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Institutional Analytics: A Response to the Pressures of Academic Capitalism

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Institutional Analytics: A Response to the Pressures of Academic Capitalism

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By

Molly Eleanor O'Keefe

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INSTITUTIONAL ANALYTICS: A RESPONSE TO THE PRESSURES OF

ACADEMIC CAPITALISM

by

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Table of Contents

i

iv

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Higher education is all I have known my entire life, growing up in an academic family on a variety of college campuses. Many years ago, I started this culminating effort towards a PhD by way of a major life transition that found me in a new location, knowing no one, with some time (but not a lot of money) on my hands. Taking free courses at the high caliber institution I worked at seemed a sensible way to spend some of that time, and as one transition led to another, eventually it ended here, with this document. It was difficult, and interesting, and maddening, and exciting, and frustrating, and so many more things that kept me on a mental seesaw for a good number of years. Nevertheless, she persisted!

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List of Tables

List of Figures

Abstract

The higher education sector today faces an environment unlike any it has seen before. Serving a wide variety of internal and external stakeholders and facing diverse and fast-changing economic, social, and political pressures, universities can benefit from corporate-like approaches such as the use of analytics to inform strategic decision-making and planning. Institutional analytics programs can be a valuable resource in guiding university responses to modern challenges around fiscal responsibility, accountability, competition, and student success. Customizable when it comes to leadership, staffing, and data and technology infrastructure, analytics initiatives can be targeted to meet individual institutional resources, environments, challenges, needs, mission, and values.

One such resource available at most institutions is Institutional Research (IR), a field that has undergone regular evolution to meet the changing needs of postsecondary education. The unique combination of technical, analytical, and interpersonal roles and skills needed for the effective use of data and analytics can often be met through the engagement of Institutional Research leaders and staff in these initiatives, and they are frequently key participants in the support and delivery of analytics efforts on campus. With Institutional Research as a resource, and flexibility in creating an analytics program that best meet the needs of individual institutions, analytics can serve as a powerful and effective tool for universities responding to todays' pressures of academic capitalism.

Keywords: academic capitalism, analytics, higher education, institutional research

Institutional Analytics: A Response to the Pressures of Academic Capitalism

CHAPTER ONE: INTRODUCTION

Historically, higher education has long faced "forces of disruption" (McGee, 2015, p. 100), many resulting in the need for institutions to change and respond with efficiency and agility. The mid-1940s onward, in particular, ushered in decades of significant and rapid change for postsecondary institutions, with drastically increasing enrollments and changing student demographics after World War II (Brumbaugh, 1960; Calderon & Mathies, 2013; Lanius, Logsdon, & Smith, 2000; Lasher, 2011); increased interest from external constituents resulting in new levels of legislative and organizational oversight in the 1960s and 70s (Brumbaugh, 1960; Foraker, 2014; Lasher, 2011); unstable economic environments and reduced financial support in the 1980s and 90s (Lasher, 2011; McGee, 2015; Peterson, 1999); and ever-shifting political pressures based in neoliberalism and academic capitalism driving increasing demands for accountability and transparency from that time on (Apple, 2013; Lasher, 2011; McGee, 2015; Peterson, 1999; B. J. Taylor, Webber, & Jacobs, 2013).

Encouraging a more market-based, consumer-driven perspective of higher education, neoliberalism and academic capitalism have maintained their hold on the workings of higher education to date. This neoliberalism orientation creates "a vision that sees every sector of society as subject to the logics of commodification, marketization, competition, and cost-benefit analysis" (Apple, 2013, p. 6). Rhoades and Slaughter (2004) outlined a related concept involving increased likeness between higher education and business, that of "academic capitalism" or a "capitalist knowledge/learning/consumption regime" (p. 37). Academic capitalism argued for "blurring the boundaries between the for-profit and not-for-profit sectors, and a basic

change in academy practices- changes that prioritize revenue generation, rather than the unfettered expansion of knowledge, in policy negotiation and in strategic and academic decision making" (Rhoades & Slaughter, 2004, p. 37). As a result of these trends, universities wrestle to adapt to high demands for transparency and outcomes as evidenced by the neoliberal, accountability-driven views.

The Spellings Report (2006) and the increasing prevalence of performance-based funding models (National Conference of State Legislators, 2015) document government approaches to require accountability in the higher education sector. An expectation of routine evaluation and measurement under this "value added" perspective of a college education means institutions must regularly assess how they are responding to accountability-driven demands spurred by this changing public perception of higher education (Calderon & Mathies, 2013, p. 77). For example, President Barack Obama's 2010 strategic plan to graduate an additional 5 million community college students by 2020 who are prepared for the workforce (American Association of Community Colleges, n.d.) requires tracking of progress towards that goal via outcomes data on degrees awarded and graduation rates. For universities, these changes drive:

> a renewed sense of urgency for improving higher education's accountabilities, transparency, and performance is in place… [as] students, parents, accreditation agencies, and other external constituencies are demanding more from higher education, searching for an overall return on this investment from the student, state, and federal perspective. (Baer & Campbell, 2012, p. 53)

As part of their response to these increasing neoliberal views and demands, universities need to be able to proactively and effectively collect and analyze data to provide evidence of their value and contributions to their many constituents and stakeholders.

While this focus on evaluation of outcomes is not necessarily a new endeavor, as institutions have, in fact, reported data to bodies such as accreditation agencies and legislative boards of education much more commonly since the 1940s, the focus on "making better, data-informed decisions, improving performance, and becoming less reliant on 'gut instinct' regarding critical issues facing the institution or the quality of education" (Stiles, 2012, p. 5) is the more significant shift in the approach to current demands for and use of institutional information. In response, more universities are now exploring the use of analytics, or "actionable intelligence" (Baer & Campbell, 2015, p. 53).

Analytics in Higher Education

In their 2012 report *Analytics in Higher Education: Benefits, Barriers, Progress, and Recommendations*, EDUCAUSE formally defined analytics as "the use of data, statistical analysis, and explanatory and predictive models to gain insight and act on complex issues" (Bichsel, 2012, p. 6). Analytics programs can offer institutions a way to be responsive to the increasingly challenging demands of academic capitalism and accountability they now face. Providing nuance to the definition of "academic analytics," P. Long and Siemens (2011) argued "analytics spans the full scope and range of activity in higher education, affecting administration, research, teaching and learning, and support resources" (p. 36). Analysts engaged in these efforts have the opportunity to be a resource for both operational and strategic constituents throughout the university, with

4

technology and information delivery driving expansion of both their roles and reach to more stakeholders through technology (Swing & Ross, 2016a).

A 2016 EDUCAUSE report detailed the concept of "business analytics" and provided differentiation of two separate types of analytics that encompass the term. These terms, including "learning analytics [which are] intended to enhance or improve student success" and focus on student learning and outcomes, and "institutional analytics [which are] intended to improve services and business practices across the institution," and are focused on goals such as improving student success, reducing costs, and increasing efficiencies (Arroway, Morgan, O'Keefe, & Yanosky, 2016, pp. 6-7). Even though learning analytics are certainly an increasingly important focus for advancing student success, research, and discussions about "analytics" have only relatively recently distinguished between learning analytics and business analytics (Yanosky & Arroway, 2015). As well, the more traditional and common focus for institutional researchers, who are frequently among those most involved with analytics on campus, is more often on institutional data (Brooks & Thayer, 2016; Jones, 2015; Reinitz, 2015; Yanosky & Arroway, 2015).

As a sector, institutions of higher education are often described as being "data rich but information poor" (Reinitz, 2015, p. 4). This assessment represents a relatively new perspective on the use of data in postsecondary education, and represents an evolution in the sector beyond just looking at and reporting standard data, to a new vision involving applied use of findings, contextual understanding, and a focus on impact (Stiles, 2012; Stocker, 2012). Baer and Campbell (2012) proposed three overall components that must be in place for what they call a successful "analytics program":

Beyond the data, technology, and statistical requirements, academic analytics

projects require skill and leadership. Three characteristics of successful academic

analytics projects include:

- leaders who are committed to evidence-based decision making,

- staff who are skilled at data analysis, [and]

- a flexible technology platform that is available to collect, mine, and

 analyze data. (p. 57)

The field of Institutional Research (IR), defined as an area that conducts research "within

an institution of higher education to provide information which supports institutional

planning, policy formation and decision making" (Saupe, 1990, p. 1), is uniquely situated

as a functional role that can lead and guide the expanded use of institutional analytics on

campus.

The Evolving Role of Institutional Research

Institutional Research professionals can, and often do, have the leadership and

support roles necessary for analytics success in this rapidly changing and evolving

"culture of evidence" (Kerrigan & Jenkins, 2013, p. 1). Roles related to these initiatives

entail responsibility for the guidance of, accountability for, and maintenance and delivery

of analytics efforts. Role theory, based in sociology and social psychology theory, sees

roles "traditionally defined as a set of behavioral expectations attached to a position in an

organized set of social relationships" (Sluss, van Dick, & Thompson, 2011, p. 506).

Utilizing role theory as a framework for examining the evolution of Institutional

Research, and its long history of adapting to the data and information needs of

postsecondary education, can be useful in analyzing the extent to which the field is

perched on the cusp of adopting a new and expanded role for institutional researchers that involves the leadership and delivery of analytics in higher education.

The role of Institutional Research has certainly been impacted throughout history as organizational and individual demands and needs have changed. The current context of higher education requires yet another change to the functions and duties of Institutional Research. As such, these changing demands have resulted in "role innovation" for the field and its occupants, which occurs "when individuals, leaders, and organizations instigate role modifications aimed at enhancing outcomes" (Sluss et al., 2011, p. 518). Such innovation can take place through a variety of methods, including flexible role orientation as individuals take on a wider or different set of goals and behaviors and task revision, when actual job duties are changed in order to adapt to new organizational expectations and demands (Sluss et al., 2011). The use of analytics in higher education is certainly a current example of this phenomenon, as it includes roles defined specifically by new institutional needs related to the advancement of academic capitalism.

Historical role changes in Institutional Research. Facing regular role innovation throughout its lifespan, Institutional Research has already evolved significantly from its 1701 inception as a study of Harvard's organizational structure by the Yale founders (Cowley, 1960; Doi, 1979; Lasher, 2011). Institutional Research offices have become an instrumental resource for universities and their leadership, as:

the profession has developed and matured into a vital function in higher education. This development has occurred in an environment of rapidly changing expectations of higher education that have been characterized by expanded

7

capabilities of technology and increased demand for its services, shrinking

resources, and vocal demands for accountability. (McLaughlin & Howard, 2001,

p. 163)

Formally identified as a distinct role with designated tenets and duties in the 1920s, "the

University of Illinois established its Bureau of Institutional Research in its College of

Education in 1918…, [which] many agree… was probably the first administrative unit

created for the purpose of ongoing institutional research" (Lasher, 2011, p. 13). Eells

(1937) identified the following specific developments as influential factors in the growth

of the Institutional Research profession around this time:

(1) The development of the scientific spirit in education; (2) the efficiency

movement in business and industry; (3) the social survey movement; (4) the

growth of higher education; (5) the complexity of higher education; (6) the cost of

higher education; (7) the criticisms of higher education; (8) the development of

accrediting agencies; (9) the influence of the general educational survey

movement, and (10) self-protection. (pp. 54-68)

The breadth of the Institutional Researcher's role has therefore, expectedly,

increased in parallel with the evolution of the field. With a focus on providing

information that serves diverse institutional needs and constituents, Institutional Research

offices and staff are often responsible for a wide range of tasks, including legislatively

mandated reporting, policy analysis, strategic planning, program and learning assessment,

research support, and accreditation efforts, just to name a few (Volkwein, Liu, &

Woodell, 2012). The responsibilities of any given unit may vary from school to school,

but when the Association for Institutional Research (AIR) conducted a review of 43

campus based Institutional Research job descriptions and position announcements submitted by member institutions, they identified 1,351 different tasks falling into 18 different domains (Lillibridge, Swing, Jones, & Ross, 2016), revealing just how diverse and extensive the breadth of Institutional Research roles and duties can be.

Contemporary Institutional Research. The history of Institutional Researchers' roles has been a progression from educational research (Doi, 1979; Lasher, 2011), to institutional self-study (Lasher, 2011), to providing data for growing accreditation and legislative demands (Lasher, 2011), to accountability and efficiency monitoring (Calderon & Mathies, 2013; Lasher, 2011), and now to institutional researchers as strategic data interpreters (Leimer, 2011; Peterson, 1999; J. Taylor, Hanlon, & Yorke, 2013).

In spite of the historical variability in roles and duties, Institutional Researchers have remained core providers of university data throughout time, adapting to the time sensitive needs of their institutions in the changing postsecondary education environment as it underwent significant changes over the last four centuries, including the most recent shift towards academic capitalism (Slaughter & Rhoades, 2004). As J. Taylor et al. (2013) noted, "closely associated with marketing and competitive behavior… institutional researchers are [increasingly] working across a spectrum from an emphasis on internal performance and improvement to an emphasis on external performance and competition" (p. 64). Heightened competition in higher education means universities need more than just data; they need someone to interpret it, translate it, and in some cases even make suggestions based on it (Leimer, 2011). Here is where institutional researchers can draw upon the shared knowledge and skills of the profession in order to

support their institutions and leadership as they adapt to external public demands for accountability (Peterson, 1999).

Institutional Research offices and staff now act as not merely a source of data, but increasingly as interpreters and translators of its meaning (Leimer, 2011; Swing & Ross, 2016b). Moving away from their traditional roles rooted in educational research, Institutional Research units and staff increasingly have a larger role in decision-making, policy setting, and strategic planning on their campuses (Calderon & Mathies, 2013). The adaptive role of Institutional Research now more frequently focuses on providing "actionable intelligence" (Baer & Campbell, 2012, p. 53), often delivered through analytics programs on campuses (Reinitz, 2015).

Institutional Research units and staff, often working in tandem with Information Technology, can play a role in analytics programs, which yield these actionable products and information, both in leadership and support capacities (Jones, 2015; Leimer & Terkla, 2009; Reinitz, 2015; Yanosky & Arroway, 2015). As such, Institutional Research units can therefore draw upon this role as part of efforts to communicate the knowledge data offers in support of evidence-based decision making by constituents (J. Taylor et al., 2013). Institutional Research staff now function as "knowledge brokers, linking those who need the knowledge to those who possess it" (Delaney, 2009, p. 37) through analytics programs.

Higher Education Meets Big Business

Higher education leaders are increasingly recognizing how analytics can help in decision making and planning using "big data" (West, 2012, p. 1), incorporating the mining of copious amounts of information to discern patterns and trends and predict

future behavior in support of agile and efficient responses to changing environments (McGee, 2015; Stiles, 2012; Stocker, 2012; West, 2012). Further distinguishing "big data" is the focus on data structure and mining involving "analytics" that builds upon using advanced statistical methods to communicate actionable findings (Bear & Campbell, 2012; Fisher, Drucker, & Czerwinski, 2014; Stiles, 2012; West, 2012).

Brooks and Thayer (2016) noted that universities "have troves of data related to institutional performance and are hoping to discover new efficiencies, cost savings, or revenue streams, [and are] enthusiastic about the potential of analytics" (p. 3). However, merely having data is not enough. Leaders need to commit to the use of evidence-based decision-making and build flexible data platforms to collect and mine the data (Baer & Campbell, 2012). As noted earlier in this chapter, Baer and Campbell (2012) propose three characteristics of what they call a successful "academic analytics program" (leadership, skilled staff, and flexible technology platforms).

Analytics leadership. Regardless of the location of analytics responsibility, which most frequently resides in Institutional Research and/or Information Technology units (Yanosky & Arroway, 2015), Bear and Campbell (2012) noted that general leadership committed to evidence-based decision making is critical to a successful analytics program on campus. Institutional leaders who exhibit interest, investment, and effort in analytics initiatives and who regularly utilize data to assess needs and support strategic planning are as valuable to the efforts as the staff who actually perform the routine work to make them happen (Baer & Campbell, 2012; Bichsel, 2012; Elena, 2011; Stiles, 2012). Indeed, focus groups conducted by EDUCAUSE in 2015 with Information Technology, Institutional Research, analytics units, and business and finance leadership

and professionals revealed that "top leadership often drives analytics adoption, especially by incorporating it into the strategic planning process and by bringing it to bear on such high-level issues as enrollment management and performance-based funding" (Yanosky & Arroway, 2015, p. 13). Leadership support for and use of analytics is a key factor to a successful effort, and has significant impact potential when it comes to buy-in across all constituents.

In addition to executive leadership champions, there is also a need for a secondary level of leadership with direct responsibility for the analytics initiatives at the university. Both during implementation and after, specific individuals, often across multiple units, must keep the operational and strategic work moving forward (Reinitz, 2015; Yanosky & Arroway, 2015). Which university areas and leaders "own" analytics efforts on campus varies from institution to institution, ranging anywhere from Information Technology/Chief Information Officer to the highest academic units, such as the Provost/Chief Academic Officer (Reinitz, 2015; Yanosky & Arroway, 2015). Some universities are exploring a new role, that of Chief Data Officer (CDO), in response to this need, though it remains a relatively new and rare role to date (Reinitz, 2015). Most frequently, however, the leadership for analytics efforts falls to Institutional Research or Information Technology leaders, and frequently involves a combination of the two (Yanosky & Arroway, 2015). This collaboration makes sense as it can support everything from data infrastructure to analysis to visualization to presenting actionable information for decision-making (Bichsel, 2012; Yanosky & Arroway, 2015).

Analytics staffing. Regardless of where leadership for analytics initiatives is located on campus, appropriate staffing of an analytics program is critical. It is frequently noted, however, that staffing is arguably more important than the technology used for data analytics (Reinitz, 2015). These staff members must have advanced skills in technology, data analysis, and communication/interpersonal skills (Reinitz, 2015). These skills align closely with the demands facing institutional researchers as the field has evolved, and often requires a close relationship with Information Technology (IT) and operational units on campus who "own" and know their data (Backscheider et al., 2015; Bichsel, 2012; Reinitz, 2015).

Institutions expectedly vary in their investment in and availability of staff with the skills needed to support analytics, and there is a general acknowledgement of the need to add more staff (Yanosky & Arroway, 2015). Brooks and Thayer (2016) reported that:

institutions are relatively immature with regard to funding analytics as an investment, investing in analytics training, and funding at levels sufficient to meet institutional needs. For resources, institutions are underdeveloped in terms of having sufficient professionals who have specialized analytics training, know how to apply analytics, and know how to support analytics, as well as having an appropriate number of data analysts. (p. 15)

The staffing challenge for universities is, then, actually two-fold: not only do they not generally have enough staff to support such initiatives, but the staff they do have may not have the specific skills and training needed.

