investigator was able to assess that space management could work well at Clemson because both the Provost and the Vice President for Research were data-oriented and they needed more information to drive decisions on future research space. She was also aware that as faculty members retired, there was an opportunity for the University to restructure its research focus areas. These factors made the adoption of space management timely; under other circumstances it might not have been successful. However, being part of the culture and attempting to analyze the processes provided an additional concern for this project as participants seemed to assume that she was already aware of the many challenges as well as the participants' views about the process. Finally, it seemed that some of the participants were concerned that any negative comments would be relayed to the senior administration and perceived as disloyal to the institution. The investigator remained uncertain about gathering accurate opinions from the deans and department chairs.

Given the above-mentioned concerns, this project did represent an initial attempt to evaluate perceptions of space as an institutional priority and the use of

Academic Space Management to track space in a research institution environment. Results from these analyses can be utilized by administrators and state level governing bodies interested in learning more about space management and how a new practice is integrated into institutional practice. Some practical advice for administrators or others seeking to implement a new practice into university environment emerged from the study. As noted by Cohen and March (1986), the nature of higher education is to evolve, meaning that a process which fails at one time in the organization, may not fail in the future. Changing leadership and changing priorities mean that space management may be implemented successfully regardless of its past acceptance levels.

Some Contributions of the Study

The research questions pursued and data gathered from across the institutions provide guidance for those interested in facilities management. In 2006, colleges and universities spent $15.1 billion on new construction and renovation, with the expenditures varying significantly by state. As an example, the median cost per square foot for a specialized science building was $290 in 2006 (Abramson, 2007). For public and private institutions alike, gathering funds to support construction can be challenging. Donors, both individual and corporate, are pleased to see their names given to a facility. Raising funds for a new building offers a set of one-time challenges and an opportunity for donor prestige. Obtaining funds to outfit and maintain space, on the other hand, is very challenging because there is little prestige attached for a donor to give for a new heater, and too often cyclical maintenance is deferred until the heater breaks. In *Tuition Rising,* Ehrenberg (2000) notes that

several institutions have more invested in their facilities than they hold in their endowments but their leaders possess little knowledge of how this resource is maintained. Understanding facilities and space is an additional facet of knowledge related to how effectively an institution is fulfilling its mission and vision, knowledge that contributes to more powerful accreditation, assessment, and accountability reporting.

The data constructs proposed in Academic Space Management offer lessons in the evolution of data priorities for institutions and they also offer instruction on delegating data integrity down to the level of the end users. Facilities data for research institutions consists of millions of square feet that can be impossible to maintain in a single centralized office, similar to other data such as student progress information, personnel data, and others. From this project, the benefits of delegating data responsibilities can be gleaned, including increased accuracy, increased timeliness and, according to several participants, an increased sense of responsibility for maintaining the system. Trying to keep an accurate database within a central university office poses challenges to the timeliness of information, particularly when changes can be made without consulting anyone outside of a particular college or department. In this study, USC data suffered from the greatest number of inaccuracies, with the University Architect's office trying to keep the only space data inventory for the entire University. Without delegating responsibility for a system's integrity, gaining acceptance and broad use of that system becomes even more challenging.

In addition to space management, there are several practical implications for those seeking to implement a space management system, or any innovation, at an institution. The results of the interviews and discussions yielded important information about building trust and communication in order to successfully create change on a campus. There are many models that provide a framework or context from which to consider how to best successfully implement an innovation into a university environment. For example, when considering change implementation from a management perspective, one would focus on the extent to which the innovation was required, the level of modification allowed, and how much the innovation would be a top-down structured implementation. The management literature suggests that gaining long-term support for an innovation is more difficult when participant modification is not allowed (Timmerman, 2003). None of the institutions participating in this study had implemented a space system in such a planned manner. Both Clemson and MUSC had allowed for participating and modification throughout the implementation period.

In contrast to the structured implementation, there are options within the space management process for more of an adaptive change implementation process. An adaptive model allows, even encourages, participants to change or adapt the processes to fit best into the existing culture. Results from this study suggested that both institutions with space management systems also had encouraged modifications from their deans and department chairs. Within the higher education environment, implementing any new process can be more successful if there is time to explore options, discuss the benefits and costs, and test the possible outcomes. The

department chairs at both Clemson and at MUSC made many comments relative to the evolution of the space system and how their concerns had resulted in changes to the system. At Clemson, the early inclusion of department chairs in the design process gave them a sense of ownership with the process and several of them became advocates for the system.

An important implication from the study was the time required for a successful implementation. The concept of space management is simple, the database structure is also relatively simple. However, incorporating the edit process within departments and the reporting process across the administration requires a substantial time commitment. The simplicity of the data is countered by the challenges of asking faculty members and administrators to report on another institutional resource. The space system at Clemson University had been in use for slightly more than three years, and still was not perceived as a regular part of annual reporting by most participants. If there were turnover in either the Provost or Vice President for Research position, the space management implementation process could disappear because space management was not yet part of the culture. For those seeking to implement a change like Academic Space Management into their institutional processes, allowing plenty of time for adjustments and regular use is paramount to its long term success.

Implications from this study include: a) suggesting a new tool that contributes to knowledge about an institution; b) the value in delegating data responsibility away from a single location; c) the process of implementing an innovation into a campus culture; and d) the time required to successfully integrate an innovation. Perhaps the

truth is that an innovation brought into a higher education environment is never truly duplicated in its entirety. The innovation process requires the interactions of institutional culture, participation of its leadership, and the innovation itself, always yielding a slightly different result in the end.

