QUALITATIVE AND QUANTITATIVE MANAGEMENT TOOLS USED BY FINANCIAL OFFICERS IN PUBLIC RESEARCH UNIVERSITIES

A Dissertation

by

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ABSTRACT

This dissertation set out to identify effective qualitative and quantitative management tools used by financial officers (CFOs) in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling at a public research university. In addition, impediments to the use of these tools were identified which may assist in breaking down barriers to the implementation of these tools within higher education. The research endeavor also provided additional significance through the CFOs identifying benefits from the use of quantitative and qualitative management tools. Finally, the study undertook the task of identifying quantitative and qualitative management tools that are important to public research university CFOs in carrying out their management functions in the future.

In this study, the Delphi method was used to gain consensus from a panel of fifteen public research university CFOs who were experts on qualitative and quantitative management tools. The experts were self-identified through their response to a questionnaire on their use of the management tools and represented 12 different states. Due to the nature of the research, a computer-based Delphi method was used to facilitate a four round, electronically based Delphi study. The questionnaires were based upon a review of the literature and tested by a pilot group of higher education CFOs.

Through a series of four electronic questionnaires, the Delphi panel identified twenty-three qualitative and quantitative management tools which they believe are moderately effective for use by public research university CFOs in carrying out their

functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. Additionally, the panel of experts identified sixteen barriers/impediments to the use of qualitative and quantitative tools in carrying out the above functions. The panel also identified eighteen benefits that the tools provide to public research university CFOs in carrying out their management functions. Finally, the Delphi panel identified three qualitative and quantitative management tools that will be highly important, and twenty qualitative and quantitative management tools that the panel of experts considered to be important, for public research university CFOs in carrying out their management functions in the future.

This dissertation study is significant because the results are expected to provide public research university CFOs qualitative and quantitative management tools that they may use to assist them in carrying out their management functions. The barriers/impediments and benefits noted also provide CFOs with knowledge to assess whether the tools can be used at their institutions, knowing the specific climate and culture which exists. The qualitative and quantitative management tools which were identified as being important in the future can serve as a guide to develop training programs to enhance the knowledge of public research university CFOs.

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proud of you in so many different ways. When your mom and I made the decision to move from Orange County to College Station, you probably thought we were crazy and did not look forward to the changes in your lives. I hope that the change was for the best and you are glad we made the move. You all have so much potential. I only hope that someday each of you achieve your goals and dreams. The three of you are the inspiration of my life and you make me a better man. To Toni, thank you for your support and encouragement during our life together. To Dana, twenty-nine more like the last one.

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CHAPTER I

INTRODUCTION

The more things change the more things stay the same. Hutchins (1933) wrote:

> Hard times are producing nothing less than a complete change in character of our institutions of higher learning. Every aspect of their work is being affected. Their faculty, their students, their organization, their methods, their teaching, and their research are experiencing such alteration that we who knew them in the good old days shall shortly be unable to recognize them. Many of these changes are for the better. Others may wreck the whole system. (p.714)

While Garcia (1991) stated:

> There are rarely any new problems, according to some; only variations on old ones – "old wine in new bottles." Perusal of any recent issues of the Chronicle of Higher Education might seem to confirm this. "Current issues" may give long-time readers a sense of déjà-vu, but those new to higher education will find them fresh and different. In point of fact, there are some of each-old and new. Whatever one's perspective, issues and problems will never disappear, though immediacy of their need for solution may lessen with progress. There are increased calls for assessment and accountability, the redefinition of scholarship, the inclusion of other voices within curricula and the tension between new and old voices, the new paradigms that are being introduced within the research community, the national fiscal crisis and concomitant cost containment that will bind our colleges and universities. (p.675)

Today, legislators, students, and families are demanding that higher education do more with less while at the same time improving access and requesting greater accountability. Productivity gains and improved cost-effectiveness are crucial in meeting higher education's goals of teaching, research, and service. As higher education continues to struggle with these issues, the role of the Chief Financial Officer ("CFO," as used herein, describes the highest ranking financial officer in an institution of higher education, other titles can be vice president of finance or vice president of finance and administration) within these institutions has become more important. Anderson (1986) stated that because of the multiplicity of the problems in higher education, especially the financial ones, the business officer has to develop new ways and new technologies to achieve a situation where the academic world uses new techniques in decision making. Anderson (1986) noted that decisions need to be based upon a sound analysis of facts while studying and weighing all of the possible alternatives. Alas, even though these statements were made more than 25 years ago it seems in the end, CFOs end up doing the same thing about the same way.

A number of characteristics differentiate higher education from other enterprises. The most important are the lack of profit motive, a variety of goals within the institution (often times competing), and distributed decision making. These characteristics preclude the use of the relatively clear guiding principles of profit maximization and cost minimization, and closely circumscribe the decision making of senior administrators. Birnbaum (1988) stated that “there is no metric in higher education comparable to money in business, and no goal comparable to profits,” p.11. Most colleges and universities see themselves as unique and an institution’s culture is so intertwined with the existing order that new ideas which may come up are not put forward. Decision making occurs in an environment where the goals, and constraints, the effects of potential outcomes are not always known (Bellman & Zadeh, 1970). Financial management in higher education is becoming more complex and hence more difficult to manage. As a result, there is a need for leaders to generate good ideas and to translate them into strategies for effective actions.

Higher education CFOs have varied backgrounds and skill sets. Hacking (2004) in a survey of higher education CFOs found that the typical CFO had fifteen years of experience with less than nine years in their current position (more than 35% were in their current position for fewer than four years), 44% had some experience outside of higher education, 90% had an advanced degree (typically an MBA), and most had a degree in accounting. These CFOs also stated that their analytical skills were one of their strengths while their soft skills (communication and written) could be improved. The analytical skills of CFOs will continue to be tested as researchers (Bender, 2002; Gumport, 2000; Wellman, 2008) acknowledged that the current environment facing higher education is not expected to change in the near future as increasing financial demands for health care, prisons, and public education must be confronted by both state and the federal government. Wellman (2008) stated that “realistically, most of the funding needed to support future program innovation and change is going to come from reallocation of internal resources, not from new dollars from the state or tuition revenues” (p.6). As a result, students and their families are paying a higher percentage of their education costs; on November 20, 2009 the University of California Board of Regents approved a 32 percent increase in undergraduate tuition, amid the protests of hundreds of students (Lewin & Cathcart, 2009).

The influence of higher education CFOs on their campuses has increased over the past several decades. Institutions’ have faced declining public and private support, increased dependence on tuition revenues to offset the loss of this support, expensive technology upgrades, a growing backlog of long neglected deferred maintenance on campuses, an emphasis on revisiting decades old budgeting techniques and fiscal policies, and increased scrutiny from stakeholders and governing bodies. Academic leaders are challenged by an expanding universe of information technology and its uses and by a changed focus from a provider-centered culture to a learner-centered culture. Facing storms of change within and outside the academy, higher education officials have realized that major realignments are underway creating demographic, economic, political, and cultural imperatives. Quality, accountability, efficiency, and institutional effectiveness have become part of the culture for stakeholders in higher education (Gumport, 2000; Nedwek, 1996; Wellman, 2008).

The decentralized structure of the university as a complex adaptive system has evolved over the centuries to solve extremely complex problems. However, this structure is not conducive to risk taking and one size does not fit all due to the diversity of missions within institutions of higher education. Accordingly, the current culture of accountability and transparency can be enhanced, facilitated by new systems of data measurement. To meet this improved culture of accountability and transparency requires the leadership of financial officers that can effectively implement and utilize qualitative and quantitative management tools to make complex decisions in a difficult environment, an environment that seems to be becoming more difficult each day. While increased data, its analysis, and expertise in interpreting the data are needed, Trussell and Bitner (1996) found that many institutions have accounting systems that are inadequate for decision making; higher education is relying on antiquated hardware and software as it faces difficult, complex decisions. Higher education has not invested in their information systems to the extent seen in private industry and as a result, decision making is more complex due to a lack of information. Purves and Glenny's study (as cited by Floyd, 1991), stated that a minimal level of logic and analysis should be factored in public sector decision making. Attention needs to be given to providing higher education CFOs quality information to assist them in making decisions but not so much that both universities that produce the information and the stakeholders that receive it are swamped by its detail.

Statement of the Problem

In all enterprises, managers face the same dilemma of how, given the constraints imposed on them, to achieve an optimal or at least satisfactory allocation of scarce resources across an array of competing activities. Higher education CFOs are looked upon as organization experts on finance and accounting by internal and external stakeholders and are often asked to provide guidance and analysis on areas outside of their direct span of control or authority, maybe more so than in for-profit entities. Higher education CFOs are expected to monitor the interface within the institution as well as the impact from external forces, establish appropriate strategies, and develop useful linking and cushioning methods. As a result, their role in institutions of higher education has become increasingly important and technical, with a greater reach across the institution (Iwanowsky, 1996; Lai, 1996, Lambert, 2002).

The world has moved from the industrial age to the knowledge age to the information economy. Information and knowledge are replacing physical resources as the most important currency in the world (W.K. Kellogg Foundation, 1999). In the current economic and political environment surrounding higher education, the management of resources – their purchase, safeguarding and allocation – and the management of relationships between the institution and its internal and external environments – become a key institutional practice. However, the application of qualitative and quantitative approaches to higher education, in which the underlying processes are not fully understood and in which adequate measures of the conceptual constructs have not been developed, has not occurred (Lindsay, 1982).

Critical to the decision making process is the quality and quantity of information that higher education leaders have readily available (Dodd, 2004; Ehrenberg, 2005; Ferren & Aylesworth, 2001). There is minimal research on effective qualitative and quantitative management tools used by higher education CFOs and the extent of their use in performing the CFO management functions. Past studies on CFOs have mainly addressed the identification of CFOs routine assignments and educational and career backgrounds, or an exploration of organizational relationships within higher education administration and CFO leadership orientations (Hacking, 2004).

Research as to the management tools that higher education CFOs use to assist them managing in these difficult times has been limited. Redenbaugh (2005) researched accounting tools that CFOs use in managing their work and also discussed barriers to the use of management accounting tools. Valero (1999) researched qualitative and quantitative management techniques used by non-academic and academic administrators in Virginia institutions of higher education. Since 1993, Bain & Company has been conducting surveys (every year or two) of tools used by managers (Rigsby, 2011).

Higher education CFOs have to manage multifaceted systems with many interrelated, yet unpredictable, components.

Purpose of the Dissertation

The purpose of this study was to identify effective qualitative and quantitative management tools used by CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling at a public research university. In addition, impediments to the use of these tools were identified which may assist in breaking down barriers to their implementation. The research endeavor provides additional significance through the CFOs identifying the benefits from the use of quantitative and qualitative management tools. Finally, the study also identifies quantitative and qualitative management tools that the CFOs believe will be important in carrying out their management functions in the future. CFOs at public research universities were chosen as the population due to the complexity of the organizations and a review of research that noted CFOs from these institutions typically had advanced degrees and therefore were more likely to have been trained in the use of these tools.

“The quality of a decision depends on the quality of the knowledge used to make it” (Evangelou & Karacapilidis, 2007, p. 2069). One major benefit of the study is providing knowledge on qualitative and quantitative management tools to higher education CFOs which they can then use to make better decisions in these times of limited resources.

Research Questions

The study addresses the following questions:

1. What qualitative and quantitative management tools are currently effective for public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling (Kreitner, 2004)

2. What are the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFO management functions?

3. What benefits do public research university CFOs perceive from using qualitative and quantitative management tools in carrying out their management functions?

4. What qualitative and quantitative management tools will be important to public research university CFOs in carrying out their management functions in the future?

Operational Definitions

To the end that this research effort establishes the current situation of the use of qualitative and quantitative management tools at public research universities, it is imperative to develop a list of tools that are used in an academic environment. For this study, the following operational definitions will be used:

<u>Qualitative management tools</u>. Techniques in which data are typically obtained from a relatively small group of respondents and not analyzed with statistical techniques. The user's judgment, experience, and the complexity of the decision to be made may affect

whether a qualitative tool is used in decision making. Qualitative tools may include: focus groups, factor analysis, flow charts, peer reviews, benchmarking, brainstorming, checklists, and decision trees.

Quantitative management tools. The orderly scientific investigation of quantitative phenomena and their associations, the objective of which is to develop and utilize mathematical models, theories and/or hypotheses (Hanacek, 2010). Quantitative tools may include activity based costing, cost-benefit analysis, trend analysis, responsibility centered management, ratio analysis, strengths-weaknesses-opportunities and threats (SWOT) analysis, data mining and data warehouses, and continuous improvement (CI).

Planning. Planning is the formal process of deciding in advance what is to be done and how and when to do it. It involves selecting goals and objectives and developing policies, programs, and procedures for achieving them. Planning prescribes desired behaviors and results (Hellriegel & Slocum, 1992).

Decision making. Decision making is a process of identifying and choosing alternative courses of action. (Kreitner, 2008). Evangelou & Karacapilidis (2007) describe decision making as an organizational activity that includes a series of knowledge representation and processing tasks to resolve an issue, reach a goal or objective, or take hold of an opportunity.

Organizing. Organizing is viewed as determining how resources (physical and human resources) are to be allocated and arranged (prepared) for accomplishing an organization's goals and objectives (Boone & Kurtz, 1981; Higgins, 1991).

Staffing. Staffing may also be considered more broadly as the management of the organization's human resources. Staffing by itself can be described as the process of recruiting and training qualified individuals for positions within an organization. Bartol and Martin (1991) define staffing as activities that are developed to improve the effectiveness of an entity's workforce in attaining the organization's goals and objectives.

Communicating. Communication is often one of the most difficult tasks that a manager performs on a daily basis. How much communication is enough and at what level and when should communication occur? Communication is the exchange of information between two or more people. Communication can occur through both verbal and non-verbal means. Communication is the most dominant activity performed at all levels of an organization (Daft, 1988).

Motivating. Kreitner (2008) stated that motivating is a psychological process giving behavior purpose and direction. Motivating involves developing an understanding of internal and external factors and traits that stimulate a specific employee to perform or behave in a particular manner.

Leading. Bartol and Martin (1991) described leading as working with others while developing an outline of what is expected to be achieved, providing direction and motivating members of the organization. Kreitner (2008) described leading as inspiring and guiding others in a common effort to reach a goal or objective.

Controlling. Controlling involves methods used to make sure that certain behaviors conform to an organization's objectives, plans, and standards. Controls help maintain or redirect actual behaviors and results. Thus, planning and controlling complement and support each other (Hellriegel & Slocum, 1992).

Process. A process is the interaction of organizational members where the objective is to change, manage, or develop an organizational pattern or outcome (Childers, 1991).

The above list does not include definitions for all of the tools which will be studied; these definitions are included in Chapter II, Literature Review.

Assumptions

1. The methodology proposed for this study is an appropriate design for this particular research project.
2. Participant CFOs have the requisite expertise and experience to participate in the Delphi group.
3. Participant CFOs comprehend the study; they will be knowledgeable in their answers and will respond purposely and truthfully during the Delphi process.
4. Participant CFOs will be able and willing to devote time to the Delphi process.

Limitations

1. The study is limited to "Public Research Universities" as defined in Carnegie Classification of Universities and may not be applicable to other institutions of higher education or private universities.
2. The study is limited to the information developed during the literature review and results of the Delphi method based on the responding CFOs answers to the research questions.
3. Participant CFOs may feel influenced to respond in a particular way.

4. The study is limited in time dimension to an assessment of changes during the period of observation. Longer term changes, improvements and other considerations should be accessed through multiple cycles of improvement over time.
5. The economic environment during the period of the study was conducted may have influenced the CFOs perspective of the importance of the use of the quantitative and qualitative tools.

Significance

Higher education lags behind other industries in the use of management tools (Patterson, 2004). At the same time, events in the last decade have produced a number of factors that have led to the increased significance of the CFO in higher education. Increased demands are being placed on CFOs due to institutional and societal demands for: increased access, greater accountability and transparency, a focus on student retention and success, quality and educational excellence (however defined), all while operating in a climate of lower state and federal funding of higher education and increased demands to lower tuition growth. CFOs must stretch their budget dollars further, doing more with less, or even less with less. The use of qualitative and quantitative management tools can enhance the CFOs role in higher education by improving their decision making processes. The importance of implementing managerial tools for improving CFO management functions in for-profit organizations has been stressed in the literature; however, only limited research has been performed specifically to review the extent of the use of management tools in colleges and universities. As a result, there is a need to determine what qualitative and quantitative tools are used by

CFOs in order to enhance knowledge, training, and thereby the effectiveness of these CFOs.

This study will also benefit higher education CFOs and academicians. CFOs will obtain a practical understanding of the qualitative and quantitative management tools that are used by their colleagues in higher education which could help them evaluate alternative management techniques that may be effective for their unique campus culture and environment. Higher education institutions may be able to use the knowledge obtained in this study related to qualitative and quantitative management tools used by CFOs and the important tools for use in the future to tailor their teaching and research towards the needs of higher education administrators.

Organization of the Dissertation

This study consists of five chapters. Chapter I is an introduction of the topic of qualitative and quantitative management tools used by higher education CFOs. Chapter II reviews existing literature providing background as to the current context surrounding higher education, discussing management functions in higher education, reviewing the qualitative and quantitative management tools used in the for-profit sector and in higher education, and the use of the Delphi technique. Chapter III describes the research methodology used in the study. Chapter IV explains and analyzes the results of the study. A summary of findings, conclusions and recommendations for further research are presented in Chapter V.

CHAPTER II

LITERATURE REVIEW

Section 1: The Current State of Higher Education

One component of a study of the use of qualitative and quantitative management tools in higher education is importance of understanding the current state of higher education. For the last three decades, higher education has faced rising costs, declining resources on the state and federal level, calls from stakeholders inside the institution and those that regulate higher education for accountability, demands for more efficient allocation of resources, and improved outcome evaluation. These features along with others influence higher education CFOs; a review of internal and external attributes that influence higher education CFOs follows.

Rising Costs

The cost of higher education has risen more than four times the rate of the cost of living, increasing 498 percent from 1985 to 2011 (Wood, 2012). One factor that influences the costs of higher education is the increasing cost of sophisticated scientific research and the high percentage of costs associated with salaries and benefits that are difficult to cut (Clotfelter, 1996; Hayden, 2010). Faculty salaries have also increased as a result of institutions competing for the services of expert faculty who bring in significant research grants and the associated research funding. As a result, universities bid up salaries for high quality candidates (Duderstadt & Womack, 2003; Ehrenberg, 2003; Rowley, Lujan & Dolence, 1997).

Institutions of higher education use the following strategies to offset the rising costs of higher education: expanding undergraduate enrollments; increasing the number of out of state and foreign students admitted; using graduate assistants or adjunct faculty to teach large undergraduate classes; using lecturers rather than tenure track faculty to instruct classes; and increasing class sizes. According to Gerdes (2011), over half of faculty members are part-time and more than 40 percent of full-time professors are temporary or off the tenure track. However, as tuition rates at universities continue to rapidly increase, state and federal officials, students, and parents, have started questioning these practices and these studies have become concerned with the quality of instruction within higher education. The demands of these key stakeholders on higher education to manage tuition rates has led administrators to look at new methods to reduce costs and/or find other sources of funding (Gumport, 2000; Suskie, 2006; Wellman, 2008). With state budget deficits hitting $130 billion in 2011, legislators and boards of trustees have had no choice but to increase tuition (KPMG, 2011). The significant increase in tuition places a greater financial burden on students and their families.

Declining Resources

Universities face increasing indecision, volatility, deregulation, and a scarcity of financial and human capital (Perkin, 2007). Competing social issues, for example crime, gender and race inequality, public welfare, and healthcare and retirement costs create a difficult situation wherein colleges and universities cannot claim a major portion of available public funding. Higher education competes for funding with other societal needs and as a result higher education has seen funding decreases over the past two decades as state and federal governments allocate their budgets to other societal concerns (Duderstadt & Womack, 2003). Mortenson (2011) stated that from 1980 to 2011 there was a forty percent decrease in average state support for higher education, with 2011 levels approximating 1967 funding after accounting for inflation. As a result, institutions of higher education have had to find alternative funding sources to make up for declining federal and state financial support (Kerr, 2001).

Over the past several decades, at the same time as costs of higher education have increased, federal and state funding has decreased. For example, in California, the budget projection for the fiscal year beginning July 1, 2011, cut $500 million from California State University System (CSU) and $500 million from University of California (UC) campuses. The CSU could potentially face a $1 billion reduction in state funding if certain revenue measures aren't extended by voters or the state legislature. That potential level of reduction – to $1.79 billion in state general fund allocation - would drop the CSU's state support below 1996-97 levels when the CSU served 100,000 fewer students (CSU Reviews Initial Strategies to Address $500 Million Cut in State Funding, 2011). In April 2011, Jerry Brown, California's governor, warned that if a special election to extend temporary increases in sales, personal income, and vehicle taxes is not called and the measures passed, then UC undergraduate tuition could reach $20,000 to $25,000 a year, making the UC system the most expensive public system in the world (Williams, 2011). In July 2012, CSU Trustees discussed two possible approaches to close an additional $250 million budget gap if the special election fails; both necessarily include salary and benefit reductions because salaries and benefits account for nearly 85 percent of the CSU’s annual costs:

- The first approach protects student access—and avoids further reductions in student enrollment—with a $150 tuition fee increase and a 2.5 percent system wide average pay and benefit reduction for faculty, staff and administrators.
- The second preserves tuition “price” by reducing enrollment and by implementing a 5.25 percent system wide average pay and benefit cut for faculty, staff and administrators (personal communication, Gail Brooks - Vice Chancellor Human Resources, July 19, 2012).

In the United States, the amount of student loan debt surpassed the amount of credit card debt in the third quarter of 2011. Americans had a total of about $870 billion in student loan debt surpassing the nation's $693 billion credit card balance based upon an analysis from the Federal Reserve Bank of New York (Kurtzleben, 2012). Calls for lowering the costs of higher education can be heard in most every state as well as at the national policy level.

President Barack Obama, in his 2010 State of the Union address said, "It's time for colleges and universities to get serious about cutting their own costs, because they too have responsibility to help solve this problem" while in a speech at the University of Michigan on January 27, 2012 he stated that state governments need to spend more on higher education, describing cuts by Michigan and 39 other states as "the largest factor in tuition increases at public colleges over the past decade." And he urged students to pressure Congress to keep the interest rate on federal student loans from doubling in July. The President also warned that colleges themselves needed to do more to cut costs, instead of assuming they can "just jack up tuition every single year." Government "can't just keep on subsidizing skyrocketing tuition," (Blumenstyk, Stratford, & Supiano, 2012).

Accountability and Efficiency in Higher Education

Bowen's (1980) revenue theory of costs describes the dominant goals of higher education institutions. Bowen's revenue theory of costs are:

1) The dominant goals of institutions are educational excellence, prestige, and influence;
2) In the quest of excellence, prestige, and influence, there is virtually no limit to the amount of money an institution could spend for seemingly fruitful educational ends;
3) Each institution raises all the money it can;
4) Each institution spends all that the money it raises which leads toward ever increasing expenditure (Mills, 2008).

While the statements within Bowen's theory of costs are generalizations, they depict the prevailing objectives and the related actions of public and private universities. In Bowen's view, public self-control is a mechanism that keeps institutions of higher education from over spending. However, historically, institutions spent all the money they could raise, their only limit were costs. As costs rose, institutions responded by requesting and seeking more revenue from government and students. However, state and the federal government has not been able to provide additional funding those institutions requested, resulting in the amount of support provided to higher education declining to a level not seen in decades. State and local support per full-time-equivalent student was $6,454 in 2010, a 7 percent decrease from 2009, and the lowest in the last 25 years (State Higher Education Executive Officers "SHEEHO," 2011).

Bowen's revenue theory of costs has been well studied in the literature and has caught the attention of higher education stakeholders who have been increasingly demanding on institutions of higher education and required a call for greater accountability and institutional efficiency and effectiveness. This is not a new phenomenon as demands for evaluation and accountability, and a concern with effectiveness were discussed more than twenty years ago by Carter (1972), Hoos (1975), and Romney, Bogen & Micek (1979). However, many in higher education still regard the notion of efficiency as being wholly inappropriate in the context of the educational process.

Today, higher education administrators must be responsible for cultivating improved performance while overseeing efficiency gains in their operations, in addition to acquiring additional resources. Higher education has become an industry under a microscope as federal and state governments question the return on their investment in higher education (Massy, 2003). It seems that higher education's stakeholders: prospective and currently enrolled students and their families; businesses; federal and state governments; accrediting agencies; faculty and staff within the university; and the media; are all asking for evidence that higher education is providing effective programs and services (Padro, 2007). In addition, concerns about the success rates of for profit universities, student loan debt, student persistence and retention rates, along with the fact that higher education costs are outpacing most other sectors of the U.S. economy, increases the focus on the finances of universities. Members of the public and their representatives in government want evidence about value for money – what are they getting for the massive sums being plowed into higher education (Massy, 2003).

Facing storms of change within and outside the academy, higher education officials have realized that major realignments are underway creating demographic, economic, political, and cultural imperatives. Improving productivity and reducing the higher education costs are core issues in the demands for accountability while the most important financial challenge is not how colleges and universities can obtain new revenue sources but how to increase returns from existing investments (Burke, 2004). Quality, accountability, and institutional effectiveness have become part of the culture for stakeholders in higher education. The academy has been asked to improve effectiveness, efficiency and economy in what it does; more importantly, higher education must change while living in a fishbowl (Nedwek, 1996).

Questions related to higher education include: the value of institutional activities after four to six years of attendance (often times without graduation); its caginess for documenting and the distributing results of the outcomes of higher education; and its reluctance to accept its limitations and attempt to improve (SHEEHO, 2005). These factors have placed increasing demands for higher education to be more efficient, effective, and accountable. Higher education has become a "prime target for accountability in terms of how faculty spend their time, what the products of higher education are, and what costs are associated with those products" (Wellman, 2008, p. 3).

Boards of trustees, along with state legislatures, have called for increased accountability as they believe that their best possible option to improve accountability is to legislate change (Lucas, 2000). Due to the budget deficits currently faced by most states and the federal government, appropriations to higher education have decreased while private donors and private sector contributions have become an increasingly critical part of institutional budgets. At the same time, private donors are requiring greater accountability as to the use of their funds with some companies tying their donations to controlling an aspect of the university's research agenda.

The call for higher education to be more transparent and accountable for student learning, efficiency, and effectiveness is not going away. Therefore, colleges and universities should embrace the call and begin to deliver more effective communications to internal and external stakeholders (Welsh & Metcalf, 2003). Institutions of higher education must hear the cry from their stakeholders for further accountability, efficiency and effectiveness, and improved outcomes. However, efficiency and effectiveness are generally not highly ranked within academia (Kerr, 2001). Taking action to address the calls for greater accountability, institutional efficiency, and effectiveness has been difficult for many institutions of higher education due to their preference, as well as that of their faculty and staff, for autonomy in running the institution. Massey (2003) described the challenge for higher education administrators to balance stakeholder requirements for accountability against faculty who view these efforts as additional bureaucracy.

Faculty view additional restrictions as a precursor to additional regulation and controls that the faculty believe will decrease autonomy and academic freedom (Perkin, 2007). On the other hand, higher education's stakeholders argue that their interest may not be served if institutions of higher education have liberal autonomy with little to no oversight over their affairs. In order for public universities to be provided autonomy in their operations, they need to put forth evidence that the institutions are meeting demands for efficiency and effectiveness while meeting learning and other institutional objectives. To achieve better results, accountability, efficiency, and effectiveness must be a thorough process in which shared goals and objectives are explicitly stated, advancement towards the goals and objectives is measured, and progress towards improved performance is encouraged and guided (SHEEHO, 2005). However, one of the most significant challenges of shared governance is its inability to address the deeper and most comprehensive challenges that confront an institution (Morrill, 2007).

The problem in higher education is a failure to create and put into practice accountability advances that improve performance in a complex, decentralized system (SHEEHO, 2005). Public expectations of higher education have increased while public confidence has declined. It would appear – at least superficially – that many colleges and universities have permitted an erosion of the culture of professional accountability that have traditionally assured the quality and standards of their academic programs and degrees (Dill, 1999). As colleges and universities attempt to respond to the demand for increased accountability, they are confronted with the paradox that as accountability activities within the academy become institutionalized, campus support for these activities becomes weaker and more shallow (Welsh & Metcalf, 2003). Accountability, efficiency, and effectiveness are often a battleground between faculty, administration, and higher education policymakers. Often faculty see external accountability standards as a reason to place blame or avoid responsibility for a lack of financial support while external stakeholders, frustrated because existing investments in higher education are not achieving the results they believe should be produced, believe stronger external accountability is the only way to see improvement within academia (SHEEHO, 2005).

The call for higher education to be accountable for the investments that governments, parents, and students are making will continue to impact colleges and universities; the call for accountability, increased efficiency and effectiveness will be a rallying call in the future. The calls for institutional effectiveness, efficiency, and accountability grew louder with the Spellings Commission report - "Charting the Future of U.S. higher Education" as well as the 2004 National Commission on Accountability in Higher Education report. These reports called for further productivity, efficiency, accountability, and transparency in regard to the costs of higher education (Keating & Riley, 2005; Padro, 2007).

Ruben, Lewis and Sandmeyer (2008) stated that a robust culture of accountability, efficiency, effectiveness, and transparency must be developed within higher education, aided by new systems of data measurement. Burke (2004) stated that accountability programs that use large amounts of data limit their usefulness. Better accountability requires clearer goals and better information about outcomes. However, more data is not more accountability. Policymakers need information systems that are able to provide information regarding the experiences and accomplishments of faculty and students. Such systems require a considerable investment in technology, gathering data (typically in a central repository), and the development of strategies for managing the data (Davenport, 2006). Institutions of higher education, along with federal and state governments, must better define how they measure outcomes and how these organizations react to the results of these measurements. What has been missing in higher education are systems that hold faculty accountable for performance (Massy &

Zemsky, 1994). A new era of accountability will hold greater promise for informing effective education practice if it incorporates respect for the professionalism and professional development needs of administrators (Dowd, 2005).

Outcomes of Higher Education

In higher education, quality is often looked at as the intrinsic form of value created in the discovery and transmission of knowledge. There is a prevailing belief that quality plays an increasingly essential role in higher education (Owlia & Aspinwall, 1997). However, the products of higher education - teaching, research, and service - are difficult, at best, to measure. As Haworth and Conrad (1997) pointed out, one of the reasons why "quality" is such an elusive concept in higher education is the diversity of views about what the criteria should be used to judge quality. They note that views of program quality all share similar problems: a heavy reliance on program "inputs," such as library resources; few empirical connections to student learning outcomes; an overreliance on quantitative indicators; and the general lack of attention to the views of such important stakeholders as students, alumni, and employers. Current perspectives about quality suffer from a lack of clarity and agreement about that the standards should be, often times institutions may have information that could lead to judgments regarding quality but they often lack a shared understanding about how the information is to be interpreted (Wergin & Seingen, 2000).

Teaching is a good that is evaluated after it is consumed, be it a class, a semester, or a degree. As a result, proxies are often used as signs of quality, the number of Nobel Prize faculty on staff, the difficulty in being accepted to a program, or the cost of an education, all of which can influence the decisions of students and their parents. Despite multiple instruments and surveys to measure the inputs and outcomes of higher education, higher education does not do a good job on measuring quality (SHEEHO, 2005). Despite this weakness, there are assessments that can be used to evaluate the performance of institutions of higher education. Two common proxies as to the effectiveness of an institution of higher education are faculty research productivity (typically measured in research dollars from external grants) and institutional graduation rates (six year graduation rates are the most common measure); Dugan (2006) noted that six year graduation rates are frequently used as a measure of student learning. External stakeholders (trustees, federal and state governments, accreditation boards) are keenly interested in student graduation rates as a means to determine the "success" of the investment the institution has made into its academic programs.

The quality of an institution's faculty is often judged by faculty research productivity while an institution's research expenditures are a common proxy for measuring research productivity (Mills, 2008). Research productivity is of importance to federal and state governments, faculty, and other higher education stakeholders, because of the continued economic growth within the community surrounding the institution, the prestige of the university, and its role as a funding source for many institutions. Research funding is now viewed as an essential revenue stream to institutions of higher education, becoming ever more important with the loss of state funding to higher education.

Duderstadt & Womack (2003) stated that the amount of sponsored research conducted at a university is a determinant of institutional reputation as faculty research and scholarship activity increases an institution's attractiveness to prospective students. A 2003 DFES white paper on higher education funding noted that institutions are driven towards greater involvement in research by the incentives in funding mechanisms as well as the status criteria awarded to a university with increased research funding. As a result, the more attractive the institution, the greater the demand (number of applications for enrollment), the higher the grade point average and standardized entry test scores of applicants, which can lead to increased financial resources (Volkwein & Sweitzer, 2006).

The call for improved measures of higher education's performance has been a constant throughout this century with only minor variations in the fundamental message (Stupak & Leitner, 2001). Issues of performance measurement remain controversial. Behn (1995) called performance measurement one of "the questions" in public management. Based on the continued calls for additional accountability in higher education since the release of the Spellings Commission report, the calls for accountability and measures of the outcomes higher education by external and internal stakeholders will not go away.

Competition for Resources

Colleges and universities have varying missions, institutional cultures, governance structures, enrollments, stakeholder influences, and endowments, Each of these factors influence how an institution of higher education positions its resources to acquire top notch students and increased funding dollars. Colleges and universities need to focus their missions and sharpen their priorities. In education, as in private industry, the stated mission and the true mission of the organization may not coincide; goals that comprise the mission of an institution of higher education can be hard to identify. Higher education institutions compete to acquire intellectual and financial capital, distinguishing themselves by offering superior quality products (a “better education”) or services (new and more attractive amenities) to lure high quality faculty and students (Rowley & Sherman, 2001). SHEEHO (2005) stated that institutions of higher education competing to obtain resources and prestige, pursuing rankings based on measures such as student selectivity and faculty prestige, have pushed cost-effectiveness to the side while detracting attention from institutional goals.

As competition to attract top faculty and students intensifies, institutions of higher education such as Harvard or Yale that once seemed to be resistant to the need for additional financing are finding that they must focus on efficiency and effectiveness due to shrinking endowments (Kirwan, 2007). To meet the needs of today’s students, institutions of higher education pour money into state of the art recreation centers and housing facilities, remodel food courts, increase their student services offerings, and provide other amenities to attract the very best faculty and students. This viscous cycle of competition for faculty and students requires more resources than those that are available to higher education in the pursuit of high-quality faculty and students (Slaughter & Rhoades, 2004).

However, the current budget crisis in some states has left colleges unclear about how to plan financially for the forthcoming academic year. Amid the fiscal uncertainty, college leaders in the Northeast, like those in other parts of the country, sought new ways to save money while maintaining or improving quality (Sewall, 2010). The “new normal” assumes that state aid remains limited, and in hope of avoiding severe institutional cuts in the future the call at many institutions of higher education is not “doing more with less” but “doing less with less.”

Sewall (2010) noted:

> The University of Maine system has cut 300 positions and an estimated $30 million in operating costs while also expanding its online branch to provide double the programs now offered. In June 2010, the Pennsylvania State System of Higher Education discontinued or suspended nearly 80 programs with low enrollment, but as it did so, it encouraged more online enrollment.

Prestige, Institutional Attractiveness, and Reputation

Newman & Couturier (2001) stated that competition was a strength within the system of higher education as it requires that universities seek out their competitive advantages. Colleges and universities attempt will look to position themselves in such a manner that they can maximize their prestige, institutional attractiveness, and reputation (Mills, 2008). Prestige is not synonymous with the quality of an education and the two concepts are relatively independent of each other (Duderstadt & Womack, 2003). The focus on the prestige of an institution of higher education has required colleges and universities to focus resources and administrative efforts on factors that affect inputs included in rankings, such as student enrollments, the size of the library, the number of Nobel laureates, instead of on other critical factors that impact a student’s learning experience (Hossler, 2004). Prestige brings more revenue, which can then be spent to produce more prestige, which generates more market power – not to mention additional research funding and gift support (Massy, 2003). The impact of competition for resources and quality faculty and students, along with other market forces has led institutions of higher education to market themselves through elaborate “branding” initiatives to differentiate themselves from the competition (Kirp, 2003). Universities can cite their prestige when trying to persuade prospects to come to their university but in the end willingness and ability to pay determine whether potential students accept a university’s offer of admittance and whether potential sponsors accept or reject its research proposals.

The selectivity of an institution of higher education by prospective students is directly correlated with the institution’s academic rankings and reputation (Duderstadt & Womack, 2003). Many institutions of higher education pursue prestige through factors such as the relative “quality” of incoming students, as measured by SAT scores; the quality of their faculty, as evidenced by federal research funding, and the success of their athletic programs (Gayle, Tewarie, & White, 2003). Institutions of higher education understand that the recruitment of high quality students strengthens the reputation of the institution and eventually adds to its financial well-being (Brint, 2002). As a result, most universities spend right up to their budget limits after allowing for reserves as spending increases the realization of the institution’s values.

As Bowen’s (1980) revenue theory of costs states, institutions of higher education will continue to increase revenues and expenditures in the pursuit of power, influence, and prestige. Higher tuition allows more spending, and more spending improves value fulfillment, which is what the university is trying to maximize. Bowen

(1986) also noted that the goals of excellence, prestige, and influence are not counteracted by motivations of frugality or efficiency.

Universities as Economic Enterprises

University performance depends on its production processes and market forces. Production refers to the methods institutions of higher education use to accomplish their goals of education, research and public service. At the same time, performance also depends on resource availability, that is, on the institution's financial condition. However, more money has given many universities the opportunity to avoid doing one thing critics of higher education see as their core competency, actually teaching large numbers of students; after a certain point, the more money you have, the fewer distinguished professors you will have in the classroom (Bennett, 1986).

Trustees and other higher education stakeholders believe institutions of higher education should be more business-like while there is some evidence that cost containment remains somewhat of a budgetary afterthought (Wellman, 2008). At the same time, professors and others within higher education argue that the academy is not a business and should not behave like one, fearing that the incorporation of a more business-like culture will emphasize improving efficiency by looking at results in comparison to resources provided (Levin, 2001; Massy, 2003). Traditional colleges and universities are not-for profit-enterprises which in a simplistic sense exist to "do good" while for profit universities exist to make money. Unfortunately, the university's non-profit status does not ensure that quality will exist; the quality of education is difficult to evaluate, and the public relies on academic traditions and values to safeguard quality (Massy, 2003).

Higher Education's Resistance to Change

Many scholars have written about the difficulty of change in higher education (Birnbaum, 1988; Bowen, 1986: Kerr, 2001; Kirwan, 2007; Massy, 2003; and Morrill, 2007) due to its loose coupling, shared governance, and fragmented decision making. The general human tendency is to resist change, the threat of the unfamiliar, which is especially evident in academic communities. Change is difficult and complex in all organizations, but especially so in institutions of higher learning. Institutions of higher education stick to their long valued traditions rather than adopt new innovations (Massy, 2003). Kirwan (2007) noted that resource allocation decisions in higher education are often swayed by institutional governance structures, culture, history, senior executive administrative styles, politics, special interests, and personalities.

The resistance to change in higher education is evident in the fight for limited resources between departments and colleges within universities. This fight occurs between divisions, departments, and programs and other academic areas, as well as areas within the institution not directly tied to academic operations. Faculty believe that the allocation of resources is a zero-sum game, one college's gain is another's loss (Gmelch, 1995). Faculty and administrators need to work together to resolve this conflict so concerns about job security and salaries, which reduces the openness and frankness with which problems of the institution can be aired, are eliminated.

Some within academia see academic freedom and participative decision making as an explicit veto culture but management practices that depend on full and timely cooperation are often potential victims of academic selfishness (Bryman, 2007). Maid (2003) stated that if it takes an institution of higher education three to five years to review and approve a change within the institution, and then another three to five years to put that change into practice, the institution is wasting its time and resources and the change is most likely outdated long before it can be implemented.

Massy and his colleagues (1994) described patterns of “hollowed collegiality” within academic departments, characterized by faculty isolation, fragmented communication, and a reluctance to engage in the kind of truly collaborative work required to develop and maintain a coherent curriculum. Faculty are typically rewarded according to standards of quality dictated by their disciplines and colleagues outside their institutions “cosmopolitans,” not “locals” who are judged by standards specific to their institutions or departments (Fairweather & Hodges, 1996). As a result, many faculty members see little relationship between their institution’s accountability mandates and the teaching and research they conduct and how they are rewarded for performing it.

To combat this culture, institutions need to develop a culture where the collective is celebrated, rather than individual achievement. Kennedy (1997) noted that public criticism of higher education has become increasingly more strident and higher education’s failure to respond adequately to economic stringency leads stakeholders to wonder, corporations everywhere are downsizing, why isn’t productivity in higher education improving? He stated that institutions must seek to remove the constraints that prevent them from responding promptly and flexibly.

Colleges and universities often operate like separate businesses, compartmentalized, with departments working in silos. Universities need to alter a rigid set of behaviors and thoughts currently not able to respond to change into an effective organization encouraging those within them to integrate their activities (Tolmie, 2005). Meyerson and Massy (1995) stated that one of higher education's challenges is to work to provide an atmosphere where change is not seen as a threat but as an exciting opportunity to engage in learning, the primary activity of a university.

Technology's Impact on Efficiency and Productivity

Technology is a tool. Tools facilitate performance of some tasks; they also enable tasks that would not be otherwise possible. Technology has more potential to alter higher education than any other input (Brint, 2002). Advances in technology have outpaced higher education's implementation causing a constant need for higher education to catch up. Many scholars, Bowen (1968), Clotfelter (1996), and Martin (2005), have noted that investments in technology have not provided higher education the same productivity gains as similar investments in other sectors of the economy. Until recently, higher education has not seen technology as a way to reduce costs and increase productivity (Matthews, 1998). While technology holds potential for positively impacting institutional productivity (Bates, 2000; Clotfelter, 1996), institutions of higher education, intent on listening to the stakeholder demands for efficiency, effectiveness and accountability, need to be mindful of previous administration's technology related failures. Higher education needs to continue to invest in technology; however, technological investments are not cheap and investments, good or bad, often last years. As technology makes information more widely available to higher education, the need for the interpretation of data grows exponentially.

In the for-profit world, competitive pressures are a driver for innovation (Zhu & Kraemer, 2005). Processes are increasingly seen as holding the key to reaching corporate goals; if you can get the process right, then operational effectiveness can be raised to a new level (Sellers, 1997). Prestige may be a competitive pressure but at the same time it is a restraint on innovation (Kirp, 2003). Innovation can often be viewed as relaxing constraints that stand in the way of progress. However, the perception of higher education stakeholders is that colleges and universities do not encourage institutional experimentation and innovation (Floyd 1991); things are often done the same way they have always been done with little change or process improvement.

Information technology can provide new alternatives and thus increase efficiency. However, few institutions maintain effective information systems. Productivity gains can be forthcoming if institutions and professors work hard enough to obtain them, but barriers to implementation make this less than certain. Institutions should promote productivity in order to protect themselves competitively (Massy, 2003).

Bates (2000) stated that while technology may not be able to reduce costs to the student, it may be able to increase the institution’s productivity. He added that technology can improve the cost per student at colleges and universities by providing instruction to additional students. However, Bates also warned that to deliver on lowering the cost per student, higher education must make significant changes to the methods used to deliver instruction and its operations with the goal of increasing efficiency and effectiveness. In an era of constrained finances for higher education, it is a requirement for institutions of higher education to develop and implement strategies to ensure the maximum return on investment for their financial resources (American Association of State Colleges and Universities and SunGard Higher Education, 2010). Technology alone is not the solution to many of the problems in higher education. Higher education stakeholders and governance play critical roles in setting the stage for enhanced decision making in higher education (Ravishanker, 2011).

Institutional Effectiveness

Colleges and universities are facing endless complexities and changes in their external environments, and as a result, their internal organizations are looking to find effective ways to adapt (Brock, 1997; Shattock, 2003; Tolmie, 2005). As a result, strategy models that work in stable environments are unlikely to be helpful and often do not work within the unique higher education environment. It is possible that efficiency and effectiveness gains may be realized in higher education. However, in higher education, due to shared governance and the need for consensus building, decisions are difficult to make and take a long time before consensus is reached (Tolmie, 2005).

As previously discussed, research productivity (measured by research expenditures) and learning productivity (measured by six year undergraduate graduation rates) are used in higher education as measures of an institution's productivity and are often a key focus for internal and external stakeholders (Dugan, 2006; Suskie, 2006;

Volkwein & Sweitzer, 2006). In the current economic climate, many states funding levels are moving back to those last seen in the 1960's (CSU Reviews Initial Strategies to Address $500 Million Cut in State Funding, 2011); doing more with less has been replaced with doing less with less. Donors and legislators applaud productivity gains but barriers to their implementation, e.g., institutions and professors working collectively to achieve them, make their achievement less than certain (Massy, 2003). Institutions must improve productivity in order to protect themselves from competitive market forces. However, Bowen (1986) noted that colleges and universities have no strong incentive to cut costs because they do not seek profit and they are not forced to be competitive to reduce costs to survive. This is in part due to universities being government funded and often times being shielded by geographic location. Massy (1996) argued that the first key to effective resources allocation lies in understanding the system of incentives that guide spending within the college and university. These incentives are based partly on intrinsic values and partly on instrumental ones.

In the non-profit sector, external stakeholders often find it hard to hold managers accountable for improved performance as value and productivity cannot be easily measured (Bowen, 1986). Improving productivity means reducing costs, principally variable costs, while at the same time improving processes and increasing investments in technology. Analyzing the activities that create value in higher education helps one to assess an institution's level of efficiency and while there is no direct evidence that universities are efficient, indirect evidence indicates they are not (Massy, 2003). Stakeholders have expectations that campuses should improve student access, enhance the quality of graduates (readiness for employers and time to graduation), and reduce costs, while embracing and implementing new technologies that are often costly and unproven (Buchanan & O'Connell, 2006; Tolmie, 2005).

Summary

Demands for efficiency, effectiveness, accountability, and education quality evaluation will not go away. As a result, higher education must improve its operations and deliver its programs and services more efficiently and effectively. Performance measurement is a useful tool in reaching these goals. At the same time, regulatory efforts are intrusive and often they prove ineffective (Massy, 2003). The move toward increased transparency and accountability should be looked on by those in higher education as a call for more effective discussions with internal and external stakeholders. Colleges and universities should feel some sense of urgency for moving improvements forward and demonstrate to higher education's investors and other stakeholders that they are doing so (Massy, 2007). Excellent higher education organizations cannot stand still as external pressures mount for increased transparency, effectiveness, and efficiency. These forces challenge institutions to new levels of creativity and engagement to maintain their visibility, reputation, and institutional permanence (Massa & Parker, 2007).