Challenges around understaffing are nothing new to Institutional Research units, as a 2015 survey of Institutional Research offices conducted by AIR revealed that

between 2012 and 2015 most Institutional Research offices have not only remained relatively stagnant in size, but some even reported lower levels of staffing (Swing, Jones, & Ross, 2016). This low staffing trend mirrors similar findings from a 2008 AIR survey, indicating that institutions are not making much headway when it comes to ensuring they have the appropriate personnel support for institutional analytics (Swing et al., 2016). In addition to needing additional numbers of staff to support analytics initiatives on campus, Information Technology and Institutional Research respondents to two separate EDUCAUSE surveys in 2012 and 2015 identified the lack of appropriate investment in analytics expertise (Bichsel, 2012; Reinitz, 2015; Yanosky & Arroway, 2015). Respondents to the EDUCAUSE survey specifically indicated needing additional staff with skillsets in predictive modeling, analytics tool training, data visualization, user experience and development, and data analysis (Yanosky & Arroway, 2015).

Data and technology infrastructure. A particularly powerful collaboration between Institutional Research and Information Technology can also support the third component of a successful analytics program: a flexible technology platform to collect, mine, and analyze data (Baer & Campbell, 2012). The need to glean information from copious amounts of data requires analytic efforts to draw upon a variety of disparate data sources, bringing together information centrally in order to draw connections and create informative take-aways (Baer & Campbell, 2012; Yanosky & Arroway, 2015). Though they may have access to the data, institutional researchers are not always considered the "owners" of this information, and "data stewards" in other units are often responsible for the quality and use of their data, as well as policies and procedures governing its input and use (Backscheider et al., 2015).

One specific realm in which Institutional Research and Information Technology frequently come together as a team occurs in the creation and maintenance of a central data infrastructure, often called a "data warehouse" (Baer & Campbell, 2012, p. 58). These warehouses, "central respositor[ies] of data, often created by integrating other data sources and used for reporting and analysis" (Lang & Pirani, 2016, p. 4), are an essential foundation on which analytics programs are often built (Baer & Campbell, 2012, p. 58). Yanosky and Arroway (2015) discovered that schools with advanced analytics programs have a data warehouse, giving them a platform to conduct analysis and provide dynamic and visualized reporting.

With a stable infrastructure, analysts can then use data manipulation and visualization tools such as SAS and Tableau to mine, transform, analyze, and present data in ways that allow key decision makers to quickly assess performance and inform planning, such as dashboards (Fisher et al., 2014; Huynh, Gibbons, & Vera, 2009; Kroc, 2015; Stocker, 2012; West, 2012). Access to technical and analytical resources are critical for establishing an analytics-supported environment, including such assets as

- "digital systems enable[ing] real-time assessment and more effective systems for mining information" (West, 2012, p. 9),

- "predictive modeling tools, applications, and processes" (Baer & Campbell, 2012, p. 60), and

- data warehouses, and visualization software (Stiles, 2012).

When used together, these types of technological tools allow institutional researchers to translate operational data into actionable, strategic information primed for planning purposes (Fisher et al., 2014).

Creating analytics programs. The three components discussed in this section, leadership, staffing, and data and technology infrastructure, are each critical to creating a successful analytics program at institutions (Baer & Campbell, 2012), and many higher education leaders, in turn, indicate that these analytics are critical to effectively running their institution in the current environment facing institutions of higher education (Baer & Campbell, 2012; Calderon & Mathies, 2013; Reinitz, 2015; Yanosky & Arroway, 2015). However, though the need for increased data and analytics capacity appears to be important to institutional leaders, Bichsel (2012) found that "many IT and IR professionals believe that their institutions are behind in their endeavors to employ analytics" (p. 5). While many institutional leaders share that the use of analytics is a priority on their campuses, the reality is that universities fall along a wide spectrum of actual investment in and use of analytics (Yanosky & Arroway, 2015), whether as a result of lack of resources or decisions made to direct resources towards other initiatives or uses.

This apparent disconnect between what is espoused as the value of analytics and the lack of investment to conduct this work can have profound impact on leadership and staff supporting analytics, in particular, those who are ever more frequently asked to perform their new roles and duties under the assumption that analytics initiatives are critical to university decision making in a postsecondary environment driven by academic capitalism. As such, what remains unknown is the extent to which institutions are actually expressing interest in, supporting the development and maintenance of, and using the results of these analytics-oriented efforts, as well as the extent to which

Institutional Research offices are participants in university strategic decision making and planning through analytics efforts.

The use of analytics initiatives and programs in higher education can arguably be a strong support mechanism for universities facing ever-increasing demands for evidence and outcomes, one that big business has modeled in a similarly competitive environment (Calderon & Mathies, 2013; McGee, 2015). Stiles (2012) posited that:

> The argument for analytics is that with large data sets, powerful analytics engines, and skillfully designed visualization techniques, we can use the experience of the past to create helpful models of our processes; we can even more effectively use real-time data and information to alert us to matters requiring our attention; and we can (in some cases) extrapolate to the future using predictive modeling and optimization techniques. (p. 12)

Despite recognizing the value of such efforts to postsecondary education decision-making and strategic planning, however, it remains to be seen the extent to which universities are interested, invested, and using the necessary components associated with a successful analytics program (i.e., leadership, staffing, and data and technology infrastructure), as well as the extent to which their Institutional Research units and staff, are a part of such efforts as part of their evolving roles.

Statement of the Problem

Facing an environment of increased accountability and competition combined with reduced resources and largely driven by neoliberal views of academic capitalism (Apple, 2013; Slaughter & Rhoades, 2004), higher education practitioners increasingly recognize the impact analytics has had on big business' ability to use data and knowledge

17

to make sound, informed decisions driving strategic planning efforts (Baer & Campbell, 2012; Calderon & Mathies, 2013; Stiles, 2012). The adaptation by universities of a more business-like model can be a challenge for institutional leadership as it represents a clash of two worlds in many ways.

As noted by Berquist and Pawlak (2007), academic culture has traditionally focused on scholarship, research, and collegiality, while today's more managerial culture has evolved in order "to adapt effectively to changes in contemporary colleges and universities and… in response to the changing status of academic institutions in today's society" (Berquist & Pawlak, 2007, p. 1). Translating routine corporate efforts and activities, such as the use of analytics to drive proactive responses to changing environments within a higher education paradigm can be difficult given differences in culture (Berquist & Pawlak, 2007). As interest in utilizing analytics in postsecondary education to respond to these changing higher education demands grows, it becomes critical to understand the factors that contribute to successful analytics initiatives in order to make the best, most effective investment in and use of such programs in university planning and decision-making.

Universities expectedly vary in their responsiveness to the rapidly changing demands and pressures of academic capitalism, particularly regarding their use of analytics to address these challenges, and it is important for institutional leadership to first evaluate the extent to which their institutions are using analytics as recognition of and response to the challenges of a neoliberal focus. Examining institutional motivations for and concerns related to the use of analytics in higher education, as well as awareness of the strategic nature of analytics and the extent to which they are currently using their

data in that manner allows leaders to understand how their efforts fit into the framework of the current environmental demands. With this understanding, institutions can then examine their own analytics programs and potentially gain new insights on how they can better use their analytics programs to respond to these neoliberal pressures.

Once leaders establish the extent to which their institutions are responsive to the pressures of academic capitalism universities face today, it is then useful to assess the extent to which their analytics programs have the potential to be successful in this context. Utilizing Baer and Campbell's (2012) framework of the components of a successful academic program (i.e., leadership, staffing, and data and technology infrastructure) to assess the state of analytics initiatives within institutions responding to demands of academic capitalism at varying levels can support planning and decision-making about the programs themselves. Establishing the extent to which each of these components exists (or does not), is supported, and is used is an important foundation for the ongoing support and growth of an analytics initiative on campus, as well as its overall success.

Finally, because the role of Institutional Research has historically evolved to support the changing postsecondary education environment and its demands and it is a readily available resource on most campuses in some form, examining the role the unit and staff play in analytics efforts can yield useful understanding of how Institutional Research contributes to analytics efforts within their institutions. As interest in utilizing analytics on campus increases, Institutional Research units and staff can fill leadership and support roles in such efforts (Baer & Campbell, 2012; Leimer, 2011; Peterson, 1999; Swing & Ross, 2016a). Understanding the extent to which universities are turning to

19

Institutional Research units and staff for these roles in analytics guidance and delivery, particularly for institutions responding to neoliberal pressures as defined earlier, helps assess the extent to which Institutional Research has a designated role in using analytics to address the new demands of academic capitalism. If universities are not utilizing Institutional Research units and staff for leadership and support of analytics programs, they may be leaving an available and capable resource untapped and may want to consider involving them more.

Higher education institutions facing today's business-like, neoliberal culture of accountability and responsibility are relatively new to thinking about their work within a corporate framework (Slaughter & Rhoades, 2004). Analytics can be a useful tool for universities to adopt from the big business world to support planning and decision-making, but understanding how to effectively establish these programs within an academic paradigm can be challenging. It therefore becomes critical for those championing, leading, and supporting these initiatives on campus to be informed on the current state of analytics at their universities, establishing the extent to which they are drawing upon analytics as a resource for responding to the changing environment, and identifying targeted opportunities to support and enrich the use and effectiveness of analytics programs to enhance the potential of success of both the analytics initiatives and of the university itself.

Purpose

The purpose of this study is to assess the extent to which postsecondary institutions are using analytics programs, a business-oriented application, to respond to growing and changing demands of academic capitalism facing higher education today.

Additionally, using that understanding to then examine the current status of their programs, specifically when it comes to leadership, staffing, and data and technology infrastructure, can provide opportunities to make the most of their analytics efforts and ensure the necessary components of success are in place.

The informed use of analytics on campus with this knowledge, taking into account the environmental situation and forces facing higher education today can support university efforts to proactively address their school's specific pressures, needs, and plans. By understanding these factors, institutions will be better poised to obtain an optimum level of impact from their analytics programs when it comes to their ability to respond to the pressures of academic capitalism. Additionally, by exploring the specific ways in which institutions are utilizing the outcomes of their analytics programs, new opportunities may be discovered for the application of analytics to address new problems and questions, including applications directly related to the external, neoliberal demands on postsecondary education today.

With a perspective of applied research, the overall purpose of this study is to aid universities, their leadership, and their analytics staff in understanding the potential created by using analytics to respond to contemporary challenges and demands as a routine part of their institutional planning and decision-making. Understanding this may enable the awareness of specific areas, efforts, and roles that can be addressed to support and enhance such efforts. As a result, this knowledge can inform the successful utilization of analytics on campus to drive more efficient, effective, proactive and agile decision-making and planning and help universities better meet the needs of the current capitalistic higher education environment.

Research Questions

  The following set of research questions guide this study, and are based on the problem of understanding how Institutional Research offices are responding to demands for accountability and to neoliberal pressures on the higher education sector.

1. To what extent do institutions' motivations for and use of analytics reflect a response to the demands of academic capitalism?

2. How do institutions more highly motivated by the demands of academic capitalism differ from those less so in the key components of a successful analytics program (leadership, staffing, data and technology infrastructure)?

3. To what extent are Institutional Research units and staff contributing to the leadership, staffing, and delivery of analytics programs within their institutions?

Significance

  Returning to Apple's (2013) understanding of the lens of neoliberalism outlined earlier in this chapter, "a vision that sees every sector of society as subject to the logics of commodification, marketization, competition, and cost-benefit analysis" (p. 6), modern higher education faces an environment with demands driven more heavily by capitalistic views than ever before. Responding to these changing ideals means that institutions must increasingly think like businesses to understand these concepts within the academic paradigm, particularly as they relate to resources (Calderon & Mathies, 2013; McGee, 2015; B. J. Taylor et al., 2013; Slaughter & Rhoades, 2004). As universities grapple with this change in perspective, a shift is occurring towards a more technology and data-focused interest in utilizing analytics to provide "actionable intelligence" (Baer & Campbell, 2015, p. 53).

Understanding of potential for use of analytics programs on campus, as well as how those efforts can help their institutions address and respond to the specific demands of academic capitalism, enables leaders and their institutions to proactively make decisions and plan for the future more adaptively and effectively. The effective leadership of, support for, and design, maintenance, and use of analytics in higher education will assist leadership in efforts to make timely, agile decisions as they work to keep their universities ahead of the neoliberal challenges and changes of the current higher education environment.

Definition of Terms

The following terms are used throughout the research. Additional terms will be defined in text when appropriate.

Academic capitalism. "The involvement of colleges and faculty in market-like behaviors" (Rhoades & Slaughter, 2004, p. 37).

Analytics. "The use of data, statistical analysis, and explanatory and predictive models to gain insight and act on complex issues" (Yanosky & Arroway, 2015, p. 3).

Business intelligence. "A set of administrative functions and associated software systems that support planning and decision making by categorizing, aggregating, analyzing, and reporting on data resulting from transaction-processing systems" (Lang & Pirani, 2016, p. 4).

Data warehouse. "A central repository of data, often created by integrating other data sources and used for reporting analysis" (Lang & Pirani, 2016, p. 4).

Institutional research. "Research conducted within an institution of higher education to provide information which supports institutional planning, policy formation and decision making" (Saupe, 1990, p. 1).

Neoliberalism. "A vision that sees every sector of society as subject to the logics of commodification, marketization, competition, and cost-benefit analysis" (Apple, 2013, p. 6)

Methods Summary

Analysis of the three research questions outlined earlier in this chapter was guided by a proposed structural equation model (SEM), which utilized five statistical multivariate approaches: principal components analysis (PCA), confirmatory factor analysis (CFA), and regression, correlation, and descriptive analyses. The data used in this study were anonymized, as the data source was primarily quantitative survey data collected by the EDUCAUSE Center for Analysis and Research (ECAR) as part of their 2015 research on the state of analytics in higher education. EDUCAUSE, "a non-profit association whose mission is to advance higher education through the use of information technology" (EDUCAUSE, 2017b), created a specific unit (ECAR) dedicated to conducting research and analysis on data they collect through such efforts as their annual data collection effort and topic-specific surveys. Research findings from ECAR's work can then be utilized to support university decision-making and delivery of technological resources, activities, and initiatives on campus.

EDUCAUSE membership includes a variety of institutions of higher education, corporations involved in the delivery of Information Technology in higher education, and other related organizations and associations (EDUCAUSE, 2017b). Drawing upon their

membership-based structure as a resource, the organization is able to conduct research studies and data collection efforts using their members as the available pool of respondents.

In May and June of 2015, the EDUCAUSE Center for Analysis and Research administered a survey to a sample of over 1,800 EDUCAUSE member institutions intending to assess the "state of analytics" (Yanosky & Arroway, 2015, p. 5) in higher education. Surveys were completed by 245 respondents (a 13% response rate), with one respondent representing each individual institution. Campus respondents predominantly consisted of the primary EDUCAUSE representative at each respondent institution, most often the Chief Information Officer (CIO), with a small number of participants representing Institutional Research offices. A table mapping the specific research questions, variables, and literature which informed their selections for inclusion in this analysis can be found in Appendix A, and specific data preparation and transformation processes and details can be found in Chapter 3.

To assess research question one in this study, two distinct analytical methods were utilized: principal components analyses (PCA) and confirmatory factor analyses (CFAs). In order to assess the extent to which universities' use of data and analytics on campus reflected a response to the demands of academic capitalism, two PCAs were first conducted to examine institutional motivations for investment in analytics and the strategic priorities they believe would benefit from the use of data. These findings, employed as an indicator of academic capitalism awareness and investment, then provided this context to the results of a CFA regarding the actual reported use of and

investment in data and analytics, and the extent to which they are used in strategic institutional priorities.

Research question two guided the second phase of the structural equation model analysis, which first involved the use of three additional confirmatory factor analyses to prepare three latent variables, representing each of Baer and Campbell's (2012) three components of a successful analytics. Utilizing related measurable variables from the survey data as informed by Baer and Campbell's and other analytics success theories reviewed in detail in Chapter 2, each component was defined as a separate factor for inclusion in phase three of the SEM analysis.

After these three confirmatory factor analyses were conducted, research question two was then assessed in its entirety by examining the institutional responsiveness factor identified by the findings of research question one, as it relates to the three factors calculated in phase two (leadership, staffing, and data and technology infrastructure). This stage combined all four newly created latent variables into a single model in order to assess how institutions of varying response levels to academic capitalism are approaching their analytics programs in terms of the three components of a successful analytics program.

The final phase of the structural equation model proposed in this study, guided by Research Question 3, entailed understanding the role of Institutional Research units and staff in the institutions' analytics activities. Using frequency distributions and crosstabular analyses, the evaluation of Institutional Research's role within their institutions explored the role and duties of Institutional Research leadership and staff in

the delivery of analytics on their campuses, including how they differed at institutions of very types and sizes.

As highlighted in the history of the Institutional Research profession reviewed in Chapter 2, the field has evolved to meet ever-changing environmental and institutional needs, which would reasonably be assumed to extend to today's neoliberal changes. Investigating the role of Institutional Research in their institutions' analytics initiatives, specifically in the leadership and delivery of analytics programs, will help assess whether the field may be facing another possible role evolution.

Completion of each of these analyses, and framing of the results by the related literature and theory, helped to answer the three research questions of this study identified earlier and assess the full structural equation model. Understanding the extent to which institutional use of analytics appeared to indicate a response to the demands of academic capitalism, how those institutional analytics programs relate to the components identified with successful analytics programs, and the extent to which Institutional Research has a role in these initiatives may provide institutional leadership and analytics staff with ways to self-assess their use of analytics as a response to changing environmental pressures. This, in turn, could inform efforts to target specific facets of their initiatives, providing stronger foundations for the most effective and efficient use of analytics in university planning and decision-making.

Conclusion

In order to respond effectively and efficiently to increasing demands for accountability as part of the academic capitalist reaction to new social, political, and economic pressures, universities must increasingly consider adopting business-like

processes and planning tools (Apple, 2013; Lasher, 2011; McGee, 2015; Peterson, 1999; B. J. Taylor et al., 2013). Drawing on a method utilized regularly in the corporate world, the use of analytics to support decision-making and planning which can contribute to an agile environment, universities have available to them a resource that allows them to address these neoliberal concerns of the new higher education environment (Stiles, 2012; Stocker, 2012).