Recommendations for Future Research

Discussions related to what would make an innovation successful at a research institution yielded two primary responses, practicality and endorsement by senior leadership. Additional interesting research could have gathered the deans and department chairs into mixed focus groups to elicit additional responses and to elaborate on the themes that did emerge. Conducting the interviews individually did allow the investigator to isolate which institution and which disciplines focused on various aspects of space management. The next step would be to bring people together into focus groups.

Future research should focus on expanding the knowledge base on how institutions actually use facilities information. Identification of commonalities among institutions' use of data regarding facilities, a vital investment for any institution, can contribute much to the research base. A representative sample of research institutions, academic medical centers, and research institutes could provide valuable suggestions for those wishing to learn more about space management. As states and governing bodies question the regular requests for funding increases, institutions that possess a method for demonstrating accountability for space use will make powerful arguments compared with those that do not. This study represents a first attempt to analyze common perceptions among deans and department chairs regarding space

management, but more information is needed to validate the comments made by participants in this study.

Another need in facilities management is to determine methods for comparing institution facilities information. Institutions that create space management systems and develop reports, whether they utilize research dollars or capacity or something else, could definitely benefit from having other data that can be used as benchmarks, or even as another planning tool. For example, if a series of data on the square footage of mechanical engineering laboratories is available, an institution could recognize if their labs are within the "established" range, which can aid in planning for new facilities or in recruiting new faculty members. Additionally, just as this project noted commonalities among disciplines, having some form of comparative data by discipline could reveal trends in certain fields. This could be valuable information as technology evolves and research trends change. Research could evaluate the additional time and resources needed to operate a space management system and how the implementation of systems alters where decisions are made in the institution leadership. Finally, as discussed earlier, given the cost of construction and renovation, use of standardized utilization data could be an immediate asset to Presidents advocating priorities to governing bodies.

One other possibility for future research would be to follow Van de Ven and Rogers (1988) and study an organization as it goes through the adoption of Academic Space Management to observe the particular "break points" or where specific perceptions change. Higher education provides a unique environment from which to analyze how an innovation works and noting where those processes differ from those

found in the business environment. After all, the culture of a research institution tends to revolve around exploration, debate, and modification and, therefore, both the implementation process and the follow-up uses of an innovation could be substantially different from that same innovation imposed on a business. In a university, the expertise is located at the bottom of the organizational hierarchy, whereas in business, expertise is typically at the top of the organization.

This study used a case study methodology to examine the role of Academic Space Management at three research universities in South Carolina. As discussed in Chapter 3 a case study within a state has a variety of applications, along with some limitations. The participating institutions are assessed extensively on their levels of sponsored research and, for these institutions, the quality and quantity of laboratory facilities are key determinants underpinning all research programs. In fact, many institutions have stated that the rate-limiting factor in acquiring additional funding and recruiting qualified investigators is sufficient research space. Research space will become even more important as the value of research clashes with a lack of capital funds. As this resource becomes even more valuable it is natural to look for a method to assess how well faculty utilize their space and how effectively they manage their lab space related to the sponsored dollars they are awarded. The results from this case study can serve as a guide for institutional leaders as they face continued financial constraints, increasing construction bids, and rising energy costs. It is anticipated that facilities, and their costs, will again come to the fore of institutional priorities.

Appendix A

A sample of a traditional facilities inventory with fields and descriptors.

INSTIT	BLDNUM	BLDEXT	BLDNAM	OWNER	OWNDES	YROCCP
003448	001		JAMES F. BYRNES	1	OWNED FEE SIMPLE	1980
003448	001		JAMES F. BYRNES	1	OWNED FEE SIMPLE	1980
003448	003		1323 PENDLETON	N	NOT INVENTORIED	1989
003448	005		U M W W M	1	OWNED FEE SIMPLE	1935
003448	006		FLINN HALL	1	OWNED FEE SIMPLE	1860
003448	007		1321 PEND	4	LEASE/RENTED UNAFFILIATED	1985
003448	051		GAMBRELL HALL	2	TITLE VESTED,INSTITUTION	1975
003448	054		WELSH HUMANITIES BLDG	2	TITLE VESTED,INSTITUTION	1968
003448	055		HUMANITIES CLASSROOM	2	TITLE VESTED,INSTITUTION	1968

INSTIT	BLDNUM	BCOND	BSYEAR	BSCOST	RPLCST	LNFT
003448	001	087	1980	6980237	7167895	521
003448	001	087	1980	6980237	7167895	521
003448	003	000	1989	39950	42347	200
003448	005	071	1935	100000	1599992	289
003448	006	087	1972	309678	1009311	296
003448	007	087	1966	830200	132832	422
003448	051	100	1975	4610169	16027901	979
003448	054	096	1973	2968063	5711688	323
003448	055	098	1978	3122298	4070228	437

INSTIT	BLDNUM	MNTCST	NETFT	HNDACC	GRSSFT	BABBRV
003448	001	89599	60039	Y	92629	BB
003448	001	89599	60039	Y	92629	BB
003448	003	529	4699	N	4700	1323
003448	005	20000	4835	N	8200	UMWW
003448	006	19177	5816	Y	10235	FL
003448	007	1660	11526	Y	16056	1321
003448	051	200349	72932	Y	147750	GAMB
003448	054	71396	32984	Y	57909	HUO
003448	055	50878	27727	N	51168	HU

INSTIT	BLDNUM	DTACQR	YRCONS	SVDTE	OCOST	RNCOST
003448	001	1980	1955	200106	1915894	0
003448	001	1980	1955	200106	1915894	0
003448	003	1989	0	0	0	0
003448	005	1935	1935	199309	100000	0
003448	006	1860	1860	200107	24200	0
003448	007	1985	1966	199309	132832	0
003448	051	1975	1975	200102	5476023	0
003448	054	1968	1968	200105	0	0
003448	055	1968	1968	200106	0	0

Appendix B

Interview protocol for the participating deans and department chairs.