Section 2: Decision Making in Higher Education

Decision making is a fundamental management activity that consists of a sequence of tasks which are used to solve a problem, grasp a good or an opportunity. In all enterprises, managers face the same dilemma of how, given the constraints imposed on them, to achieve an optimal or at least satisfactory allocation of scarce resources across an array of competing activities (Breu & Rabb, 1994; Eckles, 2009; Lindsey, 1982). However, a number of factors distinguish higher education from other non-profit and for profit enterprises. The most important are the lack of profit motive, goal diversity and uncertainty, diffuse decision making, and poorly understood production technology (Massy, 2003). These characteristics preclude the use of the relatively clear guiding principles of profit maximization and cost minimization, and closely circumscribe the decision making of senior administrators (Lindsay, 1982).

Birnbaum (1988) stated that governance is what sets higher education apart from other organizations. Typically, the state is tasked with establishing a college or university (however, this is often delegated to system trustees) while decision making is in the hands of trustees, presidents, staff, and faculty. Decision making in higher education is complicated by the conflict between administrative authority and professional authority. Administrative authority is derived from one's rank within the organization whereas professional authority is based upon specialized knowledge and judgment in specific areas. In higher education, faculty often see administrators as individuals in charge of secondary processes to the primary activity of the institution (teaching) performed by the professionals (Etzioni, 1964). This often results in lack of clarity of organizational goals and what is the true mission of the institution as well as confusion within the different levels of the institution.

Enormous change has occurred in higher education that has complicated management and leadership (Scott, 2001). As a result, the principal short term concern of institutional managers is making decisions about changes in resource allocations within a constricted set of choices and limitations (Eckles, 2009; Lindsey, 1982). A manager's main need for information is for information related to the effectiveness and efficiency of resource allocation decisions. Hence, from a managerial perspective, a college or university's "performance" can be seen as encompassing these two concepts: effectiveness, which links outputs with goals or expected outcomes; and efficiency, which measures outputs with inputs (Massy, 2003). Assessing an organization's performance involves understanding its goals and objectives and how efficiently the organization use its resources in achieving these goals and objectives.

Higher education is becoming more complex and hence more difficult to manage (Inside Out, 2001). Higher education must attend to its budgets and competing claims on its resources to accomplish its mission of teaching, research and service. There is a need for leaders not just to generate good ideas but also to translate them into strategies for effective actions. Managerial skills needed in higher education differ little from those sought by nearly every other enterprise; however, most institutions see themselves as unique and culture is so intertwined with the existing order that new ideas do not come up (Inside Out, 2001).

Twenty years ago researchers understood that because of the multiplicity of the problems in higher education, especially the financial ones, the business officer had to develop new ways and new technologies to achieve a situation where the academic world could use these techniques in decision making (Bowen, 1986; Anderson, 1986). Decisions must be based upon a sound analysis of facts and studying and a weighing of all of the possible alternatives and then the arrival at a decision. As a result, national efforts to improve rational, analytical methods in higher education have been one of the most interesting trends of the past two decades (Kirwan, 2007).

At most colleges and universities, the chief financial officer is one of the executives charged by the governing board with the authority and responsibility for assuring the continued financial viability of the institution. The CFO must be able to relate the financial status and requirements of the institution to the programs and functions linked to the institution's financial capacity while grasping the varying impacts of such support on the programs of the institution. With increasing competition from private, public and for-profit colleges, changing demographics, escalating tuition, and changes in student expectations, public accountability, and increased scrutiny by external entities, it is more important than ever for CFOs to monitor and communicate the financial status of their institutions (Brockenbough, 2004).

Traditionally, the higher education CFO is the individual who is responsible for managing the allocation and proper use of institutional resources. CFOs are required to monitor the interface between the organization and the internal and external environment and determine appropriate organizational strategies to achieve goals and objectives. The management of resources, and the administration of relationships between the college or university and its environment – becomes a practice to position the organization for survival (Gumport, 2000). Higher education CFOs are required to make judgments about multifaceted systems with interconnected, yet erratic, elements. The need to manage these challenges places these CFOs in the innermost role of understanding the potential benefits and costs of any path taken to reach institutional goals.

Decisions made by higher education CFOs may promote or restrain new solutions to the multifaceted issues facing their institutions (Lake, 2005). Identifying tools used by CFOs of higher education institutions when carrying out the CFO management functions is crucial to the relevancy, availability, growth and sustainability of higher education. Consequences of mismanagement of higher education institutions can have dire and long lasting effects thus there is a need for CFOs with the ability, knowledge, and skill set to allow them to meet future challenges (Lake, 2005). But often times, higher education management adopts tools that fit specific needs and the culture of the institution. Decision makers must understand their institutional needs and the current state of their information systems and deploy tools that are appropriate for their culture (Garg, Garg, Hudick & Nowacki, 2003).

Unlike the for-profit world, colleges and universities make decisions based on the best way to provide an education while at the same time remaining in compliance with federal and state regulations (Valcik & Stigdon, 2008). Bellman and Zadeh (1970) stated decision making in higher education occurs in an environment in which the goals, the constraints, and the consequences of possible outcomes are not specifically known. According to Massy (2003), higher education offers many opportunities to improve fact-based decision making; basing decisions on facts helps break down the isolation and fragmentation that depresses collegiality. However, Bonabeau (2003) noted that administrators are very confident that, when looking at complicated choices, they can just trust their gut; 45% of corporate executives rely more on instinct than on facts and figures in running their businesses.

In higher education, intuition is often one of the most important pieces of the decision-making process while analysis is sometimes viewed as an unnecessary supporting tool for intuitive decisions. Sue Redman, former CFO at Texas A&M University, stated that she believes that decisions in higher education are often made based on relationships and based upon a university's culture rather than based on an analytical review of factors that may support a decision (personal communication, May 1, 2011). She is supported by Ravishanker, (2011, p.2) who stated "let's ignore the evidence and make our strategic decisions based on important anecdotes and guesses, the fact is that many important decisions in higher education are made this way as harvesting the right data to inform decisions is more complex than it might at first appear [sic]." Yanosky, (2007) quoted Samuel Levy, CIO at the University of St. Thomas, "sure, show me the data, as long as it doesn't challenge or mitigate what I already believe" (p. 59).

Buchanan & O'Connell (2006) stated "we don't admire gut decision makers for the quality of their decisions so much as for their courage in making them; gut decisions testify to the confidence of the decision maker" (p.40). Gut decisions are often made in when there may not be time to weigh all of the arguments for and against a position and to determine the probability of every outcome. Decision makers typically do not ignore good information when it can be provided to them but decisions are often made by other than the use of quality data. Lindsey (1982) stated that the application of a quantitative approach in an area as complex as higher education, in which the underlying processes are not fully understood and in which the development of adequate measures of the conceptual constructs has made only limited progress; convenience in analysis is purchased at the price of completeness.

Bonabeau (2003) believed that the more options a decision maker had to evaluate, the more data to weigh, the more unprecedented the challenges faced, the less one should rely on instincts; the more complex the situation, the more misleading intuition becomes. To make informed decisions requires an unwavering commitment, and willingness to change the way staff feel, work, and how they are treated. Faced with flawed decision making, CFOs have sought ways to achieve acceptable outcomes (Buchanan & O'Connell, 2006).

Use of Qualitative and Quantitative Management Tools in Higher Education

Since the 1980s, qualitative and quantitative management tools have become a common part of CFOs lives (Rigsby, 2011). Many tools to evaluate higher education performance are readily available; i.e., off-the-shelf- software packages can aggregate/disaggregate data, performing statistical and trend analysis, charting, and forecasting. There is a range of qualitative and quantitative applications, approaches, methods, and philosophies available to higher education CFOs and the successful use of these tools requires an understanding of the strengths and weaknesses of each tool as well as an ability to integrate the right tool, in the right way, at the right time (Pigsby, 2011). Tools don't eliminate human intervention; they harness the power of human intervention while covering up its most harmful flaws (Bonabeau, 2003).

In 2003, Ernst and Young (E&Y) and the Institute of Management Accountants undertook a study on the use of accounting tools in higher education. In their findings, they urged companies to start using at least 60% of the seventeen tools in the study, stating that if managers are not using these tools at least at a 60% level they run the risk of falling behind others in the use of these tools (Garg, et al., 2003). The authors also found that adapting new tools was not a priority for institutions of higher education and traditional management accounting tools are still being used. Many colleges and universities borrow tools from for-profit companies or other non-profit organizations. While some of these efforts have been demonstrated to be beneficial, Birnbaum (2000) noted the use of some of the tools were best characterized as "management fads."

Since 1993, Bain & Company has been conducting surveys (every year or two) of tools used by managers to provide:

- An understanding of how the current application of these tools and subsequent results compare with those of other organizations across industries and around the globe;
- The information needed to identify, select, implement and integrate the optimal tools to improve a company's performance (Rigsby, 2011 p. 10).

Bain's research has provided a number of important insights:

- Overall satisfaction with tools is moderately positive, but the rates of usage, ease of implementation, effectiveness, strengths and weaknesses vary widely;
- Management tools are much more effective when they are part of a major organizational effort; Managers who switch from tool to tool undermine employees' confidence;
- Decision makers achieve better results by championing realistic strategies and viewing tools simply as a means to a strategic goal;
- No tool is a cure-all (Rigsby, 2011 p. 11).

Bain also noted several important trends from their 2009 survey:

- Nearly all executives believe innovation is vital to their company's success, but few feel they have learned to harness its power effectively;
- Many executives have serious concerns about how their organizations gather customer insights and manage decision making (Rigsby, 2011 p. 11).

While E&Y and Bain regularly survey the use of tools, there are few surveys as to what specific tools are used in higher education. White (1987) found that reported applications of analytical support tools within the academic setting varied across the spectrum of decision making activities. He noted that most tools assumed a single decision maker focusing on one overriding criteria, such as time or cost, when most important decisions in higher education are made by groups or committees with different viewpoints. Within an organization, different areas will use various different pieces of analytical data.

Decision makers are the decisive users of information and they need data that is timely, relevant, and concise. Rigsby & Bilodeau (2009) noted that strategic planning was the number one tool used by managers since 1998 and companies got the best results when they employed tools as part of a broad initiative, instead of on limited projects. High performance colleges and universities do not measure processes and outcomes for the sake of measurement. They use data and information as an essential part of their measurements systems to: report to the organization regarding its performance information; determine whether based upon the information corrective action is necessary; determine whether changes are needed in the performance measurement system, to the measures themselves, or to the organization's mission, goals, and objectives (National Performance Review, 1997).

Barriers to the Use of Tools

The primary obstacles to greater use of analytics in higher education are resources and culture, and they are intertwined. Competition for resources is very much tied to the culture of the institution (Norris, Baer, Leonard, Pugliese & Lefrere, 2008). A 2009 EDUCAUSE survey of higher education CIOs found that a common barrier to the wider adoption of analytics was that institutional leaders are accustomed to an intuitive management style and therefore aren't really committed to evidence-based decision making (Yanosky, 2007). Yanosky also found that lack of funds was seen as the largest barrier to investment in institutional data management, followed by lack of staff expertise, and a decentralized or informal institutional culture. With all of these hurdles to overcome, one can understand why quantitative and qualitative management tools have not been fully implemented in higher education.

Many institutions invest large sums of money in enterprise resource planning (ERP) systems, and often they are frustrated that many years after the implementation, they do not have access to reliable data. Bob Koob, California Polytechnic State University-San Luis Obispo's recently retired Provost, stated that although the CSU System had invested millions of dollars in their PeopleSoft information systems, it was still difficult to get usable data out of the system and people had grown frustrated with the complexity of the system (personal communication, December 12, 2010). This is due to ERP systems being excellent transactional systems but not providing the much needed infrastructure for reporting or keeping some forms of data history (Ravishanker, 2011). Many institutions collect large amounts of data that they don't analyze while their staff realize that it is easy to get data into the system but difficult to get reliable and meaningful data out. To obtain the data needed to make informed decisions requires a major investment in technology, the development of large amounts of data, and the formulation of strategies for managing the data (Davenport, 2006).

Another barrier to the use of quantitative and qualitative management tools are silos that are typically seen in institutions of higher education. Ravishanker, (2011) stated that because of prior administrative decisions and data silos that often develop, the sharing of information between schools or functional offices is minimal. As a result, data is often managed centrally with central IT groups used to ensure that data is well managed and that different parts of the institution can easily share data, without problems related to inconsistent data formats, data definitions, and standards. Subcultures within the institution, such as the budget office, often own large amounts of data and can drive how the university manages its data and thus how data can be used (Valcik and Stigdon, 2008).

Massy (2003) proclaimed that university accounting systems create measurement problems and prevent the necessary cost analyses to optimize decision making. Stringer, Cunningham, Merisotis, Wellman and O'Brien (1999) identified a barrier to the use of analytical tools as the difficulty in determining the costs associated with some of the analytical tools used while Evans (2004) noted a shortcoming as the inability of institutions to truly understand the cost drivers within their institutions in a way that links cost to activities.

Management only adopts tools that fit an organization's specific needs and culture whereby the lack of a clear value proposition may constrain the adoption of the latest decision making tools (Rigsby, 2009). To break down these barriers, decision makers in higher education must understand their critical business needs, understand the current state of their IT systems, and deploy innovative qualitative and quantitative management tools that are appropriate for their organization’s culture. Therefore, management buy-in, in-house expertise, and adequate technology are needed to overcome the barriers for the use of qualitative and quantitative tools in higher education (Garg, et al., 2003).

Every qualitative and quantitative management tool should be periodically evaluated, whether it is a well long standing tool that has been featured in the textbooks for decades or a new method proposed by a CFO or staff member. Higher education needs creative thinking, consensus building, and agility to implement qualitative and quantitative management tools. However, working collectively and imitation go against the academic grain; higher education prizes individuality and originality, neither of which is conducive to replicating proven strategies. While many believe that silos and the “cosmopolitan” focus of faculty hinder the use of these tools, Miller (2010), believed that higher education might finally have learned that complex systems can only be changed through collaborative action. On the other hand, Yanosky (2009) stated that poor data quality, a small number of analytical tools that work in higher education, and a workforce that is largely unschooled in quantitative analytical methods conspire to yield a picture of relatively low adoption of analytics in higher education.

Lack of Data

Data is critical to every department in every organization and its principal purpose is to support the performance of managerial functions. As advances in computers and software improve data processing speeds, and decision makers call for additional data and analysis, there is an expansion in how data is used, managed and applied. Resources are being allocated to transform data into useful information to assist decision makers in their search for institutional effectiveness (Wallace, 2008). Massy (2003) stated that there is a lack of critical data in higher education that limits its ability to quantify key aspects of performance.

Historically, higher education's lack of data often made an objective evaluation of faculty, programs, departments, colleges and university performance less accurate (Redlinger and Valcik, 2008). Yanosky (2007) found that EDUCAUSE member institution CIOs did not believe that their institutions were getting maximum academic and business value from the information they have. When data quality is lackluster, there is often little effort made by individuals to "mine" institutional data to promote better institutional outcomes. A survey conducted by the higher education IT architects' organization ITANA in 2008 found that when asked to characterize the maturity of various aspects of their data management practice on a scale from 1 to 10, most institutions answered with a 5 or less in such areas as data quality and data management, data warehousing and business intelligence, document/content/records management, and metadata management (Yanosky, 2007). While Yanosky's 2007 survey of EDUCAUSE member institution CIOs noted that the CIOs believed that institutional data quality measures were less than average; institutional data was not consistently coded and changes disseminated appropriately, even in enterprise systems.

While data quality is a barrier to the CFO management functions that need to be addressed in higher education, higher education is also slow to adopt new technology. Strickulis (2008) stated that higher education usually follows about 10 years after for-profit businesses adopt an idea or technique. As a result, often times a college or university's computer hardware and software are years behind their for-profit counterparts and can be a source of discouragement and irritation. Valcik & Stigdon (2008) and Levy (2008), noted that many institutions of higher education still operate on mainframe computer systems, characterized by autocratic, centralized control of access to data. It may not be the IT systems that holds back or withholds access to institutional data. Levy (2008) stated that the problem is more likely to be the organizational politics and antiquated information technology policies and procedures that do not allow individuals to access the data they need to make better decisions. Higher education must recognize the existence of subcultures within the institution that have their own agendas, goals, and challenges in order to integrate knowledge for more accurate and efficient reporting of data and more thorough organizational assessment.

Data requirements for decision making vary; some decisions require weekly or monthly data (expenditures for a construction project) while others require daily or minute by minute information (a utility plant on a campus). Timeliness of information is relative and the definition of timeliness depends on the situation. Organizations need accurate and timely data to make informed decisions which meet the needs of the institution (Haag, Baltzan & Phillips, 2006).

So where does this leave the public research university CFO as they search to move their organizations towards increased efficiency and effectiveness and respond to the calls for increased accountability? Higher education CFOs need tools that assist them in meeting the needs of their constituents. The following is a review of quantitative and qualitative management tools used in higher education.

Section 3: Tools Used in Higher Education

Activity Based Costing (ABC Costing)

Activity-based costing is a cost accounting method used to accurately determine the full cost of products and services utilizing this information to construct an accurate portrait of the institution's resource allocation decisions (Gordon & Charles, 1997-1998). They also state that ABC measures the cost of resources, processes, and overhead associated with a prescribed activity.

ABC was first used in the for-profit sector. However, some higher education scholars have undertaken research to determine if ABC can be used as a tool to respond to the demands of increased efficiency, effectiveness, and fiscal accountability in post-secondary institutions (Brinkman, 2000; Cox, Downey & Smith, 1999; Gordon & Charles, 1997-1998; and Rooney, Borden & Thomas, 1999). Trussell and Bitner (1996) noted that "the output from the ABC system can be used for many purposes … more accurate activity and program costs data allow college and university administrators to make better decisions relating to resource allocation, program retention, marketing strategies, program returns and the like" (p.5). The principle underlying ABC is that decisions about allocating resources need to be made at the level responsible for implementing those decisions (Wergin & Seingen, 2000). Two models of ABC are "contribution margin analysis" and responsibility-centered management (RCM), both of which are discussed later in this section.

The "true" origin of ABC is much debated with Weisman & Mitchell (1986), and Kaplan & Waldron (as cited by Massy, 2003), stating that Texas Instruments developed activity-based costing in the late 1970s as a practical solution for problems associated with traditional costing systems, with its antecedents being traced back to accountants in England in the 1890s. However, Turk, (1992) contributed ABC as a system developed in the late 1980's by Robin Cooper and Robert Kaplan to determine the cost of products. Cooper and Kaplan proposed that the traditional system of accumulating costs distorted the "true cost" of making a product. ABC costing traces more costs as direct costs while still maintaining cost pools that are related to the activities that drive their costs. As a result, there are multiple cost pools and overhead rates that are allocated, giving a more accurate representation of a product's "true cost."

The idea of applying ABC to college courses seems to have originated in the early 1990s with Jack Wilson at Rensselaer Polytechnic University (Wilson, 1996). It was picked up by EDUCOM (a predecessor to EDUCAUSE) soon afterward and since then has been adopted widely in higher education (Massy, 2007; Massy & Zemsky, 1994). Lin (2000) noted that the characteristics for applying ABC exist in higher education; however, they do not exist consistently through all categories or units. While public and research institutions of higher education may be appropriate candidates for the implementation of ABC costing because of their institutional characteristics, private institutions are appropriate candidates for the implementation of ABC costing due to the price competition between institutions and a need for useful cost information (Lin, 2000). Alejandro (2000) stated that while ABC can be effective in a university setting, the process of implementing ABC can be very complex; the complexity dependent on the type of institution and the design of the ABC model being implemented.

Gordon & Charles (1997-1998) described ABC as a cost accounting method that determines the cost of resources, processes, and overhead associated with an activity and uses this data to build an accurate picture of the an organization's resource allocation models. Once activity and cost data have been collected, administrators can use the information to compare institutional expenditures against the amount of time dedicated to mission-critical activities (Gordon and Charles, 1997-1998; Rooney et al., 1999).

ABC may be catching on in higher education. Relationships and information gained from the application of ABC at colleges and universities was found to be very useful for improving external accountability, budget development, campus planning, and other evaluation efforts and decisions (Cox, et al., 1999; Gordon & Charles, 1997-1998). Massy (2003) noted that ABC is useful for online courses where processes receive more than the usual amount of attention and cost is seen as a significant problem.

One should not rule out some variant of ABC for higher education's long run future. Turk (1992) proposed that ABC costing should be used as a method to allocate overhead to departments in higher education so that decision makers can determine where costs can be reallocated or better contained. Trussell and Bitner (1996) suggested that ABC should be part of any re-engineering or management improvement process as current cost systems provides data that is not relevant to decision making in higher education.

Deans, provosts, presidents, and boards should ensure that their institutions embrace ABC at the grassroots level and that professors have the skills developed and technical support they need to implement ABC. Universities are subject to accountability from a range of diverse stakeholders asserting that market forces and oversight initiatives by external agencies. Critics of ABC believe that it impinges on institutional autonomy and academic freedom (Massy, 2003). Massy also believed that for most institutions ABC isn’t worth the expense and controversy that would arise from implementation.

Balanced Scorecard

Kaplan and Norton (1996) described a balanced scorecard as “a management system that can channel the energies, abilities, and specific knowledge held by people throughout the organization towards achieving long-term strategic goals” (inside cover). The scorecard expresses all of the organization’s important long and short term goals and includes data on customers, internal business processes, organizational learning, and growth. It expresses criteria of interest to internal as well as external stakeholders, and it includes measures that require judgment as well as ones that are easily quantifiable (Massy, 2003).

The balanced scorecard provides a template for performance evaluation. This management tool uses a “balanced set of goals and measurements” to determine the performance of a business unit and to let the reviewer know when corrective action needs to be taken. The balanced scorecard should be developed and aligned with an institution's strategy and to assist in communicating the mission, goals, and objectives of the organization to internal and external stakeholders. Kaplan and Norton (the originators of the balanced scorecard) suggested that measurements are needed in a variety of areas, such as customer focus, employee satisfaction, and internal efficiency rather than just focusing on one area within the business (Thalner, 2005).

A balanced scorecard expresses the organization's important long and short term goals. The balanced scorecard has been widely adopted in business, and it applies as well to non-profit enterprises. Its application to colleges and universities is straightforward (Massy, 2003). A well-developed balanced scorecard includes data on customers, internal business processes, organizational learning, and growth. It considers results obtained from operations and progress on initiatives designed to improve future performance. It expresses criterion of interest to internal (faculty, students, staff and trustees) as well as external stakeholders (funding agencies, research sponsors, donors and the general public) (Massy, 2003).

When using a balanced scorecard, leaders establish goals and look at trends over time to review whether the entity or business unit is meeting those goals and the users then make improvements where and when needed. Measures must be reviewed regularly, so that corrections can be made when trends become unfavorable while also providing reinforcement for positive trends. Some researchers have used the balanced scorecard approach when performing a strategic analysis or environmental scanning (Cullen, et al., 2003; Kettunen, 2006; and Umashankar & Dutta, 2007).

A number variety of organizations have successfully implemented balanced scorecards (Bailey, Chow, & Hadad, 1999). Examples in the not-for-profit segment include the cities of St. Charles, Illinois and Charlotte, North Carolina (Thalner, 2005). Cullen, Joyce, Hassall and Broadbent (2003) found limited evidence of the use of the balanced scorecard in education, while recommending the use of a balanced scorecard to link goals and objectives to performance measures. A 1998 study with business school deans noted that even though the implementation level of balanced scorecards in business schools was low, the deans reported that the implementation of balanced scorecards at their institutions could be beneficial (Bailey et al., 1999). Bailey et al. (1999) also noted the measures that would be most beneficial to business school deans within the balanced scorecard categories of customer perspective, internal business perspective, innovation and learning perspective, and financial perspective. The notion of a balanced scorecard is not new, but its use in higher education has been somewhat sporadic for various reasons (Birnbaum, 2005).

Benchmarking

Benchmarking was first undertaken by Xerox as a means to improve competitiveness and establish stretch goals for an organization (Zairi & Hutton, 1995). Kempner & Shafer (1993) describe benchmarking as an "ongoing systematic process for measuring and comparing the work processes of one organization to those or another, by bringing an external focus to internal activities, functions, or operations" (n.p.). According to Goetsch & Davis (1997), benchmarking is "the process of comparing and measuring an organization's operations or its internal processes against those of a best-in-class performer from inside or outside its industry" (p. 434). Barak & Knicker (2002) describe benchmarking as one organization comparing its current practices (procedures, controls, etc.) with the best practices established within an industry or another entity. Benchmarking sometimes compares one company's current practices to those of an entity in a different line of business. In the case of higher education, benchmarking is used to improve, a process, procedure or outcome. Benchmarking analyzes one entity's processes with those thought to be equal or more effective. Benchmarking identifies best practices which are then adopted or adapted so that local process can improve efficiency and/or effectiveness. Massy (2003) stated that the exceptional performers of a particular process do not have to be in the same type of industry or the same type of institution.

Benchmarking is a process of assessing various factors against other organizations, in higher education often times peer institutions, to identify strategies for improvement and innovation. Benchmarking activities often seek to assess a college's environment, achievements, and shortcomings as compared to peer institutions. Benchmarking is typically performed for performance (metric benchmarking) – analyzing data; diagnostic – assess an organization's performance and identify practices that need improvement; and process benchmarking – bringing two or more organizations into an in-depth comparative examination of a specific core practice (Dowd, 2005). However, benchmarking is not easy because of the difficulty in defining and collecting accurate, comparable performance data from institutions of higher education (Albright, 2006).

Benchmarking is a management tool that institutions of higher education use to promote continuous improvement by comparing institutional performance to a set of best practices. The methodology underlying benchmarking is that learning from best practices is an effective and efficient way to improve the practices at another organization. Benchmarking can be performed against an institution's past, against a national database, against a select group of peer institutions, and against best in class institutions and can provide a clear and informed framework for institutional decision making (Massa & Parker, 2007).

According to Massy (2007), benchmarking follows a specified set of steps. These include:

1) identifying exactly what the organization will benchmark;
2) developing a list of candidates to benchmark;
3) evaluating data that underscores the differences between the organization's activity and the benchmark; and
4) going back and establishing goals and action plans for improvement based upon what the data the organization gained from the benchmarking exercise.

Benchmarks are guidelines or targets for information that is gathered and measurements that have been taken are used to develop conclusions regarding how an organization's current performance compares to best practices and can help identify necessary improvements. Areas within an organization that are typically benchmarked include: organizational procedures and processes, continuous improvement efforts, and operations and operational strategies (Summers, 2005).

Understanding internal trends is as important in benchmarking exercises as the information gained from research and data analysis and provides important data to assist administrators in making decisions. Successful benchmarking requires the ability to identify comparable peer units, data must be benchmarked against data from similar institutions, and participation of those peer units' in the benchmarking exercise is a necessity. Using comparative data can help develop a set of common benchmarks where certain measures are associated with a best practice. Comparative analysis can also reveal differences in resource patterns that have powerful implications for the way an institution defines its vision for the future. However, institutions that make peer comparisons often express frustration at the limited amount of data which they find to be comparable; higher education peers seldom believe that other institutions have truly similar departmental and collegial structures, budgets, or student bodies (Barak & Knicker, 2002). Benchmarking allows an institution to compare its trends to other institutions and helps adjust goals to what the institution may be able to achieve.

Traditionally, benchmarking has been seen as the collecting of data so that an institution can compare itself to others. Institutions gain from undertaking the exercise themselves internally as goals and objectives are developed and data is measured. They also benefit from gaining knowledge on how other institutions of higher education perform certain tasks and reach decisions. One of the important steps in benchmarking is developing a listing of comparable institutions through research. As such, the staff and culture within educational institutions are more likely to be receptive to benchmarking than other methods which look at the efficiency and effectiveness of the institution and which may be more business-oriented (Alstete, 1995).

One strength of benchmarking is that it can provide a methodology for peer institutions, and staff within those institutions, to apply their research skills to examine complex relationships in order to develop a more thorough understanding of how inputs and practices work together to produce an educational outcome (Brown, 2001). In addition to external benchmarking, the examination of faculty and student data, ratios, and cost data, and their trends over time, may also be of value for managers in their review of their operations (Levy, 2008). One goal of benchmarking is to give managers standards for measuring how well their operations are performing and to review the cost of internal activities as compared to those standards, and to help identify where opportunities for improvement may reside (Alstete, 1995). However, processes of peer institutions must be studied thoroughly while benchmarking and decision makers must avoid the temptation to blindly adopt the processes of the benchmarked institutions since each institution of higher education has its own culture (Bender, 2002).

Examining an institution’s standards and measures of quality can assist in developing consensus regarding what higher education involves and therefore assist in its improvement. Bers (2006) discussed the growing interest in benchmarking among community colleges including the enhanced sophistication of community college benchmarking due to: the accountability pressure to show the colleges are doing the job they claim to be doing (students are learning, the institutions are fiscally responsible and efficient, and stakeholder interests are being met responsibly and responsively). Benchmarking allows an institution to study its operations to identify its strengths, its weaknesses, and areas where it can improve performance.

Institutions have many more sources of data and measures of results than will ever appear in a single collection of key strategic performance measures (Morrill, 2007).

Strategic performance measures can also be crucial in the process of establishing measurable goals as benchmarks for the aspirations as defined in a strategic plan. One of the major results of benchmarking is the ability to provide the resources to understand, identify, and adapt best practices from other organizations to assist a business improve its performance. Benchmarking has gained support in higher education due to its ability to improve students' educational experiences (Barak & Knicker, 2002).

Alstete (1995) observed that benchmarking can assist in overcoming the opposition to change that may occur in institutions of higher education. Improving the effectiveness or efficiency of an institution of higher education may require changing policies and procedures and altering subcultures and cultures within the institution. Leaders of change require numerous administrative support methods to succeed; benchmarking can be one such mechanism (Alstete, 1995). It is critical for benchmarked performance indicators to be adapted to the mission, goals and objectives, and identity the organization and to be used as interpretative tools not the ultimate way, or only way, something should be done (Gayle, Tewarie, & White, 2003).

Brainstorming

Brainstorming is a qualitative management tool that develops creative solutions to problems. Brainstorming focuses on a problem and then comes up with as many solutions as possible and by pushing the ideas developed as far as possible (Clark, 2010). All suggestions that are developed are recorded and then voted on by those involved in the brainstorming session for further in depth examination. One of the reasons brainstorming is effective is that those involved in the process not only come up with new ideas in a session, but they are also able to form associations with other group members ideas allowing the ideas to be further developed and refined

The use of brainstorming in higher education has been discussed by many including, Bonwell (2000), Kolb and Kolb (2005), and Garrison, Anderson, and Archer (2001). . Brainstorming is a simple tool to use, with few rules and a relatively formless approach. Proposals may emerge in a brainstorming session which can be provided to higher levels of authority within the institution (Bloor, 1987). Brainstorming is often used in continuous improvement. Mergen, Grant, and Widrick (2000) discussed how the Rochester Institute of Technology used brainstorming as part of their continuous improvement efforts based upon the principles of Juran.

Cause and Effect (fish-bone or Ishikawa) Diagrams

Cause and effect diagrams are excellent to use in determining root causes. These diagrams help identify causes for non-conforming or defective products and services and can be used in conjunction with flow charts and Pareto charts (Summers, 2003). Cause and effect diagrams can be a useful visual display in a brainstorming session to separate a large problem into smaller, more manageable parts. Cause and effect diagrams can serve as an aid to facilitate an understanding of the problem at hand and its root cause. They help to logically organize the possible causes of the problem and to focus on one area at a time (Summers, 2003).

Checklists

This qualitative management tool is a series of carefully formulated questions that can be applied to any department, activity, job, procedure, policy, or other component within an institution. Checklists are typically easy to develop. The occurrence or non-occurrence of specific items under consideration is “checked” by the participant and the items are then rank-ordered on the basis of the number of items present (Johnson & Kazense, 1993). Checklists are versatile, useful tools that can assist in reducing the chances of overlooking important factors. Checklists can reduce biases, while increasing the ability to defend evaluation findings.

The use of checklists makes sure that some of the common causes of problems are addressed prior to the start of a procedure or process. Despite the success of checklists, their adoption rate has been poor in many industries. Hajek (2010) speculated that part of the problem with users not wanting to adopt checklists was that they considered it below their skill level. Crossan (2009) stated that if one asks for completed checklists, then you’ll absolutely get completed checklists, because that’s what you asked for; however, there is also no evidence that would indicate the checklist was actually used like it should have been.

Checklists are used in higher education but the use of checklists in higher education finance is not well documented. Mills and Cottell (1998) developed forms and checklists which can be used in the cooperative learning classrooms while Wilson (2011) developed checklists that she suggested higher education institutional staff use as part of their professional development process and to improve the quality of service they provide for all students.

Continuous Improvement (CI)

CI is the act of developing an institutional culture committed to continuous improvement in every instance (Kreitner, 2004). CI is a long term program that seeks to involve everyone in the organization at making progressive changes in what they do through the application of systematic techniques. It requires a commitment to excellence and continued efforts to identify and eliminate inefficiencies, defects, and non-conformance to internal and external stakeholder needs and expectations.

The use of CI can be seen through a review of literature over the last thirty years. CI programs during these years were founded mainly on the Total Quality Management theories developed by Crosby (1979), Deming (1986), and Juran (1995). Deming introduced his concept of quality management in Japan more than fifty-five years ago. Deming's philosophy is based on analytical theory where management action focuses on improving the process for the future rather than judgment based on current results (Triete, 1990). Continuous improvement focuses on the use of quantitative methods to measure results against established standards.

Continuous improvement was late coming to the public sector. Institutions of higher education started using CI methods around 1990 (Baldwin, 2002; Chaffee & Sherr, 1992). However, Deming's philosophies on organizations, work within the organization, and process control are very different from those individuals within higher education are used to as a management style (Spencer, 1995). Public administration theorists and practitioners predict failure of CI without a fair test in the public sector.

Some believe that anything that succeeded in private industry, or was not developed by a public administrator, will not work in the public sector (Stupak & Leitner, 2001).

Continuous improvement supports the notion that organizations can constantly improve their activities and processes. This requires a constant commitment to “doing things right” and a persistent effort to identify and eliminate all defects, inefficiencies, and non-conformance. Massy (2003) stated that incremental improvements can almost always be made, and this process is vital to an organization’s success. In the dynamic world seen today within higher education, budgets being slashed and states throughout the country facing budget shortfalls, higher education organizations need to consider the implementation of continuous improvement and ways to change to meet these new circumstances. In a world marked by “bottom lines” and “benchmarks” evaluation is no longer a luxury. Higher education needs to ensure that it monitors quality and has sufficient indicators to assess the overall quality of its programs as well as the internal effectiveness and efficiency of the organization (Massy, 2003).

While colleges and universities offer content expertise, most don’t know how to get over the quality barrier. Reengineering and continuous improvement are far less common in teaching. Faculty and staff responsible for achieving improvements in quality view shortfalls as people issues rather than process issues, and consequently become frustrated when academic autonomy and tenure limits their ability to effect improvement (Massy, 2003). Professors usually can’t imagine doing more with less. Higher education faculty and staff need to understand CI, be motivated and empowered to produce it, be trained in continuous improvement processes, and be supported with the right tools and infrastructure. For educators, continuous improvement translates into quality improvement in all parts of the educational system.

According to Stupak & Leitner (2001), CI has not worked in higher education because:

> Higher education deals mostly with services; few universities are under the threat of losing customers (monopoly in providing services on campus) and so the incentive to increase quality and improve customer satisfaction is lacking; faculty and senior administrators have a perceived loss of power and authority with the implantation of CI; and there is considerable job security within higher education, not just through the tenure system but also with provisions provided many public employees (p. 17).

Contribution Margin Analysis

Contribution margin analysis is one of the types of models used in ABC costing. Contribution margins can loom large in decisions to expand or contract higher education departments or programs and depend on the variable components of cost and revenue. Contribution margins are calculated as total income minus total expenses and measure the funds available to support the infrastructure of a department or unit. Contribution margins are a discrete measure of profit or loss but in a strictly economic sense.

Contribution margins can be expressed in two forms: “raw” and “adjusted” (Meyerson and Massy, 1995). The raw margins are the bottom lines expressed as simple difference between revenues and expenses. The contribution margins can be “adjusted” by dividing the bottom line by revenues or costs. The advantage of creating revenue or cost adjusted contribution margins is that they offer a basis for intradepartmental or interdepartmental comparability; such analysis yields interesting comparisons (Meyerson and Massy, 1995).

The contribution margin represents the unallocated cost of managing an academic unit. It is a number that seldom appears in the lexicon of non-profit financial analysis despite its inherent utility as a device for measuring and comparing unit performance (Meyerson and Massy, 1995). Boosting efficiency means reducing variable cost, which will increase the contribution with other things being equal (Massy, 2003). The array of contribution margins must be consistent with the university's values – for example, the relative contributions of business and divinity must feel right to decision makers (Massy, 2003).

Control Charts

A control chart is a quantitative management tool that is used to differentiate between variation in a process that results from common causes as compared to variation resulting from special causes (Florida Department of Health, 2011). Control charts are a fundamental management tool used in analyzing statistical control of a process and can be a tool used for continuous improvement. Western Electric's (1956) *Statistical Quality Control Handbook* provided a detailed "how to" use control charts while Deming (1986, 1993) provided a managerial overview on the use of control charts.

Control charts typically investigate how a process changes over time. Data are plotted in time series and lines for the average (or mean); the upper control limit; and the lower control limit are plotted. These lines are determined from historical data and are functions of the standard deviation (Tague, 2004). A control chart is used to compare current data to these lines which allows the user to determine whether the process being reviewed has consistent variation and is in control, or if the variation is unpredictable and the process is out of control, and potentially affected by special causes (Wheeler & Chambers, 1992). Pierchala and Surti (1999) stated that control charts should be used as a management tool to discover quality problems, which may then be corrected to improve the process or system. Control charts are often used in higher education continuous improvement efforts.

Cost Benefit Analysis

This quantitative tool is used to analyze the potential achievement of a goal with a focus on linking the relative amount of success in meeting goals to the cost of the effort involved. Cost benefit analysis is seen by many as being insensitive to political issues and often times the benefits are difficult to quantify (Nedwek, 1996). Cost-benefit ratios are often calculated when analyzing competing proposals and also have been used in the context of accountability in higher education (Lawrence, 1975; Swiger & Klaus, 1996).

Cost benefit analysis is often used to determine how resources should be allocated. Cost benefit analysis is not a methodology as to how resource allocation decisions should actually be made as politicians and bureaucrats are often reluctant to hear the economic arguments that are provided by the implementation of cost benefit analysis. Bureaucrats and politicians often view costs and benefits with distinct differences, their viewpoint often dependent on their place within their agency. Those educated in cost benefit analysis may modify their point of reference and viewpoints as a consequence of their bureaucratic roles (Boardman, Greenberg, Vining & Weimer, 2006). The decision maker should only be aided by the use of cost benefit analysis; it should not be the sole basis for action.

Cost benefit analysis has limitations. There are technical limitations in theory, data, and analytical resources that make it impossible to measure and value all impacts of a policy as commensurate costs and benefits (Stokey & Zeckhauser (1978) and Boardman, et al., (2006). In these cases, it is often important to bring in a more qualitative approach to cost benefit analysis where qualitative estimates are brought into the analysis. Another limitation is that cost-benefit analysis focuses only costs and benefits that can be identified at the time of the study (Stokey & Zeckhauser, 1978).

Cost benefit analysis has penetrated deep into the government structure and has found a useful role in the planning, design, and operating phases of programs (Margolis, 1974). The Federal government mandated the general use of cost benefit analysis in 1981 and confirmed the commitment to its use in 1994 (Shapiro, 2010). Some federal laws now require some form of cost benefit analysis while many Western industrialized countries have these same requirements for their programs (Boardman et al., 2006).

Cost benefit analysis has become an important field in educational administration (Adams, Harkins, Kingston, & Schroeder, 1978; Swiger & Klaus, 1996; and Toombs, 1973). The growth of cost benefit analysis has taken place largely in the context of accountability (Adams, et al., 1978). However, at the same time, cost benefit analysis in higher education is controversial. There is a good deal of opposition to the use of cost benefit analysis as a measure of the value of educational programs and services (Lawrence, 1975). The trouble is that in postsecondary education, there is no output unit of measure that is easily comparable. Higher education cannot neatly and reassuringly quantify the benefits, or outputs, or outcomes, or consequences of education; indeed, it cannot even settle on one general term for them (Levin, 1987). This has made cost comparisons between institutions difficult and potentially misleading as measuring outcomes in higher education is still in a primitive state (Lawrence, 1975).

Dashboards

Dashboards are visual representations of key, select indicators and are designed to highlight important trends or other insights (Rosenberg, 2010). Dashboards communicate how something is performing in a general sense. The most commonly cited reason among business intelligence software vendors for interest in tools such as dashboards is new leadership (Rosenberg, 2010). For example, when President Michael M. Crow took control of Arizona State University in 2002 he mandated the rollout of university-wide dashboards and analytical tools while when Karen S. Hayes began her tenure as President of California State University-San Marcos she mandated the use of dashboards at the departmental level (Rosenberg, 2010).

Kirwan (2007) noted that the University of Maryland System developed a series of performance measures – "dashboard indicators" as part of the System's efforts to increase transparency and accountability to internal and external stakeholders. The core dashboard indicators that were developed were: average SAT scores; graduation rates; retention rates; freshmen acceptance rates; minorities as percentage of total undergraduate students; total research and development expenditure per full time faculty member; facilities utilization (number of hours a classroom was in use); and teaching workload; they also developed indicators for specific degree programs (Kirwan, 2007).

The dashboards used by the College of Norte Dame of Maryland include: student enrollment by program, cost per student, and alumni participation in the annual fund (Fain, 2009). The University of North Texas (UNT) Health Science Center developed web-based dashboards driven by extracted ERP data, which led to consistent definitions for key data elements across UNT campuses. The use of dashboards at UNT has been expanded such that each department has its own dashboards that align with university goals and reporting needs. (Yanosky, 2007). Higher education trustees should pick key indicators for their institution's dashboards; each indicator should be defined in such a way that it is understandable and include a goal or target. Dashboards are often developed through data mining and data warehouses.

Data-mining and Data Warehouses

Luan (2002) described data mining as an investigative and analytical data analysis tools whose goal is to identify systematic relationships between/among variables when there are no (or incomplete) preconceived ideas as to the nature and extent of the relationships. The Gartner Group (2007) defined data mining as a process of noticing significant new correlations, patterns and trends by analyzing large data sets stored in data warehouses through the use of "pattern recognition technologies" as well as statistical and mathematical techniques. Rubenking (2001) described data mining as the process of extracting relevant and timely information and relationships from large data sets. He states that data mining isn't just looking for specific information within a set of data, it begins with a question or hypothesis regarding a relationship in the data and then attempts to find patterns that exist in the data to support the question or hypothesis.

Han and Kamber (2006) defined data mining as discovering “hidden images,” trends or patterns within data sets and then developing predictions for outcomes or activities. Feelders, Daniels & Holsheimer (2000) stated that data mining is the extraction of information from large data sets, which are typically stored in data warehouses, using various data mining methods such as clustering, classification, and neural networks. Data mining is often described as the extraction of hidden information from large volumes of real world data.

Data mining uses a variety of methodologies to locate patterns and relationships within data sets and then discovers relationships within the data that help develop models used to predict the future and assist managers in making decisions. Data mining can begin with summary information that a user “drills down” to obtain more detailed information (Haag, et al., 2006). The vast amount of data within organizations requires computer-based modeling to extract useful information from recorded data. As such, a shift has occurred with business analysts spending less time performing hands-on data analysis while the use of more complex and sophisticated methodologies and data mining tools has necessitated the use of computer based, automatic data. Data mining seeks to identify trends within data sets and through the use of sophisticated algorithms providing non-statisticians the opportunity to identify key attributes of business processes and target new business opportunities and areas for improvement (Ranjan & Ranjan, 2010).

The growing volume of data in the higher education has prompted many higher education institutions to begin using data warehouses and data mining as management tools within their universities (Ranjan & Ranjan, 2010). Data mining tools used today provide an easy to use interface which helps users to quickly develop an understanding of the data structures allowing them to analyze the data to assist in strategic decision making. Data mining provides new ways to present and disseminate information faster than ever before (Wallace, 2008). Luan (2001 and 2002) discussed how data mining could be used within the framework of knowledge management, the impending application of data mining to higher education, and how data mining may be able to better allocate resources to improve efficiency in academics. The use of data mining in higher education may be able to assist in bridging the knowledge gaps that exists today.

Decision Trees

Decision trees are a graphical tool for describing the actions available to the decision maker, the events that can occur, and the relationship between these actions and events (Bierman, Bonini, & Hausman, 1986). Decision trees help to break down outcomes or ideas into major subcategories and are used when large concepts need to be broken down into manageable or more easily understood components (Langford, 2008).

Decision trees present a sequential logical structure of decision problems in terms of sequences of decisions and realizations of contingencies using a diagram that link the initial decision (trunk) to final outcomes (branches). A branch is a single strategy or event possibility which connects either two nodes or a node and an outcome while a decision node is a point on the decision tree from which two or more branches emerge (Gordon, et al., 1990). Using backward induction, one works from the final outcomes back to the initial decisions calculating the expected values of net benefits across the contingencies and eliminating branches with lower expected net values of net benefits (Boardman, et al., 2006). Decision trees may be employed within higher education as a useful tool that can be used to explore data, allowing users to locate patterns within the data that would not otherwise be apparent.

Decision trees use a “divide-and-conquer” approach to define the effects of an attribute, or set of attributes, on a dependent variable (Mahoui, Childress, & Hansen, 2010). Taken to the extreme, decision trees can be seen as a tool that segments the original dataset to the point where each segment could be a leaf of a tree. Decision trees work well when used in concert with data mining and therefore can be used for both exploration and prediction of academic problems (Ranjan & Ranjan, 2010).

Decision trees have been used in higher education to take a large number of variables and remove variables to strip data sets and information into more useable segments. Mahoui, et al. (2010) looked at supplemental learning assistance and supplemental instruction at Indiana University Purdue University Indianapolis and their impact of student retention in their research following the institution’s 2006 cohort through Spring 2010. Bonabeau (2003) noted that decision trees often cannot adequately account for emergent phenomena or chance events and can become unwieldy and tend to provide unreliable answers.