Analytics initiatives, still relatively new to postsecondary education as a whole, require specific and significant leadership and support, in terms of both people and technology (Baer & Campbell, 2012). The extent to which universities recognize the potential positive returns from the use of analytics in responding to increasing demands of academic capitalism, and commit to the factors that define a successful analytics program drive the capacity for institutions to make the most effective and efficient use of the results in responding to demands and planning for their futures. Many opportunities for strengthening and supporting these initiatives are available, and this study is intended to identify specific ways in which universities can provide positive and effective support in analytics efforts designed to respond to neoliberal challenges and pressures on higher education.

A resource already available on most, if not all, campuses, the evolution of Institutional Research throughout higher education history in response to changing needs and demands of the higher education environment creates the potential for its next evolution; having a key role in contributing to the leadership, staffing, and technical support necessary to create and deliver impactful and useful institutional analytics programs. A better understanding of the extent to which Institutional Research offices

and staff are already playing these roles can both provide understanding on the extent to which the field is amidst a new evolution, as well as ascertain the potential for their universities to take advantage of using them in this manner.

The intention of this study is to aid universities, their leadership, and their analytics staff in understanding the potential created by using analytics to respond to contemporary challenges and demands as a routine part of their institutional planning and decision-making. This understanding can inform the successful utilization of analytics on campus to drive more efficient, effective, proactive and agile decision-making and planning and help universities better meet the needs of the current capitalistic higher education environment. A deeper understanding of the specific factors that can most effectively enhance successful analytics initiatives within institutions can be used to inform further efforts. Awareness of what other universities are doing in this arena provides the potential for every institution to create, support, and utilize the results of a successful analytics program to respond to accountability-driven demands increases, improving the ability of institutions to function and thrive in the new higher education environment.

CHAPTER TWO: REVIEW OF RELEVANT LITERATURE

Recounting the last century of higher education through a demographic lens, McGee (2015) proposed that higher education has gone through four stages: moving from a *luxury good* prior to World War I, to an *earned privilege* after the 1944 G.I. Bill, becoming a *mass-market good* around the time of the passage of the 1965 Higher Education Act, and more recently transforming into a *necessity good* as a result of a declining economy, changing demographics, and greater demands for accountability and outcomes. Movement of higher education along the spectrum of being a private versus public good has coincided with these changes; as a luxury good and earned privilege weighing towards a private benefit to the student and as a mass-market and necessity good driving it more towards public benefit.

Now defined as a necessity good, modern postsecondary education finds itself wrestling with five major drivers requiring a different way of thinking about the higher education sector, namely: accessibility, affordability, accountability, sustainability, and differentiation (McGee, 2015). The rapidly evolving economic, political, social, and technological environment requires a new way of thinking about higher education and institutional management; one that reflects a much more business-centered paradigm (Eckel & King, 2004; McGee, 2015; Straumsheim, 2016; B. J. Taylor et al., 2013). Changing public expectations and heightened demand for results related to these performance-oriented pressures present universities with the challenge of how to respond

with increased agility and transparency when it comes to decision-making and resource management.

Institutional Research (IR), "a key educational field grounded in data and decisions" (Lillibridge et al., 2016, p. 2), is an available resource for institutions struggling to draw upon as they address these challenges. As J. Taylor, Hanlon, and Yorke (2013) noted, "closely associated with marketing and competitive behavior…institutional researchers are working across a spectrum from an emphasis on internal performance and improvement to an emphasis on external performance and competition" (p. 64). A field that has had to be responsive to changing university needs and the higher education environment since its inception in the 1700s, the evolution of institutional research work has tracked particularly closely with needs of institutions of higher education in the last century, as discussed later in this chapter.

Members of a distinguishable profession requiring ever advancing data management and interpretation skills and buoyed by significant advancements in technologies for analyzing and presenting actionable information to university leadership, institutional researchers are increasingly involved in, if not leaders of, analytical initiatives on campus. Defined as "the use of data, statistical analysis, and explanatory and predictive models to gain insight and act on complex issues,…[analytics] goes beyond traditional reporting to emphasize prediction and action." (Yanosky & Arroway, 2015, p. 6). It is this action-oriented work done by many institutional researchers in the current postsecondary education environment that supports data-informed decision making on campus and the ability for universities to respond to increasingly

accountability-driven societal demands (Baer & Campbell, 2012; Leimer, 2011; Rice & Coughlin, 2011; Volkwein et al., 2012).

A well-designed campus analytics initiative or program yielding actionable products and information requires key components to be successful, regardless of those on campus responsible for them (usually Institutional Research, Information Technology, or a combination of the two). As outlined in Chapter 1, Baer and Campbell (2012) maintain that there are three key components to a successful and effective analytics initiative, namely committed leaders, skilled staff, and a flexible technology platform.

The extent to which these key factors exist and are supported within institutions committed to the use of analytics in campus decision-making impact both the likelihood of successful use of information by management and the success of their institutional researchers in their evolving and advancing analytics-centered roles and careers. The commitment and advocacy of university leadership and provision of both personnel and technological resources to institutional research offices can make or break an institutional researcher's ability to perform the more advanced demands of their contemporary roles.

Academic Capitalism: The Business of Higher Education

Viewed ever more frequently through a neoliberalism lens over the last few decades, education is now viewed as a commodity that is subject to market competition and held in judgment based on the balance sheet of cost-benefit for the institution (Apple, 2013). Institutions of higher education continue to experience increasing pressure to function in a corporate manner. Rhoades and Slaughter (2004) conceived of these developments as "academic capitalism" or a "capitalist knowledge/learning/consumption regime" (p. 37). Defining this further, they shared:

By "regime," we mean that within each of these realms lies: a systematic revision

and creation of policies to make these activities possible; a fundamental change in

the interconnections between states, their higher education institutions and

private-sector organizations to support such activities, blurring the boundaries

between the for-profit and not for-profit sectors; and a basic change in academy

practices—changes that prioritize potential revenue generation, rather than the

unfettered expansion of knowledge, in policy negotiation and in strategic and

academic decision making. (p. 37)

Conceptions of postsecondary education as a commodity, markedly changes how the

institutions operate, the type of data required to measure performance, and measurements

of student success.

Redefined in the mid-1960s as a mass-market good, then in the 1980s forward as

a necessity good (McGee, 2015), institutions of higher education continue to move into a

new paradigm of education based on a more business-minded model. Correspondingly,

higher education continues to increase its perception of being a public good, knowledge

as a commodity, particularly by constituents external to the institution (McClure &

Teitelbaum, 2016; McGee, 2015). It is worth noting, however, that it is unlikely a

college education is ever divorced entirely from being cast as a private good because of

the individual benefit to graduates based on the potential for occupational, economic, and

status increases as the result of earning a college degree (Marginson, 2004; Vilorio,

2015). When defined strictly as a public good, however, higher education must provide

evidence of societal value, and not just value to the individual.

Functioning in an outcomes-driven environment and attempting to balance

economic downturns coupled with increasing college costs and declining government

funding, universities are presented with challenging tasks (Baer & Campbell, 2102;

Calderon & Mathies, 2013; McGee, 2015; Slaughter & Rhoades, 2004; Stiles, 2012; B. J.

Taylor et al., 2013). In addition, demographic shifts such as an aging baby boomer

population and increased diversity, and increasing demands for accountability require

different methods for managing institutions (B. J. Taylor et al., 2013; McGee, 2015;

Slaughter & Rhoades, 2004).

Calderon and Mathies (2013) recognized that one "of the biggest trends in recent

reforms of higher education…[involves an] agenda where public funding is based on

indicators and outputs, rather than inputs and a heavier emphasis on performance and

performance measurements" (p. 79). The interest in this neoliberal, more business-model

oriented, competition-focused culture of running universities with a higher focus on

efficiency and outcomes presents leadership with the dilemma of how to steer the higher

education sector, and individual institutions of postsecondary education, into a new realm

quickly and with urgency (Kotter, 2014; McClure & Teitelbaum, 2016; Stiles, 2012;

West, 2012).

As a result of the push and pull of rapidly changing demands and needs

(Gumport, 2000), universities find themselves in a position in which they must explore

and implement new strategic and operational methods with a different perspective

(McGee, 2015). A resource-driven, outcomes-oriented environment brings a new

paradigm into the higher education sector, one in which institutional leaders must use

data, or more importantly, knowledge and information to think proactively and respond

quickly (Gumport, 2000; McGee, 2015). Informed decision-making becomes that much more critical, as "effective action demands that the multiple choice variables be dimensionalized in ways that clarify their points of intersection and highlight required trade-offs" (McGee, 2015, p. 140).

As a sector, postsecondary education increasingly operates in a more competitive environment, fighting for students, funding, resources, recognition, and leadership (Stiles, 2012) in ways that often clash with a more academically focused mission. This situation positions "data and analytical tools as valuable resources that empower decision making at the tactical and operational levels" (Swing & Ross, 2016a, p. 6), but presents notable challenges as two worlds collide: higher education and big business.

A Clash of Worlds: Analytics and Business Intelligence in Higher Education

In 2016, the Association for Institutional Research (AIR) crafted what was envisioned as an aspirational vision for institutional research as a field. This vision asserts that:

> The demand for data to inform decisions in postsecondary education is greater
> than ever before. Colleges and universities have significantly increased capacity
> to collect and store data about student and institutional performance, yet few
> institutions have adequate capacity for converting data into information needed by
> decision makers. (Swing & Ross, 2016b, p. 3)

This performance-focused statement of the profession hones in on the importance of using information for university planning and decision making purposes, reflecting a professional responsiveness of the field of Institutional Research to recent higher education trends which will be outlined in the next section.

The neoliberal push for corporatization of education, particularly the focus on academic capitalism and expectations of running higher education institutions like businesses, has clearly impacted both the work institutional researchers are doing and the environment in which they are doing it. The AIR statement formally both acknowledges these influences, and indicates the necessity and willingness to expand the scope of the profession in response to new needs.

Given the push for a more corporate-like management of higher education with a more competitive, outcomes-driven focus (McGee, 2015; Stiles, 2012; Stocker, 2012), "higher education [could be] benefitting from the extensive business intelligence efforts found in the corporate world" (Baer & Campbell, 2012, p. 57). Big businesses frequently use "big data" (West, 2012, p. 1), mining large datasets to discover patterns and trends in order to predict future behavior, in order to adapt and improve efficiency and effectiveness amid changing consumer needs. College leaders could, and increasingly do, draw on similar efforts to guide decision making and planning for their many and varied "customers" (Gupta, Goul, & Dinter, 2015).

Business intelligence (BI) consists of "a set of administrative functions and associated software systems that support planning and decision making by categorizing, aggregating, analyzing, and reporting on data resulting from transaction-processing systems" (Lang & Pirani, 2016, p. 4) and is a concept rooted in the business sector. The focus of BI entails "interpreting and visualizing data to make useful business-oriented decisions…allow[ing] for rapid analysis for decision making, developing insights, and communicating those insights' results" (Fisher et al., 2014, p. 22). Putting it more succinctly and acknowledging the possible application to postsecondary education, Jones

(2015), the AIR Director of Research and Assessment, defined BI as "the skills, applications, and technologies leveraged to support data-informed decision making" (p. 1). Even though some use the terms "business intelligence" and "analytics" interchangeably, there is a notable distinction between the two, with business intelligence focusing more on the technology-related aspects of big data such as data warehouses and dashboards, which in turn supports analytics. Analytics instead focuses on the analytical processes and the translation, communication, and use of information to drive decision-making (Gupta et al., 2015; Koch, 2015).

For simplicity and clarity in this study, I use the term analytics to generally refer to all aspects of business intelligence and analytics, essentially viewing the two as a tandem pair forming a decision-making system. Holistically, for these purposes the reader should consider analytics as a system that is built, in part, on a business intelligence support platform. Key to a successful analytics program is leadership support, trained staff, and data systems in place to handle the storage of big data and its corresponding systems for analysis (Baer & Campbell, 2012).

The responsibility of developing and supporting a business intelligence "platform" on campus, when it occurs, is most frequently placed in the hands of institutional research and/or information technology (Bichsel, 2012; Reinitz, 2015). The combination of data analysis and technological aptitude of staff in these units makes these functional areas a logical choice for owning university analytics initiatives and offerings on campus. Any of their efforts, however, will face a high possibility of failure or lack of use if leadership does not exhibit data-informed decision making practices and

embrace an institutional data-oriented culture (Bichsel, 2012; Reinitz, 2015; Stiles, 2012). Stiles (2012) defined a data-oriented culture as:

> a pattern of behaviors and practices by a group of people who share a belief that having, understanding, and using certain kinds of data and information plays a critical role in the success of their organization. In a data-oriented culture, behaviors, practices, and beliefs are consistent with the principle that business decisions at every level are based on analysis of data. Leaders within organizations that have mastered this competency set an expectation that decisions must be arrived at analytically, and explain how analytics is needed to achieve their long-term vision. (p. 17)

It is this data-oriented culture that allows institutional researchers to utilize business intelligence and analytics resources and activities to support their leadership, and thereby, their institution. In order for institutional researchers to adapt to these changing expectations and successfully perform in their new analytics-oriented roles assumes that they have the necessary support in place, both in terms of resources and leadership commitment and use.

Analytics leadership. An analytics-reliant culture in any organization is bolstered by leaders who "convince others that data are not a threat and that using data could provide a better basis for decision making" (Bichsel, 2012, p. 17). Leadership can support a successful analytics initiative by exhibiting interest, investment, and effort, which results in the capability to make strategic and informed decisions about challenges facing their organization (Baer & Campbell, 2012; Bichsel, 2012; Elena, 2011; Stiles, 2012). In higher education, leaders who regularly assess their university environment to

identify primary concerns or needs, then utilize the related data and information available

to inform planning can actively support a data-informed culture at their universities

(Bichsel, 2012). Leaders that consider and use information strategically throughout

planning, including circling back to evaluate the ultimate outcomes of their decisions,

allow others to see the effective use of analytics and validate their analytics programs,

which can result in further acceptance by other campus constituents (Bichsel, 2012).

Indeed, EDUCAUSE focus groups conducted with Information Technology and

Institutional Research participants revealed

> the most effective leaders (a) start with a strategic question before consulting or
>
> collecting data, not the other way around; (b) do not let preconceived ideas
>
> influence questions, analysis, or decision making; and (c) rely more on the data
>
> and less on intuition, experience, or anecdotes. (Bichsel, 2012, p. 17)

Executive leadership must be not just an end user of data, but an actual champion and

example for the benefits of having an analytical culture (Baer & Campbell, 2012; Reinitz,

2015; Yanosky & Arroway, 2015).

Even though buy-in and support for the strategic use of data from executive

leadership is critical, successful initiatives are a collaborative, cross-campus effort

(Reinitz, 2015). Analytics adoption requires strong leadership support and involvement

from the beginning of any initiative, with executive sponsors leading a culture change

(Reinitz, 2015). Yet, specific champions of change are required. Individuals or units are

needed to keep both operational and strategic efforts of the analytics program moving

forward, even after a successful implementation (Reinitz, 2015; Yanosky & Arroway,

2015). As noted later in this section, this support frequently comes from staff in either

Institutional Research or Information Technology (IT) units on campus, or a combination of the two (Baer & Campbell, 2012; Bichsel, 2012; Reinitz, 2015).

Which university areas and leaders "own" analytics efforts on campus varies from institution to institution, ranging anywhere from Information Technology/Chief Information Officer to the highest academic units, such as the Provost/Chief Academic Officer (Reinitz, 2015; Yanosky & Arroway, 2015). Though a relatively new function, some universities choosing to invest heavily in analytics efforts are also now creating specific "C-Suite" roles to lead analytics initiatives on campus, such as a Chief Data Officer or Chief Analytics Officer (Reinitz, 2015). These positions are still relatively rare, however, and it is more common that the lead for analytics efforts is taken by Information Technology or Institutional Research, or a combination of the two (Yanosky & Arroway, 2015).

In many, if not most cases in the past, Information Technology has been the main actor in analytics initiatives. But, with the advancing roles for institutional researchers noted earlier, these individuals are increasingly capable and asked to play a larger role in driving these initiatives (Bichsel, 2012; Reinitz, 2015). For example, during two separate sets of focus groups with Information Technology and Institutional Research staff conducted by EDUCAUSE in 2012 and 2015, many participants indicated their belief that Information Technology should not be the owners of analytics programs, and instead should function as a support for such endeavors (Bicshel, 2012; Yanosky & Arroway, 2015), opening the door for Institutional Research to play a key role. In fact, Reinitz (2015) noted specifically that, "the relationship between IT and IR, in particular, can be a powerful collaboration" (p. 13). When it comes to creating an analytics function, and the

relationship between Institutional Research, Information Technology, and executive leadership around an analytics program can improve communication, drive decision making, and create a culture of assessment and continuous improvement (Baer & Campbell, 2012; Bichsel, 2012).

Despite the many different organizational possibilities for institutional analytics leadership and efforts on campus, a successful program is only bolstered by coordinated efforts across the units and individuals involved (Bichsel, 2012; Yanosky & Arroway, 2015). This connection seems reasonable if one considers the analytics system described earlier as collaboration of Information Technology (business intelligence technological platform), Institutional Research (analytical, interpretive, and communication roles), and leadership end users (CAO, CFO, CBO) culminating in a holistic information system from inception (original questions and raw data) to completion (analysis and decision-making) (Yanosky & Arroway, 2015).

Analytics staffing. Jack Phillips, CEO of the International Institute for Analytics, "cautioned against underestimating the value of talent to developing a successful analytics initiative and to fostering the cultural change it requires, [and] suggested that the ideal skills set is combination of quantitative methods training, technology understanding, and communication" (as cited in Reinitz, 2015, p. 10). This statement during Phillips keynote at the EDUCAUSE/NACUBO 2015 Administrative IT summit was mirrored by other Information Technology and Institutional Research professionals interviewed at the summit. These professionals emphasized the importance of focusing on staffing and skill building more than on tools and technology needs (Reinitz, 2015). The overall message from many at the summit was that the technology is not the answer;

rather, it is one of the many support mechanisms part of an analytics effort (Bichsel, 2012; Huynh et al., 2009).