Introductions will be made relative to the purpose of this research project and the methods followed.

1. Who allocates space to faculty? Is there a formal process? If you're the one involved, what is the basis for doing for allocating space? Is your process similar to that of other chairmen (or deans)? Is there a space policy at your institution?

2. How important is space to you and to your institution? (Is there a "space crunch"?) Do you have enough space now and planned for the future to conduct your programs effectively?

3. How much space do you consider adequate for your program(s)? Do you believe that your program adds enough value to the institution to justify the space?

4. How does acquisition of new space work – can you go in asking for space without it being related to recruitment? On those instances where you've asked for more space, what was the basis for your request?

5. How would you measure this value that one could use as a monetary for return on investment? If the University were to build you more space, what could you "give back" to pay for that space?

6. Do you have an idea of what your current (and the University's) dollars per square foot productivity is?

7. Do you currently use information about facilities and academic space in your college? If so, for what purposes do you use it?

8. What kinds of information sources currently exist at your institution related to academic space?

9. What department is the authenticated source for information related to academic space (not master plan items, but day to day occupancy issues)?

10. What are the strengths and weaknesses of the current space information? (follow up with ideas if necessary related to accuracy, timeliness, access, etc.)

11. Do you or others have to keep "shadow" databases related to space?

12. If space information is not well used or trusted on campus, why isn't it? Is technology the primary barrier – if not, what is?

13. How is space information disseminated to the departments and colleges? Is it viewed as a priority at your institution? If so, in what ways?

14. What factors contribute to the use (or lack of use) of space information?

15. How could you use space information from other institutions?

Appendix C

MEDICAL UNIVERSITY OF SOUTH CAROLINA
OFFICE OF ACADEMIC AFFAIRS
POLICY MEMORANDUM

Memorandum ID: AA-2005-01 Research

Title: **Assessment and Allocation of Research-dedicated Space**

Originator:	John R. Raymond, Sr., MD	**Reviewed**:	Council of Deans
Date:	March, 2005	**Date**:	July, 2005
Approved:	John R. Raymond, Sr., MD	**Implementation**:	Office of Academic Affairs
Date:	September 1, 2005	**Date**:	September, 2005
Reviewed:	University Research Council		
Distribution:	All units reporting to the Provost		
Date:	March – July, 2005		

RATIONALE

As one of three research universities in South Carolina, the Medical University of South Carolina recognizes the need to conduct health sciences research in a program of progressive and innovative scientific endeavor in its six colleges and the Medical University Hospital Authority.

Consistent with this commitment is the recognition that the faculty who pursue scientific investigation must be allowed to operate in a system that is supportive and enabling in terms of the allocation of University laboratory facilities that will meet the needs of the scientists. In the spirit of good stewardship, the University also recognizes its responsibility to assure that all of the physical facilities appropriated for scientific research are being utilized in a cost-effective and productive manner.

In order to meet its obligation to assure equitable allocation as well as continued assignment of its research facilities, the University, through the Office of the Vice President for Academic Affairs & Provost, has formulated the following policy and procedures, which will be applied to all Departments in the University.

POLICY

This policy addresses the responsibility of the Vice President for Academic Affairs and Provost to monitor and improve the utilization of the limited amount of research-dedicated space on MUSC campus. Furthermore, this policy provides for an expected level of sponsored research to support the assignment of laboratories, an assessment of how well the academic units have utilized the space relative to funding, and a method to reallocate underutilized research space.

GUIDELINES

I. DEFINITION OF RESEARCH SPACE

Full function scientific lab (i.e., "wet" lab; Coded as "Lab, Research Bench") – rooms often equipped with highly specialized equipment or facilities and assigned to Principal

Investigators. Typically they are traditional laboratory facilities with multiple benches, gas/vacuum lines, chemical fume hoods, tap water, purified water, chemical storage, etc.

Limited function scientific lab (i.e., "dry" lab; Coded as "Lab, Research Other") – Unlike wet labs, these rooms are most often equipped with minimal fixed, special purpose equipment. These rooms are also assigned to Principal Investigators. In general, these labs are used to process epidemiological or demographic data rather than wet lab generated data. "Computer Labs" are included in this category.

Shared Services lab (also known as a dual use lab; Coded as "Lab, Research Support") – may be either "wet" or "dry" facilities assigned to a Department or Center and intended as common space, usually limited in use to Department faculty and not shared across disciplines. These rooms are not assigned to a single Principal Investigator and are usually under the auspices of the Department Chair or Center Director.

Core Facilities lab (Coded as "Lab, Research Core") – facilities may be either "wet" or "dry" laboratories equipped with commonly used instrumentation and equipment, and is assigned to program Directors who are responsible for oversight. These facilities typically house University and/or college sanctioned activities including federal Core Research Awards, large Program Projects, University Research Resources Facilities (URRF) and the General Clinical Research Center (GCRC) activities

Note: all full-time faculty will be assigned a reasonable amount of office space at the time of their appointment. Such office space may be contiguous with assigned laboratory space but will not be included in the computation of funding for research space. Contiguous space for administrative assistants, technicians, graduate students, and fellows will be included in the funding computation and allocation of research space.