Delayering the Institution

Delayering is a reduction in the levels within an organization. Delayering usually means increasing the number of staff managers supervise within the organization. By the end of the 20th century, five or so layers were seen as the maximum with which any large organization could function effectively and delayering was seen as a management tool to trim the layers of management within a large corporation to this level (Hindle, 2008). When delayering occurs the layers that are typically removed are those of middle management. Delayering involves a redesign of an organization's structure to respond to changes in the internal and external environment. With delayering there is a flattening of the organization structure from the typical pyramid seen in most management textbooks into a somewhat more horizontal structure. If an organization is going through a delayering exercise it is not a denial of the need for structure within the organization, it is more likely a realization that there is a need to become more efficient in the allocation of resources and the need to increase manager's span of control.

Hindle, (2008) listed the following benefits for a delayered organization:

1) it needs fewer managers;
2) it is less bureaucratic;
3) it can take decisions more quickly;
4) it encourages innovation;
5) it brings managers into closer contact with the organization's customers;
6) it produces cross-functional employees; and
7) it improves communication within the organization.

The benefits described by Hindle are hard to achieve, and delayering often fails in implementation. Additionally, as managers take on more responsibility overseeing more areas within the institution, there is a common request for increased compensation for their efforts.

Within higher education, delayering can be seen as institutions collapse the number of departments within a college or business unit eliminating department heads and administrative staff in order to reduce budgets. Some institutions have also eliminated colleges, moving the departments under one college to another thus eliminating the dean position and the related administrative staff. For example, California Polytechnic University, San Luis Obispo eliminated its College of Education, moving it to a “school” under the College of Science and Mathematics. Another example of delayering an institution was at the University of Nevada, Reno, a land grant institution, which recently considered the elimination of the College of Agriculture, moving departments under the College of Science and the College of Business.

Environmental Scans

Brown and Weiner (1985) defined environmental scanning as "a kind of radar to scan the world systematically and signal the new, the unexpected, the major and the minor" (p. ix). Coates (1985) identified the following objectives of an environmental scanning system:

> 1) detecting scientific, technical, economic, social, and political trends and events important to the institution;
> 2) defining the potential threats, opportunities, or changes for the institution implied by those trends and events;
> 3) promoting a future orientation in the thinking of management and staff; and
> 4) alerting management and staff to trends that are converging, diverging, speeding up, slowing down, or interacting. (p. 2335)

Environmental scanning is an activity that typically takes place during a review of the external environment during strategic planning or a SWOT analysis. The goal of environmental scanning is to make management aware of important changes that may be occurring in the external environment so that management can have adequate time to consider the effect of the changes on the organization. As a result, the scope of environmental scanning is broad (Morrison, 1992).

Many strategic planning exercises within institutions of higher education use some form of environmental scanning. Friedel, Coker, and Blong (1991), Meixell (1990), and Pritchett (1990) researched the use of environmental scanning at colleges and universities or the departments within them. Morrill (2007) warned that there are enormous variations in the way institutions do environmental scans, if they do them at all. There are good reasons to be cautious about environmental scans, but not enough to abandon them; it depends on how they are done. Morrill (2007) noted that environmental scans are often misfired in early generations of strategic planning, frequently because the users were trying to use the scans to predict the future.

Environmental scanning is typically the starting point of an external analysis during strategic planning. Environmental scanning allows higher education administrators to identify developments and occurrences in the external environment which they should monitor. Environmental scanning provides these administrators a basis to better evaluate the strategic direction of an institution of higher education for strategic planning.

Factor Analysis

Factor analysis is a qualitative management tool that looks to discover relationship patterns underlying different phenomenon (Rummel, 2002). Cohen (2005) described factor analysis as a statistical method used to illustrate differences between observed variables in terms of fewer unobserved variables or factors; the observed variables are typically modeled as linear combinations of the factors, plus "error" terms. Factor analysis shows which “test” items measure the same thing; the test items would have a significant correlation on the same construct or factor (Childers, 1991). The information gained through factor analysis regarding the interdependencies between variables can also be used to reduce the set of variables in a dataset. Floyd (1991) stated that factor analysis originated in psychometrics, and is used in behavioral and social sciences, marketing, product management, operations research, and other applied sciences that deal with large quantities of data.

Factor analysis is mostly used for data reduction purposes: to obtain a smaller set of variables (preferably uncorrelated variables) from a large set of variables (most of which are correlated to each other), or to develop indexes with variables that measure comparable items (Stevens, 1986). Exploratory factor analysis is when a researcher does not have a pre-defined idea of the structure or how many dimensions there are in a set of variables while confirmatory factor analysis is when the researcher has a pre-determined hypothesis regarding the structure or the number of dimensions underlying a set of variables (Cohen, 2005).

Factor analysis is used extensively in higher education. Some examples are Davis and Murrell (1990) use of factor analysis to review outcome assessment at a large doctoral institution. Frances Stage at New York University's Steinhardt School of Education teaches a doctoral level course on factor analysis and structural equation modeling for higher education (Stage, 2011). Crisp (2010) used factor analysis to research mentoring among undergraduate students attending a Hispanic serving institution.

Flowcharting

Flowcharts are visual representations that can increase efficiency and effectiveness by allowing one to better understand how processes function; flowcharts eliminate conjecture and assumptions and heighten communication (DiPierro, 2010). A flow chart is a management tool that helps users create pictures of the steps in a process (Sellers, 1997). A flow chart shows the sequence of events or path of activities in a process, essentially a picture of any process. Burr (1990) describes a process as a series of sequentially ordered, repeatable events that have a beginning and an end, and which result in either a product or a service. Flowcharting and other analytical techniques are used in process design to develop a clear understanding of a process, how it currently works, and to assist in identifying what might be wrong with it (Massy, 2007).

Flowcharts help to identify problems and areas of confusion when used in a group or team setting, as well as helping to build consensus and commitment among participants (HCI Consulting, 2011). Flowcharts, scatter diagrams, histograms, check sheets, cause-and-effect diagrams, control charts, and Pareto charts the seven tools of quality used in continuous improvement efforts (ReVelle, 2003).

Flowcharts are used in several areas within higher education. For example, Williams (1993) discussed the University of Kansas' experience in applying continuous improvement methods and how flowcharts substantially reduce the time spent on a complex data-collection and reporting processes. The Missouri Coordinating Board for Higher Education flowcharted the typical lender flow processing scheme so that students can better understand the process (Lender process flowchart, 2011). DiPierro (2010) documented doctoral process flowcharts at Western Michigan University to increase retention within the institution's various colleges; yet she stated that flowchart use among academicians was underwhelming, and finding synergy between need and application can be challenging.

Focus Groups

Heller and Hindle (1998) defined a focus group as a meeting of individuals or experts with specific knowledge on a subject. Focus groups are typically a subset of a larger group and are used to generate ideas or forecasts. Focus groups typically supply researchers with more surprises than other types of research as focus group participants are often allowed to say anything they'd like during focus groups sessions (Grudens-Schuck, Lundy Allen & Larson 2004). Like survey research, focus groups require a dedication to the painstaking collection of high quality data, special training, and truthful reporting (Grudens-Schuck et al., 2004).

Focus groups are essentially a group interview where the social interaction of the participants can shape the data and the functions it serves. A focus group should be comprised of individuals who share similar viewpoints as ideas are sometimes self-censored by focus group participants in the presence of people whose viewpoints differ greatly from them. Focus groups need to be flexible not standardized as the researcher needs to keep the focus group moving forward on a topic of interest. Focus groups rely upon participant statements, observations of their tone and mannerisms, and the focus group report should feature patterns formed by words, called themes or perspectives (Grudens-Schuck et al., 2004).

Group decision making, such as through the use of focus groups, is further enhanced by the systematic use of facts and data (Stupak & Leitner, 2004). By examining an issue, the types of information that need to be collected in order to solve the problem are identified. In this team-solving approach, it is common for managers as well as rank and file employees to be familiar with the topic at hand so as to provide a homogenous focus group. Decisions that are reached through group dynamics such as focus groups require, above all, a dynamic group and poor group decisions are often attributable to the failure to change things and question assumptions regarding the process (Buchanan & O’Connell, 2006). Consensus is good, except when it comes too easily as in the case of a “rubber stamp,” in which case the consensus and the decision it supports becomes suspect. Drucker (1995) stated that the most important decision is what kind of team to use to make a decision, not the outcome of the group decision itself.

Focus groups have been used in higher education finance for many years. For example, Wegmann, Cunningham, and Merisotis (1993) discussed the use of regional focus groups with National Association of Student Financial Aid Administrators members on the role of private loans in higher education financing. Ponford and Masters (1998) discussed focus group research in institutions of higher learning based on experiences with groups including determining research questions, determining sampling frames, selecting moderators, developing a discussion guide, recruiting participants, conducting and recording the focus group, and analyzing, using, and interpreting focus-group data. The National Center for Public Policy and Higher Education, an independent, non-profit, non-partisan organization, conducted focus groups to examine three topics: the costs and benefits of higher education; statewide governance of higher education; and the public purposes of higher education (National Center for Public Policy and Higher Education, 2011). Universities have also turned to online focus groups and social media websites to solicit responses on topics as well as advertise the time and place for focus group meetings. If you conduct a web search for focus groups in higher education several Facebook sites are listed discussing various university focus groups on topics from admissions to tuition and fees.

Histograms

Histograms are a graphical summary of frequency distribution in data. Histograms were first implemented in 1950 by Kaoru Ishikawa, one of Japans' most renowned experts on continuous improvement (Orfano, 2009). Measurements taken from a process can be summarized through a histogram. Data is organized in a histogram to permit those reviewing the process to observe any patterns in the data that could be difficult to distinguish in a table (Summers, 2003). Histograms can be used when one wishes to disseminate data quickly and easily to others. Histograms look like bar charts, but there are distinct differences between the two.

Bar charts present "categorical data," data that can be grouped into categories where histograms typically display "continuous data," data that corresponds to a measured quantity where the numbers can represent any value in a certain range (Tague, 2004). Histograms are a variation of a bar chart where data values are assembled together and placed into different categories allowing the reader to see how frequently data in each category occurs in the data set. In a histogram, higher bars reflect a larger number of data values in a category.

After development of a histogram it can be used as a management tool for continuous improvement. One can view the histogram, analyze its shape, along with statistics calculated from the raw data (e.g., the mean, minimum, maximum, standard deviation), and get a good idea of where any problems might be, or where to make any changes to a process (Orfano, 2009).

Internal Rate of Return

In the arena of financial management, there are few management tools more essential and omnipresent than internal rate of return (IRR) calculations. IRR is appropriate to capital budgeting practices or to compare the profitability of investments and is taught to students in finance, accounting, and economics courses, as well as to engineering students (Walker, Check & Randall, 2010). The IRR refers to the yield or interest rate that equates present value of expected cash flows from an investment project to the cost of the investment project and is calculated as setting the net present value (NPV) for an investment project to zero (Brealey & Myers, 2007). In looking at an investment, the IRR must be greater than or equal to the incremental cost of capital for the project to be a good candidate for investment (Shim, Siegel & Simon, 1986). The IRR is also called the effective interest rate when looking at savings or loans.

As a management tool, IRR should not be used to rate or rank mutually exclusive projects, but to decide whether a single project is worth investing in (Brealey & Myers, 2007). One criticism of IRR is that it assumes reinvestment of cash flows in projects with equal rates of return and therefore, it overstates the annual equivalent rate of return for a project whose cash flows are reinvested at a rate lower than the calculated IRR (Brealey & Myers, 2007). Internal rate of return should not be used to compare projects of different lengths as it does not consider the cost of capital. Academics have a strong preference for NPV whereas executives prefer IRR over NPV (Pogue, 2004).

In higher education finance, the IRR is often used to evaluate alternative capital investment decisions, especially in these days of limited resources. Over the course of the last two decades, stakeholders have asked researchers to investigate the return on investment in higher education.

Interrelationship Diagram

The interrelationship diagram (digraph, network diagram, relations diagram) is a graphical management tool used to display the rational and causal relationships, cause-and-effect relationships, between the factors causing variations. This analysis can assist a group in differentiating between issues that are drivers (inputs) and those that are outputs. The process of creating an interrelationship diagram has also been found to help a group examine the natural linkages amongst diverse aspects of a complex problem and therefore can be used when a team is struggling to understand the relationships among several issues associated with a process (Teague, 2004). The interrelationship diagram can also be useful in identifying root causes (Langford, 2008).

An interrelationship diagram should be used:

1) when trying to understand links between ideas or cause-and-effect relationships, such as when trying to identify an area of greatest impact for improvement;
2) when a complex issue is being analyzed for causes;
3) when a complex solution is being implemented;
4) after generating an affinity diagram, cause-and-effect diagram, or tree diagram, to more completely explore the relations of ideas. (Teague, 2004, p. 277)

An interrelationship diagram is developed by gathering ideas through other tools such as affinity diagrams and grouping them in a circular pattern on a flip chart. Arrows are drawn to show the relationships between items, leading from cause to effect. The number of arrows leading “in” and “out” of each item within the process are counted. Items that have a high number of “out” arrows are important drivers of the process. A high number of “in” arrows suggests important outcomes and candidates for measures of success. The use of interrelationship diagrams can help display relationships between items.

Management by Walking Around (MBWA)

MBWA typically includes: 1) managers spending time to walk around their departments or being available for spontaneous discussions; 2) opportunities for discussions during breaks or in halls; and 3) managers leaving their desks to begin discussions with individual employees (Hindle, 2008). Managers implementing MBWA should learn employee concerns and problems directly and they should at the same time provide employees new ideas and methods to manage the issues that are being brought up; communication should go from employee to manager and from manager to employee.

Deming, as cited by Mallard (1999) stated that one of the main benefits of MBWA is: “If you wait for people to come to you, you'll only get small problems. You must go and find them. The big problems are where people don't realize they have one in the first place” (n.p.). However, a problem when using MBWA is that employees may be concerned that managers are really trying to see what they are doing or unnecessarily interfere in their work. This concern usually dissipates if the manager conducts their walks regularly, and if the employees can see the benefits to their manager’s presence. Hindle (2008) noted that MBWA has been found to be beneficial when an organization is under exceptional stress; for instance, after employees have been notified of a significant corporate reorganization or when a reorganization is about to occur.

Nowadays, it does not seem unusual that managers use MBWA; mobile communications have made it easy to walk around and stay in touch with employees. Tom Peters, in his book, “A Passion for Excellence”, said that he saw managing by wandering about as the basis of leadership and excellence (Peters & Austin, 1985).

Operational Analysis

Operational analysis is a management tool used to examine the performance of an operational investment, often over time, and measuring that performance against an established set of cost, schedule, and performance parameters (Department of Commerce, 2012). Operational analysis is creative in nature and should cause the user to determine how objectives could be better achieved, how to reduce costs, or whether the function being reviewed should even be performed. An operational analysis should prove that a thorough examination of the need for the investment has occurred, show the performance being achieved by the investment, if the organization should continue its investment, and potential options to achieve the same investment results (Denning & Buzen, 1978).

Operational analysis goes beyond a financial analysis of an organization and looks at processes that are key contributors to the organization's financial statements, usually focusing on revenues and expenses. Often, an operational analysis will highlight the qualitative characteristics of a financial index which may relate to functions that are outside of the financial operations such as human resources or engineering. An operational analysis provides basic information which is a required for meaningful financial analysis. Operational analysis is often used in benchmarking and typically uses countless indices that are investigated and reported upon.

Peer Reviews

Peer reviews can also be a form of benchmarking where an evaluation of the performance of a member of a peer group is undertaken by experts drawn from that group (Langford, 2008). Peer reviews may also be described as visits by others within or outside a department/organization that tests a department’s/organization’s thinking through structured conversation (Massy, 2007). Peer reviews may lead to actions to improve quality. Organizational audits, a type of peer review, often use faculty peers to review, self-study and to participate in site visits; using faculty peers enhances the quality of the review and creates a meaningful dialogue with credibility (Massy, 2007). One benefit of peer reviews is that they can develop thoughtful and introspective faculty members who are comfortable asking themselves and their colleagues puzzling questions (Davis, 1991).

Peer reviews are used in higher education. For example, in higher education a peer group of CFOs may be asked to review the accounting controls within an institution of higher education. Another example in higher education is peer reviewed journals where peer reviews are conducted to determine if a colleague's research is publishable. Other examples include institutional accreditation reviews or those that subject an author's scholarly work, research, or ideas to the scrutiny of others who are experts in the same field (Davis & Murrell, 1991). No matter if it is a review of a department, an institution, or the review of an article; peer reviews involve qualified individuals who conduct an impartial review of the matter at hand.

PERT (Program Evaluation and Review Technique) Chart

PERT charts are a diagrammatic representation of the sequence of activities and events necessary to complete a project and helps a manager to visualize how the project must proceed (Gordon, Pressmen, & Cohn, 1990). PERT charts are designed to aid a manager in planning and controlling a large, complex project with a series of activities that contains a combination of series and parallel events (Bierman et al., 1986). A PERT chart allows a manager to calculate the expected total amount of time the entire project will take to complete. The technique highlights the bottleneck activities in the project so that the manager may either allocate more resources to them or keep careful watch on them as the project progresses.

Ratio Analysis

Ratio analysis involves methods of calculating and interpreting financial ratios to assess a firm's performance and status compared to similar organizations (Brigham & Ehrhardt, 2008). Typically, ratios are developed from financial statements and are compared to other organizations at a period in time (cross sectional) or over a period of time (time series). Ratio analysis has emerged as a significant management tool in higher education. Ratio analysis is a valuable tool in financial self-assessment and in inter-institutional comparisons. Managers assume that ratios provide a basis to accurately interpret the information found in the financial statements.

Increased attention in the use of financial ratios in higher education can be traced to several events in the 1970's. The National Commission on the Financing of Postsecondary Education (1973) recommended national standard indicators should be developed to determine the relative financial status of the different types of postsecondary educational institutions. The National Association of College and University Business Officers (NACUBO) published "College and University Business Administration" in 1974 which established accounting guidelines and classifications for colleges and universities. Curry (1998) discussed Peat Marwick and Minter & Associates development of ratio analysis specifically for colleges and universities. A study conducted by Gomber and Atelsek (as cited by Curry, 1998), found that ratio analysis was useful as a management tool in determining an institution's financial viability. In 1992, NACUBO and Coopers & Lybrand designed and implemented a national database of key benchmarks for 38 functional areas ranging from academic affairs to treasury for use in ratio analysis (Kempner & Shafer, 1993). All of these endeavors combined to elevate the importance of ratio analysis in assessing the financial condition of institutions of higher education (Brockenbough, 2004).

The majority of the research conducted on financial ratios in higher education was conducted prior to several significant changes that were implemented by the Financial Accounting Standards Board and Governmental Accounting Standards Board for non-profit organizations, and although the research on the usefulness of financial ratios in higher education has slowed, the use of financial ratios by the federal government has extended to other areas that affect higher education (Fisher, Gordon, Greenlee & Keating, 2003). This includes ratio analysis being used for the student financial aid programs at institutions of higher education (Brockenbough, 2004).

Effective decision making requires that "leverage points" be deeply understood and charted, including the key ratios that indicate financial position (Morrill, 2007). A dashboard of strategic performance measures may include key ratios such as debt to assets, debt payments to revenues, tuition after discounts, and unrestricted earnings. Most accounting firms can provide a set of analytical and comparative ratios for colleges and universities, and bond agencies create powerful sets of metrics in issuing ratings (Morrill, 2007). However, there are difficulties in comparing the three major types of institutions: four year public, four year private and two year institutions with each other (Brockenbough, 2004). As such, comparisons should be conducted within the specific type of institution. Doerfel & Bruben (2002) stated that considering the financial exigency that many institutions face, any management tool that assists in financial analysis is welcomed.

Regression Analysis

Simply put, regression analysis attempts to identify factors that closely correlate with issues that one seeks to analyze. Linear regression provides a way to statistically examine the effects of one or more explanatory variables (factors) on the variable of interest (the dependent variable) or the issue being analyzed (Davenport, 2006). Regression analysis requires the assumption that the effects of the various explanatory variables on the dependent variable are additive (Boardman et al., 2006). Quantitative reasoning, such as regression analysis, is used to isolate and examine key strategic issues and becomes a way to test the relationship of different variables in the data. Generally, experts recommend indicators be developed around a number of critical decision areas such as financial affairs, academic affairs, admissions and enrollment, institutional advancement, human resources, student affairs, athletics, and facilities (Morrill, 2007).

Massa & Parker (2007) discussed how Dickinson College collected as much data as possible on prospective students and on admitted and enrolled students to develop a logistical regression enrollment projection model. This model became an invaluable tool for staff as they refined the characteristics of the incoming class: diversity, academic and financial. The model did not did not tell staff whom to admit on the basis of the likelihood of enrollment; it projected the class in the aggregate by adding all of the enrollment probabilities and the proportion of each characteristic appropriate to that probability (Massa & Parker, 2007).

Responsibility Centered Management (RCM)

RCM is a system that accumulates and reports information based on plans and actions of four types of responsibility centers, cost, revenue, profit and investment centers (Hearn, Lewis, Kallsen, Holdsworth & Jones, 2006). RCM uses responsibility accounting in a decentralized manner, pushing the responsibility to low levels within the organization and making each manager responsible for their budget (Horngren, Srikant, & Foster, 2003). RCM eliminates the disconnect between revenue generation and budget allocation. It allows each school or department within a university to stand alone and operate on (and is accountable for) however much money it generates. The general aim of RCM is to assimilate budgeting and management decision-making at the level of individual cost centers within organizations (Hearn et al., 2006). RCM places more decision making but more accountability at the departmental or unit level.

The idea of individual departments being accountable for revenue production and certain related costs has been around for decades. Jon Strauss was the first individual to use RCM in higher education when he implemented responsibility centered budgeting at The University of Pennsylvania in the 1970s (Strauss, Curry, & Whalen, 1996). Strauss went on to implement RCM at the University of Southern California and Worchester

Polytechnic University. Strauss et al., (1996) noted that although Strauss believed there were barriers to implementation of RCM, there are advantages which can be gained in institutions which have decentralized budgets and management systems that motivate with incentives that promote the objectives of the university. Other universities, mainly private institutions, also implemented RCM (Lasher & Greene, 1993; Rodas, 2001).

Public universities were slower to implement RCM, preferring their well-entrenched budgeting model of having revenue streams directed to central administration where funds can be redistributed within the institution according to its priorities (Hearn, et al., 2006). An increasing number of public higher education institutions have adopted RCM (Priest, Becker, Hossler & St. John, 2002; West, Seidits, DiMattia & Whalen, 1997).

RCM acknowledges market forces within an institution, encourages efficient allocation of resources, and makes subsidies to programs within the institution a matter of choice rather than a routine or a requirement (Hearn, et al., 2006). RCM supporters dismiss the view of Bowen (1980) and others within higher education that, when a college or university is confronting a difficult financial position, the budgets of all units should be cut by their proportionate share (West et al., 1997). RCM proponents argue that the differential funding used in RCM can actually preserve and foster the development of college/university strengths while bringing increased efficiency and effectiveness during difficult times. Incentive based systems such as RCM are thought to direct more focus to students and to identify other revenue providers as customers rather than as inputs to the system (Gros Louis & Thompson, 2002). However, RCM exemplifies formulaic decentralization known colloquially as “every tub has its own bottom (ETOB).” Early users recognized that pure ETOB tended to limit the institution’s ability to cross-subsidize departments and as a result, RCM often taxes revenues and redistributes the proceeds in the form of subsidies, including mechanisms for recovering the cost of administrative and support services (Massy, 2003).

Academic productivity is central to RCM and RCM seeks to pair accountability for results with autonomy. Today, faced with year after year of budget cuts, higher education is still unwilling to close unproductive programs. Levin (1991) stated that colleges and universities could increase productivity if they would develop clear goals and objectives, along with measures of their performance. Gayle et al. (2003) asked if traditional universities should try to be like for-profit institutions and eliminate unprofitable courses. However, sacred cows within institutions of higher education still exist even as funding has been reduced in some states by more than 30% in the last five to ten years.

Cantor and Whetten (1997) stated that RCM can lower incentives for collaboration between units while other critics of RCM contend that it does not favor academic unit values. Wergin and Seigen (2000) went as far as criticizing RCM because it “balkanizes” academic units and thus reduces incentives for cooperation. Adams (1997) noted that RCM “places at the heart of the university a mode of rationality in decision-making that subverts educational policy and weakens the university’s ability for corrective criticism” (p.59). Other critics believe that RCM, once imbedded and implemented in an institution’s culture, may push past strong boundaries (Whalen, 1991). Whalen (1991) also suggested that RCM approaches need to be cautiously observed to guarantee that information will be provided timely, and developed accurately, so that decision makers can be effective and efficient in carrying out their responsibilities. Toutkousian and Danielson (2002) argued that it is hard to determine if RCM is effective as methods to evaluate its performance in higher education have not been well identified and relationships between RCM and other influences on performance don't take into account the potential effect of other influences on those identical metrics.

Gros Louis and Thompson (2002) and Lang (2002) stated that intra-unit collaboration may be helped by RCM in certain conditions. According to Wergin and Seigen (2000), under RCM units did in fact become more fiscally responsible and they did put their flexibility to creative use. However, Wergin and Seigen (2000) did not provide evidence of greater attention to program quality.

RCM must be used with measurement and evaluation systems that are well documented and open to examination. RCM requires institutions to be more transparent in their budgeting and program investments. To the extent that higher education can accept that transparency through properly designed and applied incentives and information systems, RCM can contribute to the success of the institution. As Priest et al. (2002) noted, RCM is still evolving and is a work in progress.

Return on Investment (ROI)

ROI is a model and tool used by institutions of higher education for accessing their use of resources towards achieving the institution's mission, goals, and objectives

(Redlinger & Valcik, 2008). The data produced by a ROI model contributes towards transparency in policy discussions and allows for the analysis of the key factors that drive performance and costs within an academic unit, producing increased efficiencies, more effective operations, and added accountability (Massy, 2003). ROI is a management tool that can assist in differentiating between departments that struggle financially, but are required within the institution, and departments that are inefficient; or support programs, departments, or majors that are not viable (Redlinger & Valcik, 2008). A thorough review of costs and revenues is required today in higher education as this information is needed to control costs, improve efficiency, and improve the effectiveness and quality of education (Redlinger & Valcik, 2008).

Using ROI allows for a more vigorous means of allocation of higher education resources and provides the basis for increased transparency to higher education stakeholders. ROI provides department heads a management tool which can be used to track performance and can also be used during planning. Wallace (2008) describes a ROI model developed by Redlinger & Valcik to identify sources of revenue streams from formula funding and tuition and then following those revenues to faculty instruction activities and to the students that pay the tuition, then allowing the ROI for each faculty member to be evaluated as to whether revenues exceed costs. Return on investment is crucial to higher education's stakeholders as it can be used to estimate whether an additional dollar invested in higher education achieves the desired benefits as compared to other types of investments (Fairweather & Hodges, 2006)

Redlinger & Valcik (2008) note that a criticism of ROI analysis is that universities are not for-profit businesses, they do not contain product lines that should be examined to see which one is more profitable than another, and that faculty members should not be evaluated on their cost of instruction and the revenue streams that they are able to generate. However, higher education cannot ignore the correlation of revenues and costs. A more thorough examination of the cost of instruction within colleges and universities is being conducted by many state agencies and this data is used as a basis to develop funding formulas. For example, in September 2010, Texas A&M University released a report that analyzed annual salaries of professors against the number of students taught and tuition the faculty generated. The release of the data resulted an instantaneous uproar from the faculty who argued that the data was incomplete, error filled, and therefore misleading. The article also noted that increasingly, higher education stakeholders are requesting data proving that money is being well spent (Simon & Banchero, 2010).

Revenue and Expense Pro Formas

Revenue and expense pro formas can be defined as "a financial statement prepared on the basis of some assumed events and transactions that have not yet occurred," (Estes, 1981, p. 105). Pro forma financial statements are projections based upon certain assumptions and the historical financial statements of a business enterprise. Pro forma statements reflect a dynamic situation where changes may be possible to reach certain outcomes and, as a result, different options may be considered. Pro forma statements usually are of the same form as historical financial statements and typically have many, if not all, of the same categories.

Pro forma statements are a tool management can use when conducting financial analysis, in operational or strategic planning, or when an institution is reviewing a potential change that may have a significant impact on the enterprise (Estes, 1981). Revenue and expense pro formas are often used when an organization is considering a merger or acquisition, new debt financing, an investment in its physical plant or other fixed assets such as increasing production capacity, the launch a new business, or any other circumstance that may have a financial implication on the organization. A college or university might use revenue and expense pro formas to determine the impact of potential budget cuts on its operations and the impact on its annual operating budget. Operating budgets and financial plans used in strategic plans often contain revenue and expense pro formas that project the entity's financial performance for the time periods under examination and the financial assumptions included in the plans.

Revenue and expense pro formas use comprehensive financial projections and past associations between categories within the income statement. Revenue and expense pro formas are typically built from current financial statements. Current and historical statements are often presented with the pro formas to assist in comparison and analysis.

Reviewing Span of Control

Span of control refers to the number of subordinates a manager supervises. Reviewing an organization's span of control has direct links to delayering of organizations which was discussed earlier. Technology gains have allowed companies to reduce the number of middle managers overseeing subordinates increasing span of control and reducing costs. According to research by the Harvard Business Review over the past two decades, the CEO's average span of control, measured by the number of direct reports, has doubled, rising from about five in the mid-1980s to almost 10 in the mid-2000s (Neilson & Wulf, 2012).

Many factors affect span of control including:

1) geographical dispersion, the more widely dispersed a business is the span of control will be less;
2) capability of employees, if employees are motivated and take initiative the span of control will be wider;
3) capability of the supervisor, an experienced supervisor with good understanding of the tasks, good knowledge of the employees and good relationships with the employees will be able to supervise more staff;
4) similarity of task, if the tasks that the employees perform are similar, then the span of control can be wider; and
5) volume of the supervisor's other tasks, the more other responsibilities, the lower the number of direct reports the supervisor can manage (Ouchi & Dowling, 1974).

Scenario Planning

Scenario planning is also referred to as contingency planning or scenario thinking. Scenario planning is a well thought-out and ordered way for entities to consider potential future impacts and changes. Scenario planning is often used during strategic planning and can be thought of as a method for learning about the future by understanding the nature and impact of important driving forces affecting an organization (Rieley, 1997). Some methods used in strategic planning are based upon an assumption that the environment in which the organization operates three to ten years' from now will not significantly differ from today (Ringland, 1998). Scenario planning on the other hand assumes that the environment in which the organization operates can be quite different than today's. Scenario planning does not try to identify specific future events which may occur, but examines large-scale dynamic events that may impact the organization moving in a different direction (Wilkinson, 1996). A group of administrators may develop scenarios about potential future events that may occur and how these events may affect an issue that they face. For example, a state higher education authority might contemplate how changing demographics in the state impacts the need for new schools.

Scenario planning is not about doing the planning, it is a vehicle in which one begins to change the mental models of our world (Schoemaker, 1995). Scenario planning encourages the exchange of knowledge within an organization and promotes the development of an understanding of the significant concerns that are important to the future of an organization. According to Bain & Company's annual survey of management tools, fewer than 40% of companies used scenario planning as in 1999 but by 2009 its usage had risen to 70% (Rigsby & Bilodeau, 2009). Bain categorizes scenario planning in Enterprise Risk Management, an approach to making strategic and business decisions after considering major risks and opportunities to take a more value focused approach to risk management amid increasing volatility and uncertainty (Rigsby, 2011).

Scenario planning is not designed to give managers answers. Scenario planning can provide higher education administrators the chance to explore and expand their knowledge of the future, and what they can do as the future approaches (Rieley, 1997).

Scenario planning provides the chance to ask questions so that managers can become better at planning for the future.

Sensitivity Analysis (What-if Analysis)

Sensitivity analysis examines the effect that modifications in one part of a model have on other parts of the model. Typically, users alter the value of one variable in the model repeatedly and study the change in the other variables (Haag, et al., 2006). Sensitivity analysis is used because there is uncertainty about both the predicted impacts from decisions and dollar values of costs and benefits which may occur from such decisions. Potentially, every assumption can be changed and sensitivity analysis can be used infinitely. According to Boardman et al. (2006), one has to use judgment and focus on the most important assumptions when conducting sensitivity analysis.

The three most used types of sensitivity analysis are partial sensitivity analysis, worst and best case analysis, and Monte Carlo analysis (Bullard & Sebald, 1998). Partial sensitivity analysis looks at how net benefits change as one single assumption is changed. Partial sensitivity analysis is applied to what is believed to be the most significant and vague assumptions while analysts use worst and best case analysis to view the net benefits in what the analyst determines to be the most plausible situation and also under the least favorable or most conservative assumptions (Bullard & Sebald, 1998). Monte Carlo sensitivity analysis is a method that effectively takes into account the uncertainty of assumed parameters in complex analysis. Monte Carlo analysis has become more important as the cost of computing resources has declined and as software advances made its implementation more practical (Boardman et al., 2006).

Strengths-Weaknesses-Opportunities and Threats analysis (SWOT Analysis)

A SWOT analysis is a simple but powerful management tool for reviewing an organization's resource capabilities and deficiencies, its opportunities, and the current external threats to its future. The aim of a SWOT analysis is to determine the key internal and external issues that are important to achieving an objective. SWOT analysis explores information on internal factors – the strengths and weaknesses internal to the organization and external factors – the opportunities and threats presented by the external environment to the organization (Thompson & Strickland, 2005). Performing a SWOT analysis can help establish where an organization, team, or product stands in the marketplace and can assist in strategic decision making.

A SWOT analysis picks out those features of both the context and of the institution that represent threats and opportunities, strengths and weaknesses. The analysis is relational and contextual. One college's threat may be another's opportunity. Similarly, the strengths and weaknesses of an institution have greater or less salience depending on external trends (Morrill, 2007). A good SWOT analysis produces a substantial amount of organizational learning. The learning is not didactic but involves new levels of awareness and enlarged capacities for systematic thinking (Morrill, 2007). The insights about the most significant threats and opportunities will be determined through a process of relational thinking that systematically connects the most important trends and internal characteristics. The process is collaborative and interactive and it involves the insights and judgments from a variety of participants in the strategic conversation (Morrill, 2007).

SWOT analysis is often used in higher education strategic planning. Moen (2007) described how the University of Wisconsin-Stout performs a SWOT analysis approximately every five years as part of a stakeholder visioning process to examine strengths and weaknesses and perform an external survey of threats and opportunities. In today's higher education environment, SWOT analysis is a management tool university CFOs should consider using to develop data – facts and figures, performance trends, and emerging issues at the global, national, state, community, and organizational levels (Moen, 2007).

Trend Analysis

Trend analysis looks at information over time to determine if patterns or relationships exist in data which may be able to project future outcomes or provide information as to why a relationship occurs. Kreitner (2004) defined trend analysis as the hypothetical extension of a past series of events into the future. Massy (2003) noted that selecting measurements over time can recognize improvements or trends that may need to be stopped and corrected while reviewing time series data across similar organizations or operating units allows institutions of higher education to benchmark their progress and find out what could be accomplished with a different approach. Trend analysis data can assist a team in understanding its progress towards specific goals and objectives, recognize areas that need more attention, present a sense of closure, and offer a basis for extrinsic rewards (Massy, 2003). In many cases, the data should be presented in trend lines since the results for any given year often are not strategically significant, while recurring patterns reveal clear and decisive meanings. Accelerating or decelerating rates of change in the trends are of special significance as they often signal problems or opportunities (Morrill, 2007).

Yanosky (2007) discussed the importance of trend analysis in higher education. He noted that the University of Central Missouri has a data warehouse of time series high level key performance indicators. He quoted Mark Hoit, CIO of North Carolina State University, as stating "I think we can use trend analysis, detecting outliers, getting information on data flow and data changes to identify problems. Are things correlated that should be?" (Yanosky, 2007, p. 51). It should be possible for higher education CFOs to mix and match data elements and to analyze them not just to find past patterns and current performance but also to create informed models and scenarios looking to the future.

Summary

There are many qualitative and quantitative tools that can be used by higher education CFOs. The tools described here are some of the most common used in practice. An excellent, simple, resource for those in higher education is Brassard's (1988) "The Memory Jogger for Education: A Pocket Guide of Tools for Continuous Improvement in Schools." This guide discusses the tools that can be used in continuous improvement efforts in easy to read terms and provides a brief description of the tools allowing the user to understand how the tools might be applied to their institution.

CHAPTER III

METHODOLOGY

Introduction

This chapter describes the research methodology of the study. Composed of ten sections, the chapter presents the processes and procedures used to approach the research questions in the study.

Purpose

The purpose of this study was to identify effective qualitative and quantitative management tools used by higher education financial officers (CFOs) in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling at a public research university, as well as to determine barriers/impediments CFOs face in using these tools; benefits related to the use of tools; and to identify tools that would be important in carrying out their management functions in the future. To achieve these purposes, the study investigated the following research questions:

1. What qualitative and quantitative management tools are currently effective for public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling (Kreitner, 2004)

2. What are the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFO management functions?

3. What benefits do public research university CFOs perceive from using qualitative and quantitative management tools in carrying out their management functions?

4. What qualitative and quantitative management tools will be important to public research university CFOs in carrying out their management functions in the future?

Delphi Method

The Delphi method (technique) is a group method used to elicit, collate, and direct informed expert judgment toward a consensus (agreement) on a particular topic of interest (Helmer, 1983). Linstone and Turoff (2002) described the Delphi technique as "a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with complex problems" (p.3). The Delphi technique was chosen for this study because it has been found to be useful in defining issues and because it has been widely accepted in education research in areas such as academia, government, and education (Eggers & Jones, 1998; Spinelli, 1983; Wilhelm, 2001).

In selecting the methodology for the study, several factors were considered. First, there was not abundant research on the topic yet in today's complex higher education environment, the demand for information on the subject is great. Second, CFOs with the most knowledge on the subject are widely dispersed across the nation. Third, a systematic approach of inquiry was needed that could collect informed judgment of public research university CFOs in a timely and cost effective manner while examining and reporting the data collected in a pragmatic manner. Fourth, the Delphi method avoids dominating personalities or potential conflicts if participants were to be engaged as a group in a face-to-face meeting. As a result of reviewing all of these factors, the Delphi technique was selected as the methodology for this study.

The Delphi technique was created by RAND Corporation scientists Helmer and Dalkey in 1953 as a method for obtaining expert opinions and keeping them anonymous (Adler & Ziglio, 1996; Cornish, 2004). Cornish (2004) referred to the Delphi method as a polling process while Turoff (1975) described Delphi as not just a polling scheme; he stated the Delphi method requires subjects to think through their responses and express themselves in a consistent fashion. The Delphi method works by selecting experts to participate in a survey. Clayton (1997) stated that the Delphi method should be used on issues dealing with the distribution of limited educational resources that require critical thinking and reasoning.

The Delphi method consists of several survey rounds through which additional questions provide further clarification of the collective opinions of experts (Cornish, 2004). The selection of the expert group is critical when using this research technique. Rowe and Wright (1999) found that accuracy increases as the numbers of rounds in a Delphi study increase; however, only slight changes in responses from panel experts have been observed after a third Delphi round. Linstone and Turoff (2002) noted that responses typically become stable with convergence within three rounds. When using the Delphi method, the focus is on the stability of the expert panel opinion rather than on an individual's opinion (Scheibe, Skutsch, & Schofer, 2002).

The Delphi method typically begins with the researcher identifying a group of subject matter experts. The selection of the group of experts is vital when trying to make predictions using the Delphi method. In a standard Delphi, after the expert panel is selected, an “exploration phase” is begun where a brainstorming session takes place to identify a list of issues on a subject, typically through the form of open-ended questions (Murry & Hammons, 1995; Ziglio, 1996). The Delphi study can also be conducted in a varying form, called the modified Delphi, where the expert panel is presented with issues already identified. The modified Delphi method was also developed by Norman Dalkey and Olaf Helmer (Bell, 1997; Martino, 1983). In the modified Delphi method, the statements or list of items to be ranked are identified by the researcher, for example in this study the original list of qualitative and quantitative management tools was developed through a literature review, before it is presented to the expert panel and their opinions are solicited (Bell, 1997). The goal of the modified Delphi is to make participation easier for the expert panel (Martino, 1983).

Some of the attributes and advantages of the Delphi method are:

1) it economizes on the time needed from participants and the questionnaires can be completed at the participants’ convenience;
2) research on the Delphi method encourages new approaches to decision making;
3) anonymity reduces the conflict between participants;
4) it is an effective way to check participant bias since it develops a consensus of opinion from a panel of experts;
5) it encourages diverse and speculative thinking;
6) ratings involve quantitative scores for evaluations on a subjective and intuitive basis;
7) it involves two way communication to help develop understanding on the part of the study participants;
8) many different viewpoints are offered due to the number of participants;
9) it records the group’s actions that later can be further reviewed;
10) it can be conducted over a geographically dispersed location without having to physically bring the participants together; and
11) it is relatively inexpensive to administer as compared to other techniques (Rotondi & Gustafson, 1996; Wadley, 1977).

One of the Delphi technique's advantages is that it confines the influence of individual panel members as their responses are anonymous. This results in the Delphi method mitigating the conforming pressure that is often common in face-to-face group sessions by orchestrating a series of intentionally planned, sequential interactions that are conducted through structured questionnaires (Murry & Hammons, 1995). According to Ziglio (1996), the Delphi method is considered to be a reliable and creative way to explore ideas and produce suitable information upon which to make decisions as group members have less fear of putting out new ideas for others to consider. The Delphi method allows participants anonymity which provides the participants the ability to provide their opinions without fear of reprisal or loss of stature (Rotondi & Gustafson, 1996).

While the Delphi technique has many advantages, there are potential disadvantages in using this technique. First, it requires a significant amount of time from participants due to the various rounds of questions which can lead to attrition among participants or poorly constructed responses (Martino, 1983; Murry & Hammons, 1995). Borg & Gall (1989) stated that if respondents are not strongly motivated they may fill out questionnaires in a few minutes providing little thought to their answers. Linstone and Turoff (2002) noted that as with any research process the researcher can manipulate respondents through the editing of comments, neglect of certain items and the manner in which the results to rounds are presented. They go on to state that sloppy execution of the technique (poor selection of initial panelists, overly vague or overly specific Delphi statements, and superficial analysis of responses) are other potential disadvantages to the use of the Delphi method. Ziglio (1996) stated that the Delphi method has been criticized for not using scientific procedures in terms of sampling and the testing of results but in weighing the advantages versus the disadvantages "there is no reason why the Delphi method should be less methodologically robust than techniques such as interviewing, case study analysis or behavioral simulations, which are now widely accepted as tools for policy analysis, and the generation of ideas and scenarios" (p. 13).

Sample Size and Population

Ziglio (1996) argued that there was not a statistically-bound decision related to the proper sample size for constructing a Delphi panel and that high-quality results can be acquired from a panel of 10 to 15 experts. Dalkey and Helmer (1963) found that the preferred size of the expert panel is between 10 and 20. Cochran (1983) stated that the minimum number for an expert panel was approximately ten with a lower error rate and increasing reliability as the group size increased. (Delbecq et al., 1975) noted that homogeneous groups provided few new ideas once the expert panel used in a Delphi study exceeded thirty while Dalkey, Rourke, Lewis, and Snyder (1972) maintained that a larger panel increased study reliability. Dalkey et al. (1972) also noted increased validity from a 13 member panel of experts. Schelle (1975) noted that there is no general rule of thumb when creating Delphi panels; the exact minimum size of a Delphi panel is not known but typically ranges from ten to twenty.

The original population for the study was CFOs of "Public Research Universities" as defined in the "The Carnegie Foundation for the Advancement of

Teaching" listing per a web based inquiry of their database on June 4, 2010; 105 CFOs were included in the initial survey.

Selection of Delphi Experts

Another concern related to the Delphi technique is how the expert panel is identified and selected and how researcher bias affected its selection (Linstone & Turoff, 2002; McCabe, n.d.; Mitchell, 1971). Researcher bias did not exist in selecting the expert panel for this survey as it was selected from a pre-defined group, public research university CFOs who had knowledge and experience in using qualitative and quantitative tools. The selected expert panel met the criterion discussed by Eggers and Jones (1998) **–** they exhibited the experience, knowledge, and skills in the field being researched. Despite these concerns, Gamon (1991) noted an advantage of using the Delphi technique to be a "combination of qualitative (written) and quantitative (numerical) data and its ability to form a consensus of expert opinion" (p. 1).

The formation of a Delphi panel is of special concern for the Delphi researcher (Clayton, 1997; Welty, 1973; Ziglio, 1996). Linstone & Turoff (2002) stated that the question of how to choose a "good" expert panel is no different a problem than the formation of any study group, panel, or, committee, etc. While this concern could be a significant problem, it is not a problem unique to the Delphi technique. According to Scheele (1975), experts are individuals that possess specific knowledge about and in-depth experience with the topic being researched. Clayton (1997) defined an expert as an individual that has the required experience and knowledge to take part in a Delphi panel. The collective opinion of these experts is used as the source of information for the study.

The selection of Delphi panel participants is dependent upon the goals and framework of the study (Ziglio, 1996). The common criteria to be included when determining the appropriateness of a Delphi panel expert are:

1) whether the Delphi panel members will commit the necessary time to the Delphi exercise;
2) ensuring that the Delphi panel members have sufficient knowledge and experience with the issues being researched;
3) ensuring that the Delphi panel members have good written communication skills;
4) determining if the Delphi panel members are willing to contribute to the exploration of issues being researched;
5) whether the Delphi panel experts' skills and knowledge need to be accompanied by standard academic qualifications or degrees (Ziglio, 1996).

Delphi panel participants are not selected by chance; rather, they are rationally selected based upon their expertise related to the question/issue at hand. Clayton (1997) stated that experts may be included in the Delphi panel or a random or nonbiased sample of a variety of individuals with subject matter expertise can be sought. The Delphi technique necessitates a prolonged commitment from the expert panel and panel members have to be motivated to be engaged in and continue to provide their time and energy to the process. Participants need to value the combined judgments of the Delphi panel and be engaged in the subject at hand in order to complete their service on the panel (Delbecq, Van de Ven & Gustafson, 1975). Akins (2004) noted that the response rate of the Delphi panel lies entirely within the discretion of the respondents as reminder letters and phone calls have only been found to be slightly helpful in conducting Delphi studies.