On the one hand, Baer and Campbell's (2012) components of a successful analytics program focus primarily on the need for data analysis expertise. On the other hand, Reinitz (2015) argued that analytics programs actually need staff with advanced capabilities in three areas: technology, data analysis, and communication/interpersonal skills. These three skill sets impact and support all of the components of business intelligence, from data collection and storage to the creation of knowledge for decision-making (Fisher et al., 2014; Kirby & Floyd, 2016; Yanosky & Arroway, 2015). It is possible that the expanded set of skills could exist in the same individual, but equally as likely that the full range of expertise would require the work of multiple staff with different skills, and perhaps even across different units.

A successful business intelligence and analytics program requires the three of the skill sets described above, and the foundation begins with technological skills. Database creation and administration, and data processing skills such as managing the extract-transfer-load (ETL) process of getting data from original sources into a centralized system designed for reporting purposes are critical staff skills in an analytics program (Baer & Campbell, 2012; Kirby & Floyd, 2016; Yanosky & Arroway, 2015). The historically and predominantly information technology-oriented expertise in Information Technology supports the design and maintenance of the foundational systems discussed earlier, such as data warehouses (Baer & Campbell, 2012). Information Technology and Institutional Research staff utilizing these particular skills in tandem create a relationship in which they can work closely together, maximizing the relationship between the units

mentioned earlier in this report while also serving the needs of their individual functional

units (Baer & Campbell, 2012; Bichsel, 2012; Kirby & Floyd, 2016).

Often residing in the realm of roles for institutional researchers, increasingly

sophisticated analytical expertise is also necessary in any analytics initiative (taking it

beyond the business intelligence component). Basic quantitative and qualitative skills are

essential, but analytics requires a more advanced set of statistical methods, particularly

for activities such as predictive modeling (Kroc, 2015; Yanoksy & Arroway, 2015).

Analytical staff often "have progressed from being data brokers who assemble and report

data to knowledge managers who use experience and technical expertise to analyze data

for insights" (Huynh et al., 2009, p. 63). Combining disparate pieces of information in

order to generate new knowledge requires in-depth understanding of the data itself, the

most suitable analytical procedures needed, and the appropriate ways to organize, share,

and show the results (Huynh et al., 2009).

Another set of skills needed to support a successful analytics program equates to

the role of storyteller (Calderon & Mathies, 2013; Delaney, 2009; Reinitz, 2015),

"making the data say something meaningful" (Straumsheim, 2016, p. 21). This particular

skill set is again often the purview of institutional researchers when it is in place, due to

the logical connection to data analysis (Calderon & Mathies, 2013). Interpersonal skills,

something not always associated with technology and data-oriented people, give analysts

the ability to move among many different constituents and stakeholders in their different

environments. While assessing specific data and information needs of the varied

constituents, analysts are able to build relationships with and among institutional

stakeholders (Baer & Campbell, 2012; Huynh et al., 2009; Kirby & Floyd, 2016; Kroc,

2015; Reinitz, 2015). They are then able to take that understanding and conduct analyses and create visualizations designed specifically for those needs, providing the exact information needed to drive informed and actionable planning and decision-making.

The AIR National Survey of Institutional Research Offices (2015) revealed that though having skilled staff is critical to an analytics program, many Institutional Research offices remain relatively small, with most averaging three staff, one being a unit leader of some sort (Swing et al., 2016). Additionally, though many universities convey that analytics initiatives are a priority for their institutions, the AIR survey revealed that in the last three years, most Institutional Research offices did not change in size and in fact, some even shrank (Bichsel, 2012; Swing et al., 2016). Given that leadership often does not understand the staffing needs specific to a successful analytics program (Bichsel, 2012), the addition of these new responsibilities combined with relatively anemic staffing growth means "many participants [are] overwhelmed at the idea of beginning an analytics program given their current workloads" (Bichsel, 2012, p. 17).

Information Technology and Institutional Research respondents to both the 2012 and 2015 EDUCAUSE Analytics Surveys also confirmed the lack of appropriate investment in analytics expertise, regardless of the institutional unit(s) in which they resided (Bichsel, 2012; Reinitz, 2015; Yanosky & Arroway, 2015). Respondents to the 2015 survey indicated that in order to meet their analytical program needs, they would require a 59-100% increase in the current number of FTEs in their offices, and that the most critically needed skills include predictive modeling, analytics tool training, data visualization, user experience development, and data analysis (Yanosky & Arroway, 2015). The expanded role of data analytics on campus requires an increase in staff, and

staff with an expanded skill set in data analytics. These specific skills may be available in Institutional Research units, so it is important to understand the extent to which institutions are already drawing upon these offices for leadership and support of their analytics programs.

The variety of skills critical to roles which support a successful analytics program at universities ranges from technology-heavy database and software skills to complex data analysis skills and the ability communicate results in ways that create clear and actionable takeaways (Baer & Campbell, 2012; Kirby & Floyd, 2016). Challenges around finding such diverse expertise in a single person often mean that analytics initiatives require a combination of individual staff with specific roles and skills (Baer & Campbell, 2012; Kirby & Floyd, 2016). As Yanosky and Arroway (2015) noted, "it seems to work really well to pair up people who are really good with software systems with people who really understand the data" (p. 20).

Regardless of whether analytics staff live in a single office or multiple units, the need for a sufficient number of staff with specialized roles, in many cases requiring new and specific skill expertise, is critical to the success of analytics programs (Leimer & Terkla, 2009). As such, it is important to understand the nature of changing roles in response to changing demands, and the challenges and opportunities it can provide to universities in general, as well as analytics staff.

Data and technology infrastructure. Having enough data is certainly not a problem for institutions, as there is typically more than enough data available and the real need is in obtaining usable information. Universities have an astounding amount of data at their dispense, representing everything from operational and administrative data based

45

on enrolling students and paying faculty to learning management systems data representing coursework expectations and learning outcomes (Yanosky & Arroway, 2015). Discovering and understanding what data are available, where they are located, how to harness them centrally, and what to do with them once captured can be a challenge.

Analytics programs draw upon many disparate data sources, bringing together information that may not seem immediately related and providing opportunities to draw connections and create previously unrecognized take aways (Baer & Campbell, 2012; Yanosky & Arroway, 2015). As such, one of the first challenges to analytics implementations is related to the siloed nature of data at many schools (Backscheider et al., 2015; Bichsel, 2012). Data are often viewed as being "owned" by the units that create, use, govern, and take responsibility for them as part of their roles, such as admissions or enrollment management offices. As such, higher education data resides in a variety of disparate systems across campus (Bichsel, 2012).

Such owners (sometimes more positively termed "data stewards" as an analytics program matures) have operational responsibility for their information, its quality and use, and policies and procedures that govern it (Backscheider et al., 2015). At times, they can be reluctant to provide the data to others, including for analytics programs, and "convinc[ing] others that data are not a threat and that using data could provide a better basis for decision making" (Bichsel, 2012, p. 17) is critical in creating the foundation of an effective analytics program. Most EDUCAUSE Information Technology and Institutional Research focus group participants "agreed that it is necessary for senior leadership to institute policies that encourage the sharing, standardization, and federation

of data, [and]…that an executive-sanctioned analytics program itself can help overcome data silos" (Bichsel, 2012, p. 16). Data owners can evolve to play an integral role in an analytics initiative, ensuring that their data will be of high quality, assisting others in understanding and in the suitable use of the data in their domain, and contributing to the development of appropriate analytics within their area (Backscheider et al., 2015).

A foundational technological component supporting analytics is the "business intelligence platform," or a centralized source or set of resources that bring together the varied and extensive data across the university so that it can be analyzed holistically to provide new insights, therefore (Koch, 2015, p. 57). Sometimes also referred to as "data infrastructure" (Schoenecker, 2010, p. 85), integrated data systems such as data warehouses provide access to a wealth of varied data in way that supports ease of reporting and increases the potential for use of the information in strategic decision making and planning (Baer & Campbell, 2012; Fisher et al., 2014; Huynh et al., 2009; Schoenecker, 2010). Lang and Pirani (2016) define a data warehouse as "a central repository of data, often created by integrating other data sources and used for reporting analysis" (p. 4), and Baer and Campbell (2012) identify it as "the key component of the technology infrastructure" (p. 58). The data warehouse acts as the core infrastructure supporting the ability to manage data in ways specific to analytical reporting.

Even though technology itself is not an analytics program, it is certainly a foundational and necessary support structure upon which to build an effective analysis program. Yanoksy and Arroway (2015) noted that many schools exhibiting "analytics maturity" have data warehouses, providing them "with the capacity to store, manage, connect, [and] analyze" (p. 27) information through centralized data systems and

dynamic reporting functions. With a stable data infrastructure in place, it becomes

possible to transform, centralize, store, and mine an exorbitant amount of information

using sophisticated data manipulation and programming tools such as Excel, SAS, and

SPSS (Huynh et al., 2009; Kroc, 2015). Once data have been analyzed and prepared for

reporting, dynamic visualizing software such as Tableau or SAS Visual Analytics provide

the ability to communicate and utilize information in assessing performance and

informed planning efforts (Fisher et al., 2014; Huynh et al., 2009; Stocker, 2012; West,

2012).

Building upon the data warehousing and analytics foundation, "dashboards" are

one such visualizing business intelligence tool that overlays such structures and allows

for communication and translation of data to users in a way that is understandable and

actionable (Stocker, 2012; West, 2012). A dashboard's functionality:

> compile[s] key metrics in a simple and easy to interpret interface so that school
>
> officials can quickly and visually see how the organization is doing.
>
> Administrators automatically update dashboards based on data stored in…
>
> information systems. Software combines data from various streams to present a
>
> clear and comprehensive overview of school operations. (West, 2012, p. 6)

Dashboards put needed customizable, relatable information in front of the stakeholders,

providing them with collected, prepared, organized, and analyzed data for decision-

making (Stocker, 2012). Dashboards translate operational data into strategic knowledge

that can be utilized in planning efforts (Fisher et al., 2014).

Even though technologies such as data warehouses and dashboards are useful

tools in preparing, analyzing, and communicating information to institutional leadership,

48

no tool can be maximized without skilled staff involved in every step of the analytical process, from data gathering to analysis to presentation to translation.

Role Theory

Role theory, based in sociology and social psychology theory, "is traditionally defined as a set of behavioral expectations attached to a position in an organized set of social relationships" (Sluss et al., 2011, p. 506). As a social construct, roles are governed by norms and expectations of the relative social structure, with those in the role commonly referred to as actors (Kessler, 2013). The variety and adaptation of roles played by a single actor naturally create tensions that impact the individual, particularly as they must respond to changing norms and expectations among their many, and often conflicting, roles (Kessler, 2013). Because institutional researchers and other analytics staff have faced changing roles in response to the field's evolution in order to meet evolving higher education demands and environments, it is important to understand the nature of role change as it relates to their work.

Role changes can bring about challenges related to role ambiguity, which occurs "when people are unclear or uncertain about their expectations within a certain role, typically their role in the job or workplace" (English, 2006, p. 883), and due to role conflict that follows "when a person must adhere at the same time to two or more conflicting or contradictory sets of expectations…[in which] fulfilling the expectations for one role interferes with or prohibits fulfilling the expectations for the other role(s)" (English, 2006, p. 883).

Role ambiguity and role conflict are common occurrences when individuals respond to changing environments impacting their roles, such as those currently facing

49

institutional researchers. Awareness of these potential challenges can allow institutions to proactively set clear expectations around leadership and support for initiatives arising from changing demands, reducing the likelihood of negative consequences such as turnover and employee dissatisfaction.

One aspect of role theory focuses specifically on roles within organizations that rely on clearly identified roles with specific expectations. These specifications are evidenced in job descriptions and in expected interactions between the individual in the role, such as that of institutional researchers, and leadership (Sluss et al., 2011). Within this paradigm, organizational roles become means by which the provision of services and accomplishment of tasks and duties are negotiated, and these expectations are influenced by such factors as individual abilities and external expectations related to the role (Sluss et al., 2011). Given that analytics programs rely heavily on leadership and staff with specific roles and skill sets, establishing the expectations around their work and expected outcomes is ever important in managing successful organizational role evolutions in response to new demands.

Expectedly, as organizational and individual demands and desires change, as we are currently and regularly experiencing in higher education, original roles may fluctuate through role innovation. Role innovation occurs "when individuals, leaders, and organizations instigate role modifications aimed at enhancing outcomes" (Sluss et al., 2011, p. 518). Such innovation can take place through a variety of methods, including flexible role orientation as individuals take on a wider or different set of goals and behaviors and task revision, when actual job duties are changed in order to adapt to new organizational expectations and demands (Sluss et al., 2011). The use of analytics in

higher education is a prime example of this phenomenon, as it includes roles defined specifically by new institutional needs. As a result of related role innovations, the expectations of analytics staff, including institutional researchers, in providing support for institutional accountability have adapted responsively. It remains unknown, however, the extent to which these new roles are being utilized and supported within their institutions.

During times of such organizational, and therefore, role transition, there is, unsurprisingly, potential for individual stress and confusion related to role ambiguity and conflict (English, 2006; Sluss et al., 2011). When changing expectations are not clear, or when they are in conflict with other expectations that may be part of a different role the individual also has (English, 2006; Sluss et al., 2011), it can create challenges for both the individual and the organization (Sluss et al., 2011). Individuals experiencing role ambiguity or conflict may undergo high levels of frustration, stress, and burnout (English, 2006; Nicholson, 1984) and lower job satisfaction (Sluss et al., 2011), leading to a lower commitment to the organization and higher likelihood of leaving (Sluss et al., 2011). This potential for employees leaving the institution is particularly critical when considering the specific technical and analytics skill sets necessary for supporting institutional analytics programs, as dissatisfaction and turnover can lead to decreased capability to lead and support these initiatives.

As both the organization and the individual are harmed by role ambiguity and conflict, both can benefit from establishing role definition and clarity, whether the role is currently stable or in a state of flux (English, 2006; Sluss et al., 2011). Clear direction around role expectations and outcomes create the foundation for success for all

constituents in the relationship (English, 2006; Sluss et al., 2011). Particularly when it comes to changing role expectations, the individual and organization can work together proactively in the process of job crafting, "by which individuals endeavor to modify the physical and cognitive aspects of their tasks or relationships within the workplace…, [which is] reshaped through an improvisational and evolutionary process crafted by the individual and permitted by the organization" (Sluss et al., 2011, p. 519).

This symbiotic process can result in both individual and organizational benefits, such as improved job performance, confidence, commitment, and self-efficacy on the part of the individual leading to higher productivity and success of the institution (Sluss et al., 2011). As a key component of successfully navigating the changing higher education landscape by utilizing analytics to inform decision-making, role clarity and job crafting is an important consideration for institutional leadership, as well as analytics staff.

Looking more specifically at what he termed "work role transitions" as they relate to role theory, Nicholson (1984, p. 172) noted that in many cases, role changes are driven by the changing needs of the organization and not by inherent wants or needs of the individual. Defining the term of work role transitions as "any change in employment status and any major change in job content, including all instances of 'status passages,' forms of intra- and interorganizational mobility, and other changes in employment status" (Nicholson, 1984, p. 173), he pointed out the extent to which changes in organizational goals and structure impact a job and its expectations. As a result of these pressures, the individual must attempt to either change their role to meet the new needs, attempt to change their environment to meet their needs, or a combination of the two (Nicholson, 1984, p. 174). As with role clarity and innovation above, analytics staff require

understanding of their expected contributions and expectations in supporting the institutional initiatives they are involved with, particularly if their roles evolve to meet new needs and efforts.

Role theory, particularly the concepts involved in work role transitioning and innovation, becomes a useful frame for further understanding of changing roles of staff involved in analytics programs on campus, including institutional researchers, as they response to a new, neoliberal higher education environment. In the next section, the history of the field of Institutional Research, how it has responded to the changing higher education environment described earlier, and how it continues to evolve in the midst of the neoliberal paradigm for education provides further context for this study. Transition of Institutional Research roles have been common throughout the history of the field, as institutional researchers have had to evolve in order to meeting the changing demands and needs of their institutions and higher education as a whole.

Institutional Research

A field currently related to much of the foundational work associated with analytics programs, the area of Institutional Research within universities has taken on heightened importance and visibility over time. Traditionally focused on institutional self-study, later responding to demographic and social changes, and most recently evolving to meet increased accountability demands, Institutional Research has maintained a fluidity of roles and duties in response to changing needs. The following sections provide a historical view of the evolution of institutional research and its role as a result of changes in postsecondary education's purpose and needs.

A historical overview of Institutional Research (1700s-1920s). Though not formally named or defined at the time, the original roots of the field of Institutional Research have been traced back to the 1700s, when the founders of Yale conducted a 1701 research study on the organizational structure of Harvard. More than two centuries later, at a 1965 workshop hosted by the Western Interstate Commission for Higher Education (WICHE), Cowley (1960) gave a presentation on the historical evolution of the Institutional Research field, which reviewed changes since the original research commissioned by Yale. During this presentation, Cowley (1960) shared that the Yale study resulted in the university opting for a different governing structure than Harvard, and is the first evidence of institutional research leading to university decision-making (Doi, 1979; Lasher, 2011). This historical research study effectively redefined educational research as a potential tool for university decision making, and initiated the building of a new university profession, namely, Institutional Research.

Through the late 1700s, identifiable institutional research efforts were few and tended to be related to the study of governance structures and curriculum at some of the elite private institutions such as Harvard, Yale, and Brown (Lasher, 2011). In the 1820s, these studies began to turn inward and take on a focus of institutional improvement and guidance. With the terminology changing to "institutional self-study," board members and faculty at Harvard conducted an extensive study as a result of an extended period of student rebellion around complaints against such things as poor facilities and treatment, the call for curricular changes, and demands by faculty for representation on a school governing board (Lasher, 2011). Studying how the institution operated, the committees' work led to "many changes in governance, academic organization, curriculum, and

54

student discipline" (Lasher, 2011, p. 11). This early example of institutionally-oriented research concluded that:

> a period from the founding of Harvard to the early 1900s was a time where what we would today call institutional research was carried out by individual higher education leaders. New institutions were built based, in large measure, on the designs and policies of those founded earlier. And, certain presidents utilized information and statistical analysis—even in its most rudimentary form—to solve the institutional problems of the day. (Lasher, 2011, pp. 11-12)

Harvard continued to be a unique model for the use of data to inform institutional decision making under Charles Eliot, the President from 1869 to 1909, and his successor A. Lawrence Lowell, who studied core education issues such as class size and student engagement (Lasher, 2011). The President of the University of Chicago, William Rainey Harper, also conducted research in the late 1800s and early 1900s, including investigating student attributes that might increase the likelihood of educational success (Lasher, 2011).