The University, College or Department will assure that all of its assignable research space will be of optimal quality to assure the safe and efficient conduct of the intended research.

II. INVENTORY OF ASSIGNABLE RESEARCH SPACE

The Office of the Provost will maintain an up-to-date inventory of all assignable research space on the campus. Administered through the Associate Provost for Institutional Research and Assessment, the Provost's database will be utilized in the annual review of current space assignments, responding to new requests for space, and the allocation of newly constructed or renovated space.

III. ADMINISTRATIVE AUTHORITY FOR RESEARCH SPACE

All assignable research space on the University campus will be under the authority of the Vice President for Academic Affairs & Provost ("Provost"). Such authority may be delegated to the Associate Provost for Research. Assignment of research space will be made by the Provost's office in consultation with the Dean of the requesting College. The Dean will, in turn, allocate laboratory space to Department Chairs. The Department Chair will determine ultimate distribution of space to faculty.

Allocation of research space contained within a Center or Institute will be recommended by the coordinating body (e.g. research committee) of the program and approved by the Provost. Such space will be assigned on the basis of the mission of the program and will include administrative units such as the Hollings Cancer Center; Children's Research Institute; Institute of Psychiatry; and Gazes Heart Institute. Other Centers and Institutes will be added at the discretion of the Provost. Such space still remains under the ultimate authority of the Provost, and will be administered in a fashion that is consistent with University policies and procedures.

This University policy will not apply to the allocation of research space administered by the Veteran's Administration. Such allocation will conform to current VA policies and

procedures. The Office of the Provost will make every effort to work with the Associate Chief of Staff for Research at the Ralph H. Johnson VA Medical Center to utilize VA and MUSC research space in a consistent and efficient manner.

The Provost's office will be responsible for an annual review and assessment of productivity of all assigned research space (see Sections IV and V).

IV. ALLOCATION/ASSIGNMENT OF RESEARCH SPACE

A. Qualifying for Research Space Assignment

Generally, the criteria for consideration to receive research laboratory space will be based upon the nature of the proposed research; the number of personnel occupying the space; the amount of funding and the proposed period of time needed; and any special needs associated with the intended project.

Funding threshold: The minimum funding level shall be determined each year on the basis of $/sq. ft./year (total of direct and indirect funding) and, generally, must be achieved before a Department will be assigned new laboratory space. Departments and/or Centers not meeting the minimum can be afforded a reasonable period of time to attain the minimum level (see Section IV-C below, and Section V for details). Exceptions can be afforded for academic units with new faculty (see Section IV-C-2 below, and Section V for details).

This funding threshold will apply to all externally funded grants and contracts.

Grants and contracts awarded to multiple investigators will be held to the same minimum level of funding for all assigned space should multiple laboratories be involved.

This University-wide funding threshold will be re-evaluated by the Provost during each fiscal year. The Provost's recommendation for a change in threshold funding will be presented to the Deans' Council for approval.

B. Application for Allocation of Research Space

Requests for allocation of space (new assignments, and/or additional space) will be initiated in writing by the Department Chair to the appropriate Dean. This cover letter will include all pertinent supporting documentation to justify the requested space. The Dean will forward this material to the Provost for his/her consideration and action.

C. Terms of Assignment

1. Evaluations of Space Assignments

Allocation of laboratory space will be re-evaluated on an annual basis to assess whether the anticipated level of productivity is being achieved. This annual review will be initiated by the Department Chair and reported to the Dean. The Dean will then provide a report of his/her findings to the Provost. If the minimum amount of funding is not achieved, the Department can be given one year to attain this level if a mutaully acceptable business and academic enhancement plan can be developed. If unsuccessful, the research space assigned to the Department will (a) be reassigned to other Departments and/or Centers (assuming that the Departmental/Center productivity exceeds the threshold), or (b) be decreased to achieve the appropriate level of funding. Departments may also be given the option to retain the laboratory space through a funding process described in Section V-B, Threshold Funding. Otherwise, the laboratory space will be reassigned at the discretion of the Provost. No space may be re-assigned between Centers and/or Departments without the endorsement of the appropriate Dean (when applicable), and the written concurrence of the Provost.

2. Assessment of Faculty Research Productivity

Departments and Centers may choose to apply the University space productivity metric to each faculty member as one component of their performance. Each Department and Center can develop a scale of expectations for research laboratory productivity based on faculty rank, proportion of research effort, life events and other appropriate considerations.

3. Sub-assignment of Research Space

Once an assignment of research space has been approved by the Provost's office, the space may not be loaned or "sublet" to another Department without the written permission of the Provost's office.

D. "Backfilling" Vacated Laboratory Space

When a researcher is allocated new laboratory space (renovated or newly constructed), space equivalent to a minimum of 50% of the newly occupied laboratory space will be returned by the home Department and/or Center to the Provost's Space Inventory Database for reassignment at the discretion of the Provost. The Department/Center to which the space was previously assigned will be allowed to retain the remainder of the vacated space if the intended use meets the criteria for laboratory space assignment and the Department/Center has met the University's research productivity goals. Otherwise, all of the space will be returned for reassignment by the Provost.

E. Written Agreements

The assignment of research space will be formalized in a Memorandum of Understanding signed by the investigator and the Department Chair. This Memorandum shall contain all pertinent details regarding the space to be allocated and will define the start (move in) and stop (move out) dates for the allocated space.