The study group for this study was CFOs of "Public Research Universities" as defined in the "The Carnegie Foundation for the Advancement of Teaching" listing per a web based inquiry of their database on June 4, 2010. These CFOs were e-mailed a transmittal letter (Appendix 1) which directed them to a survey at Surveymonkey.com where they identified their knowledge and experience with qualitative and quantitative management tools used by public research university CFOs in carrying out their management functions. The survey was developed to capture their responses on an anonymous basis (their identity was only known to the researcher). Thirty CFOs responded to the initial survey and of the thirty initial respondents, twenty-four were considered experts in the use of the qualitative and quantitative management tools. The CFOs were considered experts for inclusion in the Delphi panel if they stated that they "sometimes used" or "regularly used" more than 2/3's of the qualitative and quantitative tools included in the initial questionnaire. These twenty-four CFOs were then asked to join the Delphi panel; fifteen agreed to participate in the Delphi panel and all fifteen completed each subsequent round of the study; the response rate was 100% for the Delphi study rounds. Hasson, Keeney and McKenna (2000) noted that the content validity of the Delphi survey increases if the Delphi panel members possess knowledge and curiosity in the topic. The consecutive rounds within a Delphi survey typically also improve the study's concurrent validity.

The initial letter e-mailed to the 105 public research university CFOs discussed the purpose of the study, the thesis as to the importance of the study to the respondents, and a discussion of their rights under the Institutional Review Board-Human Subjects in Research at Texas A&M University. At the end of the study, the researcher received permission from fourteen members of the Delphi panel to include their names in this dissertation. The Delphi panel member names are included in Appendix 8.

Use of Electronic Communications in Delphi Studies

The use of the Delphi method to build consensus among experts using a web-based anonymous survey technique has been shown to be effective through previous work (Green, Armstrong, & Graefe, 2007; Linstone & Turoff, 2002). Turoff and Hiltz (1996) discussed how in a computerized environment participants can engage in any facet of an issue based upon their personal preferences. Specific to this study, e-mail and web-based questionnaires were used to disseminate, display, collect and transfer information; e-mail was the only method used to communicate with study participants. Hasson, Keeney, & McKenna (2000), discussed the importance of considering the computer skills of the expert panel prior to using electronic communications in a Delphi study. According to Watson (1998), in order for electronic data collection to be effective, respondents must have ready access to and adequate proficiency in the technology being used. The study respondents had ready access to and were proficient in the use of the technology being used.

For this study, secure web-based questionnaires were developed through which information was sent and received. The data was transferred by the researcher into Microsoft Excel to capture, codify and calculate the data. The Delphi study responses were collected in three rounds, transmitted intermittently to and from study participants, and with controlled feedback provide to panel members. The Delphi panel had specific goals and tasks in each round of the study.

Importance of the Rating Scale

Ostrom and Upshaw (1968) noted that there can be a significant effect on judgment dependent upon the range of the scale provided to study participants. Likert type rating scales are one of the most common methods used in Delphi studies and can overcome some of the difficulties involved with the selection of a suitable scale range (Scheibe, et al., 2002). This study used four or five-rank scales for assessing the research questions under consideration. The rating scales for this study were modeled after Turoff's original importance rating scale. Each research question's scale was uniquely tailored to the question at hand. This is supported by Turoff (1975) who stated that the respondents must be able to distinguish between the rating scales used in the survey.

Description of Delphi Study Questionnaires

The first questionnaire was based upon a literature review of qualitative and quantitative management tools that were used by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. The questionnaires were validated through a pilot study of four knowledgeable higher education CFOs who had experience with the qualitative and quantitative management tools. The pilot study panel included one current CFO of a public university, one former CFO of a public research university, a former vice president of administration at a public research university, and a former vice president of a public research university who is now a CFO of a private university. The pilot study panel provided helpful suggestions and provided excellent feedback relating to changes in the letters to the original survey population, the first letter to panel members, and the study instrument. After consideration of the comments suggested by the pilot study panel, revisions were made to the letters to participants and the study instrument.

The initial questionnaire was used to develop a list of qualitative and quantitative management tools that public research university CFOs use in carrying out their management functions. In the initial questionnaire (Appendix 2), thirty tools were provided to participants for their consideration of effective qualitative and quantitative management tools used by public research university CFOs in carrying out their management functions. The CFOs were also asked to identify additional tools that they used in performing their management functions that were not included on the original list. The panelists were asked to state if they:

4 - were aware of the listed tool and regularly use it;

3 - were aware of the listed tool and sometimes use it;

2 - were aware of the listed tool but had not used it; and

1 - were not aware of the listed tool.

The Likert scale ratings for each research question are further outlined in Chapter IV during the analysis of the results of the surveys.

Based upon the responses to the original questionnaire, five additional qualitative and quantitative tools that public research university CFOs use to help them in management functions (Appendix 3) were included in the Delphi study. Four qualitative and quantitative tools included in the initial study questionnaire were dropped from consideration by the Delphi panel as more than 58% of the respondents were unaware of these tools or had never used the tools (Appendix 3). The revised listing of qualitative and quantitative tools was organized alphabetically for use in the Delphi study.

For the first Delphi study round, a link was sent via e-mail to the Delphi panel asking them complete a survey (Appendix 5) to identify those tools which they believed were effective in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. This round also sought to identify the barriers/impediments to the use of qualitative and quantitative tools, the benefits of using these tools, and to identify what tools the expert panel believed will be important to public research university CFO in carrying out their management functions in the future. The first Delphi panel questionnaire also asked the experts to list additional barriers/impediments to the use of qualitative and quantitative tools and additional benefits from using the tools. If two or more panelists provided analogous new barriers/impediments to the use of tools, or benefits from the use of the tools, the new barrier/impediment, or benefit, was included to accommodate all suggestions. If possible, the researcher made minimum changes to the panelist's wording. Three barriers/impediments listed by Delphi panel members were similar and were consolidated prior to dissemination to the Delphi panel in the second Delphi survey. A total of seven barriers/impediments were added by Delphi panel members and six additional benefits from the use of qualitative and quantitative management tools were added.

Based upon the pilot study, it was expected that participants would need approximately fifteen minutes to complete the initial questionnaire for this study. It was estimated that three questionnaires would be sent to the Delphi expert panel, with results being collected from the participants within two to three weeks. The actual lag time between rounds was dependent upon the responsiveness of the study participants, the time needed to analyze the data obtained from each round, and the researcher's competing time commitments. The initial study questionnaire has the longest time from when it was first e-mailed to study participants to capturing all of the data due to the researcher's efforts to obtain the highest potential response rate to achieve a large pool of possible expert panel members. Several reminder e-mails were sent to the public research university CFOs that did not reply within the initial response timeframe. The first study round took seven weeks to return thirty responses.

The Delphi expert panel responses for each survey round were received within four weeks of sending out each request for completion of the surveys. The first Delphi panel survey round concluded in twelve days while the second and third rounds concluded in thirty and sixteen days, respectively. The work with the Delphi panel took a total of three months and three weeks while the time from the original survey sent out to the entire population of CFOs to the end of the Delphi panel surveys was eight months and three weeks. The Delphi panel reached consensus within three survey rounds.

Consensus in a Delphi Study

Consensus in a Delphi study occurs when stability of responses is achieved (Murry & Hammons, 1996). Scheibe, Skutsch, and Schofer's (2002) proposed that less than a 15% change in responses between rounds in a Delphi study represents consensus. In this research, a Likert scale range of four or five was used. Using a four point Likert scale, a difference of 0.6 represented a 15% change (15% of 4 equals 0.6). Therefore, a difference of 0.6 or less between the group means of item rankings in two consecutive rounds, or less than one standard deviation for the respective item, whichever was less indicated that consensus was reached. Similarly, using a five point scale, a difference of 0.75 represented a 15% change level (15% of 5 equals 0.75). Therefore, for a five point scale a difference of 0.75 or less between the group means of item rankings in two consecutive rounds, or less than one standard deviation for the respective item, whichever was less indicated that consensus was reached.

The method is described as follows (Scheibe, Skutsch, and Schofer, 2002):

1) For each item the absolute value of the difference in the number of responses between two consecutive rounds is summed and divided by two.
2) Dividing by two is necessary to obtain the net change per person because each panelist's rank is represented in each round.
3) This number is then divided by the number of panelists and converted to a percentage.
4) If there were fewer panelists in the second round of comparison, the smaller number was used and the responses of the panelists who dropped out were not counted.

Figure 1 provides an example of consensus for one item responses in two Delphi panel:

Round 1	0	- 1s	2	-2s	4	-3s	7	-4s
Round 2	0	- 1s	2	-2s	3	-3s	9	-4s
	0		0		1		2	

1 + 2 = 3; 3/2 = 1.5; 1.5/15 = 6.67% < 15% Consensus reached

FIGURE 1. Consensus Example for a Four Point Likert Scale

The "consensus mean" was the group mean at the survey round where consensus was reached. The consensus mean specified that the expert panel opinion was stable and, as a result, the particular item was not included in subsequent study rounds. All items where consensus was not reached were re-evaluated by the expert panel in a subsequent survey round.

Greatorex and Dexter (2000) stated that answers to Likert scale questions can be judged to be on an interval scale. Thus, when using a Likert scale the mean of the group responses represents the central tendency of the Delphi panel. The standard deviation, an assessment of the diversity of the Delphi panel opinions, reflects the amount of consensus among the expert panel. If the Delphi panel mean is stable between Delphi rounds, then the panel's responses are deemed to be stable across survey rounds. If the standard deviation is stable across survey rounds, then the amount of agreement between the Delphi panelists is also deemed to be stable across rounds (Greatorex & Dexter, 2000). Hasson, Keeney and McKenna (2000) discussed the significance of when to end Delphi survey rounds: ending too soon can result in non-meaningful outcomes and/or a lack of consensus while continuing with too many Delphi panel rounds could lead to participant fatigue and a decrease in survey response rate. This Delphi study concluded after three rounds.

Statistical Analysis

The responses from the surveys were entered into Excel and the group mean and standard deviation for each item was calculated. In subsequent rounds, each panel member received the group mean, standard deviation and his or her own ranking for each item. Once the expert panel round statistics were developed, the Delphi experts were sent an e-mail with a subsequent survey link for those items that had not reached consensus and asked whether they would like to keep or change their original answers based on the additional information of the group mean and standard deviation. Hasson, Keeney and McKenna (2000), noted that in a Delphi study, the expert panelists are "judges" of the items being surveyed as it relates to their quality and significance. Therefore, the description of barriers/impediments and benefits from the use of qualitative and quantitative management tools, as suggested by the expert panelists, with only minor edits, were provided to the panelists in subsequent rounds.

The second Delphi panel questionnaire (Appendix 6) sought to move the Delphi panel towards consensus on the original survey items and to collect feedback on the survey items added by the respondents. The experts were provided the group mean and standard deviation for each item related to the various research questions as well as the individual expert's original ranking. The panel members were asked to re-rank each item in the survey as well as to rank items added based upon the open ended responses from the expert panel related to additional barriers/impediments to the use of quantitative and qualitative management tools and benefits from the use of the tools. This process was repeated in a third questionnaire that was e-mailed to the Delphi panel where the participants were only asked to rank those items where the Delphi panel had not reached consensus during the prior round (Appendix 7).

Summary

Chapter III outlined the methodology for the study to identify qualitative and quantitative management tools that CFOs in public research universities use to assist them in carrying out their management functions; to determine barriers/impediments

CFOs face in using these tools; benefits related to the use of the tools; and to identify tools that would be important in carrying out their management functions in the future. This chapter presented the processes and procedures used to approach the research questions in the study; the population, sample (panel) size, the selection of the Delphi panel, data analysis applications, and quality controls for the research study. Upon completion of the research study, the Delphi panelists were sent an e-mail the study findings and conclusions. The results of the data analysis, the results of the study, and the conclusions reached as a result of the study are presented in the next chapter.

CHAPTER IV
RESULTS

Introduction

Chapter IV of this study includes a brief description of the analysis of the data and a statistical analysis of the data for each survey questionnaire and round of the survey. The study sought to: 1) determine the qualitative and quantitative management tools used by higher education CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling at a public research universities; 2) identify the barriers/impediments to using these tools; 3) identify the benefits from the use of quantitative and qualitative management tools; and 4) identify quantitative and qualitative management tools the CFOs believe will be important in carrying out their management functions in the future. The chapter ends with a brief summary of the data where the results are provided and the relationships are synthesized.

Results of Data Analysis

The first survey questionnaire (Appendix 2) sought to obtain data on qualitative and quantitative management tools used by higher education CFOs and to identify a group of experts that would serve on the Delphi panel. The initial survey was sent electronically in an intermittent, anonymous manner using a link that was e-mailed to the study population directing them to a survey developed in SurveyMonkey.com. The results of this questionnaire showed that four of the original tools (control charts, factor analysis, fishbone or cause and effect diagrams, and interrelationship diagrams) were not used by public research university CFOs and were therefore excluded from consideration by the Delphi panel. These tools were excluded based upon their means being below 2.5, reflecting that survey respondents were not aware of or had not used the tools.

The initial respondents provided five additional tools (delayering the institution, management by walking around, operational analysis, revenue and expense pro formas, and reviewing span of control) and these additional tools were added to develop a revised list of qualitative and quantitative management tools for analysis by the Delphi panel (Appendix 5).

In the first questionnaire, the Delphi panel considered ninety-one variables on the four research questions which yielded 1,365 responses. The questionnaire also included open ended questions that allowed the respondents to list additional barriers/impediments to the use of qualitative and quantitative management tools as well as additional benefits from the use of the tools. These two open-ended questions elicited ten additional suggested barriers/impediments to the use of qualitative and quantitative management tools that were grouped and distilled down to seven additional variables and six additional benefits from the use of qualitative and quantitative management tools for the panel to consider in subsequent rounds; see Appendix 3 for a listing of the variables added. The next two survey rounds moved the Delphi panel towards consensus. Consensus was reached as early as the second round of the Delphi study for some of the survey variables.

Over the three survey rounds, no implications existed to cause the researcher to consider the removal of any of the items in the surveys although some respondents were not aware of all of the tools presented. In the initial Delphi round, four respondents were not aware of “contribution margin analysis” and four Delphi panel members were not aware of the added tool “delayering the organization.” All qualitative and quantitative management tools had at least eleven Delphi panel members that were aware of the tool and therefore could make a determination as to its effectiveness for use in higher education decision making; it was earlier noted that researchers, Dalkey & Helmer (1963) and Ziglio (1996), had stated that ten was the minimum number of respondents for a Delphi panel.

Dealing with Missing Data

The responses to the original questionnaire sent to public research university CFOs did not have any missing data. The first round of the Delphi study assessed 94 items and had 0.03% of missing data (4 missing data points out of 1,410 total data points). The participants that had missing data were contacted via e-mail and asked to complete their responses for the specific questions that they missed and their responses were added to the results of the first round of the Delphi study. The second round of the Delphi study explored 104 items and had 0.01% of missing data (2 missing data points out of 1,560 total data points). Participants that had missing data were contacted via e-mail and asked to complete their responses for the specific questions that they missed and their responses were added to the results of the third questionnaire. The final round of the Delphi study did not have any missing data.

Delphi Panel Description

The Delphi panel included 15 experts from 13 states (Appendix 8). The demographics of the expert panel are included in Table 1 below:

TABLE 1. Demographics of Expert Panel.

Gender	
Female	5
Male	10
Age	
41-50	3
51-60	8
> 60	4
Education	
Bachelors	3
Masters	8
PhD	4
Average years of experience in:	
Current position	5.3
Higher education	23.6
Administration	27.3
Other certificates	
CPA	6

Non-representative Outlier

One of the study participants assigned a rank of 5, “strongly agree that tools contribute to CFOs carrying out their management functions” to each study variable at the time the panel reached consensus for the research question related to the benefits from the use of quantitative and qualitative management tools in carrying out the public research university CFOs management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. The influence of this non-representative outlier is discussed in the section “Non-representative outlier effects on the study results.”

Research Question One

Initial Survey

Each of the research questions will be addressed in terms of the data supplied by the Delphi panel in their responses to three rounds of surveys. The first research question in this study asked public research university CFOs their “level of experience in using qualitative and quantitative management tools in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling.” To answer this question, 105 public research university CFOs were asked to review a list of suggested qualitative and quantitative management tools based upon a review of the literature and add new qualitative and quantitative management tools, not included in the initial list of tools, which they use in managing their university. The panelists were asked to state if they:

4 - were aware of the listed tool and regularly use it;

3 - were aware of the listed tool and sometimes use it;

2 - were aware of the listed tool but had not used it; and

1 - were not aware of the listed tool.

Of the 105 public research university CFOs that were surveyed, 28 CFOs responded to the survey, completed all of the survey questions, and provided their name and contact information for further follow-up by the researcher. Two additional CFOs responded to the survey but either did not complete the survey or did not provide their contact information. The results of the initial survey of the 105 public research university CFOs is included in Table 2 below.

TABLE 2. CFO Experience in Using Qualitative and Quantitative Management Tools in Carrying Out Their Management Functions – Sorted by Initial Mean.

Management tool	Initial Mean	Initial SD	Management tool	Initial Mean	Initial SD
Benchmarking	3.79	0.42	Internal rate of return	3.10	0.74
Cost-benefit analysis	3.79	0.42	Scenario planning	3.00	0.74
Checklists	3.68	0.61	SWOT Analysis	3.00	0.74
Histograms/bar charts	3.61	0.50	Regression analysis	2.86	0.45
Return on investment	3.60	0.57	Decision trees	2.75	0.44
Brainstorming	3.54	0.70	Responsibility centered mgt	2.75	0.75
Dashboards	3.50	0.58	Environmental scan	2.71	0.90
Trend analysis	3.50	0.51	Contribution margin analysis	2.68	0.98
Ratio analysis	3.46	0.69	Activity based costing	2.64	0.78
Continuous improvement	3.40	0.74	PERT Chart	2.54	0.74
Data mining	3.39	0.74	Balanced scorecard	2.46	0.74
Flow chart	3.36	0.49	Factor analysis	2.29	0.98
Focus groups	3.29	0.46	Interrelationship diagram	2.07	0.86
Sensitivity/ "what-if" analysis	3.10	0.63	Control chart	1.96	0.92
Peer review	3.10	0.71	Fishbone diagram	1.93	0.72

Benchmarking and cost benefit analysis were the qualitative and quantitative management tools which the initial group of 28 CFOs said they were the most aware of and used most often with means of 3.79 and a standard deviation of 0.42. For both of these tools, six respondents stated they were aware of the tool and sometimes use them while twenty-two respondents stated that they were aware of the tool and regularly use them. Checklists had a mean of 3.68 and a standard deviation of 0.61 with two respondents stating they were aware of the tool but had not used it, five respondents stated they were aware of the tool and sometimes use it, and twenty-one respondents stated that they were aware of the tool and regularly use it. Histograms had a mean of 3.61 and a standard deviation of 0.50. For histograms, eleven respondents stated they were aware of the tool and sometimes use it while seventeen respondents stated that they were aware of the tool and regularly use it. Return on investment had a mean of 3.60 and a standard deviation of 0.57.One respondent stated that they were aware of return on investment but had not used it, ten respondents stated they were aware of the tool and sometimes use it while seventeen respondents stated that they were aware of the tool and regularly use it.

Brainstorming had a mean of 3.54 and a standard deviation of 0.70 with one respondent that stated that they were not aware of the tool, ten respondents stated they were aware of the tool and sometimes use it while seventeen respondents stated that they were aware of the tool and regularly use it. Dashboards and trend analysis had means of 3.50 and standard deviations of 0.58 and 0.51. For Dashboards, one respondent stated they were aware of the tool but had not used it; twelve respondents stated they were aware of the tool and sometimes use it while fifteen respondents stated that they were aware of the tool and regularly use it. Trend analysis had thirteen respondents stated they were aware of the tool and sometimes use it while fifteen respondents stated that they were aware of the tool and regularly use it. Ratio analysis had a mean of 3.46 and a standard deviation of 0.69. For ratio analysis, one respondent stated they were not aware of the tool, twelve respondents stated they were aware of the tool and sometimes use it while fifteen respondents stated that they were aware of the tool and regularly use it.

Continuous improvement had a mean of 3.40 and a standard deviation of 0.74. Continuous improvement had one respondent state they were not aware of the tool, one respondent stated they were aware of the tool but had not used it, thirteen respondents stated they were aware of the tool and sometimes use it while thirteen respondents stated that they were aware of the tool and regularly use it. Data mining and data warehouses had a mean of 3.39 and a standard deviation of 0.74. Data mining and data warehouses had one respondent state they were not aware of the tool, one respondent stated they were aware of the tool but had not used it, twelve respondents stated they were aware of the tool and sometimes use it while fourteen respondents stated that they were aware of the tool and regularly use it. Flow charts had a mean of 3.36 and a standard deviation of 0.49. For flow charts, eighteen respondents stated they were aware of the tool and sometimes use it while ten respondents stated that they were aware of the tool and regularly use it. Focus groups had a mean of 3.29 and a standard deviation of 0.46 with twenty respondents stating they were aware of the tool and sometimes use it while eight respondents stated that they were aware of the tool and regularly use it.

Sensitivity “what if” analysis, internal rate of return (IRR), and peer reviews had means of 3.10 and standard deviations of 0.63, 0.74, and 0.71, respectively. Sensitivity analysis had four respondents state they were aware of the tool but had not used it and seventeen respondents stated they were aware of the tool and sometimes use it while seven respondents stated that they were aware of the tool and regularly use it. IRR had one respondent that was not aware of this tool, two respondents stated they were aware of the tool but had not used it, fifteen respondents stated they were aware of the tool and sometimes use it while ten respondents stated that they were aware of the tool and regularly use it. For peer reviews, five respondents stated they were aware of the tool but had not used it, fourteen respondents stated they were aware of the tool and sometimes use it while nine respondents stated that they were aware of the tool and regularly use it.

Scenario planning and SWOT analysis had means of 3.00 with standard deviations of 0.74. Scenario planning had one respondent state they were not aware of the tool, five respondents stated they were aware of the tool but had not used it, sixteen respondents stated they were aware of the tool and sometimes use it while six respondents stated that they were aware of the tool and regularly use it. For SWOT analysis, two respondents stated they were not aware of the tool, one respondent stated they were aware of the tool but had not used it, nineteen respondents stated they were aware of the tool and sometimes use it while six respondents stated that they were aware of the tool and regularly use it.

Regression analysis had a mean of 2.86 and a standard deviation of 0.45 with five respondents stating they were aware of the tool but had not used it, twenty-two respondents stated they were aware of the tool and sometimes use it and one respondent stated that they were aware of the tool and regularly use it.

Decision trees and responsibility centered management (RCM) had means of 2.75 and standard deviations of 0.44 and 0.75. Decision trees had seven respondents state they were aware of the tool but had not used it and twenty-one respondents stated they were aware of the tool and sometimes use it. For RCM, twelve respondents stated they were aware of the tool but had not used it, eleven respondents stated they were aware of the tool and sometimes use it, and five respondents stated that they were aware of the tool and regularly use it.

Environmental scan had a mean of 2.71 and a standard deviation of 0.90. Environmental scan had four respondents state they were not aware of the tool, four respondents stated they were aware of the tool but had not used it, sixteen respondents stated they were aware of the tool and sometimes use it while four respondents stated that they were aware of the tool and regularly use it. Contribution margin analysis had a mean of 2.68 and a standard deviation of 0.98. For contribution margin analysis, three respondents stated they were not aware of the tool, ten respondents stated they were aware of the tool but had not used it, eight respondents stated they were aware of the tool and sometimes use it while seven respondents stated that they were aware of the tool and regularly use it.

Activity based costing had a mean of 2.64 and a standard deviation of 0.78 with one respondent stating they were not aware of the tool, nine respondents stated they were aware of the tool but had not used it, fourteen respondents stated they were aware of the tool and sometimes use it while three respondents stated that they were aware of the tool and regularly use it. PERT charts had a mean of 2.54 and a standard deviation of 0.74. PERT charts had two respondents state they were not aware of the tool, eleven respondents stated they were aware of the tool but had not used it, thirteen respondents stated they were aware of the tool and sometimes use it while two respondents stated that they were aware of the tool and regularly use it. Balanced scorecards had a mean of 2.46 and a standard deviation of 0.74. For balanced scorecards, three respondents stated they were not aware of the tool, ten respondents stated they were aware of the tool but had not used it, fourteen respondents stated they were aware of the tool and sometimes use it while one respondent stated that they were aware of the tool and regularly use it.

As previously discussed, based upon the results of the responses to the original survey questionnaire four tools were excluded from consideration by the Delphi panel. These tools had means less than 2.5. Factor analysis had a mean of 2.29 and a standard deviation of 0.98. Seven respondents stated they were not aware of the tool, nine respondents stated they were aware of the tool but had not used it, nine respondents stated they were aware of the tool and sometimes use it while three respondents stated that they were aware of the tool and regularly use it. Interrelationship diagrams had a mean of 2.07 and a standard deviation of 086. Nine respondents stated they were not aware of the tool, eight respondents stated they were aware of the tool but had not used it, and eleven respondents stated they were aware of the tool and sometimes use it. Control charts had a mean of 1.96 and a standard deviation of 0.92. Eleven respondents stated they were not aware of the tool, eight respondents stated they were aware of the tool but had not used it, eight respondents stated they were aware of the tool and sometimes use it while one respondent stated that they were aware of the tool and regularly use it. Finally, Fishbone diagrams had a mean of 1.93 and a standard deviation of 0.72. Eight respondents stated they were not aware of the tool, fourteen respondents stated they were aware of the tool but had not used it, and six respondents stated they were aware of the tool and sometimes use it.

Delphi Panel Initial Round

Based upon the open ended responses from the twenty eight original survey respondents, five additional tools were added to the list of tools presented to the Delphi panel; a total of thirty-one qualitative and quantitative management tools were presented to the Delphi panel members for their consideration (Appendix 5).

The qualitative and quantitative management tools were presented to the Delphi panel members in alphabetical order. Qualitative and quantitative management tools with a consensus mean:

1) at least equal 4.50 or higher were considered to be highly effective for use by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling.
2) at least equal to 3.50 and less than 4.50 were considered moderately effective for use by public research university CFOs in carrying out their management functions.
3) at least equal to 2.50 and less than 3.50 were considered minimally effective for use by public research university CFOs in carrying out their management functions.
4) less than 2.50 were considered not effective for use by public research university CFOs in carrying out their management functions.

The scale used by the Delphi panel was a five point Likert-type scale with the following descriptions:

1. N/A – not aware of tool
2. Tool is not effective for use by public research university CFOs in carrying out their management functions
3. Tool is minimally effective for use by public research university CFOs in carrying out their management functions
4. Tool is moderately effective for use by public research university CFOs in carrying out their management functions
5. Tool is highly effective for use by public research university CFOs in carrying out their management functions

The results of the initial Delphi round noted that there were two highly effective tools and twenty qualitative and quantitative management tools that the panel of experts considered moderately effective for use by public research university CFOs in carrying out their management functions. The remaining nine qualitative and quantitative management tools surveyed in the first Delphi round were found to be minimally effective for use by public research university CFOs in carrying out their management functions.

Table 3 and Figure 2 depict the thirty-one qualitative and quantitative management tools of the first Delphi round in descending order by the group means at the end of Round 1. Each qualitative and quantitative management tool will be discussed per their ranking by the Delphi panelists.

TABLE 3. Initial Means and Standard Deviations for the Effectiveness of Qualitative and Quantitative Management Tools in Currently Carrying Out Public Research University CFO Management Functions – Sorted by Initial Mean.

Tool	**Initial Mean**	**Initial Std Dev**
Data mining and data warehouses	4.67	0.49
Benchmarking	4.53	0.74
Revenue and expense pro formas	4.47	0.92
Cost-benefit analysis	4.47	0.52
Dashboards	4.33	0.82
Ratio Analysis	4.27	0.59
Brainstorming	4.20	0.77
Sensitivity analysis	4.20	0.94
Trend analysis	4.20	0.68
Management by walking around	4.13	0.83
Return on investment	4.07	0.96
Continuous improvement	4.00	1.07
Scenario Planning	4.00	0.85
SWOT analysis	3.87	0.99
Activity based costing	3.73	0.70
Focus groups	3.73	0.80
Checklists	3.60	0.99
Flow charts	3.60	0.83
Responsibility Centered Management	3.60	1.06
Balanced Scorecard	3.53	1.06
Environmental scan	3.53	0.83
Internal rate of return	3.53	0.92
Decision trees	3.47	0.83
Operational analysis	3.33	1.11
Regression analysis	3.27	0.70
Contribution margin analysis	3.27	1.62
Reviewing span of control	3.20	1.26
Peer reviews	3.00	0.76
Histograms	2.93	0.88
Delayering the organization	2.80	1.26
PERT Chart	2.60	0.83

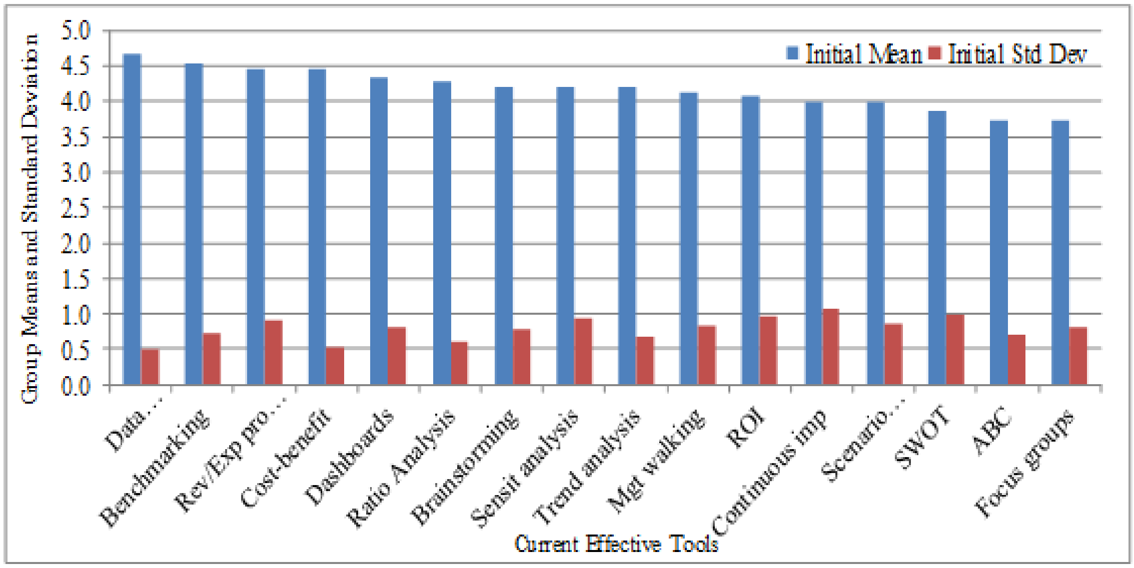

FIGURE 2. Initial Means and Standard Deviations for the Effectiveness of Qualitative and Quantitative Management Tools in Currently Carrying Out Public Research University CFO Management Functions.

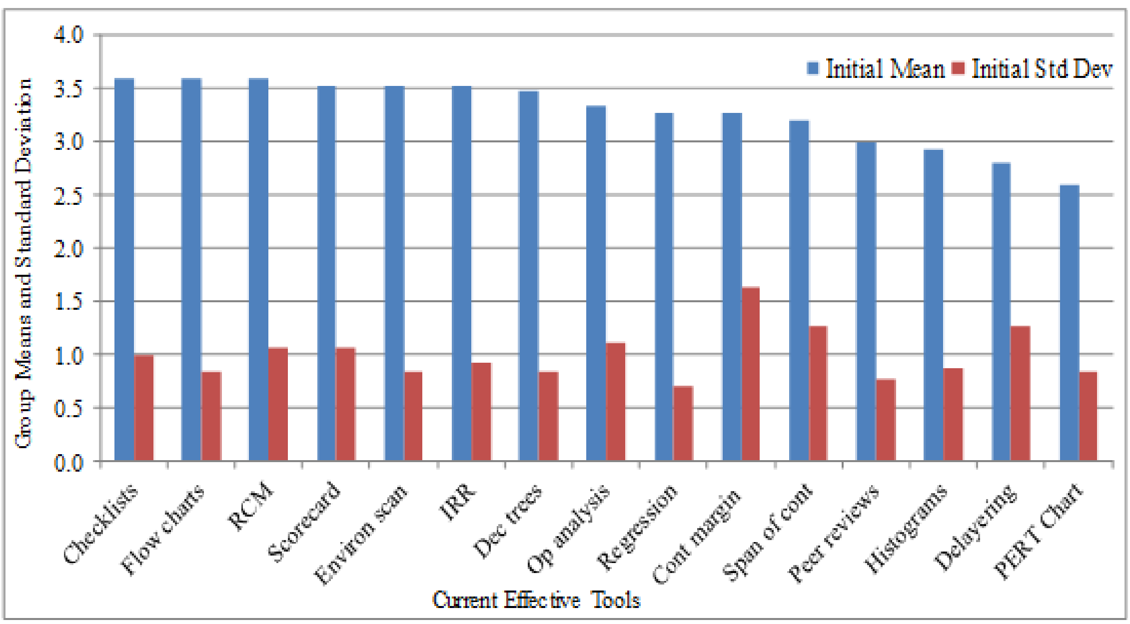

FIGURE 2. (continued).

Data mining and data warehouses was the qualitative and quantitative management tool with the highest group mean of 4.67 and a standard deviation of 0.49.

Data mining and data warehouses have been common place at many public research universities as more robust enterprise resource planning systems have been implemented in recent years. Ten panelists ranked this item as 5 and five panelists ranked it as 4. The clustering around the rank of 5 gave this item its high mean and the lowest standard deviation of all the tools surveyed in the first Delphi round indicating a very strong consensus.

Benchmarking was the next highest qualitative and quantitative management tool with a group mean of 4.53 and a standard deviation of 0.74. Ten panelists ranked this item as 5, three panelists ranked it as 4, and two panelists ranked benchmarking as a 3. Data mining and data warehouses and benchmarking were the only two tools ranked by the Delphi panel in the first round as being highly effective for public research university CFOs in carrying out their management functions, rankings greater than or equal to 4.50.

There were twenty qualitative and quantitative management tools that the Delphi panel considered to be moderately effective for use by public research university CFOs in carrying out their management functions with group means between 3.50 and 4.49. Revenue and expense pro formas had a group mean of 4.47 and a standard deviation of 0.92. Ten panelists ranked this item as 5, three panelists ranked it as 4, one panelist ranked it as a 3, and one panelist ranked revenue and expense pro formas as a 2. This tool was added during the first survey of all public research university CFOs.

Cost benefit analysis also had a group mean of 4.47 but it had a lower standard deviation of 0.52. Seven panelists ranked this item as 5 while the remaining eight panelists ranked cost benefit analysis as 4. Cost benefit analysis had the second lowest standard deviation of the tools surveyed in the first Delphi round. Dashboards had a group mean of 4.33 and a standard deviation of 0.82. Nine panelists ranked this item as 5, three panelists ranked it as 4, and three panelists ranked dashboards as a 3. As noted in the literature review, many institutions of higher education have begun managing their institution using dashboards.

Ratio analysis has been used in higher education for several decades. In the first Delphi round, Ratio analysis had a group mean of 4.27 and a standard deviation of 0.59. Five panelists ranked this item as 5, nine panelists ranked it as 4, and one panelist ranked Ratio analysis as a 3. Brainstorming had a group mean of 4.20 and a standard deviation of 0.77. Five panelists ranked this item as 5, seven panelists ranked it as 4, and three panelists ranked brainstorming as a 3. Brainstorming was the highest ranking qualitative management tool in this round.

In the first round, the Delhi panel results provided a group mean of 4.20 and a standard deviation of 0.94 for sensitivity analysis. Eight panelists ranked this item as 5, while two panelists ranked it as 4 and five panelists ranked sensitivity analysis as a 3. The first round Delphi panel standard deviation for sensitivity analysis was higher than the average (0.89) standard deviation of the tools surveyed.

Trend analysis had a group mean of 4.20 and a standard deviation of 0.68. Five panelists ranked this item as 5, eight panelists ranked it as 4, and two panelists ranked trend analysis as a 3. The standard deviation for Trend analysis was the fourth lowest of the tools surveyed in the initial Delphi panel round. Management by walking around was one of the tools added in the first survey of all public research university CFOs. It had a group mean of 4.13 and a standard deviation of 0.83 in the initial Delphi panel round. Six panelists ranked this item as 5, five panelists ranked it as 4, and four panelists ranked management by walking around as a 3.

Return on investment had a group mean of 4.07 and a standard deviation of 0.96. Six panelists ranked this item as 5, five panelists ranked it as 4, three panelists ranked return on investment as a 3, and one panelist ranked it as a 2. The standard deviation for return on investment was higher than the average (0.89) standard deviation of the tools surveyed in the initial Delphi panel round. Continuous improvement had a group mean of 4.00 and a standard deviation of 1.07. Six panelists ranked this item as 5, five panelists ranked it as 4, two panelists ranked it as a 3, and one panelist ranked continuous improvement as a 2. The standard deviation for continuous improvement was the fifth highest of the thirty-one qualitative and quantitative tools surveyed in the initial Delphi panel round.

Scenario planning also had a group mean of 4.00 while it showed less dispersion than continuous improvement with a standard deviation of 0.85, slightly lower than the average in this round. Five panelists ranked this item as 5, five panelists ranked it as 4, and five panelists ranked Scenario planning as a 3. Strength-Weakness Opportunity and Threat (SWOT) analysis had a group mean of 3.87 and a standard deviation of 0.99. Five panelists ranked this item as 5, seven panelists ranked it as 4, two panelists ranked it as a 3, and two panelists ranked SWOT analysis as a 2 in the first Delphi round.

Activity based costing (ABC) had a group mean of 3.73 and a standard deviation of 0.70. One panelist ranked this item as 5, ten panelists ranked it as 4, three panelists ranked it as a 3, and one panelist ranked ABC as a 2. The standard deviation for ABC was the fifth lowest of the thirty-one qualitative and quantitative tools surveyed in this round. In the first round, the Delhi panel results provided a group mean of 3.73 and a standard deviation of 0.80 for focus groups. Two panelists ranked this item as 5, eight panelists ranked it as 4, four panelists ranked it as a 3, and one panelist ranked Focus groups as a 2.

Checklists had a group mean of 3.60 and a standard deviation of 0.99. Two panelists ranked this item as 5, seven panelists ranked it as 4, five panelists ranked it as a 3, and one panelist ranked checklists as a 1, noting that they were unaware of a check list as a qualitative and quantitative tool. Flow charts also had a group mean of 3.60 with a standard deviation of 0.83. Three panelists ranked this item as 5, three panelists ranked it as 4, and nine panelists ranked flowcharts as a 3.

Responsibility Centered Management (RCM) had a group mean of 3.60 with a standard deviation of 1.06. Three panelists ranked this item as 5, six panelists ranked it as 4, three panelists ranked RCM as a 3, and three panelists ranked it as a 2. RCM is a tool which has been implemented in higher education but one that also carries a great deal of controversy, Cantor & Whetten (1997), Adams (1997), Whalen, (1991). This may explain the significant dispersion among responses resulting in the sixth highest standard deviation during this initial Delphi panel round.

Balanced scorecards had a group mean of 3.53 with a standard deviation of 0.83. Two panelists ranked this item as 5, seven panelists ranked it as 4, four panelists ranked balanced scorecards as a 3, one panelist ranked them as a two and one as a 1, not aware of the tool. Balanced scorecards have been applied to colleges and universities. A well-developed balanced scorecard includes data on customers, internal business processes, and organizational learning and growth.

Environmental scanning had a group mean of 3.53 and a standard deviation of 0.83. One panelist ranked this item as 5, eight panelists ranked it as 4, four panelists ranked it as a 3, and two panelists ranked Environmental scanning as a 2. Internal rate of return (IRR) also had a group mean of 3.53 with a standard deviation of 0.92. Two panelists ranked this item as 5, six panelists ranked it as 4, five panelists ranked it as a 3, and two panelists ranked IRR as a 2. In higher education finance, the IRR is often used to evaluate alternative capital investment decisions.

The Delphi panel found the remaining nine qualitative and quantitative tools to be minimally effective for use by public research university CFOs in carrying out their management functions with group means between 2.50 and 3.49. Three of the tools added during the survey of all public higher education CFOs were included in this group of tools. Decision trees had a group mean of 3.47 with a standard deviation of 0.83. Two panelists ranked this item as 5, four panelists ranked it as 4, eight panelists ranked it as a 3, and one panelist ranked decision trees as a 2.

Operational analysis was a tool added during the survey of all public research university CFOs. Operational analysis had a group mean of 3.33 with a standard deviation of 1.11. One panelist ranked this item as 5, seven panelists ranked it as 4, five panelists ranked it as a 3, and two panelists ranked operational analysis as a 1, not aware of tool. Operational analysis had the fourth highest standard deviation in the initial Delphi round.

Regression analysis had a group mean of 3.27 with a standard deviation of 0.70. One panelist ranked this item as 5, three panelists ranked it as 4, ten panelists ranked it as a 3, and two panelists ranked regression analysis as a 2. Regression analysis had the fifth lowest standard deviation in the initial Delphi panel round as responses were concentrated around 3. Contribution margin analysis also had a group mean of 3.27 with a standard deviation of 1.62. Four panelists ranked this item as 5, five panelists ranked it as 4, one panelist ranked it as a 3, and one panelist ranked contribution margin analysis as a 2, while four panelists responded 1, not aware of tool. The dispersion of answers for this tool resulted in the highest standard deviation of the tools surveyed by the Delphi panel in the first round.

Reviewing the span of control of an organization was a tool added during the survey of all public research university CFOs. Reviewing the span of control had a group mean of 3.20 with a standard deviation of 1.26. Two panelists ranked this item as 5, five panelists ranked it as 4, four panelists ranked it as a 3, and two panelists ranked it as a 2 while two panelists responded 1, not aware of tool. The dispersion of answers for this tool resulted in the second highest standard deviation of the tools surveyed by the Delphi panel in the first round.

Peer reviews had a group mean of 3.00 with a standard deviation of 0.76. Four panelists ranked it as 4, seven panelists ranked it as a 3, and four panelists ranked peer reviews as a 2. Histograms had a group mean of 2.93 with a standard deviation of 0.88.

Four panelists ranked it as 4, ten panelists ranked it as a 3, while one panelist responded 1, not aware of tool. It was surprising that one panelist was not aware that histograms are a graphical summary of frequency distribution in data.

Delayering the organization was a tool added during the initial survey of CFOs. Delayering the organization had a group mean of 2.81 with a standard deviation of 1.26. Seven panelists ranked this item as 4, three panelists ranked it as a 3, and one panelist ranked it as a 2, while four panelists responded 1, not aware of tool. The dispersion of answers for this tool resulted in the second highest standard deviation of the tools surveyed by the Delphi panel in the first round, indicating that while many panelists thought this tool was effective for use by public research university CFOs in carrying out their management functions others were not aware of the tool.

The tool with the lowest group mean in the first Delphi round was PERT charts. PERT charts had a group mean of 2.60 with a standard deviation of 0.83. One panelist ranked this item as 4, nine panelists ranked it as a 3, and three panelists ranked it as a 2, while one panelist responded 1, not aware of tool. The concentration of responses around 3 resulted in a low standard deviation. PERT charts was also one of the lowest scoring tools kept for inclusion in the Delphi round after the initial survey of public research institution CFOs.

Delphi Round 2

The Delphi panel was able to reach consensus and identified a total of 23 qualitative and quantitative management tools to be moderately effective for use by public research university CFOs in carrying out their management functions with group means between 3.50 and 4.49 (Table 4 and Figure 3) the second Delphi round. It was interesting to note that only two of the five tools that were added based upon feedback from the original survey respondents were found to be moderately effective; however, one of the tools added, revenue and expense pro formas, was identified by the Delphi panel as being the second most effective tool in carrying out the CFO management functions. Figure 4 provides the initial and consensus standard deviations for the current effectiveness of the qualitative and quantitative management tools by public research university CFOs in carrying out their management functions.

TABLE 4. Initial and Consensus Means and Standard Deviations for the Effectiveness of Qualitative and Quantitative Management Tools in Currently Carrying Out Public Research University CFO Management Functions – Sorted by Consensus Mean.

Tool	Initial Mean	Consensus Mean	Initial Std Dev	Consensus Std Dev
Benchmarking	4.53	4.47	0.74	0.64
Cost-benefit analysis	4.47	4.47	0.52	0.52
Revenue and expense pro formas	4.47	4.47	0.92	0.92
Data mining and data warehouses	4.67	4.40	0.49	0.74
Brainstorming	4.20	4.27	0.77	0.70
Ratio Analysis	4.27	4.27	0.59	0.59
Sensitivity analysis	4.20	4.20	0.94	0.77
Continuous improvement	4.00	4.13	1.07	0.74
Return on investment	4.07	4.13	0.96	0.92
Trend analysis	4.20	4.13	0.68	0.83
Dashboards	4.33	4.07	0.82	0.88
Management by walking around	4.13	3.87	0.83	0.64
Internal rate of return	3.53	3.80	0.92	0.94
SWOT analysis	3.87	3.73	0.99	0.88
Activity based costing	3.73	3.67	0.70	0.62
Focus groups	3.73	3.67	0.80	0.98
Responsibility Centered Management	3.60	3.67	1.06	0.90
Balanced Scorecard	3.53	3.60	1.06	0.83
Checklists	3.60	3.60	0.99	0.99
Contribution margin analysis	3.27	3.60	1.62	0.99
Scenario Planning	4.00	3.60	0.85	0.91
Environmental scan	3.53	3.53	0.83	0.92
Regression analysis	3.27	3.53	0.70	0.74
Operational analysis	3.33	3.47	1.11	1.13
Flow charts	3.60	3.40	0.83	0.63
Decision trees	3.47	3.33	0.83	0.62
Reviewing span of control	3.20	3.27	1.26	1.03
Peer reviews	3.00	3.20	0.76	0.86
PERT Chart	2.60	3.07	0.83	0.80
Delayering the organization	2.80	2.80	1.26	1.32
Histograms	2.93	2.73	0.88	0.70

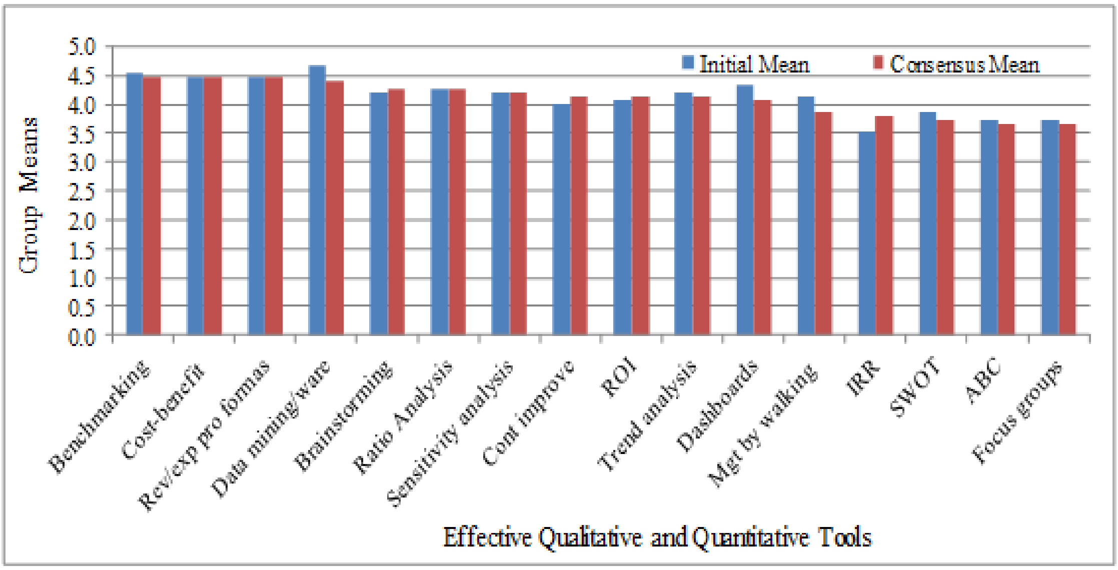

Figure 3. Initial and Consensus Means for Qualitative and Quantitative Management Tools in Currently Carrying Out Public Research University CFO Management Functions.