Institutional research was predominantly conducted until the early 1900s by the leadership at a handful of universities. At the beginning of the twentieth century, institutional research began the transition from a management-led effort to a more formalized function or unit on campuses. This institutionalization of institutional research on campus resulted in more regular investigations versus the previous focus on targeted studies commissioned by college leaders.

The formalization of Institutional Research (1920s-1980s). It was during the

1920s that Institutional Research as a functional area moved towards becoming

formalized. Throughout the 1900s, a variety of collective events and changes offered

both additional formative and evolutionary opportunities for the field of Institutional

Research. The first formal Institutional Research unit is believed to have emerged in the

University of Illinois' College of Education in 1918 as the "Bureau of Institutional

Research" (Lasher, 2011, p. 13). Eells (1937) identified the following developments

around this time period as influential in the need and demand for Institutional Research:

> (1) the development of the scientific spirit in education; (2) the efficiency
>
> movement in business and industry; (3) the social survey movement; (4) the
>
> growth of higher education; (5) the complexity of higher education; (6) the cost of
>
> higher education; (7) the criticisms of higher education; (8) the development of
>
> accrediting agencies; (9) the influence of the general educational survey
>
> movement; and (10) self-protection. (pp. 54–68)

The establishment of the research function of universities with Johns Hopkins, helped to

accentuate and advance the role of research in general into higher education (Rudolph &

Thelin, 1990).

The two decades from the mid-1940s to the mid-1960s in particular was a time of

significant change for postsecondary education, with the G.I. Bill and the Civil Rights

movement leading to significantly increased enrollments, the baby boomers reaching

college age, and the launch of Sputnik resulting in new levels of government research

funding (Brumbaugh, 1960; Calderon & Mathies, 2013; Lanius et al., 2000; Lasher,

2011). Other federal funding opportunities became available to both individuals and

institutions through legislative acts such as the 1944 Surplus Act, which granted land and infrastructure from defunct military bases for the expansion of higher education (Lanius et al., 2000; Lasher, 2011).

During these years, higher education suddenly became much more complex with increasing interest from external constituents. These changes led to greater levels of legislative and organizational oversight through the formation of coordinating and accrediting bodies such as the Southern Regional Education Board and the Western Interstate Commission on Higher Education (Lasher, 2011). In addition, increased government involvement and coordination at both the state and federal level became more common with legislatively mandated state or regional boards of higher education such as the New England Board of Higher Education (Lasher, 2011). These early accreditation-oriented organizations and state boards "pressur[ed] higher education leaders to understand their institutions better, to have better institutional data, and to use it in managing their institutions" (Lasher, 2011, p. 15).

The occurrence of multiple economic recessions and an enrollment stabilization in the late 1960s and early 1970s continued to drive forward the push for accountability and outcomes by the public and accreditation bodies, resulting in increased legislative interest in postsecondary education cost and resource efficiency (Lasher, 2011). In spite of being a predominantly non-profit venture (Brambaugh, 1960), the view of higher education as a business become even more prevalent during this time as neoliberalist interests and academic capitalism began to emerge and become more defined.

In 1965, Title IV of The Higher Education Act established a federal student financial aid system and in order to participate, institutions were required to submit

annual data on such topics as institutional costs, admissions, and enrollment. Originally

submitted as the Higher Education General Information Survey (HEGIS), this data

collection effort was the predecessor to today's *Integrated Postsecondary Education*

Data System (*IPEDS)* (Foraker, 2014; Lasher, 2011). As Calderon and Mathies (2013)

noted, "the practice of IR has risen out of the mandate for institutions to report statistical

information to governments, and it has further developed as the reporting and

accountability requirements have evolved" (p. 81). As such, it was during the 1960s that

institutional research arose both as the common language to describe the field and as

recognition of a more formalized functional role within institutions of higher education,

be it as a designated office or simply individuals on campus (Lasher, 2011).

In his 1960 work titled *Research Designed to Improve Institutions of Higher*

Learning, Brumbaugh argued that:

> the key to effective administration is the ability of the president and those who
>
> work with him [sic] to ask the right questions and then find the right answers. But
>
> the right answers to the right questions, whether they are specific in relation to a
>
> given institution or whether they are more comprehensive, must take into account
>
> all the relevant, factual data- the kind of data that only institutional research can
>
> provide. (p. 2)

Put more succinctly, decisions should be driven by data, and data should be provided by

institutional researchers (Brumbaugh, 1960; Lasher, 2011). Institutional research is, at its

core, applied research, and a valuable tool aiding administrators in understanding and

managing their university (J. Taylor et al., 2013).

As Institutional Research took on a more formal role and definition over time, workshops and meetings to share methodology, findings, and shared understanding became more common. In the mid-1960s, Institutional Research became an "identifiable 'community of practice'…with its own culture and expectations, and its own routes for professional recognition, career progression, and ongoing professional development" (J. Taylor et al., 2013, p. 59). The first annual meeting of the Association for Institutional Research (AIR) occurred in 1966, signaling that "institutional research had arrived as a recognized area in higher education administration" (Lasher, 2011, p. 20). An important early resource for researchers, *Institutional Research in the University: A Handbook*, published in 1971 by Paul Dressel and associates of his from Michigan State University, remains a critical resource for institutional researchers today, having been produced in many further versions since 1971.

The increasing demands for required and regular reporting effectively solidified the need for institutional research functions on campuses. The profession evolved over time to become distinguishable and formalized, starting as "an 'idea' in the nineteen-twenties, 'conceived' in the fourties [sic], 'born' in the fifties, in 'infancy' in the early sixties, in 'childhood' in the late sixties, and… in 'puberty' during the 1970s" (Tetlow, 1973, p. 150).

Today, the profession, which traditionally included anything from classic, theoretical educational research to standardized, routine administrative reporting, is now evolving into a strategically-oriented, mission-driven, proactive, action-oriented field requiring more complex statistical analysis such as modeling and advanced visualization techniques (Leimer, 2011; J. Taylor et al., 2013). However, increased competition in

59

postsecondary education, and public demands for accountability and efficiency mean that this changing perspective must be balanced with modern societal, political, and economic trends (Calderon & Mathies, 2013; B. J. Taylor et al., 2013); a challenge exhibiting the delicate balance of higher education as a public versus private good (Marginson, 2004). Given the consistently changing environment and number of stakeholders with varying interests in higher education, the role of Institutional Research continues to evolve as it attempted to adapt to more recent demands and changes.

Contemporary Institutional Research (1980s-present). In the 1980s, the neoliberal agenda and push for academic capitalization discussed earlier were increasingly impacting higher education, resulting in another significant transition for institutional research, one which began to move it away from simply being the quantitative data provider and informer (Leimer, 2011; McGee, 2015; Slaughter & Rhoades, 2004; B. J. Taylor et al., 2013). This shift at the end of the millennium greatly redefined institutional researchers' role on many campuses to that of "knowledge brokers, linking those who need the knowledge to those who possess it" (Delaney, 2009, p. 37) in support of continuous improvement and institutional effectiveness (Delaney, 2009; Leimer, 2011).

As the post-war and post-baby boom years set in and the nation faced economic recession in the early to mid-1980s, universities began to face increasing emphasis on outcomes and results (Lasher, 2011; Peterson, 1999). Universities were facing rapid and complex changes and pressures, including a changing student body, increasing competition between institutions, and new levels of criticism of the education sector, beginning with the 1983 report *A Nation at Risk: The Imperative for Educational Reform*

by the U.S. Secretary of Education (Lasher, 2011; National Commission on Excellence in Education, 1983; Peterson, 1999).

While this report focused specifically on the K-12 system, concerns soon expanded to higher education, with the formation of the 1984 the National Institute of Education Study Group and its report, *Conditions of Excellence in American Postsecondary Education* (Lasher, 2011), which "linked outcomes assessment with institutional improvement and suggest[ed] that assessment be a major part of any institution's quest for quality" (Ewell, 1985, p. 2). Demands for results became more formalized in 1986 when the Council on Postsecondary Accreditation required all institutions to set measurable goals and objectives, methods for assessing progress, and processes for using the findings to set policy and direction (Lasher, 2011; Nichols, 1990).

Fitting neatly in the vein of academic capitalization and corporatization, some institutional researchers during this time increased their skill sets and activities beyond earlier descriptive and investigative work to now incorporate a more holistic understanding of their institution within the competitive higher education context. Increased focus on assessment and evaluation of educational services often based on student learning and outcomes studies and policy research more frequently became regular Institutional Research duties (Peterson, 1999). It was during this timeframe that the terminology "Institutional Effectiveness" (IE) emerged, which Leimer (2011) distinguished from traditional institutional research to reflect updated roles and responsibilities, noting "the role IE plays in planning, assessment, academic and administrative program review, and accreditation activities" (p. 3). This expansion of institutional role required attention to new skill sets and job foci.

As the 1990s began with a recession, universities began to experience the steady decrease of state funding as a result of competition with other state resources such as the criminal justice system and Medicaid. Scrutiny on teaching and learning outcomes continued to be a focus, especially as they related to undergraduate education and increasing access and addressing persistence concerns. Institutional researchers in the early half of the decade were increasingly asked not only to provide data, but also to interpret and provide insight based on the information they collected, managed, and analyzed (Lasher, 2011), something Terenzini (1993) termed "organizational intelligence" (p. 23). Organizational intelligence consists of three tiers, technical/analytical intelligence, issues intelligence, and contextual intelligence. Terenzini (1993) posited that institutional researchers could build upon their original data-related skills sets with institutional knowledge and environmental context, allowing them to meet the changing expectations of their work (Coughlin & Howard, 2001; Terenzini, 1993).

Towards the end of the 1990s, a confluence of issues was effecting higher education, and therefore effecting institutional research work and demands. Institutional trends identified included "five major postsecondary education policy concerns of the day- the high price of college, the need for management efficiency and increased productivity, institutional effectiveness, access to postsecondary education for all, and accountability" (Lasher, 2011, p. 35). Peterson (1999) suggested seven "societal concerns" of his own: changing patterns of diversity, the telematics revolution, academic and instructional quality reform, economic productivity, new markets, modes, and models for postsecondary relearning (i.e., workforce development), globalization, and resource

constraint (pp. 89-97). Peterson proposed that institutional researchers had a new role to play: postsecondary knowledge industry analyst. To act in this role, he argued institutional researchers needed to:

> becom[e] the institution's expert on the various segments of the postsecondary
> relearning markets for both degree and non-degree, nontraditional, and older
> student consumers; on which postsecondary institutions and non-postsecondary
> organizations are offering postsecondary learning experiences for those markets;
> on the varied strategies and methods for delivering postsecondary learning on and
> off campus; on the new forms of technology-based delivery, including virtual
> learning systems; and on the forms of strategic alliances, joint ventures, and other
> inter-institutional linkages developed to deliver postsecondary education, promote
> knowledge dissemination, and support research. (Peterson, 1999, p. 101)

The expansion of institutional roles for Institutional Research significantly changed how data were used to make decisions within institutions, and supported a more agile response to changing perceptions and demands. As outlined earlier in this chapter, this response has often grown out of business-oriented models, including the use of analytics to inform planning and approach. As Institutional Research continued to grow as an instrumental and necessary resource for institutional leadership as the 2000s began, McLaughlin and Howard (2001) summarized its evolution over the previous few decades:

> During the past 40 years, the profession has developed and matured into a vital
> function in higher education. This development has occurred in an environment
> of rapidly changing expectations of higher education that have been characterized
> by expanded capabilities of technology and increased demand for its services,

shrinking resources, and vocal demands for accountability. As higher education

has reacted to the changing demands of society, institutional research has become

a key player by providing reliable data and valid information, responding to

accountability demands, assessing the effectiveness and efficiency of institutional

processes and programs, and preparing for future challenges. (p. 163)

The results-focused culture of postsecondary education continues today, with the addition

of new challenges such as an increasingly divisive political culture and concerns over

workforce issues. As competition continues to tighten between institutions, university

leaders require more than just data; they need information and they need institutional

researchers to not only provide it, but interpret and translate it; in some cases, even make

recommendations based on it (Leimer, 2011). This diverse set of role expectations for

institutional researchers, and indeed analytics staff in general, requires a new way of

thinking about the use of data in higher education. Peterson (1999) supported these role

changes, as he argued that,

the intent [of Institutional Research] is not merely to inform institutional leaders

but to assist them in developing the new roles and strategies for the institution in

this new industry, to become the institution's source of expertise on this new

industry paradigm, its dynamics, and its implications for the institution. (p. 101)

Increasing in both amount and complexity of data and information, growing institutional

leadership needs and external demands have resulted in not only a more advanced

professional institutional research role and skill set, but also increasing importance,

visibility, and influence of institutional research functions at many institutions.

New demands such as leadership for and involvement in analytics programs on campus have impacted the workload and expectations of institutional researchers, as "interpreting data and making recommendations is more time-consuming and requires greater knowledge of the institution and the issue at hand than does producing and disseminating data tables" (Leimer, 2011, p. 6). These factors increase the need for appropriate resources to support increasing demand for institutional research work, including qualified analytics staffing and sufficient budgetary support. Specifically, Leimer (2011) noted that Institutional Research offices not effectively meeting these new expectations are likely facing a conflict between "increased requirements for data reporting and management, [and] inadequate staffing, budget cuts, [and] organizational alignments that make the role unfeasible" (p. 7), opening up the possibility for role conflict and ambiguity. It is important for universities to address these issues proactively before they risk potential negative consequences such as staff dissatisfaction and turnover outlined earlier.

In this new era of accountability tied to limited resources and changing demands, universities need their institutional research functions to provide timely, proactive, and "actionable intelligence" (Baer & Campbell, 2012, p. 53) to institutional leadership for agile decision making (Leimer, 2011; Rice & Coughlin, 2011; Volkwein et al., 2012). Though historically, the role focused on the "keeper" aspect of data management, in which one of the main functions included a role as "the information authority" (J. Taylor et al., 2013, p. 61), today's institutional researchers are increasingly asked instead to be translators (see Figure 1). Consider Swing and Ross's (2016a) idiom: "Data don't speak for themselves, and they never talk to strangers" (p. 10). This tongue-in-cheek saying

highlights how institutional researchers must interpret and communicate take-aways from data sources so that key decision makers on campus can make evidence-based decisions (J. Taylor et al., 2013).

1700s	Late 1800s to Early 1900s		Mid to late-1900s	
Educational Research	Institutional Improvement	Student Focus	Accountability and Outcomes	Data-Driven Decision Making and Planning	Actionable Intelligence

	Early 1800s		Early to Mid-1900s		1990s to Present
• 1701 Yale study of Harvard's organizational structure • Few examples of Institutional Research • Studies of governance structures, curriculum of other institutions • Primarily happening at private and elite institutions	• Institutional self-study, inward-facing • Focus on institutional improvement and guidance • Harvard student rebellions resulted in focused study on issues of curriculum, student treatment, and faculty governance	• Primarily conducted by leadership at private institutions • Increased focus on student experience • Class sizes, student engagement, student success • Institutionalization of IR	• WWII, G.I. Bill, Surplus Act, Civil Rights Movement, Sputnik, financial aid system • Increased enrollments, land grant institutions • Accreditation, legislative oversight • Focus on efficiency, access • IR as a community of practice	• Formalization of IR • Increased awareness of environment and context • Decreased funding, enrollment stabilization, increasing diversity • AIR, IPEDS established • Focus on measurable outcomes and assessment, required reporting • Academic capitalism creates "knowledge brokers"	• Increased competition • Corporatization, higher ed as a business • Focus on efficiency, resource management, productivity, results • Growth of "big data", technology • Business intelligence, analytics • Proactive planning and decision-making • Continuous improvement, institutional effectiveness

Figure 1. Evolution of Institutional Research within a changing higher education environment

Conclusion

As universities respond to increasing demands for accountability as part of the neoliberal, academic capitalist reaction to new social, political, and economic pressures, they are increasingly exploring and adopting business-like management processes. One such response has been the creation and use of analytics programs to inform decision making and planning. These kinds of initiatives, relatively new to postsecondary education as a whole, require different leadership and support efforts, including both people and technical support.

The historical evolution of the field of Institutional Research as a result of changes in the higher education environment has brought institutional researchers to the

doorstep of the next reincarnation of the field, available to contribute to the leadership, staffing, and technical support necessary to create and maintain an institutional analytics effort. A better understanding of higher education's reaction to its changing environment in terms of analytics support and use, as well as the role of Institutional Research and analytics staff in those efforts could allow universities to enhance their analytics programs in a targeted, informed manner. By doing so, the potential for creating, supporting, and utilizing the results of a successful analytics program to respond to accountability-driven demands increases, improving the ability of institutions to function and exist in the new postsecondary education environment.

CHAPTER THREE: METHODOLOGY

Today's higher education institutions are grappling with a rapidly changing environment bringing increased demands for accountability and new levels of inter-institution competition (Apple, 2013; Slaughter & Rhoades, 2004). Complicated further by political, social, and economic challenges common to the more neoliberal views on academia, as well as rapid development and change in the technology realm, universities are beginning to adopt new ways of thinking about institutional management and planning (Eckel & King, 2004; McGee, 2015; Straumsheim, 2016; B. J. Taylor et al., 2013). Reflecting a more business and resource-centered focus, the use of corporate tactics like establishing analytics programs to use data and knowledge to make sound, informed decisions driving strategic planning efforts is becoming all the more common in postsecondary education (Baer & Campbell, 2012; Calderon & Mathies, 2013; McGee, 2015; Stiles, 2012).

Translating the new academic capitalism-centered demands and necessary responses to a higher education environment can be difficult and complicated. Understanding the various factors that enhance institutions' interest in and ability to respond to evolving neoliberal pressures such as analytics and business intelligence within the academic administration framework is necessary for universities to make the best use of these approaches. As such, institutions can benefit greatly in understanding the ways that analytics can be optimized, particularly as it relates to their academically

68

oriented environment (Baer & Campbell, 2012). The deeper the understanding leaders and supporters have of the potential benefits of applying traditionally corporate-oriented methods such as the use of analytics in decision-making and planning, and how they can best employ their personnel and technology resources as part of those efforts, the more they will be able to utilize the findings of this study to target specific components of their programs to enhance the potential of success of both the analytics initiatives and of the university itself.