V. ACCOUNTABILITY AND REVIEW PROCESS

A. Annual Review

On an annual basis the Provost or designee shall initiate a review process that will assess and evaluate the productivity associated with all research space assigned to Departments, Centers and Institutes. The timing of this audit will be such that decisions for continuing assignments can be made on or before the beginning of the fiscal year.

Reports from the Office of Research and Sponsored Programs reflecting the annual award and the Office of Grants and Contracts Accounting reflecting expenditures will be reviewed to assess and evaluate the level of productivity of the assigned space. Questions or concerns emanating from these reviews will be directed to the appropriate Dean who will engage the Department Chair in providing a response to the Provost. If deemed appropriate, the Provost may undertake an inspection of a laboratory to determine that its use is consistent with the original request.

Department Chairs will also be responsible for evaluating, at least annually, the performance of faculty conducting research in University assigned laboratory facilities to include both qualitative and quantitative measures. The Chair should be prepared to justify the continued use of a laboratory space within the Department.

B. Threshold Funding

The minimum threshold for funding of laboratory space will be be determined on the basis of $/sq. ft./year. This minimum level will be determined on the basis of the annual average award of all University researchers to whom research space has

been assigned, and will also take into consideration external benchmarks and University goals.

If research space is not being occupied at the minimum level, the Center or Department can be afforded one year to attain the required level of funding (see Section C - Terms of Assignment, above), assuming that an acceptable business and academic plan has been approved by the Dean (when applicable) and the Provost. If that level of funding is not attained during that one-year period, the amount of research space allocated can be changed as outlined in IV-D.

If research space productivity is not at a level which meets the minimum threshold, for every $10/sq. ft. below the minimum the Department may be allowed to retain the space for a charge of $1/sq. ft. at the discretion of the Provost. Otherwise, the space may be reassigned.

If a Department chooses not to pay the costs to retain a laboratory space, the facility will be reassigned at the discretion of the Provost (see Section IV-D, above). Such reassignment will be based upon the missions of the University, and not solely on departmental prerogatives.

It is important to note that space will not necessarily be re-allocated in proportion to any single metric. The Office of the Provost will be responsible for assessing the needs of highly productive units, and for re-allocating space based on (1) University, College and Departmental needs, (2) performance and productivity of the respective units, and (3) institutional priorities.

VI. EXCEPTIONAL CASES

Any requests for exceptions to this policy shall be made in writing to the Provost by the appropriate Dean and shall be supported by suitable justification of mission-specific need for the Department seeking the space.

VII. PROCEDURES TO AMEND THIS POLICY

Proposals to amend this policy shall be made in writing to the Provost. The Provost will appoint an ad hoc committee to review the proposal and provide their recommendations to the Provost. The proposed change(s) must be approved by the Deans' Council and President's Council prior to implementation.

ACCESS

Academic Affairs Policy AA-2004-01-Research will be available from the Office of the Vice President for Academic Affairs & Provost. It will be distributed digitally and/or by hardcopy to all units reporting to the Provost, and be maintained on the Office of Academic Affairs website www.musc.ecu/Academic/. The Vice President for Academic Affairs and Provost, or a designee, will be responsible for monitoring and maintaining the policy. This policy will be reviewed for revision as needed. This memorandum is a public document and has no restriction on its distribution.

Signed: John R Raymond Date: September 1, 2005
John R. Raymond, Sr., MD
Vice President for Academic Affairs and Provost

Appendix D

Sample space reports that are similar to those given to the deans and department chairs.

Engineering

Total Research Expenditures	Direct Expenditure Rate	Indirect Expenditure Rate
$6,032,401	77.90%	22.10%

	Direct Expenditures	Direct Expenditures Rate	Indirect Expenditures	Indirect Expenditures Rate
Lab Assigned	$4,518,540	74.90%	$1,274,895	21.13%
Non-Lab Assigned	$180,597	2.99%	$58,369	0.97%

Total Space=	70,238		
Research Space=	26,307	%Research Space=	37.45
Research Lab Space=	22,359		
Assigned Research Lab Space=	22,016	%Assigned Research Lab Space=	98.47

Administrative Unit Department	Research NSF*	Total Value of Awards**	$/NSF	Value of Awards Requiring Bench Lab***	$/NSF
Medicine	**234,393**	**170,040,623**	**725**	**87,058,200**	**371**
Anesthesia and Perioperative Medicine	0	105,629		0	
**** Biochemistry and Molecular Biology	24,672	10,007,413	406	9,993,413	405
Biostatistics, Bioinformatics and Epidemiology	3,428	9,230,048	2,693	3,531,840	1,030
**** Cell and Molecular Pharmacology and Experimental	13,784	5,609,788	407	5,210,128	378
**** Cell Biology and Anatomy	20,563	10,953,749	533	10,691,972	520
Comparative Medicine	0	1,151,253		519,901	
Family Medicine	1,971	2,392,645	1,214	0	0
**** Medicine	63,249	40,545,762	641	19,785,880	313
**** Microbiology and Immunology	12,327	6,483,881	526	4,695,098	381
Neurological Surgery	888	2,255,579	2,540	0	0