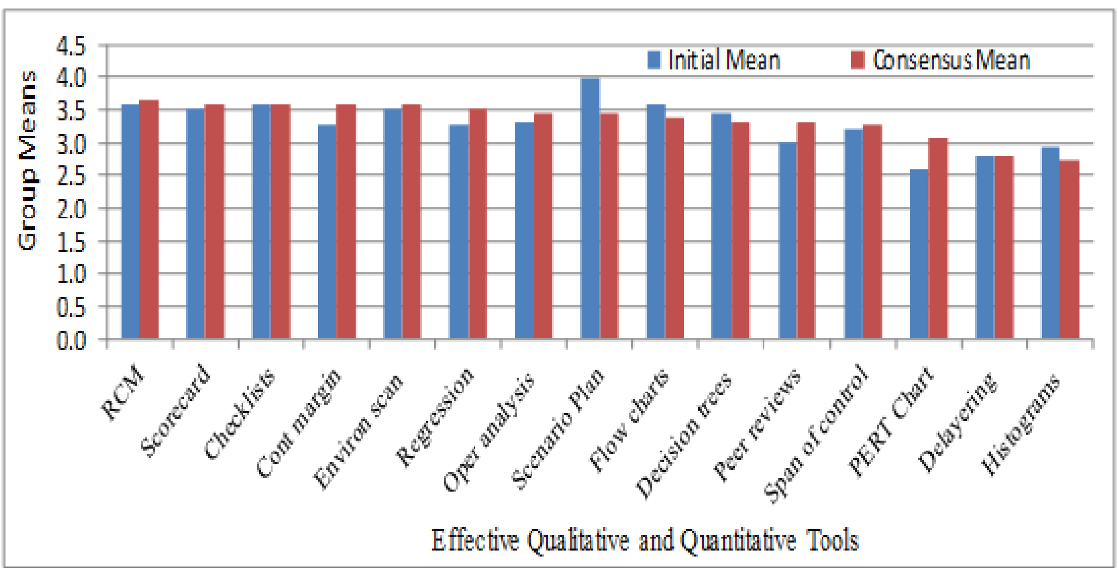

Figure 3 (continued).

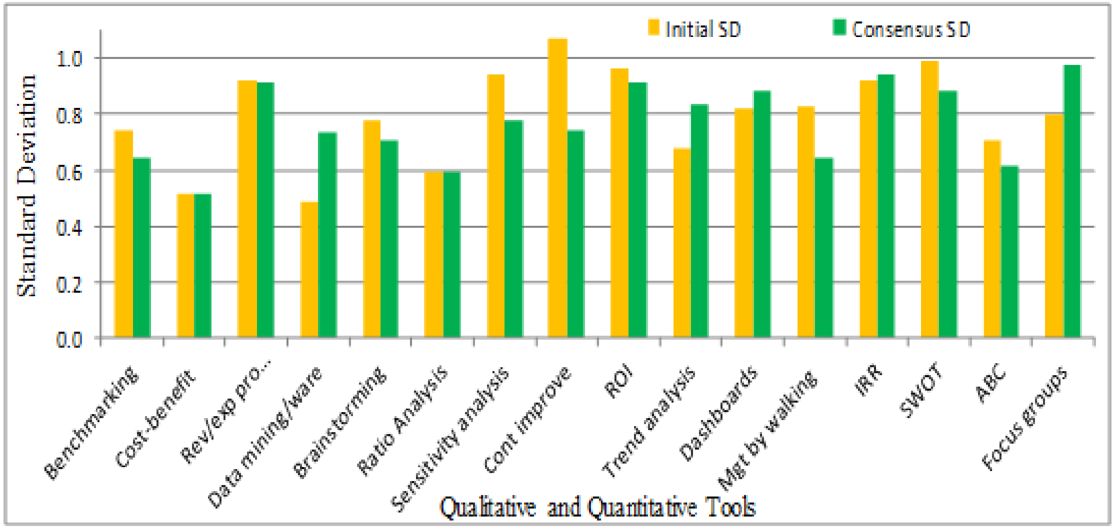

Figure 4. Initial and Consensus Standard Deviations for Qualitative and Quantitative Management Tools in Currently Carrying Out Public Research University CFO Management Functions.

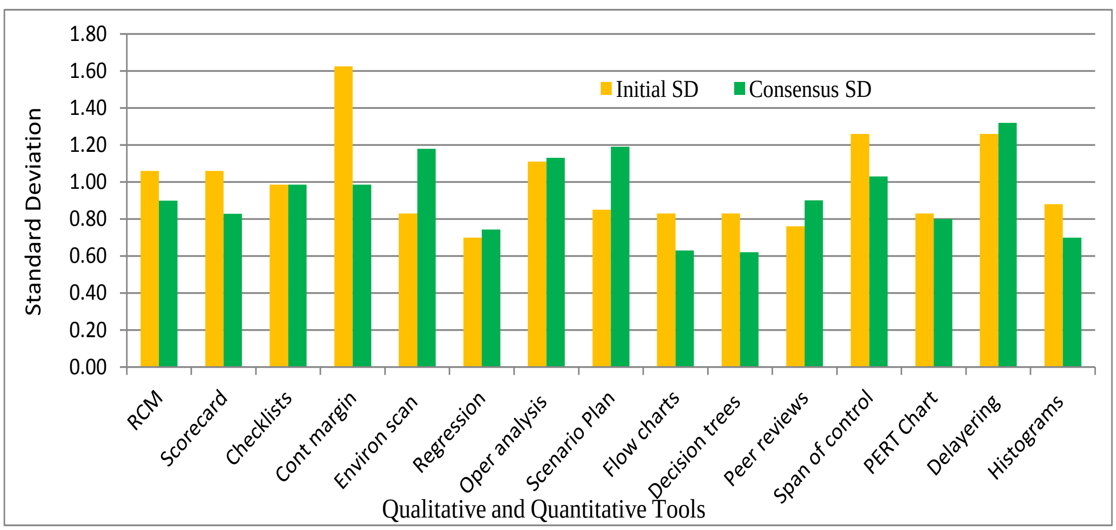

Figure 4 (continued).

The Delphi panel ranked benchmarking, cost benefit analysis, and revenue and expense pro formas as effective qualitative and quantitative management tools in carrying out public research university CFO management functions. These tools had consensus means of 4.47.

Benchmarking's consensus mean of 4.47 decreased 0.06 (1%) and it had a consensus standard deviation of 0.64. At consensus, eight panelists ranked this item as 5, six panelists ranked it as 4, and one panelist ranked benchmarking as a 3. The standard deviation for benchmarking decreased 0.10 (14%) from the first round to consensus (Figure 4). Revenue and expense pro formas also had a consensus mean of 4.47. Revenue and expense pro formas had a consensus standard deviation of 0.92, the same as the first round. Ten panelists ranked revenue and expense pro formas as a 5, three panelists ranked it as a 4, one panelist ranked it as a 3, and one panelist ranked revenue and expense pro formas as a 2. Cost benefit analysis had a consensus mean of 4.47 and a consensus standard deviation of 0.52, the same as the first round. Seven panelists ranked this item as a 5 while the remaining eight panelists ranked cost benefit analysis as a 4. Cost benefit analysis had the lowest standard deviation of the tools surveyed in the first research question (Figure 4).

Data mining and data warehouses saw a 0.27 (6%) decrease in its consensus mean of 4.40 as compared to the group mean in the first Delphi round. Eight panelists ranked data mining and data warehouses as a 5, five panelists ranked it as 4, two panelists ranked it as a 3. Data mining and data warehouses had the largest increase in standard deviation from the first to the second Delphi round, an increase of 0.25 (50%) to a consensus standard deviation of 0.74 (Figure 4). While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds is approximately one-half of the lower of the two standard deviations. Additionally, the change in panel member responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

Brainstorming and ratio analysis both had consensus means of 4.27. Brainstorming had a 0.06 (1%) increase in its consensus mean as compared to the initial Delphi round. Six panelists ranked this tool as a 5, seven panelists ranked it as 4, and two panelists ranked it as a 3. Brainstorming's standard deviation decreased 0.07 (9%) from the first to the second Delphi round (Figure 4). Ratio analysis had a consistent mean and standard deviation (0.59) at consensus as compared to the initial Delphi round. Ratio analysis had the second lowest standard deviation at consensus. Five panelists ranked this tool as a 5, nine panelists ranked it as 4, and one panelist ranked it as a 3.

Sensitivity analysis had a consistent mean of 4.20 between rounds while its standard deviation decreased 0.17 (18%) to 0.77 at consensus. Six panelists ranked this tool as a 5, six panelists ranked it as 4, and three panelists ranked it as a 3. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 3); the group mean was consistent between rounds but there was a large decrease in the standard deviation. Continuous improvement, return on investment (ROI), and trend analysis had consensus means of 4.13. Continuous improvement had a 0.13 (3%) increase in its consensus mean as compared to the first round while its standard deviation decreased 0.33 (30%). The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Five panelists ranked this tool as a 5, seven panelists ranked it as 4, and three panelists ranked it as a 3.

ROI's consensus mean increased 0.06 (2%) as compared to the first round group mean while its standard deviation decreased 0.04 (5%). Six panelists ranked ROI as a 5, six panelists ranked it as 4, two panelists ranked it as a 3, and one panelist ranked ROI as a 2. Trend analysis saw a decrease of 0.07 (2%) in its consensus mean as compared to the round one group mean while its standard deviation increased 0.15 (23%). Five panelists rank this tool as a 5, eight panelists ranked it as 4, one panelist ranked it as a 3, and one panelist ranked trend analysis as a 2. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds is approximately one-half of the lower of the two standard deviations. Additionally, the change in panel member responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

Dashboards saw a 0.26 (6%) decrease in its consensus mean of 4.07 as compared to the round one group mean while its standard deviation increased 0.06 (8%). Six panelists ranked this tool as a 5, four panelists ranked it as 4, and five panelists ranked it as a 3. Management by walking around (one of the tools added in the initial survey) saw a 0.26 (7%) decrease in its consensus mean of 3.87 as compared to the round one group mean. The standard deviation for this tool decreased significantly from 0.83 to 0.64 at consensus, a 23% decrease. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this tool as a 5, nine panelists ranked it as 4, and four panelists ranked it as a 3.

Internal rate of return had a 0.27 (8%) increase in its consensus mean, to 3.80, as compared to the initial Delphi panel group mean. The standard deviation for this tool was relatively stable with a 0.02 (2%) increase between rounds (Figure 4). At consensus, four panelists ranked this tool as a 5, five panelists ranked it as 4, five panelists ranked it as a 3, and one panelist ranked internal rate of return as a 2. SWOT analysis saw a 0.14 (3%) decrease in its consensus mean of 3.73 as compared to the initial group mean while its standard deviation increased 0.11 (11%). Two panelists ranked this tool as a 5, nine panelists ranked it as 4, two panelists ranked it as a 3, and two panelists ranked SWOT analysis as a 2.

Activity based costing (ABC), focus groups, and responsibility centered management (RCM) had consensus means of 3.67. ABC had a 0.06 (2%) decrease in its consensus mean while its consensus standard deviation decreased 0.08 (12%) as compared to the first Delphi panel round. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. For ABC, eleven panelists ranked it as 4, three panelists ranked it as a 3, and one panelist ranked ABC as a 2.

Focus groups saw a 0.06 (2%) decrease in the consensus mean as compared to the initial group mean while its standard deviation increased 0.18 or 22.0%. Three panelists ranked this tool as a 5, six panelists ranked it as 4, four panelists ranked it as a 3, and two panelists ranked focus groups as a 2. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds is approximately one-half of the lower of the two standard deviations. Additionally, the change in panel member responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

RCM had a slight increase, 0.07 (2%), in the consensus mean as compared to the initial group mean while the standard deviation decreased 0.16 (15%). The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this tool as a 5, eight panelists ranked it as 4, three panelists ranked it as a 3, and two panelists ranked RCM as a 2.

Balanced scorecards had a 0.07 (2%) increase in the consensus mean as compared to the initial group mean while its standard deviation decreased 0.23 (22%). The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this tool as a 5, six panelists ranked it as 4, six panelists ranked it as a 3, and one panelist ranked balanced scorecards as a 2. Checklists responses were stable between rounds with a consensus mean of 3.60 and a consensus standard deviation of 0.99 (Figure 4). Two panelists ranked this tool as a 5, seven panelists ranked it as 4, five panelists ranked it as a 3, and one panelist ranked checklists as a 1, they were not aware of this tool.

Contribution margin analysis had the third largest increase in its consensus mean, 0.33 (10%), between Delphi panel rounds. The consensus mean was 3.60, moving from a tool which was minimally effective for carrying out CFO management functions after the initial Delphi panel round (mean between 2.50 and 3.49) to a tool that was moderately effective for carrying out CFO management functions (consensus mean above 3.50). This tool also had the largest decrease in standard deviation between rounds, 0.63 (39%), achieving a consensus standard deviation of 0.99. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. One panelist ranked this tool as a 5, ten panelists ranked it as 4, two panelists ranked it as a 3, one panelist ranked it as a 2, and one panelist ranked contribution margin analysis as a 1, they were not aware of this tool.

Scenario planning saw a decrease in its consensus mean of 3.60 as compared to the first Delphi panel group mean of 4.00. The 0.40 (10%) decrease in means was the largest decrease between rounds. While the means between rounds decreased significantly, the standard deviation for this tool saw an increase of 0.06 moving from

0.85 to 0.91, a 7% increase (Figure 4). Two panelists ranked this tool as a 5, seven panelists ranked it as 4, four panelists ranked it as a 3, and two panelists ranked this tool as a 2.

Environmental scan reached a consensus mean of 3.53, consistent with the first Delphi panel round with a consensus standard deviation of 0.92 a 0.09 increase (11%) between rounds to 1.18 (Figure 4). The high standard deviation can be seen in the scoring for this tool where one panelist ranked this tool as a 5, nine panelists ranked it as 4, two panelists ranked it as a 3, and three panelists ranked environmental scanning as a 2. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds is approximately one-half of the lower of the two standard deviations. Additionally, the change in panel member responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

Regression analysis was another tool that moved from a tool which was minimally effective for carrying out CFO management functions (mean between 2.50 and 3.49) to a tool that was moderately effective for carrying out CFO management functions (consensus mean above 3.50). Regression analysis had a consensus mean of 3.53, an increase of 0.26 (8%) from the initial Delphi panel round. The standard deviation for regression analysis was fairly stable with a 0.04 (6%) increase between rounds (Figure 4). One panelist ranked this tool as a 5, seven panelists ranked it as 4, six panelists ranked it as a 3, and one panelist ranked regression analysis as a 2.

At consensus, eight qualitative and quantitative tools were found by the Delphi panel to be minimally effective (group mean between 2.50 and 3.49) for use by public research university CFOs in carrying out their management functions. Operational analysis was a tool added during the initial survey but was ranked as minimally effective for carrying out public research university CFO management functions. Its consensus mean increased 0.14 (4%) from the first Delphi panel round reaching a consensus mean of 3.47. The standard deviation was stable with a 0.02 (2%) increase between rounds (Figure 4). One panelist ranked this tool as a 5, nine panelists ranked it as 4, three panelists ranked it as a 3, and one panelist ranked operational analysis as a 1, they were not aware of this tool.

Flow charts moved from a tool that was moderately effective for carrying out the public research university CFO management functions during the first Delphi round to a tool which was minimally effective for carrying out the public research university CFO management functions at consensus. Flow charts consensus mean was 3.40, a 0.20 (6%) decrease while its consensus standard deviation also decreased 0.20 (24%). The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. At consensus, one panelist ranked this tool as a 5, four panelists ranked it as 4, and ten panelists ranked it as a 3.

Decision trees had consensus means of 3.33. Decision trees consensus mean increased 0.33 (11%) from the initial Delphi panel round while its standard deviation increased 0.14 (18%) to 0.90 (Figure 4). At consensus, six panelists ranked this tool as a 4, eight panelists ranked it as 3, and one panelist ranked it as a 2. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds is approximately one-half of the lower of the two standard deviations. Additionally, the change in panel member responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002). Peer reviews consensus mean of 3.20 increased 0.20 (7%) while its standard deviation increased 0.10 (13%) to 0.86. One panelist ranked this tool as a 5, four panelists ranked it as 4, seven panelists ranked it as a 3, and three panelists ranked peer reviews as a 2.

Reviewing span of control within the organization was a tool added based upon responses to the initial survey. The consensus mean of 3.27 for this tool increased 0.07 (2%) from the initial Delphi panel round while its standard deviation decreased significantly, 0.23 (18%), to 1.03. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this tool as a 5, three panelists ranked it as 4, eight panelists ranked it as a 3, one panelist ranked reviewing span of control as a 2, and one panelist was not aware of this tool.

PERT charts had the lowest ranking after the first Delphi panel round with a group mean of 2.60. At consensus, the group mean increased 0.47 (18%) to 3.07 while the standard deviation decreased 0.03 (4%) to 0.80 (Figure 4). One panelist ranked this tool as a 5, eight panelists ranked it as 4, five panelists ranked it as a 3, and three panelists ranked PERT charts as a 2.

Delayering the organization was a tool added based upon responses to the initial survey. This tool's mean of 2.80 was stable between the Delphi rounds while the standard deviation increased 0.06 (5%) to 1.32 (Figure 4). Delayering the organization's standard deviation was the highest of all the tools surveyed in both Delphi rounds reflecting that while some panelist thought this tool was effective in decision making, others were not aware of the tool. One panelist ranked this tool as a 5, four panelists ranked it as 4, five panelists ranked it as a 3, one panelist ranked Delayering the organization as a 2, and four panelists were not aware of this tool.

The lowest ranked tool at consensus was Histograms at 2.73. This tool decreased 0.20 (7%) from the initial Delphi panel round. Histograms also saw a significant decrease in standard deviation, declining 0.18 (21%) to 0.70 at consensus. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 4); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. One panelist ranked it as 4, ten panelists ranked it as a 3, three panelists ranked Histograms as a 2, and one panelist was not aware of this tool.

In summary, of the 31 qualitative and quantitative tools reviewed by public research university CFOs, twenty-three were found to be moderately effective for use by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling. The remaining eight qualitative and quantitative management tools surveyed were found to be minimally effective for use by public research university CFOs in carrying out their management functions.

Research Question Two

This study's second research question asked, "What are the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFO management functions?" Barriers/impediments that ranked:

1) 3.50 or higher were considered to consistently be a barrier/impediment to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling.
2) between 2.50 and 3.49 were sometimes a barrier/impediment to the use of qualitative and quantitative management tools by public research university CFOs carrying out their management functions.
3) between 1.50 and 2.49 were usually not a barrier/impediment to the use of qualitative and quantitative management tools by public research university CFOs carrying out their management functions.
4) with a consensus mean less than 1.50 were not a barrier/impediment to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions.

The scale used by the panel was a Likert-type four point scale with the following descriptions:

1. Item is not a barrier/impediment to the use of the tools
2. Item is usually not a barrier/impediment to the use of the tools
3. Item is sometimes a barrier/impediment to the use of the tools
4. Item is consistently a barrier/impediment to the use of the tools

At consensus, fifteen barriers/impediments were identified as sometimes being a barrier/impediment to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions; no items were identified as consistently being barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions.

Delphi Panel Initial Round

Table 5 and Figure 5 depict the initial group mean and standard deviations and for the seventeen barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions surveyed in the initial Delphi round. Each of the barriers/impediments will be discussed in descending order per their initial ranking by the Delphi panelists.

TABLE 5. Initial Mean and Standard Deviations for Barriers/Impediments to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions – Sorted by Initial Mean.

	Initial Mean	Initial Std Dev
Lack of Resources: inadequate staffing and work overloads	3.53	0.64
Cumbersome, complicated and time consuming data gathering processes	3.00	0.76
Cost of Data Collection	2.93	0.80
Lack of standardized higher education data	2.93	0.80
Insufficient data - not measuring areas where the tools could be used to support decision making	2.93	0.88
Resistance to change	2.87	1.06
Culture of the institution	2.80	0.86
Complexity of higher education information systems	2.67	0.90
Lack of technology funding needed to implement the tools	2.67	1.05
Reliance on measurement systems that lie outside the finance department for data	2.60	0.83
Reliance on human capabilities of relative few that know how to use tools	2.60	0.83
Bureaucracy	2.53	0.92
Difficulties in identifying similar organizations for use in benchmarking	2.53	0.99
Technology needed to use the tools is not available (hardware or software)	2.40	0.91
Tools don't seem to fit use in higher education	2.40	1.06
Communication: lack of transparency and openness in regard to decision making	2.13	
Institution's senior leadership lack of knowledge/understanding of the tools	1.87	0.83

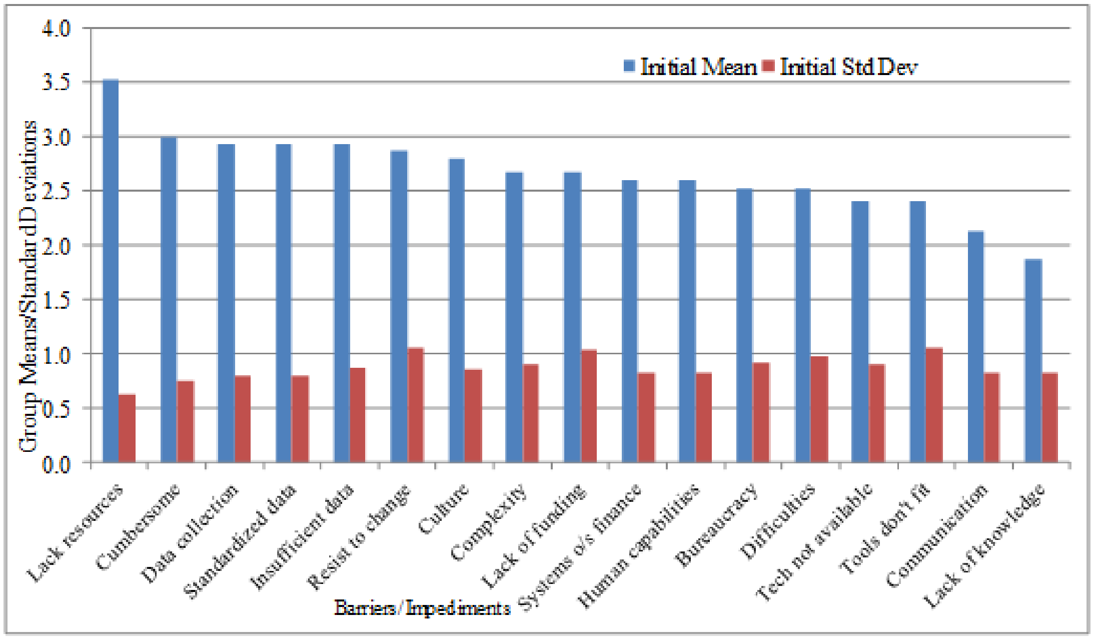

FIGURE 5. Initial Means and Standard Deviations for Barriers/Impediments to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions.

In the initial Delphi panel round, lack of resources: inadequate staffing and work overloads was noted as consistently a barrier/impediment to the use of qualitative and quantitative tools by CFOs in carrying out their management functions. Lack of resources: inadequate staffing and work overloads had a group mean of 3.53 in the initial Delphi round. This barrier also had the lowest standard deviation of 0.64. One panelist ranked this barrier as 2, five panelists ranked it as a 3, and nine panelists ranked it as a 4. During the first Delphi round, this barrier/impediment's group mean was significantly higher, 0.53 (17%) than any other barrier/impediment. In a time of budget cuts across higher education, the Delphi panel recognized that a lack of resources was a consistent barrier/impediment to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions.

In the initial Delphi round, twelve barriers/impediments were found as sometimes being barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions. Cumbersome, complicated and time consuming data gathering processes had a group mean in the initial Delphi round of 3.00 while its standard deviation was 0.76. This barrier had the second lowest standard deviation surveyed in the initial Delphi round for this research question. Four panelists ranked this barrier as 2, nine panelists ranked it as a 3, and two panelists ranked it as a 4.

Cost of data collection and lack of standardized higher education data had group means in the first Delphi round of 2.93 and standard deviations of 0.80. One panelist ranked cost of data collection as a 1 (not a barrier/impediment), two panelists ranked it as 2 (usually not a barrier/impediment), nine panelists ranked it as a 3 (sometimes a barrier/impediment), and three panelists ranked it as a 4 (consistently a barrier/impediment). For lack of standardized higher education data, five panelists ranked it as 2, six panelists ranked it as a 3, and four panelists ranked it as a 4. Insufficient data - not measuring areas where the tools could be used to support decision making also had a group mean in the initial Delphi round of 2.93 while its standard deviation was 0.88. One panelist ranked this barrier as a 1, three panelists ranked it as 2, seven panelists ranked it as a 3, and four panelists ranked it as a 4.

The barrier, resistance to change, had a group mean in the first Delphi round of 2.87 and a standard deviation of 1.06. The standard deviation for resistance to change was the largest of all barriers/impediments ranked by the Delphi participants in the first round. Two panelists ranked this barrier as a 1, three panelists ranked it as 2, five panelists ranked it as a 3, and five panelists ranked it as a 4. Culture of the institution had a group mean in the first Delphi round of 2.80 and a standard deviation of 0.86. Only one panelist that ranked this barrier as a 1 (not a barrier/impediment), four panelists ranked it as 2 (usually not barrier/impediment), seven panelists ranked it as a 3 (sometimes a barrier/impediment), and three panelists ranked it as a 4 (consistently a barrier/impediment).

Complexity of higher education information systems and lack of technology funding needed to implement the tools were barriers that had group means of 2.67. Complexity of higher education information systems had a standard deviation of 0.90 while lack of technology funding needed to implement the tools had a standard deviation of 1.05; the third highest standard deviation in the initial round for this research question. Complexity of higher education information systems had two panelists that ranked this barrier as a 1, three panelists ranked it as 2, eight panelists ranked it as a 3, and two panelists ranked it as a 4. Lack of technology funding needed to implement the tools had two panelists that ranked this barrier as a 1, five panelists ranked it as 2, four panelists ranked it as a 3, and four panelists ranked it as a 4.

Reliance on measurement systems that lie outside the finance department for data and reliance on human capabilities of relative few that know how to use the tools had group means of 2.60 and standard deviations of 0.83. Reliance on measurement systems that lie outside the finance department had two panelists that ranked this barrier as a 1, three panelists ranked it as 2, nine panelists ranked it as a 3, and one panelist ranked it as a 4. Reliance on human capabilities of relative few that know how to use tools had one panelist that ranked this barrier as a 1, six panelists ranked it as 2, six panelists ranked it as a 3, and two panelists ranked it as a 4.

Bureaucracy and difficulties in identifying similar organizations for use in benchmarking had group means of 2.53 in the initial Delphi round. Bureaucracy had a standard deviation of 0.92 while difficulties in identifying similar organizations for use in benchmarking had a standard deviation of 0.99. For bureaucracy, two panelists ranked this barrier as a 1 (not a barrier/impediment), five panelists ranked it as 2 (usually not a barrier/impediment), six panelists ranked it as a 3 (sometimes a barrier/impediment), and two panelists ranked it as a 4 (consistently a barrier/impediment). Difficulties in identifying similar organizations for use in benchmarking had three panelists rank this barrier as a 1, three panelists ranked it as 2, seven panelists ranked it as a 3, and two panelists ranked it as a 4.

The results of the initial round of the Delphi study noted four barriers/impediments as usually not being barriers/impediments to the use of qualitative and quantitative tools by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. Technology needed to use the tools is not available (hardware or software) was ranked by the Delphi panel with a group mean of 2.40 with a standard deviation of 0.91. Two panelists ranked this barrier as a 1 (not a barrier/impediment), seven panelists ranked it as 2 (usually not a barrier/impediment), four panelists ranked it as a 3 (sometimes a barrier/impediment), and two panelists ranked it as a 4 (consistently a barrier/impediment). Tools don't seem to fit use in higher education also had an initial mean of 2.40 with an initial standard deviation of 1.06. This initial standard deviation was the highest for all of the barriers/impediments ranked by the Delphi panel for this research question. Four panelists ranked this barrier as a 1, three panelists ranked it as 2, six panelists ranked it as a 3, and two panelists ranked it as a 4.

Communication: lack of transparency and openness in regard to decision making was ranked as usually not being a barrier/impediment to CFOs in carrying out their management functions. Communication: lack of transparency and openness in regard to decision making had a first round mean of 2.13 and a standard deviation of 0.83. Three panelists ranked this barrier as a 1, eight panelists ranked it as 2, three panelists ranked it as a 3, and one panelist ranked it as a 4. Institution's senior leadership lack of knowledge/understanding of the tools had a group mean of 1.87 and a standard deviation of 0.83. This barrier/impediment was ranked significantly lower, 0.26 (12%), than any of the other variables ranked in the initial Delphi panel round. Five panelists ranked this barrier as a 1, eight panelists ranked it as 2, one panelist ranked it as a 3, and one panelist ranked it as a 4.

During the first Delphi round the Delphi panel members identified seven additional barriers/impediments to the use of qualitative and quantitative tools by public research university CFOs in carrying out their management functions. These additional barriers/impediments were:

- Lack of time to implement tools

- Data governance, ownership and reluctance of other departments to share data
- Lack of empirical research on models that will predict success
- Internal political considerations
- Fund accounting rules
- Lack of common definitions
- Communication roadblocks in decentralized organizations

Delphi Round 2

In round two, the Delphi panel reached consensus on all of the barriers/impediments that they had ranked in the first Delphi round. Where lack of resources: inadequate staffing and work overloads was ranked as a significant barrier/impediment to the use of qualitative and quantitative tools by public research university CFOs in carrying out their management functions in the initial Delphi panel round, no barriers/impediments were noted to as significant barriers/impediments after the second Delphi panel round. The group means for 13 barriers/impediments to the use of qualitative and quantitative tools in carrying out the public research university CFO management functions increased from round one to round two (Figure 6).

During the second Delphi panel round, the panel reached consensus on ten barriers/impediments that are sometimes barriers to the use of qualitative and quantitative tools in carrying out the public research university CFO management functions. At consensus, the Delphi panel also noted seven barriers/ impediments that usually are not barriers to the use of qualitative and quantitative tools in carrying out the public research university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. Table 6 compares the initial and consensus and means and standard deviations, Figure 6 reflects initial and consensus means, and Figure 7 reflects the initial and consensus standard deviations for the seventeen barriers/impediments to public research university CFOs use of qualitative and quantitative tools in carrying out their management functions.

TABLE 6. Initial and Consensus Means and Standard Deviations for Barriers/Impediments to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions – Sorted by Consensus Mean.

	Initial Mean	Consensus Mean	Initial Std Dev	Consensus Std Dev
Lack of resources: inadequate staffing and work overloads	3.53	3.47	0.64	0.64
Cumbersome, complicated and time consuming data gathering processes	3.00	3.20	0.76	0.68
Resistance to change	2.87	3.07	1.06	0.88
Culture of the institution	2.80	3.07	0.86	0.59
Cost of data collection	2.93	3.00	0.80	0.53
Insufficient data - not measuring areas where the tools could be used to support decision making	2.93	3.00	0.85	0.85
Bureaucracy - State or internal to the institution	2.53	2.93	0.92	0.80
Reliance on human capabilities of relative few that know how to use tools	2.60	2.80	0.83	0.86
Reliance on measurement systems that lie outside the finance department for data	2.60	2.80	0.83	0.77
Complexity of higher education information systems	2.67	2.73	0.90	0.80
Technology needed to use the tools is not available (hardware or software)	2.40	2.47	0.91	0.83
Tools don't seem to fit use in higher education	2.40	2.47	1.06	0.83
Lack of standardized higher education data	2.93	2.47	0.80	0.83
Difficulties in identifying similar organizations for use in benchmarking	2.53	2.40	0.99	0.83
Lack of technology funding needed to implement the tools	2.67	2.33	1.05	0.82
Communication: lack of transparency and openness in regard to decision making	2.13	2.33	0.83	0.72
Institution's senior leadership lack of knowledge/understanding of the tools	1.87	2.13	0.83	0.64

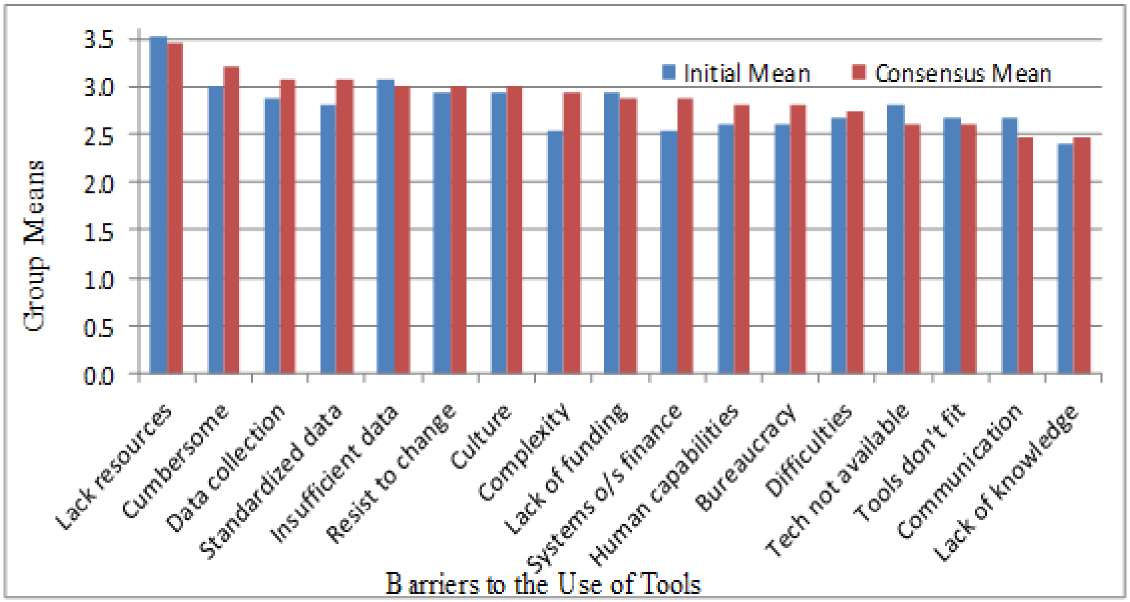

FIGURE 6. Initial and Consensus Means for Barriers/Impediments to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions.

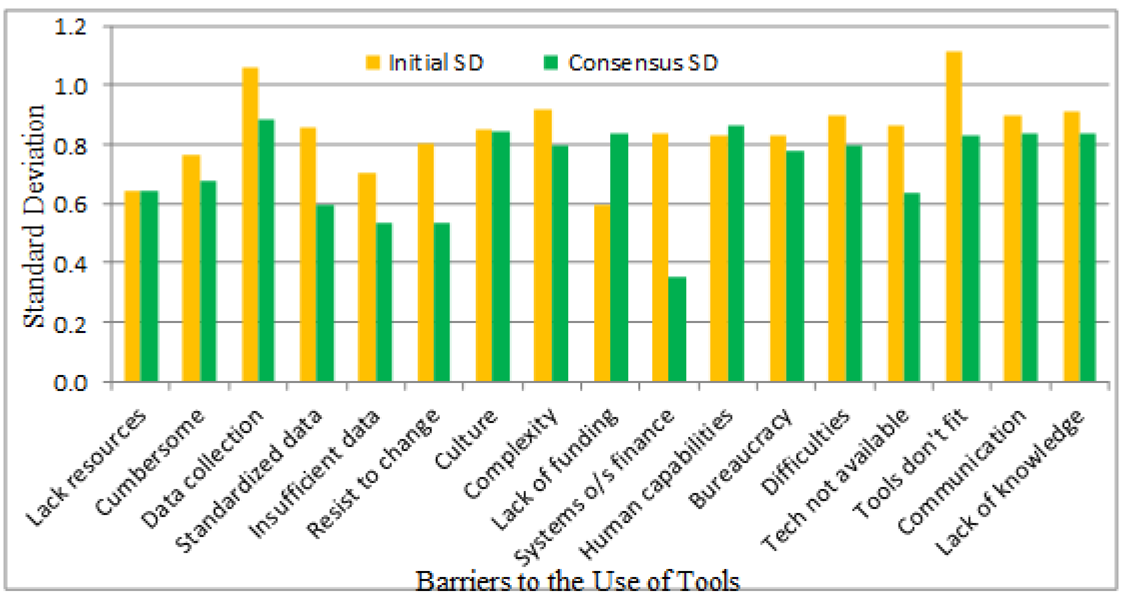

FIGURE 7. Initial and Consensus Standard Deviations for Barriers/Impediments to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions.

Lack of resources: inadequate staffing and work overloads was the highest ranked barrier/impediment to the use of qualitative and quantitative in carrying out the public research university CFO management functions. The consensus mean for this barrier/impediment was 3.47, a decrease of 0.06 (2%) moving from a barrier/impediment ranked as consistently a barrier/impediment to the use of tools to sometimes a barrier/impediment. Lack of resources: inadequate staffing and work overloads standard deviation of 0.64, the third lowest consensus standard deviation, was consistent between Delphi rounds. One panelist ranked this barrier as 2 (usually not a barrier/impediment), six panelists ranked it as a 3 (sometimes a barrier/impediment), and eight panelists ranked it as a 4 (consistently a barrier/impediment).

Cumbersome, complicated and time consuming data gathering processes had a consensus mean of 3.20, an increase of 0.20 (7%) from the initial Delphi panel round. The standard deviation for this barrier/impediment decreased .08 (11%) from the initial round to a standard deviation of 0.68, the fifth lowest consensus standard deviation. The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this barrier as a 2, eight panelists ranked it as a 3, and five panelists ranked it as a 4.

Resistance to change and culture of the institution both had a consensus mean of 3.07. Resistance to change had a 0.27 (10%) increase in its consensus mean while its standard deviation decreased to 0.88, a decrease of 0.18 (17%). The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 6); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this barrier as a 2, ten panelists ranked it as a 3, and three panelists ranked it as a 4. Culture of the institution had an increase in its consensus mean of 0.20 (7%) with a decrease in its standard deviation of 0.28 (31%) to 0.59; this was the second largest decrease in standard deviation between rounds for this research question. The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this barrier as a 2 (usually not a barrier/impediment), ten panelists ranked it as a 3 (sometimes a barrier/impediment), and three panelists ranked it as a 4 (consistently a barrier/impediment).

Cost of data collection and insufficient data - not measuring areas where the tools could be used to support decision making both had consensus means of 3.00, a 0.07 (2%) increase from their initial Delphi panel means. Cost of data collection had the lowest consensus standard deviation of 0.53 and the largest decrease in standard deviation between rounds, 0.27 (34%). The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this barrier as a 2, eleven panelists ranked it as a 3, and two panelists ranked it as a 4. Insufficient data - not measuring areas where the tools could be used to support decision making had a consensus standard deviation of 0.85, consistent with the initial Delphi panel round. One panelist ranked this barrier/impediment as a one, two panelists ranked this barrier as a 2, eight panelists ranked it as a 3, and four panelists ranked it as a 4.

Bureaucracy - State or internal to the institution had a consensus mean of 2.93, a 0.40 (16%) increase from the initial Delphi panel mean and a consensus standard deviation of 0.80, a decrease of 0.12 (13%). Five panelists ranked this barrier as a 2, six panelists ranked it as a 3, and four panelists ranked it as a 4. Complexity of higher education information systems had a consensus mean of 2.73, a 0.06 (2%) increase from the initial Delphi round. Complexity of higher education information systems had a consensus standard deviation of 0.80, a decrease of 0.10 (11%) from the initial Delphi round. At consensus, complexity of higher education information systems had one panelist that ranked this barrier as a 1, four panelists ranked it as 2, eight panelists ranked it as a 3, and two panelists ranked it as a 4.

Reliance on measurement systems that lie outside the finance department for data and reliance on human capabilities of relative few that know how to use barriers had group means of 2.80, a 0.20 (8%) increase from the initial Delphi panel round; these increases were the fourth largest of all of the barriers/impediments to the use of tools. Reliance on measurement systems that lie outside the finance department had a consensus standard deviations of 0.77, a 0.06 (7%) decrease from the initial Delphi panel round while reliance on human capabilities of relative few that know how to use the tools had a consensus mean of 0.86, a 0.03 (3%) increase (Figure 7). Reliance on measurement systems that lie outside the finance department had one panelist that ranked this barrier/impediment as a 1, two panelists ranked it as 2, nine panelists ranked it as a 3, and two panelists ranked it as a 4. Reliance on human capabilities of relative few that know how to use tools had one panelist that ranked this barrier as a 1, four panelists ranked it as 2, nine panelists ranked it as a 3, and two panelists ranked it as a 4.

Seven barriers/impediments were noted as usually not barriers/impediments to the use of qualitative and quantitative tools in carrying out the public research university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling in higher education. Technology needed to use the tools is not available (hardware or software) and tools don't seem to fit use in higher education both had consensus means of 2.47 while their first round means were 2.40, a 0.07 (3%) increase. Both barriers/impediments had consensus standard deviations of 0.83 with technology needed to use the tools is not available (hardware or software) decreasing 0.08 (8%) while tools don't seem to fit use in higher education had a decrease in standard deviation of 0.23 (22%); the fourth largest decrease in standard deviation between rounds. The decrease in the standard deviation between rounds for tools don't seem to fit use in higher education confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Both barriers/impediments had two panelists ranked these barriers as a 1, five panelists ranked them as a 2, seven panelists ranked these barriers as a 3, and one ranked them as a 4.

Lack of standardized higher education data also had a consensus mean of 2.47, a decrease of 0.53 (17%) from the initial Delphi round. For lack of standardized higher education data, the consensus standard deviation increased 0.03 (4%) to 0.83 (Figure 7). This was one of two barrier/impediments that had an increase in its standard deviation between the first two Delphi rounds. Three panelists ranked this barrier as a 1, five panelists ranked it as a 2, seven panelists ranked this barrier as a 3, and one ranked it as a 4.

Difficulties in identifying similar organizations for use in benchmarking had a consensus mean of 2.40, a decrease of 0.13 (5%) from the initial Delphi round. Difficulties in identifying similar organizations for use in benchmarking had a decrease of 0.16 (16%) in its consensus standard deviation of 0.83. The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Three panelists ranked this barrier as a 1, three panelists ranked it as a 2, and nine panelists ranked this barrier as a 3. Lack of technology funding needed to implement the tools saw a significant, 0.34 (13%), decrease to its consensus mean of 2.33 as compared to the initial Delphi round group mean of 2.67. This barrier's consensus standard deviation, 1.05, saw a large significant decrease, 0.23 (22%) from the first Delphi round standard deviation of 0.82%; the fourth largest decrease in standard deviation between rounds. The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this barrier as a 1, seven panelists ranked it as 2, five panelists ranked this barrier as a 3, and one ranked it as a 4.

At consensus, an institution's senior leadership lack of knowledge/understanding of the tools and communication: lack of transparency and openness in regard to decision making remained the least significant barriers/impediments to the implementation of qualitative and quantitative tools by public research university CFOs in carrying out their management functions. Communication: lack of transparency and openness in regard to decision making had a 0.20 (10%) increase in its mean from the initial Delphi round to consensus group mean of 2.33. The consensus standard deviation saw a decrease of 0.11 (13%) with a consensus standard deviation of 0.72. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this barrier as a 1, six panelists ranked it as 2, and seven panelists ranked this barrier as a 3.

Institution's senior leadership lack of knowledge/understanding of the tools had a 0.26 (14%) increase in its mean from the initial Delphi round to consensus group mean of 2.13. The consensus standard deviation saw a significant decrease of 0.19 (23%) to a consensus standard deviation of 0.64. This barrier’s increase in mean and decrease in standard deviation were the third largest of the seventeen barriers/impediments through the first two rounds of the Delphi panel. The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 7); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this barrier as a 1, nine panelists ranked it as 2, and four panelists ranked it as a 3. Where one individual ranked both of the above barriers as a 4 in the first Delphi panel round, neither of these barriers was ranked as a 4, “item is consistently a barrier/impediment to the use of the tools” at consensus.

For the seven barriers/impediments to the use of qualitative and quantitative tools by public research university CFOs in carrying out the management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling in higher education added by the Delphi panel members in the first round, Table 7 and Figure 8 present the ranks as assigned by individual Delphi panel experts.

TABLE 7. Initial Means and Standard Deviations for Barriers/Impediments Added by Delphi Panelists to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions – Sorted by Initial Mean.