In an effort to identify the perspectives and structures of postsecondary education institutions utilizing analytics programs as a response to changing demands, as well as the role(s) of the Institutional Research (IR) function in those efforts, secondary data analysis using both descriptive and multivariate techniques was conducted using anonymized, primarily quantitative survey data collected by the EDUCAUSE Center for Analysis and Research (ECAR) as part of their 2015 Analytics Survey effort. EDUCAUSE "is a non-profit association whose mission is to advance higher education through the use of information technology" (EDUCAUSE, 2017b, para. 1). Within the organization, the ECAR unit specifically conducts research and analysis on data obtained through various means, including an annual data collection effort and topic-specific surveys of primarily Information Technology (IT) and occasionally Institutional Research (IR) leadership and staff. Through these studies, EDUCAUSE and ECAR provide information to member institutions to support university decision-making and delivery of technological resources such as data warehouses and visualization techniques, activities such as data analysis, and the overall analytics initiatives on campus.

The 2015 EDUCAUSE survey, completed by 245 institutions, contained questions regarding institutional leadership and staffing support for analytics efforts, motivations for investment and prioritization of analytics, data infrastructure and use, and depth of analytics use on campus for strategic planning and decision-making. As such, the data collected lent itself well to the analysis of this study, both in content and in its relationship to the academic capitalism, analytics, and Institutional Research literature and theory covered in Chapter 2.

Examination of institutional motivations for establishing analytics initiatives, strategic prioritization and use of data, and concerns related to the business-oriented nature of using analytics as a response to pressures all contributed to the creation of a framework for understanding varying levels of institutional responsiveness to the rapidly changing neoliberal demands on postsecondary education today. Further analysis of analytics-specific leadership, staffing, and data and technology infrastructure, as well as the application of analytics within the respondent institutions guided further investigation into the extent to which institutions with varying levels of responsiveness to these new demands are designing analytics efforts likely to be successful (Baer & Campbell, 2012).

Results of this study are intended to provide a better understanding of what institutions with varying levels of responsiveness to the demands of academic capitalism are specifically doing, or not doing, to support their analytics efforts.

Data analyses were guided by the following research questions:

1. To what extent do institutions' motivations for and use of analytics reflect a response to the demands of academic capitalism?

2. How do institutions more highly motivated by the demands of academic capitalism differ from those less so in the key components of a successful analytics program (leadership, staffing, data and technology infrastructure)?

3. To what extent are Institutional Research units and staff contributing to the leadership, staffing, and delivery of analytics programs within their institutions?

The results of this study will aid institutional leadership and analytics staff in understanding their responsiveness to neoliberal pressures and how analytics may assist in those efforts, as well as provide additional insight on the possibilities of enhancing the use of analytics in university planning and decision making.

Research Design

This study employed a structural equation model (SEM) method to guide a progressive, quantitative analysis of data directly related to the relevant research questions, theory, and framework using a combination of principal components analyses (PCA), confirmatory factor analyses (CFAs), regression and correlation analyses, and descriptive analyses. The ability to propose specific relationship models for each research question based on established theoretical framework and literature in order to create latent variables, or factors, then utilizing each of these factors subsequently in further analysis reflects the application of the overarching structural equation model (SEM). In this study's SEM, each latent variable was calculated from indicators selected based on guidance of the literature and theory, at which point the relationships between

71

the factors themselves are further explored. A diagram of the proposed full SEM model, as well as the individual analytical approaches included in it, can be found in Figure 2.
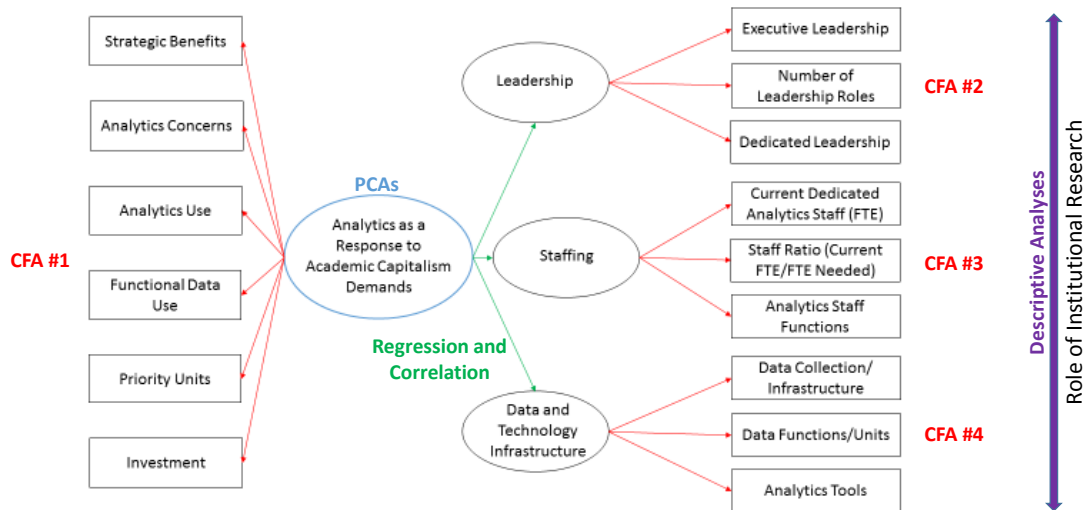
Figure 2. Structural Equation Model of analytics as a response to demands of academic capitalism and the components of a successful analytics program

The first two types of analysis utilized in this structural equation model, principal components and confirmatory factor analyses, are both appropriate methods for use in this study. Principal components analysis (PCA), a dimension technique used to identify the core components that explain total variance in the findings, was used to identify the primary drivers for institutional investment in and perceived benefit of analytics use as they relate to the influences of academic capitalism. Both PCA analyses conducted in this research meet the subject-to-variables (STV) ratio requirements for reliability of PCA results, which require a population of at least five times the number of variables. With populations of 194 and 216 institutions, and variables numbering 18 and 14 respectively, the resulting ratio of 194/18 and 216/14 both fall within the acceptable ratio for the reliability of results.

Confirmatory factor analysis (CFA) examines the relationship between a series of latent variables (in this case, responsiveness to academic capitalism and each of the three components of a successful analytics program) based on measured variables (the analytics survey data). The analytics survey data meet the underlying assumption of SEM that variables are intervally scaled, and while not all of the measured variables may have a normal distribution, SEM still allows for a certain amount of violation of normality. Additionally, the number of cases in the dataset used for this study meet the sample size criterion considered appropriate for the use of SEM, at least 100-150 cases for validity, as the data set for this study included 216 cases for analysis.

As noted above, the SEM method in this study included, among other analysis techniques, the creation of four latent variables by conducting a series of sequential confirmatory factor analyses. Because the nature of this inquiry was heavily guided by existing theory and literature, confirmatory factor analysis (CFA) was the most appropriate statistical approach for evaluating each of the individual research questions within the larger structural model. Confirmatory factor analyses, frequently used as steps in the SEM method, focuses on specified indicators of unmeasured, latent variables, also known as factors. CFA is also useful in the development of new scales, which was the aim of the analysis of research question one, intended to yield a scale variable representing the extent to which institutional analytics efforts indicate a level of responsiveness to neoliberal pressures.

Analytics initiatives are frequently a response to the neoliberal demands of postsecondary education today (Baer & Campbell, 2012), and several of the survey questions address respondents' awareness of and accounting for specific pressures

73

associated with academic capitalism identified in Chapter 2 such as accountability, transparency, and efficiency. The related literature presented in Chapter 2 helped determine which variables were most appropriate to include in this analysis (see Appendix A).

Drawing on academic capitalism theory and literature, the first phase of the structural equation model was conducted to answer research question one, and entailed using a combination of PCA and CFA to create a latent variable representing the level of "institutional response to academic capitalism" for each institution that responded to the EDUCAUSE 2015 Analytics Survey. This factor represents a cumulative value comprised of measured variables selected based on existing theory, including the strategic use of data and analytics, investment in analytics, and concerns about a business-oriented approach to higher education management.

The results from two principal component analyses, institutional motivations for investing in analytics and strategic priorities that would benefit from their use, were used to provide context for the CFA on the extent to which this academic capitalism factor actually reflects a response to academic capitalism pressures. This latent variable, combined with the context provided by the PCAs, measures overall institutional use of data and analytics as a response to contemporary neoliberal pressures, with higher scores indicating higher levels of responsiveness.

Phase two of the structural equation model drew upon Baer and Campbell's (2012) theory on the components of a successful analytics program. Three separate CFAs were conducted to create three factors representing leadership, staffing, and data and technology infrastructure to align with the theory's components. Once these three

latent variables were assessed, they were then analyzed against the institutional response factor resulting from the analysis for research question one utilizing regression and correlation analyses. The combined analysis of the four latent variables provided the answer to research question two, allowing for understanding of the extent to which institutions are responding to demands created by academic capitalism, and how institutions of varying levels are managing their analytics programs.

In addition to the types of analysis utilized two answer research questions one and two as part of the structural equation model up until this point, the role of Institutional Research, as defined by leadership, staff, and analytics services delivery roles, was then explored using descriptive analyses. Employing frequency and crosstabular analysis, useful methods for establishing overall understanding and comparing the results of one or more variables against the results of others, this study examined data on Institutional Research leadership, staffing, and involvement in analytics delivery as it relates to the institutional responsiveness factor and other institutional characteristics. In sum, this analysis helped to assess the extent to which Institutional Research units, leadership, and staff are utilized in their campus' analytics initiatives, providing the answer to research question three.

The combinations of these statistical methods for conducting quantitative analysis, namely structural equation modeling, principal components analysis, confirmatory factor analysis, and descriptive analyses were appropriate for this study given the structure of the data, the research questions being considered, and the theory and literature for the specific topics being investigated.

Measures and Participants

EDUCAUSE membership includes a variety of postsecondary institutions, corporations involved in the delivery of Information Technology in higher education, and other related organizations and associations (EDUCAUSE, 2017b). A searchable directory of member institutions and organizations can be accessed at the following website: https://members.educause.edu. Drawing upon their membership-based structure as a resource, the organization is able to conduct research studies and data collection efforts using their members as the available pool of respondents.

In May and June of 2015, the EDUCAUSE Center for Analysis and Research (ECAR) administered a survey to a sample of over 1,800 EDUCAUSE member institutions intending to assess the "state of analytics" (Yanosky & Arroway, 2015, p. 5) in higher education as compared to a similar survey conducted in 2012. Thirteen percent of the institutions asked to participate in the 2015 Analytics Survey responded (245 institutions). Campus respondents predominantly consisted of the primary EDUCAUSE representative at each surveyed institution, most frequently the Chief Information Officer (CIO). Though the respondents' specific roles within the institution are not discernable from the survey data provided, EDUCAUSE's Chief Research Officer indicated that a small number of participants might also represent Institutional Research functions (Eden Dahlstrom, personal communication, December 12, 2016). Each institution had only one respondent to the survey, and as such, the record level data represents individual institutions with no duplicates.

Institutions represented by survey respondents encompass a diverse population, varying extensively by region, educational sector, institutional type, and enrollment size.

Delimitations of this study, described further later in this chapter, determine that only

institutions located in the United States, and in the public or private sector, will be

included in analysis. For-profit institutions, assumed to have different overall missions

and values than traditional higher education, and non-U.S. institutions, which may face a

different set of pressures than U.S.-based institutions, were excluded from analysis. The

addition of these criteria yielded a study population of 216 institutions. A balanced ratio

of public and private U.S. institutions was represented in the survey population (Table 1),

as are all general Carnegie classifications (Table 2).

Table 1

Respondent Institutions, Region and Sector

Region	Sector	Frequency	Percentage
United States	Public	107	43.7%
	Private	109	44.5%
	For Profit	1	0.4%
Canada		6	2.4%
International		22	9.0%

Table 2

Respondent Institutions vs. IPEDS Institutions, Carnegie Classification

	EDUCAUSE		IPEDS*		Comparison
Carnegie Classification	Freq.	%	Freq.	%	% Diff.
Associates	29	11.8%	1,113	23.9%	-12.1%
Baccalaureate	49	20.0%	976	20.9%	-0.9%
Masters, Public	23	9.4%	273	5.9%	3.5%
Masters, Private	33	13.5%	486	10.4%	3.1%
Doctoral, Public	40	16.3%	196	4.2%	12.1%
Doctoral, Private	19	7.8%	139	3.0%	4.8%
Other	24	9.8%	1,479	31.7%	-21.9%
Non-U.S.	28	11.4%	-	-	-
Total	245	100.0%	4,662	100.0%	-

* Does not include non-degree granting or non-accredited institutions that report to the
Integrated Postsecondary Education Data System (IPEDS).

In addition to the diversity in sector and type of the institutions themselves, a wide range in institutional size was represented in the population, with schools having less than 2,000 FTE (full-time equivalent student enrollment) to those with over 15,000 FTE (Table 3).

Table 3

Respondent Institutions vs. IPEDS Institutions, Full-Time Equivalent Enrollment

	EDUCAUSE		IPEDS*		Comparison
FTE	Freq.	%	Freq.	%	% Diff.
Less than 2,000	40	16.3%	2,784	59.7%	-43.4%
2,000-3,999	57	23.3%	701	15.0%	8.2%
4,000-7,999	40	16.3%	530	11.4%	5.0%
8,000-14,999	32	13.1%	314	6.7%	6.3%
15,000+	39	15.9%	243	5.2%	10.7%
Unknown	37	15.1%	90	1.9%	13.2%
Total	245	100.0%	4,662	100.0%	-

* Does not include non-degree granting or non-accredited institutions that report to the Integrated Postsecondary Education Data System (IPEDS).

Due to the diversity of their membership institutions, ECAR was able to survey and collect data from respondents representing a host of schools with differing characteristics, allowing for deeper investigation and understanding of the factors related to institutional commitment to analytics in planning and decision making across the spectrum of types of institutions of higher education. When considering the characteristics of the EDUCAUSE survey population, however, it is necessary to acknowledge that compared to all degree-seeking, accredited institutions reporting to IPEDS in Fall 2015, the respondent population does not necessarily mirror these characteristics in the general higher education population.

Non-response bias may be present in this study for two groups of institutions. The two particularly notable differences included the sizeable underrepresentation of

community colleges and "other" classifications in the survey population as compared to the IPEDS population (11.8% compared to 23.9%, and 9.8% compared to 31.7%, respectively) and smaller institutions with FTE enrollment less than 2,000 (16.3% compared to 59.7%). These findings are not surprising, however, given that EDUCAUSE is membership organization requiring institutions to pay dues as part of the services. As such, it is not unexpected that smaller schools and non-4 year institutions would be represented at lower levels in the EDUCAUSE population. Still, despite the lack of comparability in these particular types of schools, the survey population still yields enough variability to make consideration of these characteristics valuable.

Reliability and Validity

Because this study is based on secondary analysis of data collected by an external organization as part of a separate investigation, there is limited direct control over the reliability and validity of the measures utilized in this study. However, reliability confidence in the 2015 survey results is at least conditionally supported by considering the alignment of summative results from other related EDUCUASE survey and data collection efforts.

The first of these efforts to consider is the original EDUCAUSE analytics survey conducted in 2012, which culminated in their *Analytics in Higher Education: Benefits, Barriers, Progress, and Recommendations* report (Bichsel, 2012). Informed by a 2010 analytics "maturity" framework outlined by Davenport, Harris, and Morrison, which considers factors including "the right data, the right amount of enterprise, integration, communication, the right leadership, the right targets for analytics, and the right analysts" (as cited in Bichsel, 2012, p. 20), results from the EDUCAUSE 2012 survey were

modeled and used to develop and guide further EDUCAUSE analytics research efforts, further outlined below.

One of the subsequent research efforts included the addition of analytics-specific questions to the annual EDUCAUSE data collection from member institutions called the Core Data Service (CDS) (Yanosky & Arroway, 2015). The CDS collects an extensive amount of data encompassing topics which include IT staffing, financials, and services offered, which are utilized to benchmark member institutions against their peers (EDUCAUSE, 2017a). This specific component of the annual data collection was intended to track institutions' longitudinal status of and progress in analytics by use of an Analytics Maturity Index designed based on the analysis and modeling of the 2012 survey data (Bichsel, 2012; Yanosky & Arroway, 2015).

The 2012 "first generation version of the maturity modeling served as a basis for the analytics maturity index that is now part of [this service]" (Yanosky & Arroway, 2015, p. 25). In 2015, the index was expanded to include 32 different factors organized by the following dimensions: decision-making culture, policies, data efficacy, investment/resources, technical infrastructure, and Institutional Research involvement (Yanosky & Arroway, 2015). The data to feed this model were then collected as part of the CDS each year forward, and comparison of the 2014 index scores were not found to be significantly different than that in the initial 2012 survey (Yanosky & Arroway, 2015). The consistency in these findings over time, many of which are reviewed in more detail in the literature review, provide some measurement of reliability of the 2012 findings, particularly since the two analysis efforts were different in nature (a survey and an annual data collection, specifically).

The 2015 EDUCAUSE Analytics Survey data specifically informing this current study, then, was intended to continue the ongoing exploration into the general topic, building on the earlier efforts through by establishing a more nuanced definition of analytics (examining learning and institutional analytics independently) and addressing new analytics issues that became apparent since the 2012 survey (Yanosky & Arroway, 2015). In sum, because all of the previous EDUCAUSE research on the topic of analytics described here and leading up to the 2015 Analytics Survey built upon that before it with a level of congruency in general findings as described throughout Chapter 2, the 2015 survey data is expected to be reasonably reliable when considering its informed nature by the earlier and foundational research that preceded it.

In addition to the 2012 results informing the development of the latter 2015 survey effort and providing some level of arguable reliability, EDUCAUSE conducted six focus groups in June 2015 at the EDUCAUSE/NACUBO Administrative IT Summit, allowing for deeper exploration of themes related to this study and providing plausible validity. With representation of both EDUCAUSE and NACUBO members, these focus groups consisted of "nearly 200 higher education thought leaders representing information technology, business operations, institutional research, and business intelligence and analytics" (Reinitz, 2015, p. 3). Content and takeaways from these focus groups were summarized in an EDUCAUSE/NACUBO report, *Building Institutional Analytics Maturity* (Reinitz, 2015), which has been referenced throughout the literature review for this current study.

Though direct control over the reliability and validity of the survey data utilized in this study was a challenge, the preliminary 2012 survey and the 2015 focus groups

provide a higher level of confidence in the data than if there had been no other research conducted on the topic. As such, a measure, if somewhat limited, of both reliability and validity exists here. A copy of the 2015 Analytics Survey utilized in this study can be found in Appendix B.