Table 1. Retired Faculty and Staff Room

Department Building Name	Department Room	Room Use	NASF	Name	Title
College of Agriculture, Forestry & Life Sciences					
0326	Biological Sciences				
000033-Long Hall	337	311-Faculty Office	101	Hays,Ruth L	Professor
000272-Jordan Hall	308B	255-Research Laboratory Service	118	Ruppert,Edward E	Professor
000272-Jordan Hall	311	250-Research Laboratory	234	Ruppert,Edward E	Professor
000272-Jordan Hall	313	250-Research Laboratory	424	Ruppert,Edward E	Professor
000272-Jordan Hall	313A	311-Faculty Office	187	Ruppert,Edward E	Professor
Total Rooms Department	**5**	**Total Department NASF =**	**1064**		
0331	Forest Resources				
000266-Lehotsky Hall	219	250-Research Laboratory	206	Hamnitt,William E	Professor
Total Rooms Department	**1**	**Total Department NASF =**	**206**		
0355	Agricultural and Applied Economics				
000265-Barre Hall	258	311-Faculty Office	87	Bayles,Allen B	Extension Associate
000265-Barre Hall	295	311-Faculty Office	87	Bradford,Garnett L	Professor
Total Rooms Department	**2**	**Total Department NASF =**	**174**		

Table 2. Retired Faculty with Active Research

Dept	Department Name		Percent Credit	Award	Direct	Indirect
Name	Business Title	Project Title	Start Date	End Date		
College of Agriculture, Forestry & Life Sciences						
0362	**Aquaculture, Fisheries and Wildlife**					
Fendley,Timothy	Professor	Neonatal White Tailed Deer Mortality and Movements in the Coastal Plain of South Carolina	100	$61,500	$61,500	$0
			7/../2001	6/4/2004		
Fendley,Timothy	Professor	Mortality, Emigration, and Antler Development in a Population of White-tailed Deer	100	$127,600	$127,600	$0
			7/1/1997	6/30/2003		
College of Engineering & Sciences						
0919	**School of the Environment**					
Grady,C P Leslie	Named Professor	Biodegradation of Aromatic Organic Compounds in Alternating Aerobic and Denitrifying Environments	100	$317,511	$221,884	$95,627
			8/1/2001	7/31/2003		

Bibliography

Abramson, P. (2007). College Construction Report. *College Planning & Management 10,* C2(7). Retrieved Mar. 21, 2007, from InfoTrac oneFile via Thomson Gale http://find.galegroup.com/itx/infomark.do?&contentSet=IAC-Documents&type=retrieve&tabID=T003&prodId=ITOF&docId=A160590810&source=gale&userGroupName=clemson_itweb&version=1.0

Ang, G. K. I., and Wyatt, D. P. (1999, June). Performance Concept in the Procurement of Durability and Serviceability in Buildings. *Proceedings of the Eighth International Conference on Durability of Building Materials and Components*, Vancouver, Canada, pp. 1821-1832.

Bareither H.D., & Schillinger, J.L. (1968). *University Space Planning: Translating the Educational Program of a University into Physical Facility Requirements*. Chicago, IL: University of Illinois Press.

Bensimon, E.M., Neuwmann, A., & Birnbaum, R. (1989). *Making Sense of Administrative Leadership: The "L" Word in Higher Education.* ASHE-ERIC Higher Education Report No. 1. Washington, DC: School of Education and Human Development, The George Washington University.

Berdahl, R., and McConnell, T. (2001). Autonomy and Accountability: Who Controls Academe? In P. Altbach, R. Berdahl, and P. Gumport (eds.), *American Higher Education in the Twenty-First Century: Social, Political, and Economic Challenges*. Baltimore: Johns Hopkins University Press.

Birnbaum, R. (1988). *How Colleges Work: The Cybernetics of Academic Organization and Leadership.* San Francisco: Jossey-Bass.

Birnbaum, R. (2000). *Management Fads in Higher Education.* San Francisco: Jossey-Bass.

Bok, D. (1982). *Beyond the Ivory Tower: Social Responsibilities of the Modern University*. Cambridge, MA: Harvard University Press.

Bowen, H. (1980). *The Costs of Higher Education: How Much Do Colleges and Universities Spend per Student and How Much Should They Spend?* San Francisco: Jossey-Bass.

Boyd, D. (2002, October). *State Spending for Higher Education in the Coming Decade.* National Center for Higher Education Management Systems, Boulder, CO.

Boyer, E.L. (1990). *Scholarship Reconsidered: Priorities of the Professoriate.* Princeton, NJ: Princeton University Press.

Brainard, J. (2001, May 11). Elitism, excellence, or both at the National Academy of Sciences? *The Chronicle of Higher Education*, pp. A24-A26.

Brainard, J. (2005, Aug. 5). Ghosts of Stanford: Have federal constraints on reimbursing overhead for research grants gone too far? *The Chronicle of Higher Education*, 51(*48*), p. A16.

Brainard, J. (2006, Feb. 17). Bush budget generous to physical sciences but gives biomedical research a flat line. *The Chronicle of Higher Education*, pp. A24-A28.

Brinkman, P.T. (1981). Factors affecting institutional costs at major research universities. *Journal of Higher Education*. Vol. 52(3), p. 265-279.

Brinkman & Leslie (1986) – Economies of scale in higher education: Sixty years of research. *Review of Higher Education*, 10(1), pp. 1-28.

Bullock, R.J. & Batten, D. (1985). It's just a phase we're going through: A review and synthesis of OD phase analysis. *Group & Organization Studies*, 10(4), pp. 383-412.

Burke, J.C. & Modarresi, S. (2000, July/August). To keep or not keep performance funding: Signals from the stakeholders. *The Journal of Higher Education*, 71(4), pp. 432 – 453.

Cain, D.A. & Kinnaman, M. (2004, March-April). The needs index: A new and improved FCI. *Facilities Manager*, pp. 44-49.

Cairns, G. (2003). Seeking a facilities management philosophy for the changing workplace. *Facilities*, 21(5/6), pp. 95-105.