	Initial Mean	Initial Std Dev
Lack of time to implement tools	3.07	0.70
Internal political considerations	2.93	0.59
Communication roadblocks in decentralized organizations	2.80	0.86
Data governance, ownership and reluctance of other departments to share data	2.67	1.11
Lack of empirical research on models that will predict success	2.67	0.90
Lack of common definitions	2.53	0.83
Fund accounting rules	1.87	0.92

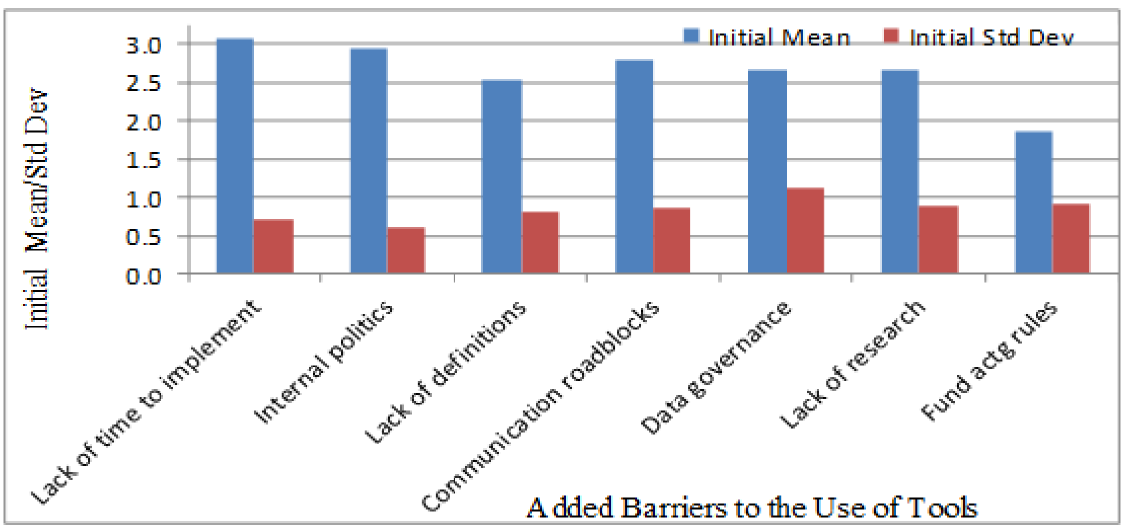

FIGURE 8. Initial Means and Standard Deviations for Barriers/Impediments Added by Delphi Panelists to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions.

These additional barriers/impediments were ranked for the first time in the second Delphi panel round as follows:

Six of the seven barriers/impediments added by the Delphi panelists during the first Delphi round were noted as sometimes being a barrier/impediment to the use of qualitative and quantitative tools by CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. Lack of time to implement tools had an initial group mean of 3.07 and an initial standard deviation of 0.70. Two panelists ranked this barrier as 2 (usually not a barrier/impediment), ten panelists ranked it as a 3 (sometimes a barrier/impediment), and three panelists ranked it as a 4 (consistently a barrier/impediment).

Internal political considerations had an initial group mean in round 2 of 2.93 and an initial standard deviation of 0.59; the lowest standard deviation of the barriers/impediments added by the Delphi panel. Four panelists ranked this barrier as a 1, eight panelists ranked it as 2, and three panelists ranked it as a 3. Communication roadblocks in decentralized organizations had a group mean of 2.80 and a standard deviation of 0.86 in the initial ranking for this item. One panelist ranked this barrier/impediment as a 1 (not a barrier/impediment), four panelists ranked this barrier as 2 (usually not a barrier/impediment), seven panelists ranked it as a 3 (sometimes a barrier/impediment), and three panelists ranked it as a 4 (consistently a barrier/impediment).

Data governance, ownership and reluctance of other departments to share data and lack of empirical research on models that will predict success had group means of 2.67 in the initial ranking of these barriers/impediments. Data governance, ownership and reluctance of other departments to share data had a standard deviation of 1.11; the highest standard deviation of any of the barriers/impediments surveyed three panelists ranked data governance, ownership and reluctance of other departments to share data as a 1, three panelists ranked it as 2, five panelists ranked it as a 3, and four panelists ranked it as a 4. Lack of empirical research on models that will predict success had a standard deviation of 0.90. Lack of empirical research on models that will predict success, had one panelist rank this barrier/impediment as a 1 (not a barrier/impediment), six panelists ranked this barrier as 2 (usually not a barrier/impediment), five panelists ranked it as a 3 (sometimes a barrier/impediment), and three panelists ranked it as a 4 (consistently a barrier/impediment).

Lack of common definitions had a group mean of 2.53 and a standard deviation of 0.83 in the initial ranking. Two panelists ranked this barrier/impediment as a 1, four panelists ranked this barrier as 2, seven panelists ranked it as a 3, and one panelist ranked it as a 4. Finally, one barrier/impediment added by the Delphi panelists during the first Delphi round was noted to usually not inhibit the use of qualitative and quantitative tools by CFOs in carrying out their management. Fund accounting rules had the lowest mean of all the barriers/impediments to the use of qualitative and quantitative management tools at 1.87 and a standard deviation of 0.92. Six panelists ranked this barrier as a 1, three panelists ranked it as 2, two panelists ranked it as a 3, and four panelists ranked fund accounting rules as a four.

Delphi Round 3

In round three, the Delphi panel reached consensus on all of the barriers/impediments that they had initially ranked in the second Delphi round. Where six of the seven barriers/impediments added by the Delphi panelists during the second Delphi round as sometimes being barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling, lack of empirical research on models that will predict success had a decreased consensus mean which led it to be a barrier/impediment that was usually not a barrier/impediment to the use of tools by public research university CFOs in carrying out their management functions.

In this Delphi panel round, one of the panelists assigned high ranks to all of the barriers/impediments, an average of 3.29, approximately 10% higher than any other panel member. However, these rankings were not considered to be an outlier as compared to the other rankings. No other panel members assigned ranks that were significantly different than their fellow Delphi panel members. Only one mean, lack of common definitions, increased from round two to round three (Table 8 and Figure 9). Table 8 and Figure 9 present the initial and consensus means and standard deviations while and Figure 10 presents the initial and consensus standard deviations for barriers/impediments added by the Delphi panel.

TABLE 8. Initial and Consensus Means and Standard Deviations for Barriers/Impediments Added by Delphi Panelists to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions – Sorted by Consensus Mean

	Initial Mean	Consensus Mean	Initial Std Dev	Consensus Std Dev
Lack of time to implement tools	3.07	3.00	0.70	0.53
Internal political considerations	2.93	2.87	0.59	0.83
Lack of common definitions	2.53	2.87	0.83	0.83
Communication roadblocks in decentralized organizations	2.80	2.60	0.86	0.63
Data governance, ownership and reluctance of other departments to share data	2.67	2.60	1.11	0.83
Lack of empirical research on models that will predict success	2.67	2.47	0.90	0.83
Fund accounting rules	1.87	1.87	0.92	0.83

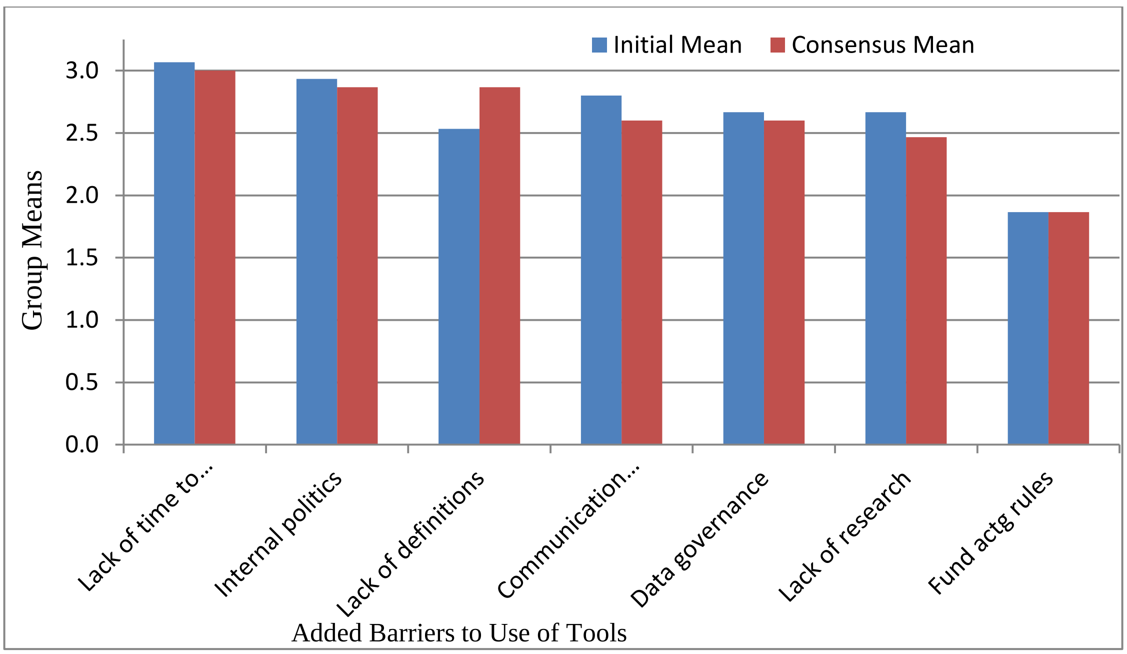

FIGURE 9. Initial and Consensus Means for Barriers/Impediments Added by Delphi Panelists to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions.

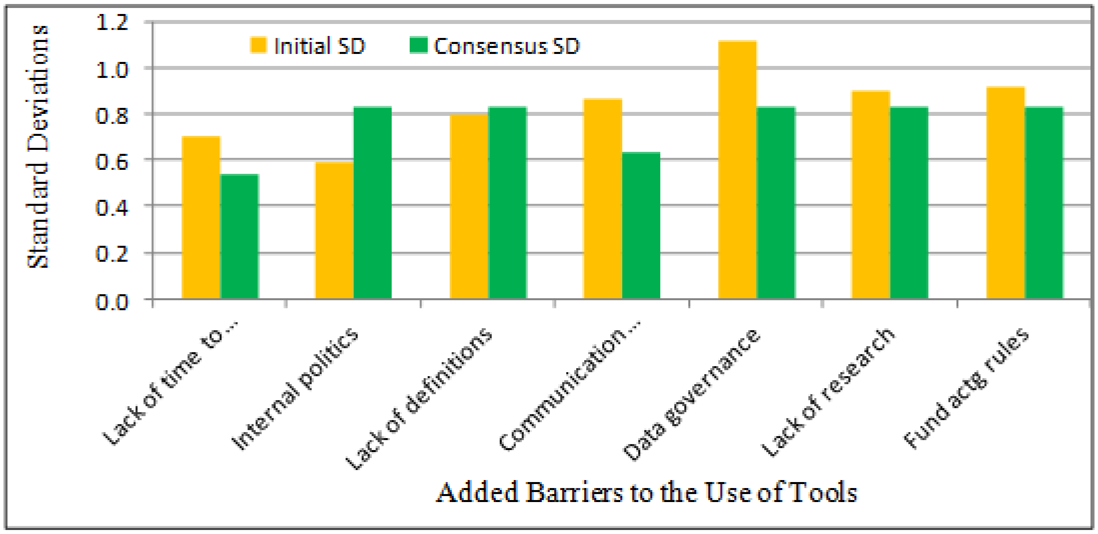

FIGURE 10. Initial and Consensus Standard Deviations for Barriers/Impediments Added by Delphi Panelists to the Use of Qualitative and Quantitative Management Tools by Public Research University CFOs in Currently Carrying Out Their Management Functions.

Lack of time to implement tools had a consensus mean of 3.00, a decrease of 0.07 (2%), and a consensus standard deviation of 0.53, a decrease of 0.17 (24%). The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 10); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. In round three, two panelists ranked this barrier as 2 (usually not a barrier/impediment), eleven panelists ranked it as a 3 (sometimes a barrier/impediment), and two panelists ranked it as a 4 (consistently a barrier/impediment).

Internal political considerations had a consensus mean of 2.87, a decrease of 0.06 (2%), and a consensus standard deviation of 0.83, an increase of 0.24 (41%). One panelist ranked internal political considerations as a 1, three panelists ranked it as 2, eight panelists ranked it as a 3, and three panelists ranked it as a 4. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds of 0.06 is approximately ten percent of the lower of the two standard deviations. Additionally, the change in responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

Lack of common definitions also had a consensus mean of 2.87, an increase of 0.34 (13%), and a consensus standard deviation of 0.35, a decrease of 0.49 (59%); the largest standard deviation decrease of any barrier/impediment between Delphi rounds. Lack of common definitions was the only barrier/impediment that had an increase in its consensus mean in round three as compared to its group mean in round two. The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 10); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. One panelist ranked this barrier/impediment as a 1, three panelists ranked it as 2, eight panelists ranked it as a 3, and three panelists ranked it as a 4.

Communication roadblocks in decentralized organizations had a consensus mean of 2.60, a decrease of 0.20 (7%), and a consensus standard deviation of 0.63, a decrease of 0.25 (27%). The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 10); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. In round three, one panelist ranked this barrier/impediment as a one (not a barrier/impediment), four panelists ranked this barrier as 2 (usually not a barrier/impediment), and ten panelists ranked it as a 3 (sometimes a barrier/impediment). Data governance, ownership and reluctance of other departments to share data had a consensus mean of 2.60, a decrease of 0.07 (3%), and a consensus standard deviation of 0.83, a decrease of 0.28 (25%). The decrease in the standard deviation between rounds for this barrier/impediment confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 10); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked internal political considerations as a 1, three panelists ranked it as 2, nine panelists ranked it as a 3, and one panelist ranked it as a 4.

Lack of empirical research on models that will predict success and fund accounting rules were ranked by the Delphi panelists as usually not barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. Lack of empirical research on models that will predict success had a consensus mean of 2.47, a decrease of 0.20 (8%), and a consensus standard deviation of 0.83, a decrease 0.07 (7%). Two panelists rank this barrier/impediment as a one (not a barrier/impediment), five panelists ranked this barrier as 2 (usually not a barrier/impediment), seven panelists ranked it as a 3 (sometimes a barrier/impediment), and one panelist ranked it as a 4 (consistently a barrier/impediment).

Fund accounting rules once again had the lowest mean of all the barriers/impediments to the use of qualitative and quantitative management tools at 1.87 (consistent with the prior round) and a standard deviation of 0.83, a 0.07 decrease (9%). Of all the barriers/impediments ranked by the Delphi panel, fund accounting rules had the lowest consensus mean. The Delphi panelists did not see fund accounting rules as being a barrier/impediment to the use of qualitative and quantitative management tools by public research university CFOs. Five panelists ranked this barrier as a 1, eight panelists ranked it as 2, one panelist ranked it as a 3, and one panelist ranked fund accounting rules as a four.

Research Question Three

Research question three of this study asked, "What benefits do public research university CFOs identify from using qualitative and quantitative management tools in carrying out their management functions." Benefits from the use of tools that ranked:

1) 4.5 or higher were considered to strongly benefit public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling.
2) between 3.5 and 4.49 were considered to benefit research public university CFOs in carrying out their management functions.

3) between 2.5 and 3.49 were considered neutral as benefitting research public university CFOs in carrying out their management functions; none of the benefits surveyed ranked lower than 2.5.

The scale used by the panel was a Likert-type five point scale with the following descriptions:

1. Strongly disagree that the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
2. Disagree that the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
3. Neutral as to whether the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
4. Agree that the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
5. Strongly agree that the qualitative and quantitative management tools benefit CFOs in carrying out their management functions

Delphi Panel Initial Round

During the first Delphi round, a total of ten benefits from the use of tools were identified as benefitting public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling (group means between 3.5 and 4.49) while two benefits from the use of tools were considered neutral to benefitting public university CFOs in carrying out their management functions (group means between 2.5 and 3.49).

Table 9 and Figure 11 depict initial group means and standard deviations for the benefits from the use of tools to public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the initial Delphi round. Each of the benefits will be discussed in descending order per their initial group mean ranking by the Delphi panelists.

Table 9. Initial Means and Standard Deviations for Benefits from the Use of Tools to Public Research University CFOs in Carrying Out Their Management Functions – Sorted by Initial Mean.

	Initial Mean	Initial Std Dev
Tools provide identifiable support for decisions	4.40	0.51
Tools allow graphical representation of ideas that assist in "telling the story"	4.27	0.59
Tools provide the basis for repetitive data analysis over time	4.07	0.59
Tools identify relationships not uncovered through other means	4.00	0.76
Tools assist decision makers in developing a group decision	3.80	0.56
Tools promote use of best practices	3.80	0.86
Tools provide for improved communication in the decision making process	3.73	0.96
Tools increase the reliability of decision making	3.67	0.98
Tools assist in supporting accreditation reviews	3.60	0.63
Tools assist in the development of staff	3.53	0.83
Tools assist in changing the culture of the organization	3.47	0.99
Tools bring other experts into the decision making process	3.27	0.70

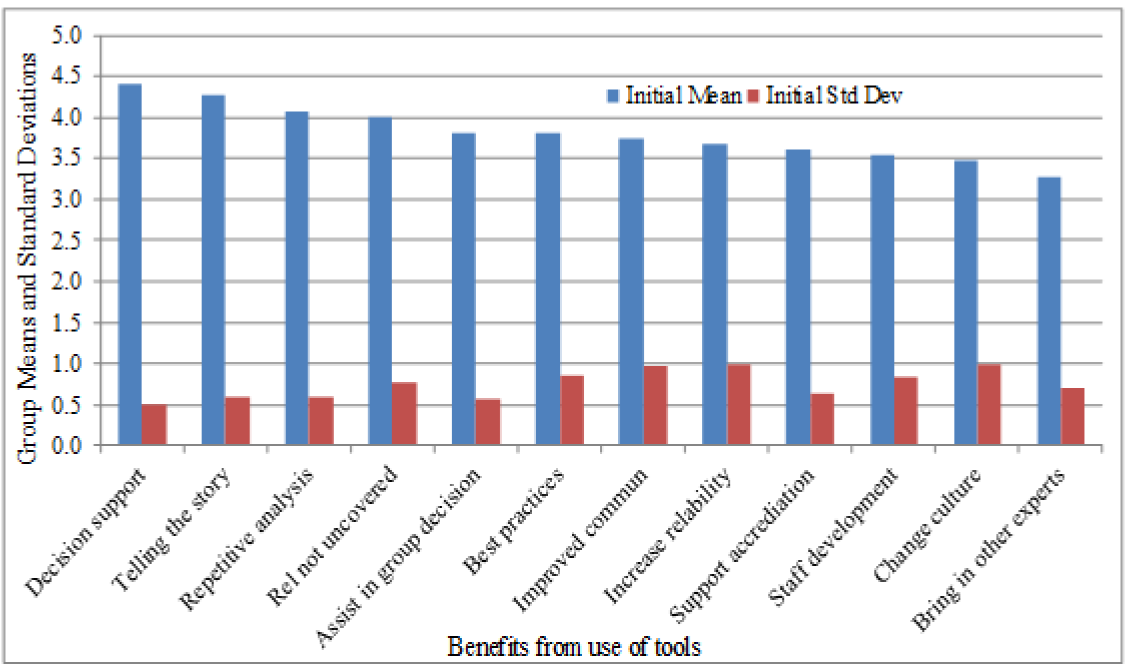

Figure 11. Initial Means and Standard Deviations for Benefits from the Use of Tools to Public Research University CFOs in Carrying Out Their Management Functions.

Tools provide identifiable support for decisions had the highest initial group mean of 4.40 and the lowest initial standard deviation of 0.51. Six panelists ranked this benefit a 5 and nine panelists ranked the benefit as a 4. Tools allow graphical representation of ideas that assist in "telling the story" had an initial group mean of 4.27 and a standard deviation of 0.59, the third lowest standard deviation in the initial Delphi round. Five panelists ranked this benefit as a 5 (strongly agree that tools benefit CFOs in carrying out their management functions), nine panelists ranked the benefit as a 4 (agree that tools benefit CFOs in carrying out their management functions), and one panelist ranked it as a 3 (neutral as to whether tools benefit CFOs in carrying out their management functions).

Tools provide the basis for repetitive data analysis over time had an initial group mean of 4.07 and a standard deviation of 0.59, the third lowest standard deviation in the initial Delphi round. Three panelists ranked this benefit as a 5, ten panelists ranked the benefit as a 4, and two panelists ranked it as a 3. Tools identify relationships not uncovered through other means had an initial group mean of 4.00 and a standard deviation of 0.76. Four panelists ranked this benefit as a 5, seven panelists ranked the benefit as a 4, and four panelists ranked it as a 3.

Tools assist decision makers in developing a group decision and tools promote use of best practices had initial group means of 3.80. Tools assist decision makers in developing a group decision had a standard deviation of 0.56, the second lowest standard deviation for all of the benefits ranked in this round. Tools promote use of best practices had a standard deviation of 0.86. Tools assist decision makers in developing a group decision had one panelist rank the benefit as a 4, ten panelists ranked it as a 3, and four panelists ranked it as a 2. Tools promote use of best practices had three panelists rank this benefit as a 5, seven panelists ranked the benefit as a 4, seven panelists ranked it as a 3, and one panelist ranked it as a 2.

Tools provide for improved communication in the decision making process had an initial group mean of 3.73 and a standard deviation of 0.96, the third highest standard deviation in the initial Delphi round. Three panelists ranked this benefit as a 5, seven panelists ranked the benefit as a 4, three panelists ranked it as a 3, and two panelists ranked it as a 2. Tools increase the reliability of decision making had an initial group mean of 3.67 and a standard deviation of 0.98, the second highest standard deviation for all of the benefits ranked in this round. One panelist ranked this benefit as a 5, eleven panelists ranked the benefit as a 4, one panelist ranked it as a 3, one panelist ranked it as a 2, and one panelist ranked tools increase the reliability of decision making a 1.

Tools assist in supporting accreditation reviews had an initial group mean of 3.60 and a standard deviation of 0.63, the fifth lowest standard deviation in the initial Delphi round. Two panelists ranked this benefit as a 5, five panelists ranked the benefit as a 4, seven panelists ranked it as a 3, and one panelist ranked it as a 2. Tools assist in the development of staff had an initial group mean of 3.53 and a standard deviation of 0.83, the fourth highest standard deviation in the initial Delphi round. Two panelists ranked this benefit as a 5, four panelists ranked the benefit as a 4, eight panelists ranked it as a 3, and one panelist ranked it as a 2.

The benefits “tools assist in changing the culture of the organization” and “tools bring other experts into the decision making process” were ranked as neutral to benefitting public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling. Tools assist in changing the culture of the organization had an initial group mean of 3.47 with a standard deviation of 0.99, the highest standard deviation for all of the benefits ranked in this round. Two panelists ranked “tools assist in changing the culture of the organization” as a 5, six panelists ranked the benefit as a 4, four panelists ranked it as a 3 and three panelists ranked it as a 2. Tools bring other experts into the decision making process had the lowest initial group mean of 3.27 with a standard deviation of 0.70. Three panelists ranked “tools bring other experts into the decision making process” as a 4, eight panelists ranked it as a 3 and five panelists ranked it as a 2.

During the initial Delphi round the Delphi panel members identified six additional benefits to public research university CFOs in carrying out their management functions. These additional benefits were:

1) tools help focus senior management’s attention in setting priorities
2) tools can help educate individuals in leadership roles
3) tools greatly improve external communication capacity
4) tools can be used to demonstrate successful practices/transitions
5) tools can help counter decision making based on anecdote and emotion
6) data and tools can add credibility to the discussion

Second Delphi Round

During the second Delphi round, the Delphi panel was able to reach consensus on all of the benefits they ranked in the initial Delphi round and ranked for the first time the six benefits that were added during the initial Delphi round. While two benefits were considered as neutral to benefitting public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling during the initial Delphi panel round, all twelve benefits that were ranked in both the initial and second Delphi panel round were identified as benefitting public research university CFOs in carrying out their management functions at consensus, Table 10 and Figure 12. Initial and consensus standard deviations for benefits from the use of qualitative and quantitative management tools are shown in Figure 13.

Table 10. Initial and Consensus Means and Standard Deviations for Benefits from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions – Sorted by Consensus Mean.

	Initial Mean	Consensus Mean	Initial Std Dev	Consensus Std Dev
Tools provide identifiable support for decisions	4.40	4.47	0.51	0.52
Tools provide the basis for repetitive data analysis over time	4.07	4.20	0.59	0.56
Tools allow for the graphical representation of ideas that can assist in "telling the story"	4.27	4.07	0.59	0.46
Tools assist decision makers in developing a group decision	3.80	4.07	0.56	0.46
Tools provide for improved communication in the decision making process	3.73	4.07	0.96	0.70
Tools increase the reliability of decision making	3.67	4.00	0.98	0.76
Tools assist in supporting accreditation reviews	3.60	4.00	0.63	0.65
Tools identify relationships not uncovered through other means	4.00	3.87	0.76	0.52
Tools assist in the development of staff	3.53	3.87	0.83	0.74
Tools bring other experts into the decision making process	3.13	3.80	0.74	0.77
Tools promote the use of best practices	3.80	3.67	0.86	0.90
Tools assist in changing the culture of the organization	3.47	3.53	0.99	0.99

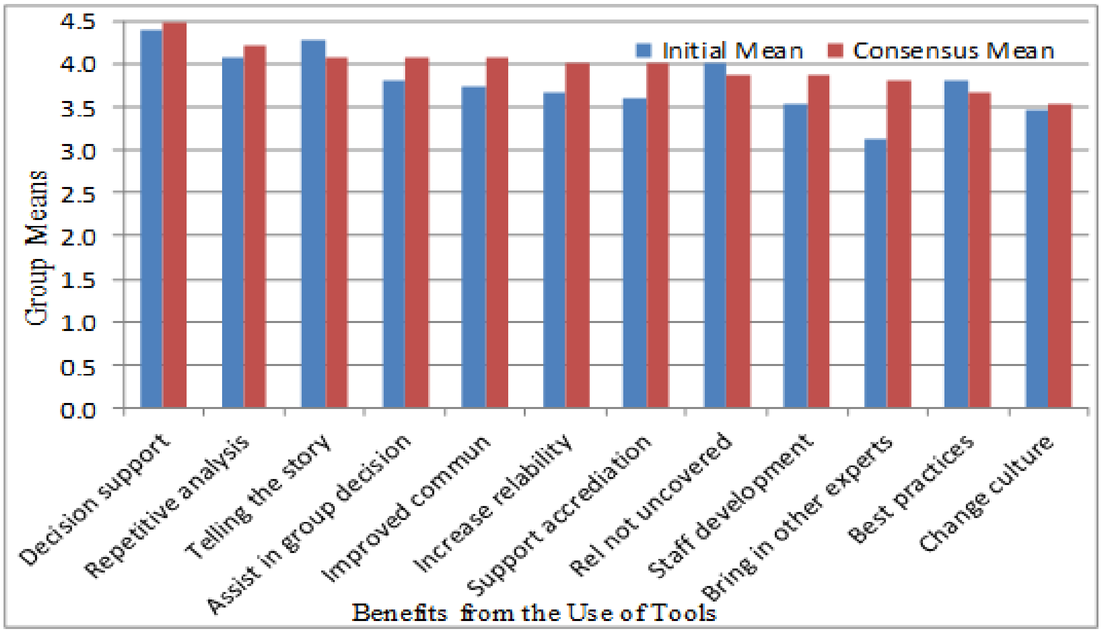

Figure 12. Initial and Consensus Means for Benefits from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions.

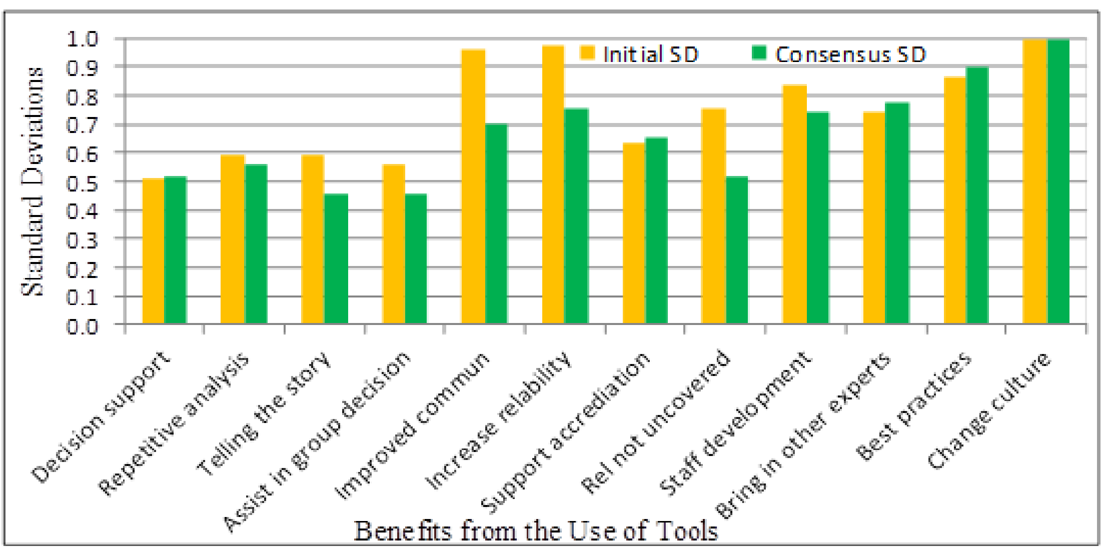

Figure 13. Initial and Consensus Standard Deviations for Benefits from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions.

Tools provide identifiable support for decisions had a consensus mean of 4.47, an increase of 0.07 (2%), and a consensus standard deviation of 0.52, an increase of 0.01 (2%). Tools provide identifiable support for decisions had the third lowest consensus standard deviation reflecting the clustering of responses for this benefit (Figure 13). Seven panelists ranked this benefit as a 5 (strongly agree that tools benefit CFOs in carrying out their management functions) and eight panelists ranked the benefit as a 4 (agree that tools benefit CFOs in carrying out their management functions). Tools provide the basis for repetitive data analysis over time had a consensus mean of 4.20, an increase of 0.13 (3%), and a consensus standard deviation of 0.56, the fifth lowest standard deviation in the initial Delphi round, a decrease of 0.03 (6%). Four panelists ranked this benefit as a 5, ten panelists ranked the benefit as a 4, and one panelist ranked this benefit as a 3.

Tools allow for the graphical representation of ideas that can assist in "telling the story" had a consensus mean of 4.07. Tools allow for the graphical representation of ideas that can assist in "telling the story" had the largest decrease in means between rounds, 0.20 (5%). Tools allow for the graphical representation of ideas that can assist in "telling the story" standard deviation decreased 0.13 (23%) to 0.46 at consensus. The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 13); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Tools assist decision makers in developing a group decision also had consensus mean of 4.07, a 0.27 (7%) increase in means between rounds. Both of these benefits also had the lowest consensus standard deviation, 0.46, reflecting their clustering of responses. Tools assist decision makers in developing a group decision had a standard deviation decrease of 0.10 (18%). The decrease in the standard deviation between rounds for these benefits confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 13); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Both benefits had two panelists rank them as a 5, twelve panelists ranked these benefits as a 4, and one panelist ranked these benefits as a 3.

Tools provide for improved communication in the decision making process also had consensus means of 4.07, an increase of 0.34 (9%) but had more widely dispersed responses and a consensus standard deviation of 0.70; a decrease of 0.26 (27%), the second largest standard deviation decrease from the initial Delphi round. The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 13); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Four panelists ranked tools provide for improved communication in the decision making process as a 5, eight panelists ranked this benefit as a 4, and three panelists ranked it as a 3.

Tools increase the reliability of decision making and tools assist in supporting accreditation reviews both had consensus means of 4.00. Tools increase the reliability of decision making consensus mean increased 0.33 (9%) while tools assist in supporting accreditation reviews consensus mean increased 0.40 (11%). The Delphi panel responses to tools increase the reliability of decision making reflected more variation with a consensus standard deviation of 0.76, a decrease of 0.22 (23%), the second largest standard deviation decrease from the initial Delphi round. The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 13); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Three panelists ranked this benefit as 5, eight panelists ranked this benefit as a 4, and four panelists ranked this benefit as a 3. Tools assist in supporting accreditation reviews had a consensus standard deviation of 0.65, an increase of 0.02 (4%) from the initial Delphi round; only one of three benefits that had an increase in its standard deviation between rounds (Figure 13). For tools assist in supporting accreditation reviews, three panelists ranked this benefit as a 5, nine panelists ranked this benefit as a 4, and three panelists ranked this benefit as a 3.

Tools identify relationships not uncovered through other means had a consensus mean of 3.87, a 0.13 (3%) decrease from the initial Delphi round. At consensus, tools identify relationships not uncovered through other means had a standard deviation of 0.52 (a decrease of 0.24, 32%, the largest standard deviation decrease from the initial Delphi round). The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 13); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. One panelist ranked tools identify relationships not uncovered through other means as a 5, eleven panelists ranked this benefit as a 4, and three panelists ranked this benefit as a 3.

Tools assist in the development of staff also had a consensus mean of 3.87, a 0.24 (7%) increase from the initial Delphi round. Tools assist in the development of staff showed more variation in responses with a standard deviation of 0.74 (a decrease of 0.09, 11%, from the initial Delphi round, Figure 13). Tools assist in the development of staff had two panelists rank this benefit as a 5, eleven panelists ranked this benefit as a 4, and two panelists ranked this benefit as a 3.

Tools bring other experts into the decision making process had the largest increase in means from the initial Delphi panel round to consensus, 0.67 (21%), reaching a consensus mean of 3.80. Its consensus standard deviation was 0.77, an increase of 0.03 (4%). The consistent standard deviation between rounds for this benefit confirms stabilization of the group opinion (Figure 13). Two panelists ranked this benefit as a 5, nine panelists ranked this benefit as a 4, three panelists ranked this benefit as a 3, and one panelist ranked tools bring other experts into the decision making process as 2.

Tools promote the use of best practices had the second largest decrease in means between the rounds (0.13, 3%) reaching a consensus mean of 3.67. The consensus standard deviation for this benefit was 0.90, the largest increase in standard deviations (0.04, 4%) between Delphi panel rounds; this benefit advantage also had the second highest standard deviation at consensus (Figure 13). Three panelists ranked this benefit as a 5, five panelists ranked this benefit as a 4, six panelists ranked this benefit as a 3, and one panelist ranked this benefit as a 2.

Finally, tools assist in changing the culture of the organization had a consensus mean of 3.53 and a consensus standard deviation of 0.99 (Figure 13). This was the lowest mean and the highest standard deviation (more variation in responses) of all the benefits surveyed in the first two Delphi panel rounds. The change in the mean was 0.06 (2%), while the standard deviation did not change between rounds. Two panelists ranked this benefit as a 5, seven panelists ranked this benefit as a 4, three panelists ranked this benefit as a 3, and three panelists ranked this benefit as a 2.

The average initial rankings for the benefits added by the Delhi panel were higher than the original benefits that the Delphi panel ranked in round one. The rankings for all of the benefits added by the Delhi panel were identified as benefitting public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling; see Table11 and Figure 14 below.

Table 11. Initial Means and Standard Deviations for Benefits Added by Delphi Panel from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions – Sorted by Initial Mean.

	Initial Mean	Initial Std Dev
Data and tools can add credibility to the discussion	4.27	0.59
Tools can help educate individuals in leadership roles	4.07	0.59
Tools can help counter decision making based on anecdote and emotion	4.07	0.70
Tools help focus senior management's attention in setting priorities	4.00	0.76
Tools can be used to demonstrate successful practices/transitions	4.00	0.85
Tools greatly improve external communication capacity	3.73	0.70

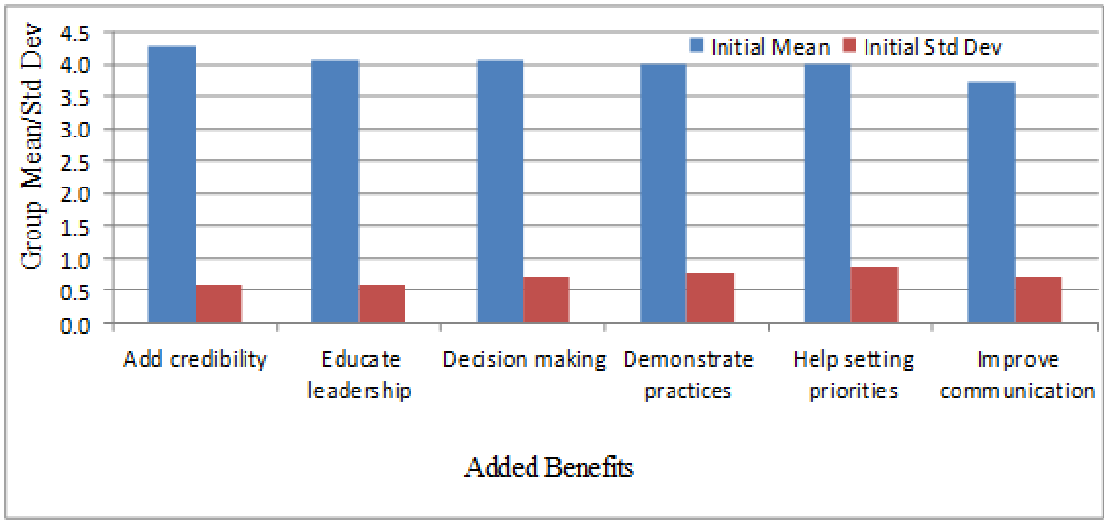

Figure 14. Initial Means and Standard Deviations for Benefits Added by Delphi Panel from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions.

Data and tools can add credibility to the discussion had an initial group mean of 4.27 and a standard deviation of 0.59. This benefit's mean was ranked the second highest in its initial ranking by the Delphi panel. Five panelists ranked this benefit as a 5, nine panelists ranked the benefit as a 4, and one panelist ranked it as a 3.

Tools can help educate individuals in leadership roles and tools can help counter decision making based on anecdote and emotion had initial means of 4.07. Tools can help educate individuals in leadership roles had an initial standard deviation of 0.59. Three panelists ranked this benefit as a 5, ten panelists ranked the benefit as a 4, and two panelists ranked it as a 3. Tools can help counter decision making based on anecdote and emotion had an initial standard deviation of 0.70. Four panelists ranked this benefit as a 5, eight panelists ranked the benefit as a 4, and three panelists ranked it as a 3.

Tools help focus senior management's attention in setting priorities and tools can be used to demonstrate successful practices/transitions had initial group means of 4.00. Tools help focus senior management's attention in setting priorities had an initial standard deviation of 0.76. Four panelists ranked this benefit as a 5, seven panelists ranked the benefit as a 4, and four panelists ranked it as a 3. Tools can be used to demonstrate successful practices/transitions had an initial standard deviation of 0.85. This was the highest standard deviation of all benefits added by the Delphi panel. Four panelists ranked this benefit as a 5, nine panelists ranked the benefit as a 4, and two panelists ranked it as a 3. Tools greatly improve external communication capacity had an initial group mean of 3.73 and a standard deviation of 0.70. Two panelists ranked this benefit as a 5, seven panelists ranked the benefit as a 4, and six panelists ranked it as a 3.

Third Delphi Round

In the third Delphi panel round, the panel was able to reach consensus on all of the benefits that were added during the initial Delphi round. All added benefits were identified as benefitting public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling. None of the added benefits had more than a two percent change in their consensus means as compared to their initial mean Table 12 and Figure 15. Two of the added benefits had the lowest standard deviations of any of those surveyed by the Delphi panel, Figure 16.

Table 12. Initial and Consensus Means and Standard Deviations for Benefits Added by Delphi Panel from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions - Sorted by Consensus Mean.

	Initial Mean	Consensus Mean	Initial Std Dev	Consensus Std Dev
Data and tools can add credibility to the discussion	4.27	4.33	0.59	0.49
Tools can help educate individuals in leadership roles	4.07	4.13	0.59	0.35
Tools can help counter decision making based on anecdote and emotion	4.07	4.07	0.70	0.59
Tools can be used to demonstrate successful practices/transitions	4.00	4.00	0.85	0.38
Tools help focus senior management's attention in setting priorities	4.00	3.93	0.76	0.46
Tools greatly improve external communication capacity	3.73	3.73	0.70	0.70

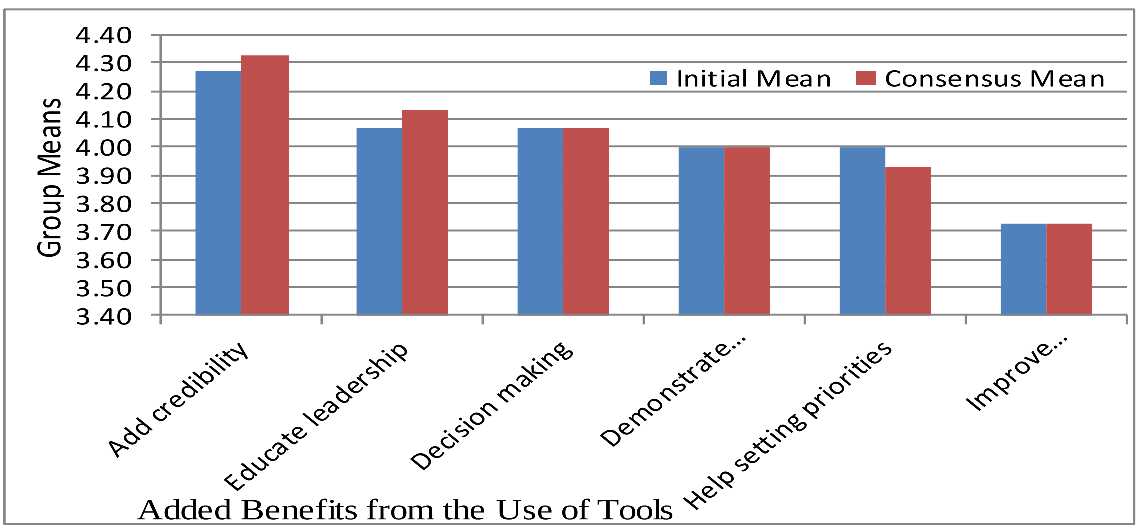

Figure 15. Initial and Consensus Group Means for Benefits Added by Delphi Panel from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions.

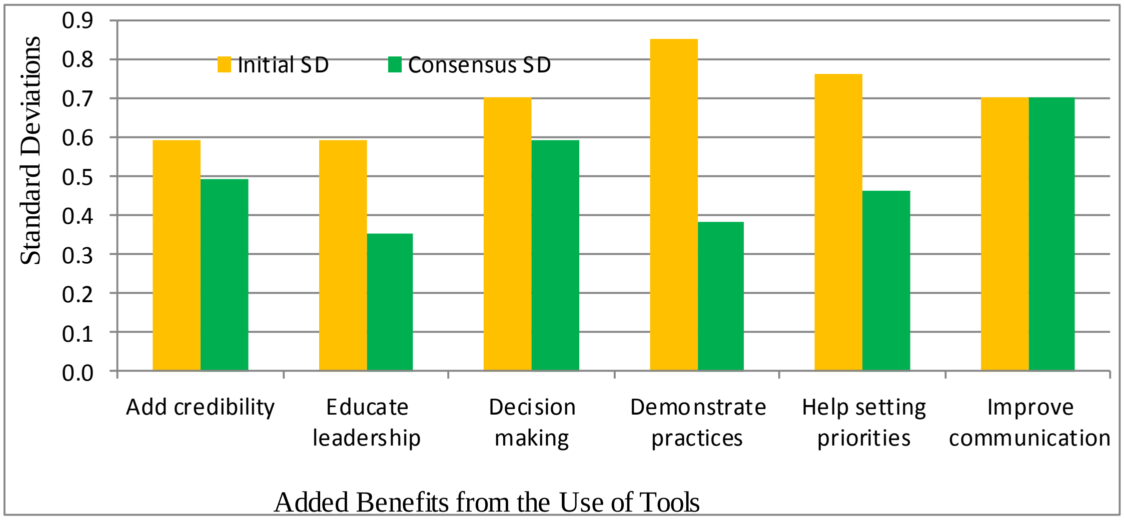

Figure 16. Initial and Consensus Standard Deviations for Benefits Added by Delphi Panel from the Use of Qualitative and Quantitative Management Tools to Public Research University CFOs in Carrying Out Their Management Functions.

Data and tools can add credibility to the discussion had a consensus mean of 4.27, an increase of 0.06 (2%), and a consensus standard deviation of 0.49, a decrease of 0.10 (18%). Four panelists ranked this benefit as a 5, ten panelists ranked the benefit as a 4, and one panelist ranked this benefit as a 3. Tools can help educate individuals in leadership roles discussion had a consensus mean of 4.13, an increase of 0.06 (2%), and a consensus standard deviation of 0.35, a decrease of 0.24 (41%). The percentage decrease in the consensus standard deviation was the second largest of all benefits surveyed and the consensus standard deviation was the lowest of all benefits surveyed. The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 16); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Two panelists ranked this benefit as a 5 and thirteen panelists ranked the benefit as a 4, agreeing that tools benefit public research university CFOs in carrying out their management functions.

Tools can help counter decision making based on anecdote and emotion had a consensus mean of 4.07, consistent with the initial ranking of this benefit, and a consensus standard deviation of 0.59, a decrease of 0.11 (16%). The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 16); the group mean was consistent between rounds but there was a large decrease in the standard deviation. Tools can help counter decision making based on anecdote and emotion, had three panelists rank this benefit as a 5, ten panelists ranked the benefit as a 4, and two panelists ranked this benefit as a 3. Tools can be used to demonstrate successful practices/transitions also had no change between its initial and consensus mean of 4.00 and a consensus standard deviation of 0.38, a decrease of 0.47 (55%). This decrease in standard deviations was the largest of any benefit both in terms of absolute value and percentage change. The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 16); the group mean was consistent between rounds but there was a large decrease in the standard deviation. One panelist ranked this benefit as a 5, thirteen panelists ranked the benefit as a 4, and one panelist ranked this benefit as a 3.

Tools help focus senior management's attention in setting priorities had a 0.07 decrease (2%) in its consensus mean of 3.93 as compared to its initial mean of 4.00. At the same time, tools help focus senior management's attention in setting priorities saw a significant decrease in its standard deviation, 0.30 (39%), to a consensus standard deviation of 0.46. The decrease in the standard deviation between rounds for this benefit confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 16); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. One panelist ranked this benefit as a 5, twelve panelists ranked the benefit as a 4, and two panelists ranked this benefit as a 3. Tools greatly improve external communication capacity saw no change in its mean or standard deviation between rounds. Its consensus mean was 3.73 while its consensus standard deviation was consistent between rounds at 0.70. Two panelists ranked this benefit as a 5, seven panelists ranked the benefit as a 4, and six panelists ranked this benefit as a 3.