Procedures and Analysis

Investigation of the three research questions posed in Chapter 1 entailed the progressive multivariate approach of structural equation modeling (SEM). A table mapping the specific research questions and variables included in this analysis can be found in Appendix A. This section provides a comprehensive overview of analytical techniques, first explaining the overall SEM, principal components analyses (PCAs) and confirmatory factor analyses (CFAs), and then outlining the transformative and preparatory work done to ready the measurable variables for inclusion in this model.

Structural equation modeling. Consisting of a series of principal components analysis (PCA) conducted in SPSS Statistics, Version 24.0 (IBM Corporation, 2016) and confirmatory factor analyses (CFAs) conducted in Mplus, Version 7 (Muthén & Muthén, 2012), both outlined in more detail below, the first phase of the SEM analysis examined the extent to which institutions' use of data and analytics reflects a response to the demands of academic capitalism. To ascertain the extent to which respondents appear to tie their use of and investment in analytics to the pressures of academic capitalism, two PCAs were first conducted to assess institutions' core motivations for investing in analytics and the strategic institutional priorities that could benefit from the use of data and analytics on their campuses.

Principal components analyses. After initially exploring the use of exploratory

factor analysis (EFA) and maximum likelihood estimates (MLE) methods of factor

analysis to assess these two topics and finding that neither returned valid results within a

reasonable number of iterations (analysis attempted were ceased at 100 iterations),

principal components analysis was utilized to determine the core components for each.

The results from these two PCAs, primary motivations for investing in analytics and

strategic priorities that would benefit from the use of data and analytics, were then

utilized to frame and understand the results from the first confirmatory factor analysis.

This first CFA was utilized to assess whether the institutions' actual use of data and

analytics aligned with the neoliberal demands of academic capitalism as established in

the two PCA analyses above.

Confirmatory factor analyses. The academic capitalism confirmatory factor

analysis included six measurable survey variables established to be associated with

responses to neoliberal demands by academic capitalism theory covered in Chapter 2 (see

Figure 3). These variables focused on topics including the extent and sophistication of

the use of data and analytics on campus, views on the strategic benefit of using analytics

at their institutions, concerns about the use of analytics in higher education, and

investment in analytics.
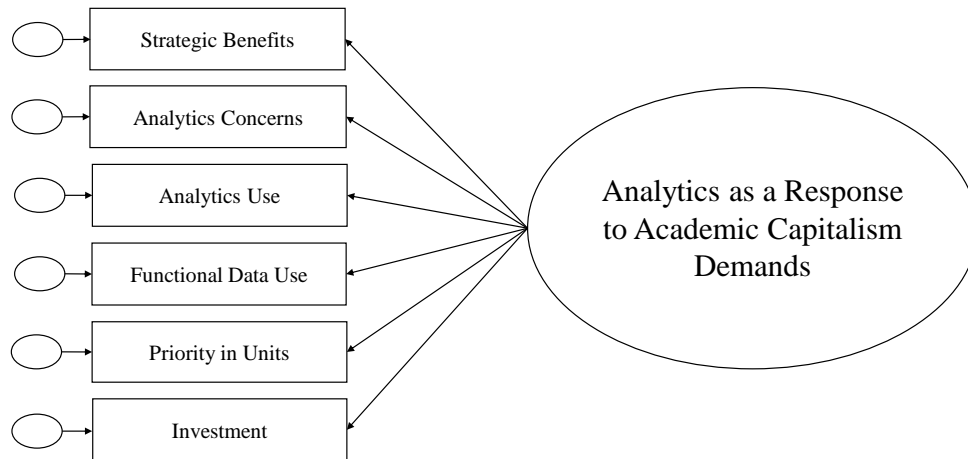
Figure 3. Use of analytics as a response to demands of academic capitalism

These six variables were included in a confirmatory factor analysis using Mplus, Version 7 (Muthén & Muthén, 2012) and used to create a latent scale variable indicating the extent to which institutions' use of analytics on campus responds to the demands of academic capitalism. This new latent variable, or factor, was then used in subsequent confirmatory factor analyses assessing the variables associated with each of the Baer and Campbell's (2012) components of a successful analytics program (see Figure 4).
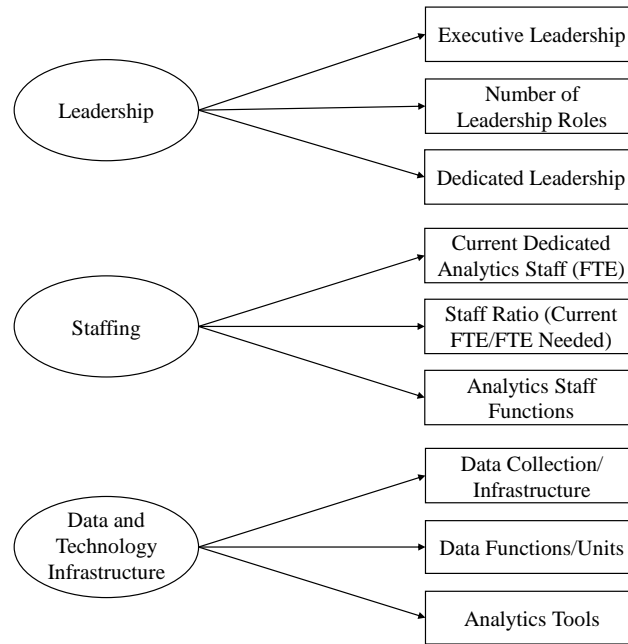
Figure 4. Components of a successful analytics program

In order to conduct this second phase of the structural equation analysis, latent variables representing each of Baer and Campbell's (2012) three components of a successful analytics program were created using the same confirmatory factor analysis method in Mplus, Version 7 (Muthén & Muthén, 2012). Utilizing related measurable variables from the survey data as informed by Baer and Campbell's (2012) and other analytics success theory reviewed in Chapter 2, each component was defined as a separate factor for inclusion in phase three of the SEM analysis.

Once these first two phases of SEM analyses were conducted using the PCA and CFA methods, the factor from phase one (analytics as a response to academic capitalism demands) was then examined as it related to the three factors of Baer and Campbell's (2012) model in phase two (leadership, staffing, and data and technology infrastructure) for the third phase of analysis (see Figure 5). Utilizing Mplus, Version 7 (Muthén & Muthén, 2012) to conduct regression analysis between the four factors, this stage of

analysis combined all of the previously created latent variables into a single model in order to assess how institutions with varying responses to academic capitalism are approaching their analytics programs in terms of the three components of a successful analytics program. Additionally, correlation analysis was used to further explore and understand the relationships between these four factors.
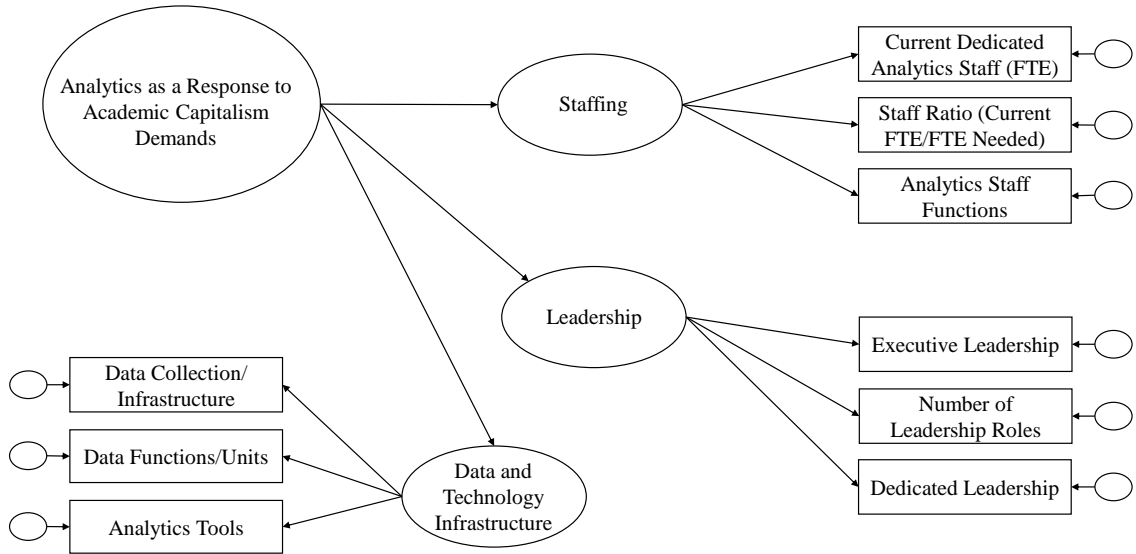
Figure 5. Relationship between institutional use of analytics as a response to demands of academic capitalism and the components of a successful analytics program

Understanding the role of Institutional Research. In addition to the multi-phase, multi-method analysis described above intended to explore the nature of analytics programs as an institutional response to today's changing demands and pressures, the final phase of the structural equation model entailed descriptive analysis of the role of Institutional Research units and staff in institutional analytics efforts. As highlighted in the history of the field in Chapter 2, the profession has always adapted and evolved to meet the changing environmental and institutional needs, which would reasonably be assumed to extend to today's neoliberal changes. Investigating the role of Institutional Research units in the delivery of analytics initiatives, individually or in tandem with other

86

units and staff on campus, as well as the roles of Institutional Research leadership and staff in the in those efforts, can help clarify the extent to which the field is undergoing another possible evolution. Additionally, this information can assist Institutional Research units and practitioners in understanding their institutions' data and analytical needs and how they can better support them.

The evaluation of Institutional Research's role within their institutions was conducted by exploring the roles of Institutional Research units, leadership, and staff in the delivery of analytics on their campuses. This entailed an examination of the extent to which Institutional Research units, alone or in tandem with other units and/or staff, are involved in analytics services and delivery, the role of Institutional Research leadership in these initiatives as a dedicated leader and/or as part of a leadership team, and the capacity of Institutional Research staff support as determined by staff full-time equivalent positions. SPSS Statistics, Version 24.0 (IBM Corporation, 2016) was used to analyze frequency distributions and crosstabular analyses of survey questions related to analytics delivery support staff and methods, and the role of Institutional Research leadership, including whether that leadership was dedicated to analytics or it was just one of many priorities under their purview. Additionally, differences among types and sizes of institutions were analyzed to better understand variances in Institutional Research contribution by variables such as Carnegie classification, control (public vs. private), and enrollment FTE.

Upon completion of this structural equation model using a series of principal components analyses, confirmatory factor analyses, regression and correlation analyses, and the descriptive evaluation of Institutional Research roles, this study examined the

extent to which institutional use of analytics appears to indicate a response to the demands of academic capitalism, how varying response levels relate to the components identified with successful analytics programs, and the extent to which Institutional Research has a role in these initiatives and efforts. The following section describes the research questions, analytical methods, and survey variables and data used in this study.

Data preparation and transformation. In order to prepare the individual survey variables utilized in this analysis, SPSS Statistics, Version 24.0 (IBM Corporation, 2016) was used to transform some variables into a qualitatively oriented structure more appropriate for inclusion in the statistical modeling. The section below describes the data preparation conducted for each variable, and where applicable, by research question. As noted in the previous section, a map of this study's research questions to the survey questions/variables and their response options used in their analysis can be found in Appendix A.

Research Question One: To what extent do institutions' motivations for and use of analytics reflect a response to the demands of academic capitalism? As noted earlier, this study first evaluated the extent to which institutional use of data and analytics indicate a response to the pressures related to academic capitalism, using both principal components analysis (PCA) and confirmatory factor analysis (CFA). Literature on academic capitalism and neoliberalism theory reviewed in Chapter 2 guided which survey questions/variables to include in this first phase of the structural equation model analysis. The first two survey questions below on motivations for investing in and strategic institutional priorities that could benefit from analytics were first transformed for use in the principal components analysis using SPSS Statistics, Version 24.0 (IBM

Corporation, 2016), and were considered to be evidence of awareness and consideration of contemporary neoliberal pressures as part of the need for a dedicated analytics program.

1. What are the top 3 factors that motivated your institution to invest in institutional analytics?

This survey question included 14 different response options, many of which reflect pressures of academic capitalism, such as optimizing resources, containing or reducing costs, creating greater transparency, and reaching a different or broader segment of students. Preparation of these data for principal components analysis was done by creating a dummy variable indicating one if the response was selected and zero if not. As a result, this survey question yielded 14 separate measured variables to include in the PCA, each of which indicated whether the factor was in their top three institutional motivations for investing in analytics.

2. Please specify the strategic priorities at your institution that would benefit from the use of data.

This question (two) was intended to assess the breadth of initiatives that universities could utilize analytics to support. Because the response was open-ended, transformation of this measure involved conducting a review and thematic analysis of all responses guided by academic capitalism theory and literature, resulting in the creation of a series of 17 separate dummy variables indicating if the theme was indicated in the response. An underlying assumption driving the inclusion of this variable in the CFA was that the more areas institutions identified as potential targets for data-informed

decision making benefits, the more aware they are of their environment and how

analytics can benefit them in responding to it.

Using the results from the two PCAs to understand respondents' perspectives on

using analytics in response to the demands of academic capitalism as described earlier in

this chapter, confirmatory factor analysis (CFA) was then used to assess the actual extent

to which and purposes for using data and analytics on their campuses. Preparation of the

survey questions utilized as measured variables in this CFA, as well as the transformation

methods used to prepare them for loading into the CFA, are outlined below, and

additional information on all variables as they related to the research questions, methods

of analysis, and related literature and theory can be found in Appendix A.

3. Would any strategic priorities at your institution benefit from the use of data,

regardless of whether data are actually being collected or used for analytics

now?

Survey question three was used to assess institutional awareness of the benefits of

using data and analytics strategically for assessment, prioritization, and planning efforts.

As noted in Chapter 2, the values associated with academic capitalism put pressure on

universities to be strategic and, where possible, proactive, when it comes to addressing

their internal and external needs and demands, and acknowledgement of the strategic

benefit of a data-informed model is assumed to indicate awareness of opportunities

provided by the use of analytics in planning.

4. Indicate which response best describes the use of analytics in each of the

following areas at your institution. (no discussion to date; considered but not

pursued; experimenting/considering; in planning; used sparsely; used broadly; don't know)

In order to transform the data from question four for inclusion in the factor analysis, a numeric value from one to six was assigned based on their answer as outlined above for each of the 22 functional areas identified in this survey question. A numeric value of one was assigned to the response of "no discussion to date" and each response on the scale increasing by one to the top of the range at six, assigned to "used broadly." Missing data and "don't know" responses were both coded as zero. These scores were then summed across all functions for a possible total of 132 points. The total point value was divided by 22, the number of total functional areas, in order to place the respondent on the original six-point data use scale. The higher the composite score, the broader and more ingrained the use of analytics is assumed to be at the institution. The broader the use, the more analytics-oriented the respondent institution is assumed to be overall when planning for the various areas, most of which relate to accountability and efficiency demands related to academic capitalism.

This same transformation method, creating a five-point scale, was also used to prepare the data from survey question five for exploration of the strategic, complex, and proactive use of data to guide these same 22 functional areas. The assumption for this variable was that institutions utilizing data for at least monitoring, but more importantly projecting outcomes and triggering proactive responses are more mature in their use of data to able responsiveness and agility in the quickly changing, accountability-driven higher education environment. As such, the answer of "we do not collect useable data" was assigned the lowest score on the scale (1), while "we create and use predictive

analyses or reports that may trigger proactive responses" was the culminating value (5). Institutions higher on the scale were assumed to be using data more strategically and proactively than those on the lower end. The following survey question guided this analysis:

5. Provide your best estimate of how data are being used in various functional areas of your institution. ("we do not collect useable data;" "data are collected but are never or rarely used;" "we create and use analyses or reports to monitor operations or programs;" "we create and use analyses or reports to make projections for programs or groups;" "we create and use predictive analyses or reports that may trigger proactive responses")

The sub-questions included in survey question six reflect concerns often expressed by institutions examining the use of analytics in their decision-making and planning processes. As noted in the literature on today's neoliberal values, higher education's concerns about trying to "measure" their work, being run like a business, and external governmental pressures around performance and value are regularly expressed. As such, this question was addressed similarly to survey questions four and five above, with each institution being given a single, calculated "analytics concern" score.

6. To what extent do you see the following as concerns about the use of data or analytics in higher education? ("not a concern;" "minor concern;" "moderate concern;" 'major concern;" "don't know")

A single score for survey question six was calculated by assigning a numeric value from one to four based on the answer to each of the 18 concerns identified in the question. A numeric value of one was assigned to the response of "not a concern" and

each response on the scale increased by one to the top of the range at four, assigned to "major concern." Responses of "don't know" and missing data were coded as zero. These scores were then summed across all concerns for a possible total of 72 points. The total point value was divided by 18, the number of possible concerns, in order to place the respondent on the original four-point analytics concern scale. The higher the individual score, the more potential reservations the respondent institution is assumed to have around the use of data and analytics in higher education, so this variable is suspected of having a negative association with the use of analytics (i.e., the higher the concerns response, the less likely the institution would be to engage in analytical programs).

Preparation of data to include survey question seven in the analysis involved transforming responses from a qualitative, open-ended structure to a quantitative measure for loading into CFA by counting the number of departments, units, and programs identified as considering analytics a major priority.

7. Which departments, units, or programs consider institutional analytics a major
   priority?

The total number of units was included in the factor analysis as an evaluation of the breadth of analytics prioritization, or level of buy-in, across campus.

8. What level of investment has your institution made in institutional analytics?
   ("major investment;" "minor investment;" "little or no investment;" "no
   investment;" "don't know")

The inclusion of survey question eight was intended to assess the extent to which institutions report making investments in their analytics programs. Reponses were coded on a scale of 1 to 4, with the highest number indicating the highest level of investment

and proceeding downward for the other responses ("no investment" being coded as 1).

Responses of "don't know" or missing were coded as zero. The level of investment is

interpreted in this analysis as an indicator of commitment to institutional analytics, as

funded initiatives are often those with the highest levels of importance.

Analysis of the eight survey questions reviewed above, the combination of

principal components analysis of survey questions one and two guiding the findings from

the confirmatory factor analysis of survey questions three through eight, is anticipated to

provide an answer to research question one: the extent to which institutions' motivations

for and use of analytics reflect a response to the demands of academic capitalism.