Castaldi, B. (1987). *Educational Facilities: Planning, Modernization, and Management*. Boston: Allyn and Bacon.

Chaffee, E.E. & Jacobson, S.W. (1997). Creating and changing institutional cultures. In M.W. Peterson & D. D. Dill (Eds.), *Planning and Management for a Changing Environment* (pp. 230-245). San Francisco: Jossey-Bass.

Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 509–534). Thousand Oaks, CA: Sage.

The Chronicle of Higher Education Almanac, (2004-05). Trends by state appropriations and research spending. Vol. 51(1), p. 12.

The Chronicle of Higher Education Almanac, (2006-07). Trends by state appropriations and research spending. Vol. 53(1), p. 11.

Cohen, M.D. & March, J.G. (1986). Leadership in an organized anarchy. In M.C. Brown, II (Ed.), *Organization and Governance in Higher Education, Fifth Edition* (pp.16-35). Boston, MA: Pearson Custom Publishing.

Cohn, E., Rhine, S.L.W., & Santos, M.C. (1989). Institutions of higher education as multi-product firms: Economies of scale and scope. *Review of Economics and Statistics*,71, 284-290.

Commonwealth Fund Task Force on Academic Health Centers (2003, Feb.). *Envisioning the Future of Academic Health Centers.* Available from www.cmwf.org.

Cook, K.S. & Emerson, R.M. (1978, October). Power, equity and commitment in exchange networks. *American Sociological Review*, v.43(5), pp. 721-739.

Deal, W.A. (2003, October). Plenary session, Southeastern Society for College and University Planning conference. Atlanta, GA.

Dirks, K.T. & Ferrin, D.L. (2001). The role of trust in organizational settings. *Organization Science*, 12(4), pp. 450-470.

Dunphy, D.C. & Stace, D.A. (1988). Transformational and coercive strategies for planned organizational change: Beyond the O.D. model. *Organization Studies*, 9(3), pp. 317-334.

Dunn, J.A. (1989). Financial planning for plant assets. In H.H. Kaiser (Ed.), *Planning and Managing Higher Education Facilities* (pp.89-101). New Directions for Institutional Research, San Francisco: Jossey-Bass.

Ehrenberg, R.G. (2000). *Tuition Rising: Why College Costs So Much*. Cambridge, MA: Harvard University Press.

Ehrenberg, R., Rizzo, M., and Condie, S. (2003). "Start-up Costs in American Research Universities." Working paper no. 33, Cornell Higher Education Research Institute. Retrieved December 28, 2004 from http://www.ilr.cornell.edu/cheri/wp/cheri_wp33.pdf

Farrell, E. (2005, Oct. 28). Public colleges tame the cost of tuition. *The Chronicle of Higher Education*, 52(10), p. A1.

Federal Demonstration Partnership (2004, January). Unpublished minutes from Federal Demonstration Partnership Winter Meeting, Washington, DC.

Fink, I. (1997). Adapting Facilities for New Technologies and Learners. In M.W. Peterson, D.D. Dill, & L. A. Mets (Eds.), *Planning and Management for a Changing Environment* (pp. 319-339). San Francisco, CA: Jossey-Bass.

Fink, I. (2002, May-June). Classroom use and utilization. *Facilities Manager,* 18(*3*) pp. 13-24.

Fischer, K. (2006, Jan. 20). Building pressure. *The Chronicle of Higher Education*, 52(20), p. A31.

Florida Board of Governors (2003). Proposing a Blueprint for Higher Education in Florida: Outlining the Way to a Long-term Master Plan for Higher Education in Florida. Retrieved August 1, 2007 from http://www.flbog.org/BOG/meetings/2007_01_25/StructureReport.pdf.

Fossum, D., Painter, L.S., Eiseman, E., Ettedgui, E., & Adamson, D.M. (2004). *Vital Assets: Federal Investment in Research and Development at the Nation's Universities and Colleges.* Rand Corporation.

Gabarro, J.J. (1987). *The Dynamics of Taking Charge.* Boston: Harvard University Press.

Gumport, P.J.& Pusser, B. (1997). Restructuring the academic environment. In M.W. Peterson & D. D. Dill (Eds.), *Planning and Management for a Changing Environment* (pp. 453-478). San Francisco: Jossey-Bass.

Henderson, T. (1998). *Financing Medical Education by the States.* Washington, DC: National Conference of State Legislatures.

Hollander, E.P. & Offerman, L.R. (1990). Power and leadership in organizations. *American Psychologist.* 45(2), pp. 179-189.

Jones, D. (2006, February). *State Shortfalls Projected to Continue Despite Economic Gains.* National Center for Public Policy and Higher Education. San Jose, CA.

Kabanoff, B., Waldersee, R., & Cohen, M. (1995). Espoused values and organizational change themes. *Academy of Management Journal.* 38(4), pp. 1075-1104.

Kaiser, H. (ed.) (1989, Spring). *Planning and Managing Higher Education Facilities*. New Directions for Institutional Research, no. 61. San Francisco: Jossey-Bass.

Kaiser, H. (2004, Nov.-Dec.). Reviewing the state of deferred maintenance. *Facilities Manager*. pp. 14-21.

Keller, G. (1983). *Academic Strategy: The Management Revolution in American Higher Education.* Baltimore, MD: The Johns Hopkins University Press.

Kuh, G.D. & Witt, E.J. (1988). Culture in American colleges and universities. In M.C. Brown, II (Ed.), *Organization and Governance in Higher Education, Fifth Edition* (pp.160-169). Boston, MA: Pearson Custom Publishing.