Non-representative Outlier Effects on the Study Results

Review of the data for this research question noted that one study participant had assigned a rank of 5 – “strongly agree that tools benefit public research university CFOs in carrying out their management functions” during round two. Although the outlier’s results were correctly recorded, they were considered to be unique because they were 26% higher than the average ranking for all fifteen Delphi panel experts. Therefore, the study results with the consensus group means and standard deviations with the outlier ranks included in the group results compared to the study results with exclusion of the outlier ranks is included in Table 13 below.

TABLE 13. Comparison Between Consensus Means and Standard Deviations With and Without the Rankings of the Outlier Participant – Sorted by Consensus Mean with Outlier Included.

	Consensus Mean with Outlier Included		Consensus Mean with Outlier Excluded	
	Mean	Std Dev	Mean	Std Dev
Tools provide identifiable support for decisions	4.47	0.52	4.43	0.51
Tools provide the basis for repetitive data analysis over time	4.20	0.56	4.14	0.53
Tools allow for the graphical representation of ideas that can assist in "telling the story"	4.07	0.46	4.00	0.39
Tools assist decision makers in developing a group decision	4.07	0.46	4.00	0.39
Tools provide for improved communication in the decision making process	4.07	0.70	4.00	0.68
Tools increase the reliability of decision making	4.00	0.76	3.93	0.73
Tools assist in supporting accreditation reviews	4.00	0.65	3.93	0.62
Tools identify relationships not uncovered through other means	3.87	0.52	3.79	0.43
Tools assist in the development of staff	3.87	0.74	3.79	0.70
Tools bring other experts into the decision making process	3.80	0.77	3.71	0.73
Tools promote the use of best practices	3.67	0.90	3.57	0.85
Tools assist in changing the culture of the organization	3.53	0.99	3.43	0.94

The comparison between the study results with and without the outlier revealed the following effects of the non-representative outlier:

- All of the means decreased from with the outlier to without the outlier; the average decrease in the means 0.54 (1.9%) with the outlier as compared to without the outlier.

- All of the standard deviations decreased from with the outlier to without the outlier; the average decrease in the standard deviations 0.04 (7.3%) with the outlier as compared to without the outlier.
- One benefit, "tools assist in changing the culture of the organization" decreased 0.10 from with the outlier to without the outlier. This benefit moved from benefitting public university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling with the outlier to neutral in benefitting public research university CFOs in carrying out their management functions with the outlier excluded from the consensus mean.

Research Question Four

The study's final research question was "What qualitative and quantitative management tools will be important to public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future?" The listing of qualitative and quantitative management tools developed from the initial study questionnaire survey were analyzed by the Delphi panel as to their importance in the future. Tools that ranked:

1) 4.50 or higher were considered to be highly important to public research university CFOs in carrying out their management functions in the future.
2) between 3.50 and 4.49 were considered to be important to public research university CFOs in carrying out their management functions in the future.

3) between 2.50 and 3.49 may be important to public research university CFOs in carrying out their management functions in the future.

4) between 1.50 and 2.49 were not important to public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future.

5) lower than 1.50 were tools that public research university CFOs were not aware of for carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future.

The scale used by the panel was a Likert-type five point scale with the following descriptions:

1. N/A - not aware of tool
2. Tool will not be important to public research university CFOs in carrying out their management functions in the future
3. Tool may be important to public research university CFOs in carrying out their management functions in the future
4. Tool will be important to public research university CFOs in carrying out their management functions in the future
5. Tool will be highly important to public research university CFOs in carrying out their management functions in the future

Delphi Panel Initial Round

The results of the initial Delphi round as to qualitative and quantitative management tools that will be important to public research university CFOs in carrying out their management functions in the future noted four highly important tools and sixteen qualitative and quantitative management tools that the panel of experts considered to be important for public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future. The remaining eleven qualitative and quantitative management tools surveyed in the first Delphi round were ranked as maybe being important to public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future. Table 14 and Figure 17 depict the initial means and standard deviations for the thirty-one qualitative and quantitative management tools of the first Delphi round in descending order by their initial means. No qualitative and quantitative tools were found to be unimportant to public research university CFOs in carrying out their management functions in the future. Each of the qualitative and quantitative management tools will be discussed in descending order per their initial mean in Round 1 based upon their ranking by the Delphi panelists.

Table 14. Initial Means and Standard Deviations for Qualitative and Quantitative Management Tools in Carrying Out Public Research University CFO Management Functions in the Future – Sorted by Initial Mean.

Tool	Initial Mean	Initial Std Dev
Benchmarking	4.80	0.56
Cost-benefit analysis	4.60	0.63
Revenue and expense pro formas	4.60	0.83
Data mining and data warehouses	4.53	0.64
Sensitivity analysis	4.33	0.98
Dashboards	4.20	0.94
Brainstorming	4.13	0.74
Ratio Analysis	4.13	0.83
Scenario Planning	4.13	0.92
Continuous improvement	4.07	1.10
Trend analysis	4.07	0.96
Management by walking around	4.00	0.93
SWOT analysis	3.87	1.06
Return on investment	3.80	1.21
Responsibility Centered Management	3.73	1.16
Environmental scan	3.67	0.72
Flow charts	3.67	0.63
Internal rate of return	3.67	1.29
Focus groups	3.60	0.91
Balanced Scorecard	3.47	0.99
Reviewing span of control	3.47	0.99
Contribution margin analysis	3.40	1.59
Peer reviews	3.40	0.99
Activity based costing	3.27	0.80
Checklists	3.27	1.03
Operational analysis	3.27	1.10
Decision trees	3.20	0.86
Regression analysis	3.07	0.70
Delayering the organization	2.80	1.42
Histograms	2.73	0.88
PERT Chart	2.53	0.92

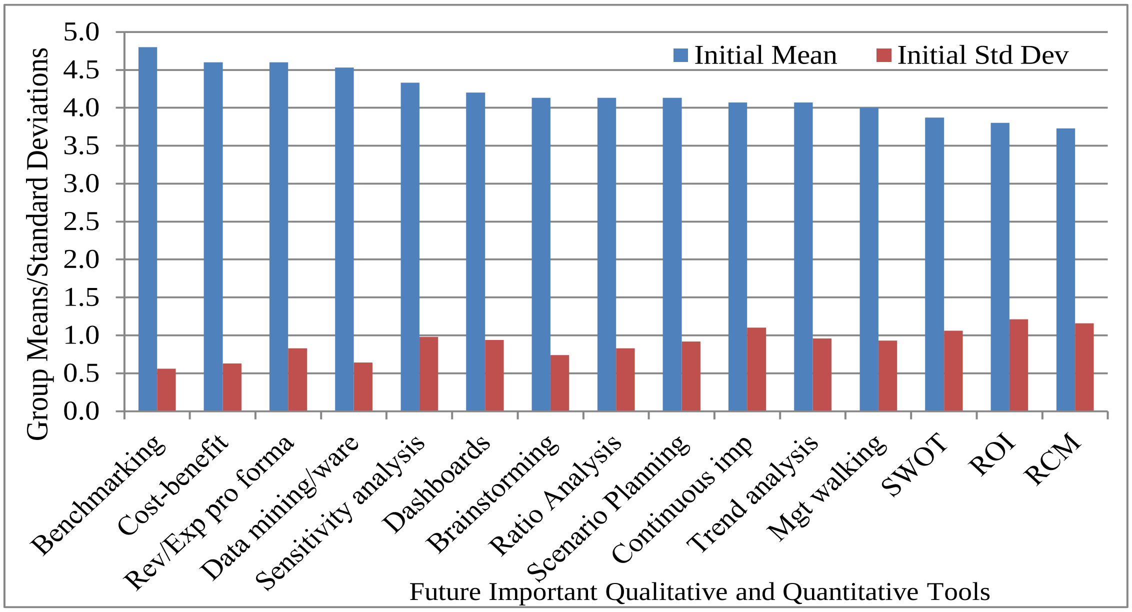

Figure 17. Initial Means and Standard Deviations for Qualitative and Quantitative Management Tools in Carrying Out Public Research University CFO Management Functions in the Future.

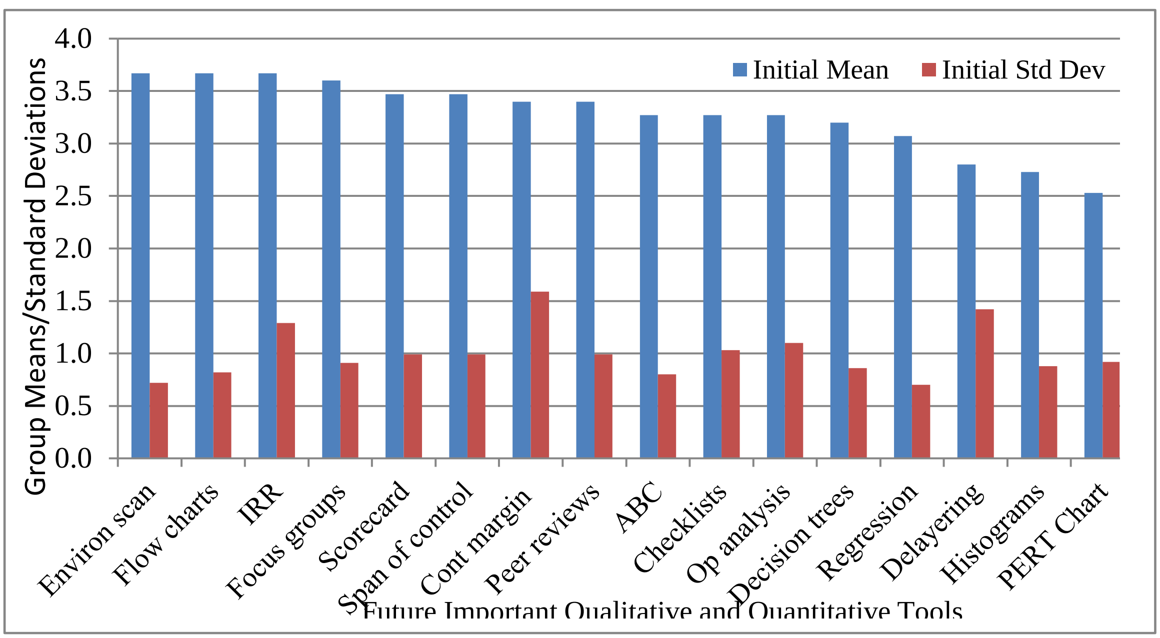

Figure 17 (continued).

Benchmarking, cost benefit analysis, revenue and expense pro formas, and data mining and data warehouses were considered to be highly important to public research university CFOs in carrying out their management functions in the future. Benchmarking had the highest group mean of 4.80 and a standard deviation of 0.56, the lowest standard deviation for this research question in the initial Delphi panel round. Thirteen panelists ranked benchmarking as a 5, one panelist ranked it as a 4, and one panelist ranked benchmarking as a 3. Cost benefit analysis and revenue and expense pro formas had group means of 4.60 in the initial Delphi round. Cost benefit analysis had a standard deviation of 0.63, the second lowest standard deviation for this research question in the initial Delphi panel round. Ten panelists ranked cost benefit analysis as a 5, four panelists ranked it as a 4, and one panelist ranked this tool as a 3. Revenue and expense pro formas was a tool added by the respondents to the initial survey. Revenue and expense pro formas had a standard deviation of 0.83. For revenue and expense pro formas, eleven panelists ranked this tool as a 5, three panelists ranked it as a 4, and one panelist ranked this tool as a 1; they were not aware of this tool. The one response of "not aware of this tool" caused the higher standard deviation as compared to cost benefit analysis. Data mining and data warehouses had an initial group mean of 4.53 and an initial standard deviation of 0.64, the fourth lowest standard deviation for this research question in the initial Delphi panel round. Nine panelists ranked data mining and data warehouses as a 5, five panelists ranked it as a 4, and one panelist ranked this tool as a 3.

The Delphi panel considered sixteen qualitative and quantitative management tools to be important for public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future. Sensitivity analysis had an initial group mean of

4.33 and a standard deviation of 0.98. Nine panelists ranked this tool as a 5, five panelists ranked it as a 4, two panelists ranked it as a 3, and one panelist ranked this tool as a 2. The use of dashboards as a tool for carrying out the CFO management functions had an initial group mean of 4.20 and a standard deviation of 0.94. Eight panelists ranked this tool as a 5, two panelists ranked it as a 4, and five panelists ranked dashboards as a 3.

Brainstorming, ratio analysis, and scenario planning had initial group means of 4.13. Brainstorming had an initial standard deviation of 0.74, ratio analysis had an initial standard deviation of 0.83, and scenario planning had an initial group standard deviation of 0.92. Five panelists ranked brainstorming as a 5, seven panelists ranked it as a 4, and three panelists ranked it as a 3. For ratio analysis, six panelists ranked this tool as a 5, five panelists ranked it as 4, and four panelists ranked it as a 3. Finally, scenario planning had six panelists rank this tool as a 5, six panelists ranked it as a 4, two panelists ranked it as a 3, and one panelist ranked this tool as a 2.

Continuous improvement (CI) and trend analysis had initial group means of 4.07. CI had a standard deviation of 1.10 during the initial Delphi round where trend analysis had a standard deviation of 0.96. CI had seven panelists rank this tool as a 5, four panelists ranked it as a 4, two panelists ranked it as a 3, and two panelists ranked this tool as a 2. Trend analysis had six panelists rank this tool as a 5, five panelists ranked it as a 4, three panelists ranked it as a 3, and one panelist ranked this tool as a 2.

Management by walking around was a tool added by the respondents to the initial survey. Management by walking around had an initial mean of 4.00 and a standard deviation of 0.93. Management by walking around had six panelists rank this tool as a 5, three panelists ranked it as a 4, and six panelists ranked it as a 3. SWOT analysis had an initial mean of 3.87 and a standard deviation of 1.06. SWOT analysis had five panelists rank this tool as a 5, five panelists ranked it as a 4, three panelists ranked it as a 3, and two panelists ranked this tool as a 2. Return on investment (ROI) had an initial mean of 3.80 and a standard deviation of 1.21, the fourth highest standard deviation. ROI had six panelists rank this tool as a 5, three panelists ranked it as a 4, three panelists ranked it as a 3, and three panelists ranked this tool as a 2. Responsibility centered management (RCM) had an initial group mean of 3.73 and a standard deviation of 1.16, the fifth highest standard deviation for this research question in the initial Delphi panel round. RCM had five panelists rank this tool as a 5, four panelists ranked it as a 4, three panelists ranked it as a 3, and three panelists ranked this tool as a 2.

Environmental scan, flowcharts and internal rate of return (IRR) had an initial group mean of 3.67. Environmental scan had an initial standard deviation of 0.72, flowcharts had an initial standard deviation of 0.63 (the second lowest initial standard deviation of all tools surveyed for the importance of the tools in carrying out the public research university CFO management functions in the future), and IRR had an initial standard deviation of 1.29, the third highest initial round standard deviation for this research question. Environmental scan had one panelist rank this tool as a 5, nine panelists ranked it as a 4, four panelists ranked it as a 3, and three panelists ranked this tool as a 2. Flowcharts had three panelists rank this tool as a 5, four panelists ranked it as a 4, and eight panelists ranked it as a 3. The clustering of responses around three led to the lower standard deviation. IRR had six panelists rank this tool as a 5, two panelists ranked it as 4, three panelists ranked it as a 3, and four panelists ranked this tool as a 2. Focus groups had an initial group mean of 3.60 and a standard deviation of 0.91. Focus groups had three panelists rank this tool as a 5, four panelists ranked it as 4, seven panelists ranked it as a 3, and one panelist ranked this tool as a 2.

The remaining eleven qualitative and quantitative management tools surveyed in the first Delphi round were found as “may be important” to higher education CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future. Balanced scorecard and reviewing span of control had initial means of 3.47 and initial standard deviations of 0.99; reviewing span of control was a tool added during the initial survey round. Both balanced scorecard and reviewing span of control had three panelists rank these tools as a 5, three panelists ranked them as a 4, seven panelists ranked them as a 3, and two panelists ranked these tools as a 2.

Contribution margin analysis and peer reviews had initial group means of 3.40. Contribution margin analysis had the highest initial standard deviation of 1.59 while peer reviews had an initial standard deviation of 0.99. Contribution margin analysis had six panelists rank this tool as a 5, one panelist ranked it as a 4, four panelists ranked it as a 3, one panelist ranked this tool as a 2, and three panelists ranked this tool as a 1; they were not aware of the tool. As discussed by Meyerson and Massy (1995), contribution margin analysis has been used in higher education for many years so the fact that some of the respondents were not aware of this tool was surprising. Peer reviews had two panelists rank this tool as a 5, five panelist ranked it as a 4, five panelists ranked it as a 3, and three panelists ranked this tool as a 2.

Activity based costing (ABC), checklists, and operational analysis had initial group means of 3.27. ABC had an initial standard deviation of 0.80. Checklists had an initial standard deviation of 1.03 while operational analysis had an initial standard deviation of 1.10. Operational analysis was a tool added in the initial survey. ABC had one panelist rank this tool as a 5, four panelists ranked it as a 4, eight panelists ranked it as a 3, and two panelists ranked this tool as a 2. Checklists had one panelist rank this tool as a 5, six panelists ranked it as a 4, five panelists ranked it as a 3, two panelists ranked this tool as a 2, and one panelist ranked checklists as a 1; they were not aware of this tool. Operational analysis had nine panelists rank it as a 4, three panelists ranked it as a 3, one panelist ranked this tool as a 2, and two panelist ranked checklists as a 1; they were not aware of this tool.

Decision trees had an initial group mean of 3.20 and a standard deviation of 0.86. Decision trees had one panelist rank this tool as a 5, four panelists ranked it as a 4, seven panelists ranked it as a 3, and three panelists ranked this tool as a 2. Regression analysis has been used in higher education for many years. Regression analysis had an initial group mean of 3.07 and a standard deviation of 0.70, the fifth lowest standard deviation. Regression analysis had four panelists rank it as a 4, eight panelists ranked it as a 3, and three panelists ranked this tool as a 2. The clustering around three led to the low standard deviation.

As in research question one, what tools are important to public research university CFOs in carrying out their management functions today, delayering the organization, histograms, and PERT charts were the lowest ranked tools for use by public research university CFOs in carrying out their management functions in the future. Delayering the organization was a tool added following the initial survey of 105 public research university CFOs and had an initial group mean of 2.80 and a standard deviation of 1.42. This was the second highest standard deviation reflecting that some panelists believed this tool would be highly relevant to public research university CFOs in carrying out their management functions in the future while others were not aware of this tool. Delayering the organization had had two panelists rank this tool as a 5, three panelists ranked it as a 4, four panelists ranked it as a 3, two panelists ranked this tool as a 2, and four panelists ranked checklists as a 1; they were not aware of this tool. Histograms had an initial group mean of 2.73 and a standard deviation of 0.88. Histograms had two panelists rank it as a 4, nine panelists ranked it as a 3, two panelists ranked this tool as a 2, and two panelists ranked checklists as a 1; they were not aware of this tool. The lowest ranked tool for use by public research university CFOs in carrying out their management functions in the future was PERT charts. PERT charts had an initial group mean of 2.53 and a standard deviation of 0.92. For PERT charts, two panelists ranked it as a 4, six panelists ranked it as a 3, five panelists ranked this tool as a 2, and two panelists ranked checklists as a 1; they were not aware of this tool.

Delphi Round 2

Following the second Delphi round, the Delphi panel was able to reach consensus and identified three qualitative and quantitative management tools that will be highly important tools for public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future and twenty qualitative and quantitative management tools that the panel of experts considered to be important for public research university CFOs in carrying out their management functions in the future. The Delphi panel noted that the remaining eight qualitative and quantitative management tools may be important for public research university CFOs in carrying out their management functions in the future. Table 15 and Figure 18 depict the thirty-one qualitative and quantitative management tools based upon their consensus means at the end of Round 2. Figure 19 depicts the thirty-one qualitative and quantitative management tools initial and consensus standard deviations. Each of the qualitative and quantitative management tools will be discussed in descending order per their consensus mean ranking by the Delphi panelists.

Table 15. Initial and Consensus Means and Standard Deviations for Qualitative and Quantitative Management Tools in Carrying Out Public Research University CFO Management Functions in the Future – Sorted by Consensus Mean.

Tool	Initial Mean	Consensus Mean	Initial Std Dev	Consensus Std Dev
Benchmarking	4.80	4.67	0.56	0.62
Cost-benefit analysis	4.60	4.53	0.63	0.74
Data mining and data warehouses	4.53	4.53	0.64	0.74
Revenue and expense pro formas	4.60	4.47	0.83	0.74
Continuous improvement	4.07	4.40	1.10	0.74
Brainstorming	4.13	4.27	0.74	0.70
Ratio Analysis	4.13	4.20	0.83	0.86
Sensitivity analysis	4.33	4.20	0.98	0.86
Trend analysis	4.07	4.20	0.96	0.77
Dashboards	4.20	4.00	0.94	1.07
Management by walking around	4.00	3.93	0.93	0.80
Return on investment	3.80	3.87	1.21	0.92
Scenario Planning	4.13	3.87	0.92	0.92
SWOT analysis	3.87	3.80	1.06	0.94
Responsibility Centered Management	3.73	3.73	1.16	1.03
Environmental scan	3.67	3.60	0.72	0.99
Internal rate of return	3.67	3.60	1.29	1.06
Balanced Scorecard	3.47	3.60	0.99	0.99
Contribution margin analysis	3.40	3.60	1.59	1.30
Activity based costing	3.27	3.60	0.80	0.99
Operational analysis	3.27	3.60	1.10	0.83
Focus groups	3.60	3.53	0.91	0.74
Peer reviews	3.40	3.53	0.99	1.13
Flow charts	3.67	3.40	0.63	0.51
Checklists	3.27	3.33	1.03	1.05
Regression analysis	3.07	3.33	0.70	0.82
Reviewing span of control	3.47	3.13	0.99	0.99
Decision trees	3.20	3.13	0.86	0.64
Delayering the organization	2.80	3.00	1.42	1.51
PERT Chart	2.53	3.00	0.92	0.93
Histograms	2.73	2.87	0.88	0.51

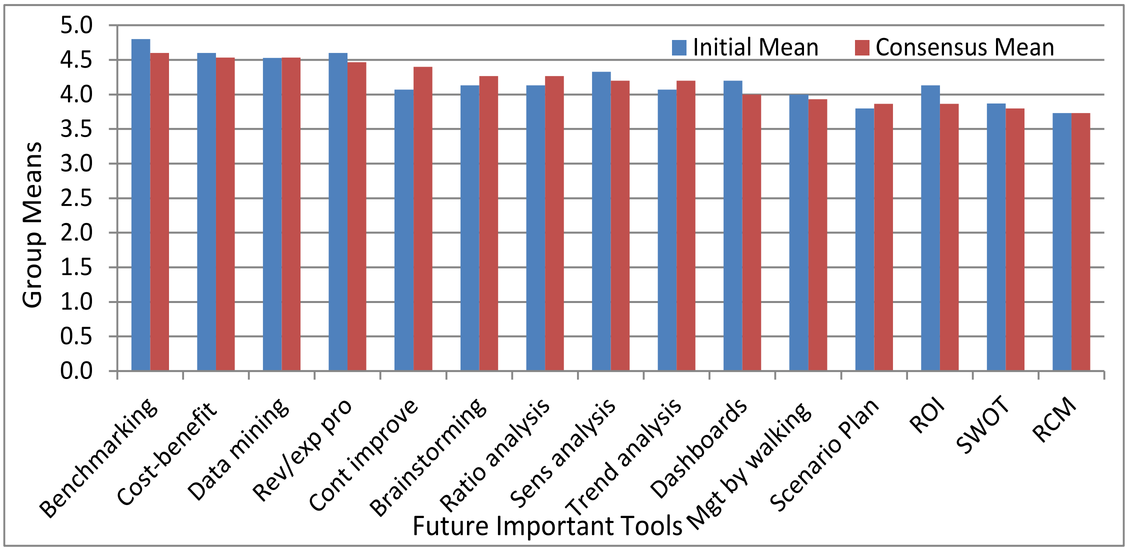

Figure 18. Initial and Consensus Means for Qualitative and Quantitative Management Tools in Carrying Out Public Research University CFO Management Functions in the Future.

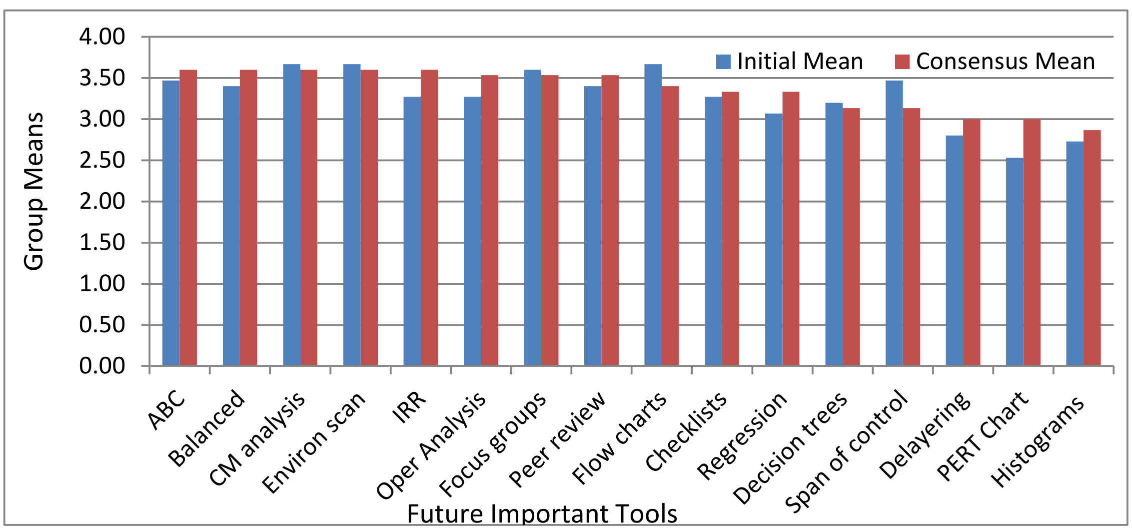

Figure 18 (continued).

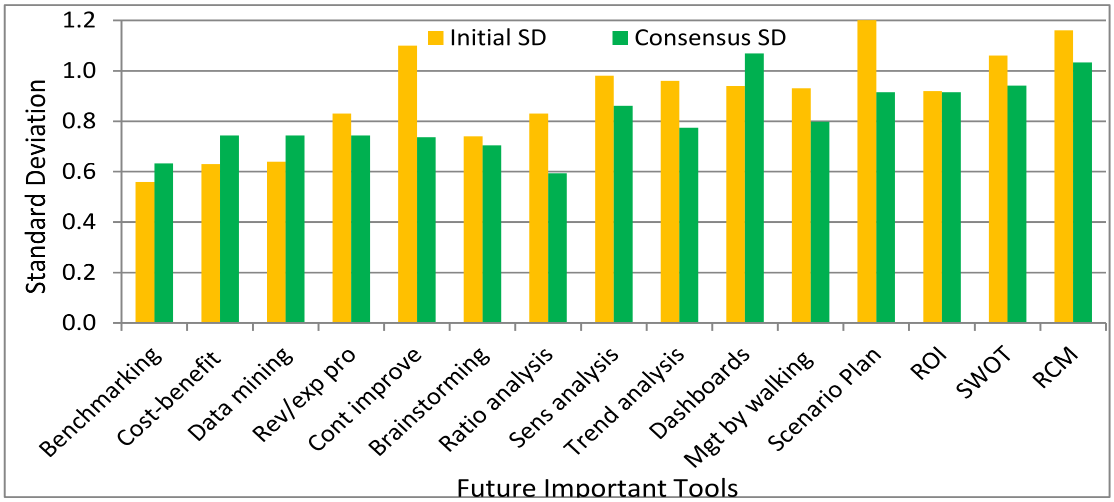

Figure 19. Initial and Consensus Standard Deviations for Qualitative and Quantitative Management Tools in Carrying Out Public Research University CFO Management Functions in the Future.

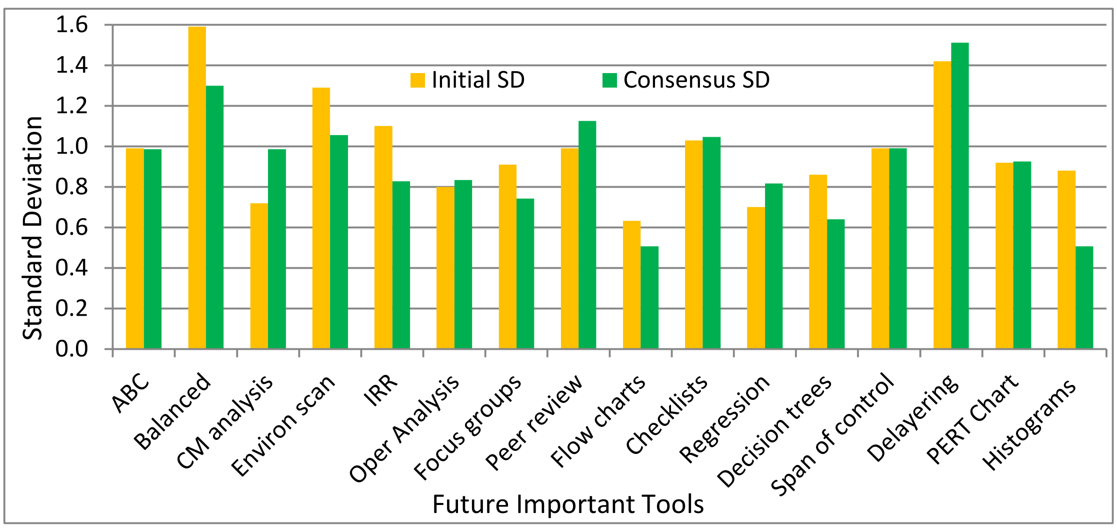

Figure 19 (continued).

The Delphi panel results showed that benchmarking, cost benefit analysis, and data mining and data warehouses would be highly effective qualitative and quantitative tools for public research university CFOs in carrying out their management functions in the future. These items had consensus means of 4.60, 4.53, and 4.53, respectively. Panelists ranked these items as 4 or 5 with the exception of one panelist who rated benchmarking as a 3 while two panelists ranked both cost benefit analysis and data mining and data warehouses as a 3. Benchmarking had a 0.13 decrease (3%) in its consensus mean as compared to the original mean and had a consensus standard deviation of 0.63, an increase of 0.06 (9%). Benchmarking's standard deviation was the third lowest standard deviation at consensus. Benchmarking had eleven panelists rank this tool as a 5, three panelists ranked it as a 4, and one panelist ranked it as a 3.

Cost benefit analysis had a 0.07 (1%) decrease in its consensus mean as compared to the initial Delphi panel mean where data mining and data warehouse's mean did not change between rounds. Cost benefit analysis and data mining and data warehouses had consensus standard deviations of 0.74, increases of 0.11 (15%) and 0.10 (13%), respectively. While these tools reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds of 0.07 for cost benefit analysis was 11% of the lower of the two standard deviations. Additionally, the change in responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002). Data mining and data warehouse's mean did not change between rounds and the change in responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002). Both tools had ten panelists rank these tools as a 5, three panelists ranked these tools as a 4, and two panelists ranked them as a 3.

The Delphi panel considered twenty qualitative and quantitative management tools to be moderately effective for carrying out the public research university CFO management functions of planning, organizing, staffing, communicating, motivating, leading and controlling in the future. Revenue and expense pro formas moved from a tool that was considered to be highly effective for carrying out the public research university CFO management functions in the future during the first Delphi panel round to be moderately effective at consensus. Revenue and expense pro formas had a consensus mean of 4.47, a decrease of 0.13 (3%) from the initial Delphi round. Revenue and expense pro formas had a consensus standard deviation of 0.74, a decrease of 0.09 (11%) from the initial Delphi round. Revenue and expense pro formas had nine panelists rank this tool as a 5, four panelists ranked it as a 4, and two panelists rank it as a 3.

Continuous improvement (CI) had a consensus mean of 4.40, a 0.33 (8%) increase from the initial Delphi round, and a consensus standard deviation of 0.74, a 0.36 (33%) decrease from the initial Delphi round. CI's standard deviation decrease was the second largest between rounds one and two of the future qualitative and quantitative tools for carrying out the public research university CFO management functions. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. CI had eight panelists rank this tool as a 5, five panelists ranked it as a 4, and two panelists rank it as a 3.

Brainstorming had consensus means of 4.27, a 0.14 (3%) increase from the initial Delphi round. Brainstorming had a consensus standard deviation of 0.73, a 0.04 (5%) decrease from the initial Delphi round. Brainstorming had the fifth smallest change in standard deviation between rounds of the 31 tools reviewed by the Delphi panel for this research question (Figure 19). Brainstorming had six panelists rank this tool as a 5, seven panelists ranked it as a 4, and two panelists rank it as a 3.

Ratio analysis, sensitivity analysis and trend analysis had consensus means of 4.20. Ratio analysis had an increase in its consensus mean of 0.07 (2%). Sensitivity analysis had a decrease in its consensus mean of 0.13 (3%), and trend analysis had an increase in its consensus mean of 0.13 (3%). Ratio analysis and sensitivity analysis had consensus standard deviations of 0.86. Ratio analysis had a 0.03 (4%) increase in its standard deviation from the first Delphi round while sensitivity analysis had a decrease of 0.08 (8%). Trend analysis had a consensus standard deviation of 0.77, a decrease of 0.19 (20%) from the first Delphi round. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Ratio analysis and sensitivity analysis had seven panelists rank these tools as a 5, four panelists ranked them as a 4, and four panelists rank them as a 3. Trend analysis had six panelists rank this tool as a 5, six panelists ranked it as a 4, and three panelists rank it as a 3.

Dashboards had a consensus mean of 4.00, a 0.20 (5%) decrease from the first Delphi round. Dashboards had the sixth highest consensus standard deviation at 1.07, a

0.13 (14%) increase from the initial Delphi round (Figure 19). For Dashboards, seven panelists ranked this tool as a 5, two panelists ranked it as a 4, five panelists rank it as a 3, and one panelist ranked this tool as a 2. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds of 0.20 is approximately 21% of the lower of the two standard deviations. Additionally, the change in responses between rounds, 7%, was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

Management by walking around was a tool added in the initial survey. Management by walking around had a consensus mean of 3.93, a 0.07 (2%) decrease from the initial Delphi round and a consensus standard deviation of 0.80, a 0.13 (14%) decrease from the initial Delphi round (Figure 19). Management by walking around had four panelists rank this tool as a 5, six panelists ranked it as a 4, and five panelists rank it as a 3.

Return on investment (ROI) and scenario planning had consensus means of 3.87. ROI had a 0.07 (2%) increase from the initial Delphi round and a consensus standard deviation of 0.92, a 0.29 (24%) decrease from the initial Delphi round. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. ROI had four panelists rank this tool as a 5, six panelists ranked it as a 4, four panelists rank it as a 3, and one panelist ranked ROI as a 2. Scenario planning had a decrease of 0.26 (14%) in its mean between rounds. At the same time, scenario planning's consensus standard deviation was consistent at 0.92 between rounds (Figure 19), confirming stabilization of the group opinion. Scenario planning had four panelists rank this tool as a 5, six panelists ranked it as a 4, four panelists ranked it as a 3, and one panelist ranked scenario planning as a 2.

SWOT analysis had a consensus mean of 3.80, a 0.07 (2%) decrease from the initial Delphi round and a consensus standard deviation of 0.94, a 0.12 (11%) decrease from the initial Delphi round (Figure 19). SWOT analysis had three panelists rank this tool as a 5, eight panelists ranked it as a 4, two panelists rank it as a 3, and two panelists ranked it as a 2. Responsibility centered management (RCM) had a consensus mean of 3.73, consistent with the initial Delphi round and a consensus standard deviation of 1.03, a 0.13 (11%) decrease from the initial Delphi round. RCM had four panelists rank this tool as a 5, five panelists ranked it as 4, four panelists ranked it as a 3, and two panelists ranked RCM as a 2.

Environmental scan, Internal rate of return (IRR), balanced scorecard, contribution margin analysis, and operational analysis had consensus means of 3.60. Environmental scan had a 0.07 (2%) decrease from the initial Delphi panel round to its consensus mean while its consensus standard deviation increased 0.27 (38%) to 0.99. This was the largest increase for all 31 tools surveyed for this research question (Figure 19). Environmental scan had three panelists rank this tool as a 5, seven panelists ranked it as a 4, two panelists rank it as a 3, two panelists ranked it as a 2, and one panelist ranked Environmental scan as a 1, not aware of tool. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds of 0.07 is approximately ten percent of the lower of the two standard deviations. Additionally, the change in responses between Delphi panel rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

IRR had a 0.07 (2%) decrease from the initial Delphi panel round to its consensus mean while its consensus standard deviation decreased 0.23 (18%) to 1.06. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. IRR had three panelists rank this tool as a 5, six panelists ranked it as a 4, three panelists ranked it as a 3, and two panelists ranked it as a 2.

Balanced scorecard's consensus mean increased 0.13 (4%) from the initial Delphi panel round while its consensus standard deviation was consistent with the initial Delphi round at 0.99. Balanced scorecard had three panelists rank this tool as a 5, five panelists ranked it as 4, five panelists ranked it as a 3, and two panelists ranked it as a 2. Contribution margin analysis had a 0.20 (6%) increase in its mean at consensus while its standard deviation decreased 0.29 (18%) to 1.30. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Contribution margin analysis had four panelists rank this tool as a 5, six panelists ranked it as a 4, one panelist ranked it as a 3, three panelists ranked it as a 2, and one panelist ranked Contribution margin analysis as a 1, not aware of tool.

Operational analysis was a tool added during the initial survey. It had a 0.33 (10%) increase in its mean from the initial Delphi round to its consensus mean of 3.60 while its consensus standard deviation decreased 0.27 (25%) to 0.83. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Operational analysis had eleven panelists ranked it as a 4, three panelists ranked it as a 3, and one panelist ranked it as a 1, not aware of tool.

Activity based costing (ABC), focus groups, and peer reviews all had consensus means of 3.53. ABC had a 0.26 (8%) increase in its mean from the initial Delphi round to consensus while its consensus standard deviation increased 0.03 (4%) to 0.83 (Figure 19). ABC had two panelists rank this tool as a 5, five panelists ranked it as a 4, seven panelists ranked it as a 3, and one panelist ranked it as a 2. Focus groups had a 0.07 (2%) decrease in its mean from the initial Delphi round to consensus while its standard deviation decreased 0.17 (19%) between rounds. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Focus groups had one panelist rank this tool as a 5, seven panelists ranked it as a 4, six panelists ranked it as a 3, and one panelist ranked it as a 2.

Peer reviews had a 0.13 (4%) increase in its mean from the initial Delphi round to consensus while its standard deviation increased 0.14 (14%) to 1.13. Peer reviews had the fifth highest standard deviation of those tools evaluated as to their importance to carrying out the public research university CFO management functions in the future (Figure 19). Peer reviews had four panelists rank this tool as a 5, three panelists ranked it as a 4, five panelists ranked it as a 3, and three panelists ranked it as a 2. While this tool reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds of 0.06 is approximately ten percent of the lower of the two standard deviations. Additionally, the change in responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002). Balanced scorecard, ABC, operational analysis and peer reviews went from being ranked as tools that may be important to carrying out the public research university CFO management functions in the future in the initial Delphi round to being ranked important to in the future at consensus.

The Delphi panel noted that the remaining eight qualitative and quantitative management tools may be important to carrying out the public research university CFO management functions in the future. Flow charts went from being ranked important for carrying out the public research university CFO management functions in the future to a tool that may be important in the future with a decrease of 0.27 (7%) from its initial group mean to its consensus mean of 3.40. Flow charts standard deviation decreased from 0.63 to 0.51 (13%). The 0.51 standard deviation was the lowest of all “future tools” and was evident with clustering of responses, six panelists ranked it as a 4 and nine panelists ranked it as a 3. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation.

Checklists’ consensus mean of 3.33 had an increase of 0.06 (2%) from the initial Delphi round and its consensus standard deviation increased 0.02 (2%) to 1.05. Checklists had one panelist rank this tool as a 5, seven panelists ranked it as a 4, four panelists ranked it as a 3, two panelists ranked it as a 2, and one panelist ranked checklists as a 1, not aware of tool. Regression analysis also had a consensus mean of 3.33, a 0.26 (9%) increase from the initial Delphi round. Its consensus standard deviation was 0.82, a 0.12 (17%) increase from the initial Delphi round. one panelist rank this tool as a 5, five panelists ranked it as 4, seven panelists ranked it as a 3, and two panelists ranked it as a 2. While regression analysis reached consensus, the large change in standard deviation required additional analysis. The difference between the means from the two rounds of 0.06 is approximately ten percent of the lower of the two standard deviations. Additionally, the change in responses between rounds was less than 15%. Hence the two means can be considered indistinguishable (Scheibe, Skutsch & Schofer, 2002).

Reviewing span of control had a consensus mean of 3.13 which decreased 0.34 (10%) from the initial Delphi round; this decrease was the second largest of those qualitative and quantitative tools ranked by Delphi panel members for this research question. Reviewing span of control had a consensus standard deviation of 0.99, consistent with the first Delphi panel round and confirming stabilization of the group opinion. Reviewing span of control had one panelist rank this tool as a 5, four panelists ranked it as a 4, seven panelists ranked it as a 3, two panelists ranked it as a 2, and one panelist ranked reviewing span of control as a 1, not aware of tool.

Decision trees also had a consensus mean of 3.13 which decreased 0.07 (2%) from the initial Delphi round. Decision trees consensus standard deviation was 0.64, a decrease of 0.22 (26%) from the initial Delphi round. Decision trees had the fourth lowest consensus standard deviation of those qualitative and quantitative tools ranked by Delphi panel members for this research question. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean decreased slightly between rounds but there was a large decrease in the standard deviation. Decision trees had four panelists ranked it as a 4, nine panelists ranked it as a 3, and two panelists ranked it as a 2.

Delayering the organization had a consensus mean of 3.00, a 0.20 (7%) increase from the initial Delphi round. Consistent with the initial Delphi round, delayering the organization had the highest standard deviation at consensus, 1.51, a 0.09 (6%) increase from the initial Delphi round. While some panelists ranked this tool as being highly relevant to carrying out the public research university CFO management functions in the future, other panelists were not aware of the tool. Delayering the organization had three panelists rank this tool as a 5, three panelists ranked it as a 4, four panelists ranked it as a 3, one panelist ranked it as a 2, and four panelists ranked delayering the organization as a 1, not aware of this tool.

Consistent with the initial Delphi round, PERT charts and histograms were the lowest ranked tools. PERT charts had a consensus mean of 3.00, a 0.47 (19%) increase from the initial Delphi panel round. This increase was the largest of all future qualitative and quantitative tools ranked by Delphi panel members for this research question. Although PERT charts had a large increase in its mean, its standard deviation at consensus only increased 0.01 (1%) to 0.93 reflecting stabilization of the group opinion (Figure 19). PERT charts had one panelist rank this tool as a 5, three panelists ranked it as a 4, six panelists ranked it as a 3, and five panelists ranked it as a 2. Histograms had a consensus mean of 2.87, a 0.14 (5%) increase from the initial Delphi round. Its consensus standard deviation was 0.51, a 0.37 (42%) decrease from the initial Delphi round. Histograms consensus standard deviation was the lowest of all qualitative and quantitative tools ranked by Delphi panel members for this research question. The decrease in the standard deviation between rounds for this management tool confirms stabilization of the group opinion, i.e., the variability in the rank distribution decreased (Figure 19); the group mean increased slightly between rounds but there was a large decrease in the standard deviation. Histograms had two panelists rank it as a 4, ten panelists ranked it as a 3, two panelists ranked it as a 2, and one panelist ranked histograms as a 1, not aware of tool.

Comparison of Currently Effective Tools with Tools that will be Important in the Future

A comparison between what qualitative and quantitative management tools public research university CFOs ranked as currently effective in carrying out the public research university CFO management functions of planning, organizing, staffing, communicating, motivating, leading and controlling as compared to what tools the CFOs believe will be important in the future showed interesting results. The current effectiveness of the 31 tools surveyed as to their as compared to their future importance did not reflect significant variation, an overall change of 0.002 (0.05%). Twelve tools were noted as more important in the future as compared to their current effectiveness. In addition, thirteen tools were considered to be less effective in the future and six tools did not change rankings. Table 16 and Figure 20 depict the thirty-one qualitative and quantitative management tools based upon their consensus means at the end of Round 2. Each of the qualitative and quantitative management tools will be discussed in descending order per their consensus mean ranking by the Delphi panelists.

TABLE 16. Comparison of Consensus Means for the Current Effectiveness and Future Importance of Qualitative and Quantitative Tools in Carrying Out the Public Research University CFO Management Functions – Sorted by Current Effectiveness.

Tool	Current Effectiveness	Future Importance	Increase (Decrease)	% Change
Benchmarking	4.47	4.60	0.13	3.0%
Cost-benefit analysis	4.47	4.53	0.06	1.5%
Revenue and expense pro formas	4.47	4.47	0.00	0.0%
Data mining and data warehouses	4.40	4.53	0.13	3.0%
Brainstorming	4.27	4.27	0.00	0.0%
Ratio analysis	4.27	4.27	0.00	0.0%
Sensitivity analysis	4.20	4.20	0.00	0.0%
Continuous improvement	4.13	4.40	0.27	6.5%
Return on investment	4.13	3.87	-0.26	-6.5%
Trend analysis	4.13	4.20	0.07	1.6%
Dashboards	4.07	4.00	-0.07	-1.6%
Management by walking around	3.87	3.93	0.06	1.7%
Internal rate of return	3.80	3.60	-0.20	-5.3%
SWOT analysis	3.73	3.80	0.07	1.8%
Activity based costing	3.67	3.60	-0.07	-1.8%
Focus groups	3.67	3.53	-0.14	-3.6%
Responsibility Centered Management	3.67	3.73	0.06	1.8%
Balanced Scorecard	3.60	3.60	0.00	0.0%
Checklists	3.60	3.33	-0.27	-7.4%
Contribution margin analysis	3.60	3.60	0.00	0.0%
Scenario Planning	3.60	3.53	-0.07	-1.9%
Environmental scan	3.53	3.60	0.07	2.0%
Regression analysis	3.53	3.33	-0.20	-5.7%
Operational Analysis	3.47	3.60	0.13	3.8%
Flow charts	3.40	3.40	0.00	0.0%
Peer review	3.33	3.53	0.20	6.0%
Decision trees	3.33	3.13	-0.20	-6.0%
Reviewing span of control	3.27	3.13	-0.14	-4.1%
PERT Chart	3.07	3.00	-0.07	-2.2%
Delayering the organization	2.80	3.00	0.20	7.1%
Histograms	2.73	2.87	0.14	4.9%

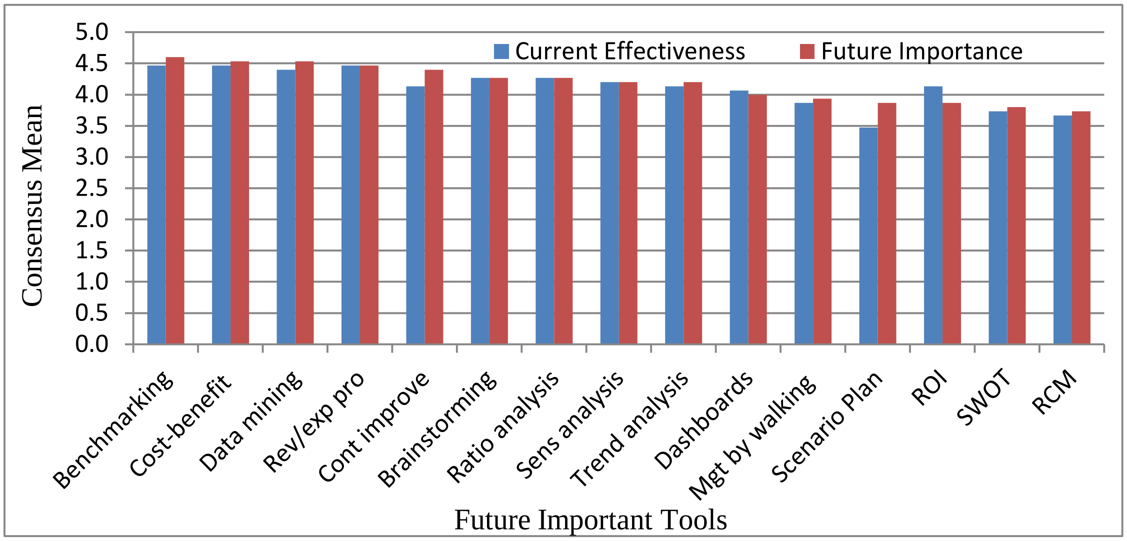

FIGURE 20. Comparison of Consensus Means for the Current Effectiveness and Future Importance of Qualitative and Quantitative Tools in Carrying Out the Public Research University CFO Management Functions.

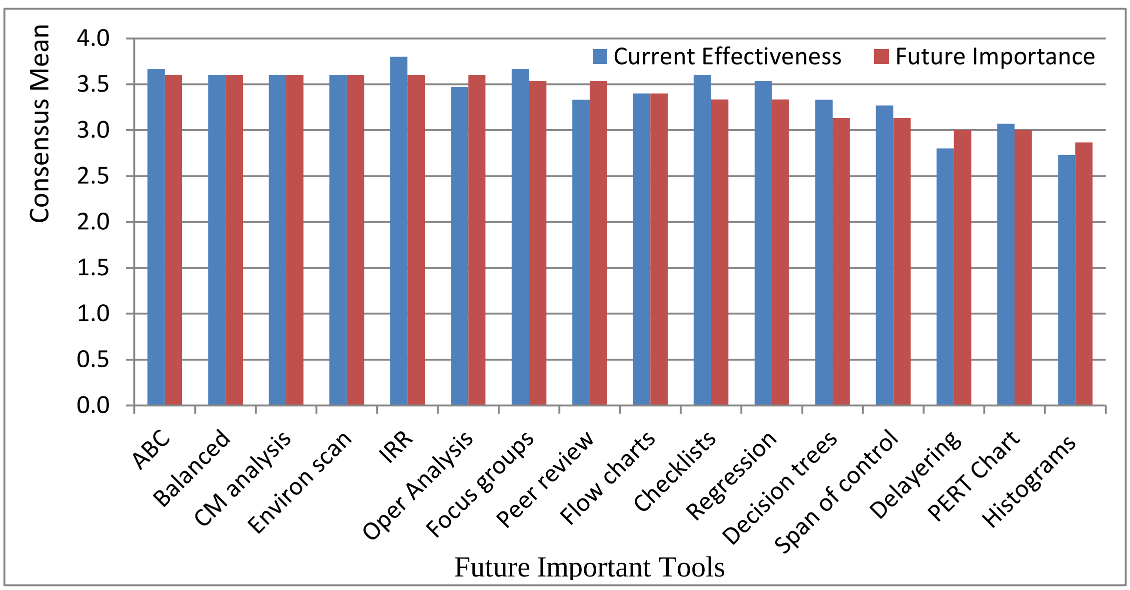

FIGURE 20 (continued).

Three tools (Benchmarking, Cost-benefit analysis, and Data mining and data warehouses) were determined by the Delphi panel to be moderately effective currently in carrying out the public research university CFOs management functions and were considered to be highly important in carrying out the public research university CFOs management functions in the future. These three tools increased 3%, 2%, and 3%, respectively, from their current effectiveness ranking to their future importance ranking. Regression analysis was ranked as being moderately effective currently and ranked as a tool that may be important in the future with a 0.20 (6%) decrease in its ranking. Operational analysis and peer reviews were ranked as being minimally effective currently and ranked as being important in carrying out the public research university CFOs management functions in the future. These two tools had current to future importance ranking increases of 0.13 (4%) and 0.20 (6%), respectively.

For the twelve tools that were noted as more relevant in the future as compared to their current effectiveness the average increase was 3%. Delayering the organization had the largest increase in rankings, current effectiveness as compared to future importance, with a 0.20 (7.1%) increase. Continuous improvement saw a 0.27 (6.5%) increase in its future importance as compared to its current effectiveness.

For the thirteen tools that were considered to be less relevant in the future as compared to their current effectiveness the average decrease was 4%. Many of the tools that ranked lower in terms of their future relevance are tools that have been used in higher education for many years such as regression analysis, return on investment, and internal rate of return. Checklists had the largest decrease in its future importance as compared to its current effectiveness, 0.27 (7%) while return on investment had a decrease of 0.20 (6%).

Summary

The Delphi panel of experts consensus results from this study indicated: twenty-three qualitative and quantitative management tools to be currently moderately effective in carrying out the public research university CFOs management functions; ten barriers/impediments were ranked as sometimes being a barrier/impediment to the use of qualitative and quantitative tools in carrying out the public research university CFOs management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling in higher education; all eighteen benefits to the use of tools were identified to benefit public research university CFOs carrying out their management functions, but not strongly; and three qualitative and quantitative management tools were noted to be highly important tools for public research university CFOs carrying out their management functions in the future, with an additional twenty tools being important tools for public research university CFOs carrying out their management functions in the future.

A series of conclusions for each of the four research questions have been reached based on the outcomes of this study. The following chapter summarizes the results of the data analysis and the conclusions made from the study results.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Institutions of higher education operate in a complex environment with calls for increased accountability in which there is constant pressure to increase efficiency and effectiveness while maintaining or increasing results (graduation rates, time to graduation, and successful placement of graduates). CFOs are the main stewards of the institution's budget and therefore must use all available resources to meet these sometimes conflicting goals. This study was designed for the practical purpose of: 1) identifying the qualitative and quantitative management tools public research university CFOs believe are effective in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling; 2) identify the barriers/impediments to public research university CFOs using these tools in carrying out their management functions; 3) identify the benefits public research university CFOs perceive from the use of quantitative and qualitative management tools in carrying out their management functions; and 4) identify quantitative and qualitative management tools the public research university CFOs believe will be important in carrying out their management functions in the future. This chapter provides a summary of findings, associated conclusions, and recommendations, both for practice and further research.

Summary of Study Methodology and Procedures

This study used the Delphi technique to gain consensus from the study experts on effective qualitative and quantitative management tools in carrying out public research university CFOs management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling; identify the barriers/impediments to public research university CFOs from using these tools in carrying out their management functions; identify the benefits public research university CFOs perceive from the use of quantitative and qualitative management tools in carrying out their management functions; and identify quantitative and qualitative management tools the CFOs believe will be important to the public research university CFOs management functions in the future. This study was comprised of three major phases:

1) Development of the original survey instrument,
2) Identification of an expert panel of public research university CFOs, and
3) Carrying out the surveys with the expert panel.

The first phase employed a review of the literature to identify qualitative and quantitative management tools used by public research university CFOs and four higher education CFOs validated the questionnaire instrument. The questionnaire was then sent to a population of 105 public research university CFOs in the second phase to identify a panel of experts to participate in the third phase of the study. The third phase of the research study, a Delphi study of the research questions, was completed by fifteen expert panelists and was accomplished in three iterations.

The initial questionnaire given to 105 public research university CFOs consisted of thirty qualitative and quantitative management tools used by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. The questionnaire also allowed respondents to add qualitative and quantitative management tools they use in carrying out their management functions. The original study population added five additional qualitative and quantitative management tools to the original list and four tools were removed as the respondents were not familiar or did not use these tools.

Each qualitative and quantitative management tool was assessed twice by the Delphi panel: once in terms of its current effectiveness in carrying out public research university CFOs management functions and a second time in terms of the qualitative and quantitative management tools' future importance to carrying out the public research university CFOs management functions. Two additional research questions were surveyed in the first Delphi panel round. One research question sought to identify the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFOs management functions while another research question sought to identify the benefits to the use of qualitative and quantitative management tools in carrying out the public research university CFOs management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. The Delphi panel members were also asked through open ended questions to add any new barriers or benefits that should be included in the study and that were not part of the original list. The Delphi panel experts added a total of seven new barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions and added six new benefits from the use of qualitative and quantitative management tools in carrying out the public research university CFOs management functions. Overall, the Delphi panel members assessed a total of 101 items in the first round.

The Delphi panelists were asked to rank the qualitative and quantitative management tools on a five point Likert-type scale indicating a level of current effectiveness for carrying out the public research university CFOs management functions from “tool is not effective in carrying out the public research university CFOs management functions” to “tool is highly effective in carrying out the public research university CFOs management functions.” Respondents could also answer “I am not aware of this tool.” Similarly, in terms of the future importance of the tools for carrying out the public research university CFOs management functions, the Delphi panelists were asked to rank the qualitative and quantitative management tools on a five point Likert-type scale indicating the level of the future importance from “tool will not be important to public research university CFOs in carrying out their management functions in the future” to “tool will be very important to public research university CFOs in carrying out their management functions in the future.” Again, respondents could also answer “I am not aware of this tool.”

The Delphi experts were asked to indicate the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFOs management functions based on a 4-point Likert-type scale ranging from "item is not a barrier/impediment to the use of use of qualitative and quantitative tools in carrying out the public research university CFOs management functions" to "item is consistently a barrier/impediment to the use of use of qualitative and quantitative tools in carrying out the public research university CFOs management functions." Similarly, the Delphi panel was asked to identify benefits to the use of qualitative and quantitative tools by public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling based on a 5-point Likert scale ranging from "strongly disagree that the item listed was a benefit to public research university CFOs in carrying out their management functions" to "strongly agree that the item listed was a benefit to public research university CFOs in carrying out their management functions."

The second round questionnaire included all original qualitative and quantitative management tools, barriers to the use of the tools, and benefits from using the tools from the initial Delphi panel round along with additional barriers and benefits suggested by the panelists in the first round. For each item that was ranked by the Delphi panel in the initial round, an e-mail was sent to each Delphi panel member that provided the group mean score and the standard deviation for the group from the initial Delphi round and the individual panel member's score. The e-mail provided the Delphi panel members a link to an electronic survey, developed in SurveyMonkey, which required the respondents to re-rank each item. The Delphi panelists were permitted to change their rankings in the process of building group consensus. During the second round, the

Delphi panel members were able to reach consensus on all variables originally ranked in the initial Delphi panel round.

The third Delphi panel round provided the study experts the group mean score and the standard deviation from the second Delphi round and the individual panel member's score for the seven barriers/impediments that inhibit the use of qualitative and quantitative management tools in carrying out the public research university CFOs management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling and the six benefits from the use of qualitative and quantitative management tools in carrying out the management functions that were added during the initial Delphi round. An e-mail was sent to each Delphi panel member that provided the above information and a link to an electronic survey, developed in SurveyMonkey, which required the respondents to re-rank each item. The Delphi panel was given the opportunity to review, and change if they so desired, their ranking on the added variables in the process of building consensus. During the third round, the Delphi panel members were able to reach consensus on all variables added in the initial Delphi panel round.

Summary of Findings

The following findings were determined from an analysis and review of the Delphi study results:

1. Key findings regarding the current effectiveness of the qualitative and quantitative management tools in carrying out the public research university

CFOs management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling were:

- Twenty three (74%) of the qualitative and quantitative management tools were identified as currently being moderately effective (a consensus mean of at least equal to 3.50 and less than 4.50) for use by public research university CFOs in carrying out their management functions (Table 4).
- Eight (26%) of the qualitative and quantitative management tools were identified as currently minimally effective (group mean between 2.50 and 3.49) for use by public research university CFOs in carrying out their management functions (Table 4). Three of the five tools added by the initial survey participants, delayering the organization, reviewing span of control, and operational analysis were found to be minimally effective. Delayering the organization and reviewing span of control were the second lowest and fifth lowest ranked tools.
- Three of the five tools added by the initial survey participants: delayering the organization, reviewing span of control, and operational analysis, had the highest standard deviations of all 31 tools reviewed by the Delphi panel. While some Delphi panel members were not aware of these tools many of the Delphi panel members believe these tools are "highly effective" in carrying out the public research university CFOs management functions of planning, organizing, staffing, communicating, motivating, leading and controlling.

2. Key findings regarding the barriers/impediments to the use of the qualitative and quantitative management tools in carrying out the public research university CFOs management functions were:

- Based upon the results of the study, it does not appear that there are significant barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFOs management functions of planning, organizing, staffing, communicating, motivating, leading and controlling.
- None of the barriers/impediments were noted to consistently be barriers to the use of the qualitative and quantitative management tools in carrying out the public research university management functions.
- Fifteen (63%) of the barriers/impediments were noted by the Delphi panel to sometimes be barriers to the use of the qualitative and quantitative management tools in carrying out CFOs management functions (Tables 6 and 8).
- Nine (37%) of the barriers/impediments were noted by the Delphi panel not to be barriers to the use of the qualitative and quantitative management tools in carrying out public research university CFOs management functions (Tables 6 and 8). Two of the seven barriers/impediments added by the Delphi panel, lack of empirical research on models that predict success and fund accounting rules were noted by the Delphi panel not to be barriers/impediments to the use of the

qualitative and quantitative management tools in carrying out public research university CFOs management functions. Fund accounting rules was the lowest ranked barrier/impediment.

3. Key findings regarding benefits to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling were:

- All seventeen benefits were identified as benefitting public research university CFOs in carrying out their management functions (Tables 10 and 12). One of the benefits added by the Delphi panel, data and tools add credibility to the discussion, had the second highest ranking of all benefits surveyed.
- Review of the data for this research question noted that one study participant had assigned a rank of 5 – "strongly agree that tools benefit CFOs carrying out their management functions" during round two. These rankings were considered to be an outlier and additional analysis was performed. All of the consensus means and standard deviations decreased from with the outlier to without the outlier. The average decrease in the consensus means and standard deviations were 1.9% and 7.3%, respectively, with the outlier as compared to without the outlier. Therefore, the outlier was not considered to have a significant effect on the study results (Table 13).

- Two of the benefits added by the Delphi panel, tools can help educate individuals in leadership roles and tools can be used to demonstrate successful practices/transitions, had the lowest standard deviations of any of those surveyed by the Delphi panel. This reflected significant agreement within the Delphi panel on the rankings of these benefits.

4. In regards to the key findings related to qualitative and quantitative management tools public research university CFOs identified as being important in carrying out CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling in the future:
    - Three (10%) qualitative and quantitative management tools were noted as highly important tools for public research university CFOs in carrying out their management functions in the future: benchmarking, cost benefit analysis, and data mining and data warehouses. These items had consensus means of 4.60, 4.53, and 4.53, respectively. Panelists ranked these items as 4 or 5 with the exception of one panelist who rated benchmarking as a 3 while two panelists ranked both cost benefit analysis and data mining and data warehouses as a 3.
    - An additional twenty tools (64%) were identified as important tools for public research university CFOs in carrying out the CFO management functions in the future (Table 15).

- The remaining eight tools (26%) were identified as tools that may be important for public research university CFOs in carrying out the public research university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling in the future (Table 15).
- Finally, the Delphi panel members expected that some effective qualitative and quantitative management tools public research university CFOs currently use in carrying out the public research university CFO management will have higher importance in the future than in the present; some will have slightly lower importance; and some will be equally important.
    - Twelve tools were noted as more important in the future as compared to their current effectiveness; the ranking for delayering the organization noted the largest increase as to its importance in the future, 7.1%;
    - Thirteen tools were considered to be less important in the future; the ranking for checklists noted the largest decrease as to its importance in the future, 7.4%; and
    - Six tools did not change rankings (Table 16).

Summary of Dissertation Study Conclusions

The following conclusions were developed from an analysis and evaluation of the study findings:

1. Benchmarking a public research institution against its peers is an effective management tool today for carrying out the public research university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling and is expected to be more important in the future. The significance of benchmarking being ranked as the highest currently effective tool in carrying out the CFO management functions was that benchmarking requires common or similar data to be effective. So while the literature review noted that institutions that make peer comparisons express frustration at the limited comparability of data, in this survey, the study participants did not believe that a lack of standardized higher education data and common definitions were barriers/impediments to the use of these tools. Building partnering relationships with other institutions of higher education will be an important activity for public research university CFOs in the future. Creating and designing effective benchmarks will allow CFOs to move their organization forward in a challenging higher education environment.
2. Public research CFOs need to be continually aware of new qualitative and quantitative management tools that may be able to assist them in carrying out their management functions. Several of the respondents in this survey were not aware of management tools which their colleagues believed were highly effective in carrying out the public research university CFO management functions. This was evident when one analyzed the responses for reviewing

the span of control and delayering the institution. With budget cuts that have been occurring in higher education over the last decade, organizations are being flattened and supervisor's span of control are increasing. The data suggests that some CFOs may not be keeping up with new developments in tools that can assist them in managing their institutions. The data also showed that these differences were not based upon age or education level. At the same time, many tools that have been used in higher education for decades (cost-benefit analysis, ratio analysis, ROI) were among the highest rated current management tools.

3. Although higher education has invested in enterprise resource planning systems that can manage the large amounts of data within the institution, there will continue to be a need for higher education to invest in technology and seek to use new tools to help manage resources. Higher education continues to be slow to adopt new tools for managing their business; this may be due to shared governance and the use of committees to gain concurrence for new approaches. For example, data warehouses and the use of data mining has come into vogue in the last five to ten years in higher education where these tools were implemented in the "for-profit" sector by companies in the early to mid-90's. To smooth information flows among business areas within the institution, as well as manage the connections to outside stakeholders, higher education needs to continue to exploit the management tools through the use

of technology. However, technology is costly and has a short lifetime while decisions regarding the implementation of new technology often last years.

4. As budget constraints continue to affect higher education, and CFOs consistently have to do more with less, or even less with less, lack of resources (staffing and work overloads) will only become more important. This was implied by the CFOs surveyed through the addition of reviewing the span of control and delayering the organization as management tools that were considered by the Delphi panel. Demands for efficiency, effectiveness, accountability, and education quality evaluation will not go away. As a result, higher education faces increased pressure to improve the effectiveness of its operations and provide its programs and services more efficiently; higher education must be accountable to its stakeholders for improved performance.
5. Benchmarking; cost-benefit analysis; and data mining and data warehouses will be the most important qualitative and quantitative management tools to public research university CFOs in carrying out their management functions in the future. While cost-benefit analysis has been used in higher education for many years, the application of benchmarking and data mining and data warehouses are relatively new within higher education. CFOs should consider the application of these tools at their institutions.
6. The vast majority of barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions are systematic in nature. This finding can

contribute to the development of strategies to overcome these barriers/impediments and thus facilitate the use of qualitative and quantitative tools by public research university CFOs in carrying out their management functions. If the systems at institutions of higher education can be improved, then strategies to overcome these barriers/impediments can be developed and thus facilitate the use of qualitative and quantitative tools by public research university CFOs in carrying out their management functions. However, colleges and universities often operate like separate businesses, compartmentalized, with departments working in silos. Universities need to transform a rigid set of habits, thoughts, and arrangements, often times incapable of responding to change, to an effective organization encouraging those within them to integrate their activities. Public research university CFOs need to adopt tools that fit the specific needs and the culture of their institution.

7. Although the Delphi panel believed that there are benefits to the use of qualitative and quantitative management tools in carrying out the public research university CFO management functions, the strength of the benefits was not evident. Efforts to improve rational, analytical methods in higher education have increased in recent years but if the results of the survey are any indication, CFOs do not see the benefit. Higher education offers many opportunities to improve fact-based decision making; basing decisions on facts helps break down the isolation and fragmentation that depresses

collegiality. However, top administrators, when faced with complicated choices, often choose to just trust their gut.

8. Some of the tools that have historically been used by public research university CFOs (e.g., regression analysis, PERT charts, and decision trees) were found not to be important to CFOs in carrying out their management functions in the future. Similarly, tools that have been historically used in higher education (return on investment, internal rate of return, regression analysis, and checklists) saw the largest decrease between their current effectiveness and future importance underlying the importance of CFOs staying current with qualitative and quantitative management tools that may be able to assist them in carrying out their management functions.
9. The results of this study indicate that public research university CFOs must be able to use both qualitative and quantitative management tools in carrying out their management functions. Both types of management tools were noted to be effective currently and important in the future. Only by being able to apply both types of tools will public research university CFOs be able to most effectively solve the challenges they face.

Recommendations for the Field

The data from this study suggest that in order to enhance the use of qualitative and quantitative management tools in public research universities CFOs should:

1. Stay current in the expanding research field of qualitative and quantitative management tools, continuous improvement efforts, organizational change,

and benchmarking in order to ensure their institutions use these tools to add credibility to discussions and help focus senior management's attention to setting priorities and managing operations.

2. Effectively communicate the importance of using qualitative and quantitative management tools to provide identifiable support for decisions with repetitive data analysis over time.
3. Understand that the cumbersome, complicated, and time consuming data gathering processes, often needed to implement qualitative and quantitative management tools, may be a result of the culture of their organization and the resistance to change often seen in higher education institutions.
4. Design and implement comprehensive data warehouses and data mining concepts while acknowledging that the complexity of higher education information systems which lie outside the oversight of the CFO and a lack of technology to implement qualitative and quantitative management tools are not barriers to the use of the tools in carrying out the public research university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling.
5. Understand that while the qualitative and quantitative management tools can be used to demonstrate successful practices, potentially through the use of benchmarking, they can also help counter decision making which can be based upon anecdote and emotion thus increasing the reliability of decision making.

6. Coordinate data gathering processes to make them as efficient and effective as possible to reduce bureaucracy and minimize the cost of data collection while providing more time to implement the qualitative and quantitative management tools to ensure that institutional goals and missions are supported.
7. Monitor and regularly review qualitative and quantitative management tools being used at peer universities to improve their knowledge base and benchmarking activities. This can also improve the education of staff, as well as other higher education constituents, as to the importance of qualitative and quantitative management tools in carrying out the public research university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading, and controlling.
8. Integrate qualitative and quantitative management tools in the decision making process to assist in the development of staff and to improve collaboration between departments leading to reduced silos in the organization and further sharing of data within decentralized institutions of higher education.

Recommendations for Further Studies

This study sought to identify qualitative and quantitative management tools public research university CFOs use in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling; barriers/impediments and benefits to the use of these tools in carrying out the management functions; and what qualitative and quantitative management tools will be important to public research university CFOs in carrying out their management functions in the future. The Delphi technique was the methodology used in this study and the expert panel consisted of fifteen public university CFOs from across the U.S. The concerns related to the methodology used in this dissertation study and the selection of the Delphi panel compel the recommendations for further study. The researcher recommends the following aspects to be pursued in further studies:

1. A mixed methods study would provide an opportunity to explore some of the reasons behind the lack of perceived effectiveness and utilization of the qualitative and quantitative management tools by public research university CFOs.
2. There are two ways to construct questionnaires using the Delphi method. The first construct is when a researcher designs a questionnaire based on the perspectives found in a literature review and then sends the questionnaire out to the experts for validation, the experts also have an opportunity to add new information if they desire (the modified Delphi technique). The second way to construct Delphi questionnaires is for the researcher to use the first questionnaire to pose a problem to the experts in broad terms (an open survey) and invite answers and comments from the experts. In the second method, replies to that questionnaire are then summarized and used to construct a second questionnaire. In this study the first approach was used. The modified Delphi technique was used in this study, further research studies may begin by asking the panel experts to identify qualitative and quantitative management

tools public research university CFOs use in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling which may provide additional tools that were not included in the literature review or added by the panel experts from this study.

3. A larger panel size, may allow researchers to perform data reduction techniques using exploratory and confirmatory factor analyses to verify different hypotheses that the variables used in the study may form and to exam the qualitative and quantitative management tools public research university CFOs use in carrying out their management functions.
4. A different panel composition could lead to diverse research results. The Delphi panel for this study were public research university CFOs with the majority of the CFOs between 51 and 60 years of age, an average of twenty four years of experience in higher education who were in their current position for approximately five years. Therefore, a different panel with adequate numbers of CFOs with different demographic composition may: (1) suggest other qualitative and quantitative tools used in carrying out the public research university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling; (2) evaluate the results of a new study with the results found in this study and determine the amount of agreement on the significance of qualitative and quantitative tools to the public research university CFO management

functions; and (3) validate the future importance of the qualitative and quantitative tools in carrying out the public research university CFO management functions as identified in this study.

5. Similarly, a new expert panel with adequate numbers of CFOs from private research universities, private universities, community colleges, or non-research public institutions may: (1) distinguish between tools that are important for public research universities as compared to these other institutions of higher education; (2) suggest other qualitative and quantitative tools used in carrying out the university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling; (3) evaluate the results of the new study with the results found in this study and determine the agreement on the importance of qualitative and quantitative tools to the university CFO management functions; and (4) validate the future importance of the qualitative and quantitative tools used in carrying out the university CFO management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling.
6. A different panel could also discover a different set of barriers/impediments to the implementation of qualitative and quantitative tools used in carrying out the public research university CFO management functions or rank the significance of the barriers/impediments in a different manner. As new legislation and accreditation requirements are placed on higher education, the

barriers/impediments to the use of qualitative and quantitative tools will change over time. A subsequent analysis on the key barriers/impediments to the implementation of qualitative and quantitative tools in performing the public research university CFO management functions will provide valuable information to CFOs, governing boards, and higher education policy-makers.

7. As a suggestion for future Delphi studies, steer clear of corruption of the Delphi panel results from distinctive responses and the influence of non-representative outlier responses on the overall study. Researchers need to be observant in identifying potential outlier responses early in their review of the data and reach out to the suspected outlier participants as early as possible.
8. Researchers should consider developing case studies or citing successful examples of the application of qualitative and quantitative management tools in higher education to improve educational opportunities in higher education.

Summary: Dissertation Study Significance

This dissertation study identified twenty-three effective qualitative and quantitative management tools used by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. The number of identified effective qualitative and quantitative management tools is significant and provides a significant body of knowledge as to their importance to public research university CFOs in carrying out their management functions. The Delphi panel also provided insight into the future and identified three highly important qualitative and quantitative management tools for public research university CFOs in carrying out their management functions in the future (benchmarking, cost-benefit analysis, and data mining and data warehouses) and an additional twenty tools that will be important tools for public research university CFOs in carrying out their management functions in the future.

The Delphi panel also provided barriers/impediments to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling. Additionally, the Delphi panel provided insights into benefits to the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions.

The currently effective and future important qualitative and quantitative management tools used by public research university CFOs in carrying out their management functions identified in this research, along with the identified barriers/impediments to the use of the tools in carrying out their management functions, and the benefits from the use of the tools in carrying out their management functions, can be useful in the development of curriculum for higher education post-secondary education courses. In addition, due to the unfamiliarity of some of the Delphi panel members to the qualitative and quantitative management tools that were included in this research study, further continuing education of higher education CFOs in the application of these tools could prove to be valuable. Finally, there may be potential to enhance the efficiency and effectiveness to which public research university CFOs carry out their management functions through the dissemination of the results of this study.

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APPENDIX 1

<u>Initial Letter to Public Research University CFOs</u>

Dear Colleague:

We would like to ask for your participation in a research study which we believe will offer value to higher education financial officers (CFOs). Today, legislators, trustees/boards, families, and students are demanding that higher education do more with less while at the same time providing greater accountability and improved access. Increased productivity and cost-effectiveness are essential in meeting higher education's goals of teaching, research, and service, as well as meeting the demands of these stakeholders. As a CFO in a Tier 1, public research institution, you are keenly aware of these demands and the importance of these issues to higher education.

The purpose of this study is to identify effective qualitative and quantitative management tools used by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling at a public research university. My thesis is that to meet these stakeholder demands, the current culture of accountability and transparency can be enhanced through the leadership of financial officers that can effectively implement and utilize qualitative and quantitative management tools to carry out their management functions in an increasingly difficult environment.

Participation in this study is voluntary and since your time is valuable, a web based instrument has been developed to record your responses in an efficient manner. We ask that you navigate to (SurveyMonkey link was inserted here) and answer the questions related to your knowledge of the various tools and their application at your institution. Results collected will be reported in aggregate form and your individual responses will remain anonymous (except to the complier of the survey information). This research study has been reviewed and approved by the Institutional Review Board-Human Subjects in Research, Texas A&M University. If you have any questions regarding your rights as a participant, please log on to the Texas A&M University Institutional Review Board website at irb.tamu.edu.

It is requested that you respond within the next fourteen days. Your participation will provide valuable information regarding tools used by public research university CFOs and following this initial response, a panel of experts will be formed to participate in further analysis of this subject.

Thank you for your participation in this study and your contribution to making this effort a successful research endeavor. If you have any questions on the study, or the website, please contact Grant Trexler at gtrexler@tamu.edu or at (979) 574-7576.

Grant Trexler
Associate Executive Director,
Finance and Business Operations
Administration
Cal Poly Corporation
Doctoral Student Texas A&M University

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APPENDIX 2

Original Questionnaire Submitted to Public Research University CFOs

Thank you for taking the time to complete this survey. It will take no more than 5 minutes to complete. Your feedback is important to us to identify effective qualitative and quantitative management tools used by public research university financial officers.

In order to progress through this survey, please use the following navigation links:
- Click the Next >> button to continue to the next page.
- Click the Previous >> button to return to the previous page.
- Click the Submit >> button to submit your survey.

If you have any questions on the study, please contact Grant Trexler at gtrexler@tamu.edu or at (979) 574-7576.

For each tool listed below used by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling; indicate your level of experience in using the tool considering the following definitions:
1 = I am not aware of this tool
2 = I am aware of this tool but have not used it
3 = I am aware of this tool and sometimes use it
4 = I am aware of this tool and regularly use it

Level of experience with tools

Tools Used in Higher Education Decision Making	Not aware of tool	Aware, have not used tool	Aware, sometimes use this tool	Aware, regularly use this tool
Activity based costing				
Balanced scorecard				
Benchmarking				
Brainstorming				
Checklists				
Continuous improvement				
Contribution margin analysis				
Control chart				
Cost-benefit analysis				
Dashboards				
Data mining				
Decision trees				
Factor analysis				
Fishbone diagram				
Flow chart				
Focus groups				
Histograms/bar charts				
Internal rate of return (IRR)				
Interrelationship diagram				
Peer review				
PERT Chart				
Ratio analysis	-	-	-	-
Regression analysis				
Responsibility centered management				
Return on investment				
Scenario planning				
Sensitivity/ "what-if" analysis				
SWOT Analysis				
Trend analysis				

Please list other tools, not listed above, that you believe are highly relevant to public research university CFO's in carrying out their management functions:

APPENDIX 3

<u>Tools Dropped from Original Listing</u>
(greater than 58% of respondents were not aware of or had not used the tools)

Control chart	Fishbone diagram
Factor analysis	Interrelationship diagram

<u>Tools Added Based Upon Responses to Open-Ended Questions</u>

Delayering the institution	Revenue and expense pro formas
Management by walking around	Reviewing span of control
Operational analysis	

APPENDIX 4

<u>Letter to Potential Delphi Panel Participants</u>

Dear ___:

In July, you participated in the initial survey related to qualitative and quantitative management tools used by public research university financial officers (CFOs). Based upon your responses to the original questionnaire, you have been identified as an expert, someone with comprehensive knowledge of and experience in the use of these management tools. Therefore, I am respectfully asking for your continued participation with this study, joining a panel of experts with firsthand knowledge of the subject area.

To obtain data for the study, the panel of experts will participate in a research method known as a modified Delphi technique. This technique is used to seek consensus on a subject of uncertainty using a structured communication process among panelists. It is anticipated that up to three rounds of surveys (the estimated time to complete each survey is ten to fifteen minutes per round), less than an hour in time over the next six to eight weeks.

I assure you that complete confidentiality and anonymity will be utilized in this study. All expert panelists and their respective institutions will never be specifically mentioned in the text of this study. At no time during this study will your name or institution be mentioned, nor will you know others serving on the panel.

Please e-mail me at if you are willing to participate in the study to further contribute to the improvement of CFO management functions in higher education. I anticipate the first surveys being sent within the next week to ten days.

If you have any questions on the study, please contact me at gtrexler@tamu.edu or at (979) 574-7576.

Thank you for your time.

Grant Trexler
Associate Executive Director, Finance and Business Operations
Cal Poly Corporation
Doctoral Student
Texas A&M University

APPENDIX 5

Original Survey Sent to Delphi Panel

Thank you for taking the time to complete this survey. It will take approximately 10 minutes to complete. Your feedback is important to us to identify effective qualitative and quantitative management tools used by public research university financial officers.

At the end of the survey, Click the Submit >> button to submit your survey. If you have any questions on the study, please contact Grant Trexler at gtrexler@tamu.edu or at (979) 574-7576.

For each tool listed below, indicate how effective you believe each tool is for use by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling:

1 = I am not aware of this tool
2 = Tool is not effective in carrying out public research university CFO management functions
3 = Tool is minimally effective in carrying out public research university CFO management functions
4 = Tool is moderately effective in carrying out public research university CFO management functions
5 = Tool is highly effective in carrying out public research university CFO management functions

Additionally, for each tool indicate how important you believe it will be in the future (5-10 years) to public research university CFOs in carrying out their management functions:

1 = N/A - not aware of tool
2 = Tool will not be important to public research university CFOs in carrying out their management functions in the future
3 = Tool may be important to public research university CFOs in carrying out their management functions in the future
4 = Tool will be important to public research university CFOs in carrying out their management functions in the future
5 = Tool will be very important to public research university CFOs in carrying out their management functions in the future

	Current effectiveness of tool	Future importance of tool
Tools	Your Response	Your Response
Activity based costing		
Balanced scorecard		
Benchmarking		
Brainstorming		
Checklists		
	Current effectiveness of tool	**Future importance of tool**
Tools	Your Response	Your Response
Continuous improvement		
Contribution margin analysis		
Cost-benefit analysis		
Dashboards		
Data mining and data warehouses		
Decision trees		
Delayering the institution		
Environmental scan		
Factor analysis		
Flow chart		
Focus groups		
Histograms/bar charts		
Internal rate of return (IRR)		
Management by walking around		
Operational analysis		
Peer review		
PERT Chart		
Ratio analysis		
Regression analysis		
Responsibility centered management		
Return on investment		
Revenue and expense pro formas		
Review span of control		
Scenario planning		
Sensitivity/ "what-if" analysis		
SWOT Analysis		
Trend analysis		

2. Based upon your experience, please indicate the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFO management functions:

Barrier/impediment	Item is not a barrier	Item is usually not a barrier	Item is some-times a barrier	Item is consistently a barrier
Cost of data collection				
Lack of resources: inadequate staffing and work overloads				
Technology needed to use the tools is not available (hardware or software)				
Resistance to change				
Culture of the institution				
Institution's senior leadership lack of knowledge/understanding of the tools				
Reliance on measurement systems that lie outside the finance department for data				
Complexity of higher education information systems				
Insufficient data - not measuring areas where the tools could be used to support decision making				
Communication: lack of transparency and openness in regard to decision making				
Reliance on human capabilities of relative few that know how to use tools				
Cumbersome, complicated and time consuming data gathering processes				
Tools don't seem to fit use in higher education				
Bureaucracy - State or internal to the institution				
Lack of standardized higher education data				
Difficulties in identifying similar organizations for use in benchmarking				
Lack of technology funding needed to implement the tools				

3. Please list other barriers/impediments, not listed above, to public research university CFOs using qualitative and quantitative management tools :

4. Based upon your experience, please indicate whether qualitative and quantitative management tools benefit public university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling:

Benefit	1 - Strongly Disagree	2 - Disagree	3 – Neutral	4 – Agree	5 – Strongly Agree
Tools provide identifiable support for decisions					
Tools identify relationships not uncovered through other means					
Tools promote the use of best practices					
Tools allow for the graphical representation of ideas that can assist in "telling the story"					
Tools bring other experts into the decision making process					
Tools assist decision makers in developing a group decision					
Tools increase the reliability of decision making					
Tools assist in the development of staff					
Tools assist in supporting accreditation reviews					
Tools provide the basis for repetitive data analysis over time					
Tools provide for improved communication in the decision making process					
Tools assist in changing the culture of the organization					

5. Please list other benefits, not listed above, that you believe occur from the use of qualitative and quantitative management tools by public research university CFOs in carrying out their management functions:

APPENDIX 6

Second Survey Sent to Delphi Panel

Thank you for taking the time to complete the second round of this survey. Please review the mean responses and your original responses to the first round of the survey that were sent to you via e-mail. Then answer the survey a second time. Some questions have additional items based on feedback from Round One. It will take approximately 10 minutes to complete this survey.

At the end of the survey, Click the Submit >> button to submit your survey. If you have any questions on the study, please contact Grant Trexler at gtrexler@tamu.edu or at (979) 574-7576.

1. For each tool listed below, indicate how effective you believe each tool is for use by public research university CFOs in carrying out their management functions of planning, decision making, organizing, staffing, communicating, motivating, leading and controlling:

1 = I am not aware of this tool
2 = Tool is not effective in carrying out public research university CFO management functions
3 = Tool is minimally effective in carrying out public research university CFO management functions
4 = Tool is moderately effective in carrying out public research university CFO management functions
5 = Tool is highly effective in carrying out public research university CFO management functions

Additionally, for each tool indicate how important you believe it will be in the future (5-10 years) to public research university CFOs in carrying out their management functions:

1 = N/A – not aware of tool
2 = Tool will not be important to public research university CFOs in carrying out their management functions in the future
3 = Tool may be important to public research university CFOs in carrying out their management functions in the future
4 = Tool will be important to public research university CFOs in carrying out their management functions in the future
5 = Tool will be very important to public research university CFOs in carrying out their management functions in the future

Tools Used in Carrying Out CFO Management Functions	Effectiveness of tools Mean	 Your Response	Future importance of tool Mean	 Your Response
Activity based costing	3.73		3.33	
Balanced scorecard	3.60		3.53	
Benchmarking	4.53		4.80	
Brainstorming	4.20		4.13	
Checklists	3.60		3.27	
Continuous improvement	3.93		4.07	
Contribution margin analysis	3.27		3.40	
Cost-benefit analysis	4.47		4.60	
Dashboards	4.27		4.13	
Data mining and data warehouses	4.60		4.53	
Decision trees	3.53		3.20	
Delayering the institution	2.80		2.80	
Environmental scan	3.53		3.73	
Flow chart	3.60		3.67	
Focus groups	3.73		3.60	
Histograms/bar charts	2.93		2.73	
Internal rate of return (IRR)	3.53		3.67	
Management by walking around	4.00		3.87	
Operational analysis	3.33		3.20	
Peer review	3.00		3.40	
PERT Chart	2.67		2.60	
Ratio analysis	4.27		4.13	
Regression analysis	3.33		3.13	
Responsibility centered management	3.60		3.73	
Return on investment	4.07		3.80	
Revenue and expense pro formas	4.47		4.60	
Reviewing span of control	3.20		3.47	
Scenario planning	4.00		4.13	
Sensitivity/ "what-if" analysis	4.13		4.27	
SWOT Analysis	3.87		3.87	
Trend analysis	4.20		4.07	

2. Based upon your experience, please indicate the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFO management functions:

Barrier/impediment	Mean	Your Response
Cost of data collection.	2.93	
Lack of resources: inadequate staffing and work overloads.	3.53	
Technology needed to use the tools is not available (hardware or software).	2.40	
Resistance to change	2.87	
Culture of the institution	2.80	
Institution's senior leadership lack of knowledge/understanding of the tools.	1.87	
Reliance on measurement systems that lie outside the finance department for data.	2.60	
Complexity of higher education information systems.	2.67	
Insufficient data - not measuring areas where the tools could be used to support decision making.	2.93	
Communication: lack of transparency and openness in regard to decision making.	2.13	
Reliance on human capabilities of relative few that know how to use tools.	2.60	
Cumbersome, complicated and time consuming data gathering processes.	3.00	
Tools don't seem to fit use in higher education.	2.40	
Bureaucracy - State or internal to the institution	2.53	
Lack of standardized higher education data	2.93	
Difficulties in identifying similar organizations for use in benchmarking	2.53	
Lack of technology funding needed to implement the tools	2.67	
Lack of time to implement tools		
Data governance, ownership and reluctance of other departments to share data		
Lack of empirical research on models that will predict success		
Internal political considerations		
Fund accounting rules		
Lack of common definitions		
Communication roadblocks in decentralized organizations		

3. Based upon your experience, please indicate whether qualitative and quantitative management tools benefit public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling:

Benefit	Mean	Your Response
Tools provide identifiable support for decisions	1.57	
Tools identify relationships not uncovered through other means	1.93	
Tools promote the use of best practices	2.14	
Tools allow for the graphical representation of ideas that can assist in "telling the story"	1.71	
Tools bring other experts into the decision making process	2.64	
Tools assist decision makers in developing a group decision	2.21	
Tools increase the reliability of decision making	2.36	
Tools assist in the development of staff	2.43	
Tools assist in supporting accreditation reviews	2.36	
Tools provide the basis for repetitive data analysis over time	1.93	
Tools provide for improved communication in the decision making process	2.29	
Tools assist in changing the culture of the organization	2.57	
Tools help focus senior management's attention in setting priorities		
Tools can help educate individuals in leadership roles		
Tools greatly improve external communication capacity		
Tools can be used to demonstrate successful practices/transitions		
Tools can help counter decision making based on anecdote and emotion		
Data and tools can add credibility to the discussion		

APPENDIX 7

Third Survey Sent to Delphi Panel

Thank you for taking the time to complete the first two rounds of this survey. The Delphi panel was able to reach consensus on all questions contained in the original survey. For the items that were added in the second round of the survey, please review the mean responses and your original responses that were sent to you via e-mail. Then answer the survey again. Completing the survey for the thirteen remaining items should take less than five minutes.

At the end of the survey, Click the Submit >> button to submit your survey. If you have any questions on the study, please contact Grant Trexler at gtrexler@tamu.edu or at (979) 574-7576.

1. Based upon your experience, please indicate the barriers/impediments to the use of qualitative and quantitative management tools in carrying out the public research university CFO management functions:

1. Item is not a barrier/impediment to the use of the tools
2. Item is usually not a barrier/impediment to the use of the tools
3. Item is sometimes a barrier/impediment to the use of the tools
4. Item is consistently a barrier/impediment to the use of the tools

Barrier/impediment	Mean	Your Response
Lack of time to implement tools	3.07	
Internal political considerations	2.93	
Communication roadblocks in decentralized organizations	2.80	
Data governance, ownership and reluctance of other departments to share data	2.67	
Lack of empirical research on models that will predict success	2.67	
Lack of common definitions	2.53	
Fund accounting rules	1.87	

2. Based upon your experience, please indicate whether qualitative and quantitative management tools benefit public research university CFOs in carrying out their management functions of planning, organizing, staffing, communicating, motivating, leading and controlling:

1. Strongly disagree that the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
2. Disagree that the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
3. Neutral as to whether the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
4. Agree that tools the qualitative and quantitative management tools benefit CFOs in carrying out their management functions
5. Strongly agree that the qualitative and quantitative management tools benefit CFOs in carrying out their management functions

Benefit	Mean	Your Response
Data and tools can add credibility to the discussion	4.27	
Tools can help counter decision making based on anecdote and emotion	4.07	
Tools can help educate individuals in leadership roles	4.07	
Tools help focus senior management's attention in setting priorities	4.00	
Tools can be used to demonstrate successful practices/transitions	4.00	
Tools greatly improve external communication capacity	3.73	

APPENDIX 8

DELPHI PANEL EXPERTS

Name	Position	University
Anonymous	Vice President, Administration & Finance	
BJ Crain	Vice President for Finance and Chief Financial Officer	Texas A&M University
David J. Cummins	Vice President for Finance & Administration/CFO	University of Akron
Dick Cannon	Vice President for Finance and Administration	University of New Hampshire
Frances Dyke	CFO and Vice President for Finance and Administration (retired)	University of Oregon
Gerry Bomotti	Sr. Vice President for Finance and Business	University of Nevada, Las Vegas
Kenneth A. Jessell	Senior Vice President and Chief Financial Officer	Florida International University
Lynda Gilbert	Vice President for Financial Affairs and Treasurer	University of Alabama
Matthew Fajack	Vice President and Chief Financial Officer	University of Florida
Michelle Quinn	Senior Vice President, CFO Finance & Administration	University of Northern Colorado
Michael J. Curtin	Vice President for Finance & CFO	University of Louisville
Morgan Olson	Executive Vice President, Treasurer and CFO	Arizona State University
Neil D. Theobald	Senior Vice President & CFO	Indiana University
Pamela A. Currey	Associate Vice President, Finance & Administration	Virginia Commonwealth University
Roger D Patterson	Vice President for Business and Finance	Washington State University