Layzell, D.T. & Caruthers, J.K. (2002, Spring). Higher education costs: Concepts, measurement issues, data sources, and uses. *Planning for Higher Education*, 30(3), pp. 6-14.

Marcus, A.A. (1988). Implementing externally induced innovations: A comparison of rule-bound and autonomous approaches. *The Academy of Management Journal*. 31(2), pp. 235-256.

Maryland Higher Education Commission (2003). *Distance Learning in Maryland Colleges and Universities.* Retrieved August 1, 2007 from http://www.mhec.state.md.us/publications/whatsnew.asp.

Mayer, R.C., Davis, J.H., & Schoorman, F.D. (1995). An integrative model of organizational trust. *The Academy of Management Review*. 20(3), pp. 709-734.

McEvily, B., Perrone, V., & Zaheer, A. (2003). Trust as an organizing principle. *Organization Science*. 14(1), pp. 91-103.

Middaugh, M. (1996). Closing in on faculty productivity measures. *Planning for Higher Education, 24*(2), 1–12.

Middleton, W.D. (1989). Comprehensive facilities management. In H.H. Kaiser (Ed.), *Planning and Managing Higher Education Facilities* (pp.5-12). New Directions for Institutional Research, San Francisco: Jossey-Bass.

Miller, R.I. (1990). *Major American Higher Education Issues and Challenges in the 1990s*. London, England: Jessica Kingsley.

Mintzberg (1994)

Mohr, D., Offhaus, H., & Dannemiller, K. (2005, April 15). *Enabling the Lean and Adaptive Organization.* Presentation at the AAMC Group on Institutional Planning-Group on Institutional Resources annual conference, New York.

Montgomery, D.A. (1989). Organizing for space management. In H.H. Kaiser (Ed.), *Planning and Managing Higher Education Facilities* (pp.21-36). New Directions for Institutional Research, San Francisco: Jossey-Bass.

National Association of College and University Business Officers (2007, July). *The Evolving Relationship: Public Institutions and Their States.* Retrieved October 1, 2007 from http://www.nacubo.org/documents/research/Evolving%20Relationship%20July%202007.pdf

National Science Foundation (2002). *Scientific and Engineering Research Facilities at Colleges and Universities, 1998.* NSF 01-301. Arlington, VA: Division of Science Resources Studies.

Newman, Frank (1987). *Choosing Quality: Reducing Conflict between the State and the University.* Education Commission of the States, Denver, CO.

O'Connor, G.C., Rice, M.P., Peters, L., & Veryzer, R.W. (2003). Managing interdisciplinary, longitudinal research teams: Extending grounded theory-building methodologies. *Organization Science.* 14(4), pp. 353-373.

Peterson, M. & Spencer, M. (1990). Understanding academic culture and climate. *New Directions for Institutional Research.* 17(4).

Pickens, William H. (1993). Measures of Resource Scarcity in Higher Education. In William B. Simpson (Ed.), *Managing with Scarce Resources* (pp. 5-15). San Francisco, CA: Jossey-Bass.

Probasco, J. (1989, Spring). Space planning guidelines. In Harvey Kaiser (ed.), *Planning and Managing Higher Education Facilities* (pp. 49-61). New Directions for Institutional Research, no. 61. San Francisco: Jossey-Bass.

Schmidt, P. (2005, Jan. 5). Facilities: Playing catch-up on maintenance. *The Chronicle of Higher Education*, 51(18), p. A9.

Schmidtlein, F.A. (1974, May). Decision Process Paradigms in Educaion. *Educational Researcher*, 3(5), pp. 4-11.

Schmidtlein, F.A. (1977, Autumn). Information systems and concepts of higher education governance. *New Directions for Institutional Research*. 15, pp. 29-42.

Schodek, D. L. (1971). .A Methodology for Evaluating the Technical Performance of Housing Systems,. Ph. D. Thesis, Massachusetts Institute of Technology, Cambridge.

Southern Regional Education Board (2007, June) *Percent Distribution of Core Spending at Public Four-Year Colleges and Universities and Public Two-Year Colleges.* http://www.sreb.org/DataLibrary/tables/FB83_84.xls

Southern Regional Education Board (2007). *SREB Fact Book on Higher Education.* Retrieved October 1, 2007 from http://www.sreb.org/main/EdData/FactBook/indexoftables07.asp#Revenues .

Stake, R.E. (1995). *The Art of Case Study Research.* Thousand Oaks, CA: Sage Publications.

State Council of Higher Education for Virginia (2007). *Advancing Virginia: Access, Alignment, Investment*. Retrieved August 1, 2007 from http://www.schev.edu/Reportstats/2007StrategicPlan.pdf.

Tennessee Higher Education Commission (2004). *Current Issues in Tennessee Higher Education and Public Policy*. Retrieved August 1, 2007 from http://www.state.tn.us/thec.

Timmerman, C.E. (2003). Media selection during the implementation of planned organizational change. *Management Communication Quarterly*. 16(3), pp. 301-340.

Van de Ven, A.H. (1986). Central problems in the management of innovation. *Management Science.* 32(5), pp. 590-607.

Walters, Jr., A.L. & Keim, M.C. (2001). Community college deans of instruction: Their role in institutional and facilities planning. *Community College Journal of Research and Practice*, 27, pp. 263–272.

Watt, C.E., Higerd, T.B., Tierney, N., & Marriott, R. (2005, April 15). *Utilizing Academic Space Management to Guide Academic Planning.* Presentation at the AAMC Group on Institutional Planning-Group on Institutional Resources annual conference, New York.