Research Question Two: How do institutions more highly motivated by the

demands of academic capitalism differ from those less so in the key components of a

successful analytics program (leadership, staffing, data and technology

infrastructure)? As outlined earlier in this section, this research question was analyzed

in a two-step process using confirmatory factor analysis to conduct the second and third

phases of the structural equation model. The first step involved establishing the

indicators of each of Baer and Campbell's (2012) components of successful analytics

programs: leadership, staffing, and data and technology infrastructure. In order to

prepare the measured variables for loading onto each of these three factors, or latent

variables, the following questions were transformed as outlined below.

Analytics Leadership. Three survey questions were prepared for use in the

leadership confirmatory factor.

1. Choose the option that best describes the role that each of the following

   positions plays in institutional analytics at your institution. ("don't have this

position/area;" "not currently involved in analytics in any major way;"

"support/contributor role;" "leadership/sponsor role;" "don't know")

Using the same method as those questions above with multiple answer options for multiple sub-questions, this question was prepared by the creation of a single measure of executive leadership participation, executive leadership was defined as the "C-suite" roles in higher education leadership such as the Chief Academic Officer and Chief Information Officer. A numeric score from one to three was assigned for each of the positions, with "not currently involved in analytics in any major way" receiving a score of one and "leadership/sponsor role" assigned a score of three. Missing data and responses of "don't know" or "don't have this position/area" were coded as zero. Each of these subscores for each leadership position were then totaled and divided by the appropriate number of positions.

The denominator variant was based on whether the institution reported having that role, with any position identified as not in existence removed from the calculation. For example, if all positions existed, the denominator was nine, whereas if an institution does not have a Chief Analytics Officer, the denominator was eight. This method was utilized to recognize that institutional leadership structures will vary for a variety of reasons, and intended to avoid penalizing institutions for those variances.

In addition to its use as a unique variable as described above, the previous survey question was also combined with a second survey question (2, below) on other analytics leaders in order to assess an overall analytics "leadership" measure, distinguishing it from the "participation" measure in the previous question. In order to create this second variable, the total of the number of individual titles identified in the open-ended question

below was added to the number of subquestions in the prior survey question answered with "leadership/sponsor role." The resulting value indicates the number of analytics leadership roles, not just the participation of institutional leaders.

2. What other areas or positions not listed above have leadership roles in institutional analytics at your institution?

3. Does your institution have a dedicated institutional analytics leader?

These data were not modified for inclusion in the factor analysis and remained as originally designed. Inclusion of this question (3) focused on assessing whether there is a specific, dedicated leader for institutional analytics efforts, assuming a higher level of responsibility for the programs than in cases where the responsibility is only a component of other roles with additional duties.

Analytics Staffing. The second latent variable in Baer and Campbell's (2012) addressing components of successful analytics programs, analytics staffing, was created utilizing three questions from the Analytics survey, which were prepared as described below. Responses to the first two questions were not noticeably modified in any way, as their answers are single numeric values; however, the relatively few cases in which data were missing (7 and 32 cases, respectively) were assumed to represent a different response than "zero" and were replaced with the mean of the non-missing records for analysis purposes.

1. How many current staff (FTE) are dedicated to providing analytics services and support at your institution?

2. How many more staff (FTE) would your institution need in order to optimally provide analytics services and support?

In order to give context to the additional number of staff needed to optimally provide analytics services and support, a ratio of the current staff FTE divided by the additional staff FTE was calculated. In this calculation, the actual FTE is less relevant, and the calculation is intended to create a measure of optimized staffing capacity levels instead. For example, if there are 10 staff currently and the respondent believes they would need another 10, which would be double the number the institution has now and indicate their current capacity is not sufficient. Alternatively, if the school has 10 FTE now but only needs two more staff FTE, that indicates that their capacity is closer to the optimum perceived level.

To prepare the next survey question data for inclusion in the staffing factor analysis, numeric values of one to four were assigned based on the institution's answer for each of the 18 staff functions identified in this survey question.

3. Identify which staff functions are needed or need to be augmented to optimally provide analytics services and support at your institution ("not in place, not needed;" "not in place, needed;" "already in place, no more needed;" "already in place, more needed;" "don't know").

A numeric value of one was assigned to the response of "not in place; not needed" and each response on the scale increased by one to the top of the range at four, assigned to "already in place; more needed." Reponses of "don't know" and missing data were coded as zero. These scores were then summed across all functions for a possible total of 110 points. The total point value was divided by 18, the number of total staff functions, and the institution is therefore identified with a single score on the original four-point scale. This scale was assumed to measure optimization of analytics delivery and support

97

across campus, with higher scores indicating a closer match between what analytics skills and functions are needed and the extent to which these needs are being met.

   Data and Technology Infrastructure.   To analyze the infrastructure component, four survey questions were loaded into the factor analysis constructing the infrastructure latent variable. Two of these questions were combined into a single variable, resulting in three actual indicator variables used in the CFE. The four questions and the methods used to prepare them for inclusion, in some cases similar to those used in earlier sections, are described below.

1. Check which option on the scale below best describes how your institution collects, analyzes, stores, and/or uses the types of data below ("we do not collect useable data;" "data are collected but not connected;" "data are systematically collected and connected;" "data are systematically collected and used;" "don't know").

For each of the 20 types of institutional data identified in this survey question above, a numeric value of one to four was assigned based on the institution's response in the order outlined in the question above. A numeric value of zero was assigned to all answers of "don't know" and missing data. A numeric value of one was assigned to the response of "we do not collect useable data" and each response on the scale was increased by one to the top of the range at five, assigned to "data are systematically collected and used." These scores were summed across all functions for a possible total of 80 points. The total point value was then divided by 20, the number of total data types, in order to place the respondent on the original four-point scale; the higher the score, the more systematically the respondent institution collects, connects, and uses their

institutional data overall. Higher scores are assumed to indicate a stronger data and technology foundation at the institution.

The next two survey questions were combined into a single variable for inclusion in the analysis. In order to create a single measure assessing the sophistication of reporting infrastructures for strategic use, the total number of areas respondents indicated using data in was first determined utilizing survey question two.

2. Provide your best estimate of how data are being used in various functional areas of your institution. ("we do not collect useable data;" "data are collected but are never or rarely used;" "we create and use analyses or reports to monitor operations or programs;" "we create and use analyses or reports to make projections for programs or groups;" "we create and use predictive analyses or reports that may trigger proactive responses")

"Using data" in this case was considered to include any of the answers other than "we do not collect useable data," including the collection of data and/or creating analyses and reports for various purposes. For example, if an institution indicated that they use data in eight of the 22 areas listed, they receive a score of eight.

This calculated value was then combined with the number of areas indicated in the survey question 3 (below), resulting in a single, total score indicating the total number of areas between both survey questions. This created variable was intended to assess the extent of the use of data and technology infrastructure beyond the specific applications in earlier questions, with the assumption that the higher the score, the more likely the institution is to be employing a sophisticated data and analytics reporting infrastructure in their strategic planning.

3. Please describe other areas in which your institution is using large data sets to inform or provide insight into strategic initiatives or broad questions.

The fourth measured variable included in the infrastructure factor analysis assessed the extent to which institutions are utilizing analytics tools/systems in provision of their initiatives.

4. What analytics tools, software, or application packages are essential to providing institutional analytics services and solutions at your institution?

This question was transformed into a numeric measure for inclusion in the CFA, representing the total number of tools considered essential to providing their analytics services. The assumption here is that the more tools, software, and application packaged used, the more sophisticated the analytics program as it may represent consideration of varying users, constituents, resources, etc.

All of the survey questions outlined above, once transformed as appropriate, were utilized in the three confirmatory factor analyses related to Baer and Campbell's (2012) components of a successful analytics program. The resulting latent variables for leadership, staffing, and data and technology infrastructure were then considered in regards to their relationship with the institutional response factor created as a result of research question one.

The result of this final analysis can help understand how institutions who are using analytics in ways responsive to the demands of academic capitalism differ in the ways they support and administer their analytics programs, in assessing if they are poised for higher levels of success with the neoliberal motives.

Research Question Three: To what extent are Institutional Research units and staff contributing to the leadership, staffing, and delivery of analytics programs within their institutions? Given the historical evolution of the field and roles of Institutional Research in response to changing higher education demands, it is useful to investigate the extent to which and how Institutional Research units and staff are involved in university analytics initiatives resulting from the changing demands of academic capitalism. As such, analysis of the role of Institutional Research leadership, staffing levels of Institutional Research units, and the Institutional Research unit's level of involvement in analytics delivery on campus was examined as they relate to institutional response to academic capitalism. Each of the four questions included in the analysis for this survey question were submitted for crosstabular analysis, with significance measured by the Pearson Chi-Square test. It is recognized that this analysis is limited to institutions with identified, independent Institutional Research units and/or staff, and may under-estimate their contribution in universities with a more distributed model of Institutional Research work.

1. Does your institution have a dedicated institutional analytics leader?

This question was analyzed by classifying institutions who identified that they did have a dedicated leader and that leader, as listed in the open-ended title variable, represents the Institutional Research unit or function, or a commonly related variant (institutional research, institutional effectiveness, institutional analysis, institutional evaluation). The relationship to the institutional response variable was then assessed regarding the extent to which Institutional Research is the dedicated leader for analytics

initiatives versus other personnel by assigning a value of one to Institutional Research

leadership and zero to non-Institutional Research leadership.

Regardless of whether they are the dedicated leaders of analytics efforts on

campus, in many cases the Director of Institutional Research, often the top ranking

position in the unit, is involved. The following question investigated the extent of the

role of the Director of Institutional Research in institutional analytics.

2. Choose the option that best describes the role that the Director of Institutional

Research.

As outlined earlier, leadership and staff are both important personnel components of any

successful analytics program, and assessment of the number of Institutional Research

staff dedicated to analytics programs at each institution will be assessed using the

following question. The following survey question provided insight into staffing

strength.

3. How many current staff (FTE) are dedicated to providing analytics service

and support at your institution?

Because Institutional Research is identified independent of the other categories, the FTE

associated with that unit was utilized as the measured variable for correlation with the

institutional response factor, and the other units were not considered as part of the

analysis.

Finally, the fourth survey question used in the analysis of the role of Institutional

Research in university analytics programs relates to involvement in the actual delivery of

services. The following question aided in assessing the extent to which Institutional

Research units are fully, partly, or not at all included in those activities. In addition to

assessing the extent of Institutional Research participation, this question provided a better understanding of how many institutions are using an Institutional Research/Information Technology partnership, noted in Chapter 2 as one of the most effective in analytics services delivery and use.

4. How are analytics services and activities delivered at your institution?

Obtaining a more thorough understanding the role of Institutional Research leadership and staff in analytics initiatives was intended to clarify the extent to which the field is continuing its evolutionary pattern of adapting to changing higher education demands, particularly that of the current environment. Because that environment is deeply impacted by new, business-like demands of academic capitalism, it is critical to include that as a component of the Institutional Research analysis. The changing role of institutional researchers, both in their leadership and support of analytics programs, has implications for institutions themselves as well as for the specific staff performing these duties.

This research studied the relationship between the demands of academic capitalism in higher education and institutional decisions to pursue analytics programs, the potential for success of analytics programs at institutions of varied responsiveness to neoliberal pressures as measured by Bear and Campbell's (2012) three components of a successful analytics program, and the extent to which Institutional Research units and staff have a leadership and delivery role in their institutions' analytics initiatives.

Limitations

The most prominent limitations to this research relate to the use of data collected by another entity for a separate purpose. Though the data align closely with the topics under consideration in this study, secondary data analysis of data related to a survey developed and administered by someone else comes with the implicit assumption that questions may not represent the specific framework or approach of this study. Additionally, the transformation of the data into primarily binary, nominal, and ordinal variables for inclusion in the analyses limit the depth of interpretation of findings, thereby potentially losing some nuances of topic that may be meaningful.

Another limitation of this analysis is that certain information that might have been useful to this framework of this study was either not obtained or not shared by the original researchers. For example, the inability to ascertain the unit associated with survey respondents means that this study is unable to separate responses from Information Technology with Institutional Research respondents, which would be particularly useful in the analysis of research question three on the roles of Institutional Research in analytics efforts. Institutional anonymity and limited structural and demographic identifiers (enrollment FTE, Carnegie class, control) limits the ability to link other knowledge about individual institutions to this data. For example, this study cannot explore differences in institutional structure that may be useful for depth of understanding or appropriate use of data. Specifically, this study cannot account for institutions in which the analytics and/or Institutional Research units and staff are not centralized, resulting in a more distributed model that would likely yield potentially significant differences in survey responses.

Finally, the selection of survey questions to include in this analysis, as well as the transformation of the data in preparation, might be done differently by other researchers based on their interpretation of the literature and personal experience and perspectives. In particular, other researches may choose not to perform the level of data reduction done in this study, distilling survey questions with significant depth and breadth down to predominantly ordinal and continuous measurable variables for inclusion in the structural equation model. Additionally, different interpretation of the survey questions as they relate to the theory and literature could result in assigning the variables to different parts of the model than done in this study, thereby yielding different results.

Though there are certainly challenges and limitations to conducting secondary data analysis of information collected for a separate interest, the survey questions themselves are highly aligned with the focus of this study, and the awareness of potential researcher bias can help minimize the extent these impact the results.

Delimitations

This research is delimited to the data from the 2015 EDUCASE survey. Although qualitative data are available from the transcripts to the 2015 EDUCAUSE focus groups noted earlier in this chapter, no IRB approval was obtained as part of the effort and therefore, the qualitative focus group content was not included in this study. Therefore, any specific quotations included in this research are publically available in other EDUCAUSE/ECAR reports and do not represent focus group content not made available through other means.

Additionally, as noted earlier in this chapter, this study is based on knowledge and research primarily related to domestic institutions and does not assume to have a deep

understanding of the higher education environment in other countries. As such, this analysis only examined institutions in the data identified as institutions in the United States (217 out of 245 respondents). These U.S.-based institutions are more likely to be facing the specific environment and pressures noted in Chapter 2. Furthermore, this analysis was limited to not-for-profit institutions only, with the assumption that their general missions likely differ substantially from their for-profit competitors. There was only a single for-profit institution in the original population.

The cumulative effect of these two delimitations on the survey sample, focusing analysis specifically on not-for-profit institutions in the United States, removes a total of 29 respondents from the total data set, resulting in consideration of 216 institutions in this analysis. These choices do not drastically impact the size of the respondent population, and do not present any notable challenges to the methodological choices utilized in analysis.

Assumptions

A primary assumption for this study revolves around EDUCASE, the organization that originally collected this data and the survey topic itself. Because membership in EDUCAUSE is voluntary and requires a fee, participant institutions are assumed to have a higher level of interest in technology and analytics than non-participant institutions to begin with. Because respondents' institutions have already chosen to invest resources in their membership, particularly in a time when resources constriction is a driving factor of decision-making as outlined in Chapter 2, survey respondents are assumed to have a higher basic level of at least investment, if not involvement in analytics use on their campus.

It is also assumed that differences in institutional characteristics may have indirect, potentially immeasurable impacts on survey responses. Characteristics such as size, diversity of funding streams, student and faculty demographics, and core mission differences could impact decisions about and use of analytics in ways that are not evidenced in the data. In addition, should representation of institutional characteristics among the survey respondents not align closely with the general population, the assumption of the findings being fully representative can be challenged. As outlined earlier in tables two and three, non-response bias is evident based on the lower numbers of community colleges and smaller institutions in the responses compared to the census of postsecondary institutions.

Additionally, the most common role of the respondents within their institution, predominantly Chief Information Officers as noted earlier in this chapter, is assumed to limit the extent to which they can speak to the Institutional Research efforts on their campus. Additionally, they are assumed to have a more technology-oriented focus and less involvement in the use of the actual information for decision-making and planning by other executive leadership at their institution.

Finally, though it seems logical that institutions are aware of the demands of the changing higher education environment, the assumption is made for this study that analytics efforts on campus are at least driven in part by the pressures of a neoliberal paradigm and not an independent campus based initiative. Though universities may have multiple reasons for pursuing analytics projects as part of their decision-making culture, this study assumes that the general use of analytics in postsecondary education may not have progressed at this particular time were it not as a response to changing demands and

the need for more efficient, effective, responsive, and proactive planning and decision-making.

Conclusion

This research study is intended to create a better understanding of (1) To what extent do institutional analytics efforts represent a response to the unique demands of academic capitalism?; (2) How does the level of institutional response to those demands impact the potential success of their analytics programs?; and (3) What is the role of Institutional Research in institutional analytics programs within this neoliberal environment? Understanding the answers to these each of questions would allow institutions to examine the current state of their analytics programs on each factor, whether they participated in the survey or not. Using that internal analytics assessment combined with knowledge of their specific institutional environments, universities can then identify strategic opportunities to increase the effectiveness of their analytics programs, better understand the extent to which Institutional Research units and staff can be a resource for these efforts, and respond to rapidly changing demands of academic capitalism and other postsecondary education pressures.

CHAPTER FOUR: ANALYSIS AND FINDINGS

This chapter is dedicated to analysis of the research questions identified in

Chapter 1 as outlined in the Chapter 3 methodology, including the statistical methods of

principal components analysis (PCA), confirmatory factor analysis (CFA), regression and

correlation analyses, and descriptive analyses for individual variables. Guided by each of

the three research questions posed at the beginning of this study, results of the statistical

analyses conducted to evaluate each question and the related findings as they relate to

each of the associated research questions are reviewed and evaluated.

The first section explains the principle components analyses used to assess the

motivations and strategic priorities for the use of data and analytics on campus, and the

extent to which they align with drivers of academic capitalism as indicated by neoliberal

theory and literature. The PCA provides a means to evaluate the extent to which

universities appear to be prioritizing, investing in, and utilizing data and analytics as a

response to the motivations and priorities identified as most critical to respondent

institutions as a whole.

The sections following this first stage of analysis then describe the process and

results for each of the four confirmatory factor analyses (academic capitalism, leadership,

analytics staffing, and data and technology infrastructure), the relationship between

academic capitalism and the three other latent variables created, and the role of

Institutional Research (IR) leadership and staffing as part of these efforts on respondents'

campuses.

Research Question One: To what extent do institutions' motivations for and use of

analytics reflect a response to the demands of academic capitalism?

In an effort to assess the extent to which institutions are utilizing data and

analytics to address pressures related to academic capitalism, analyses of the motivations

for the investment in analytics and the strategic priorities that could most benefit from the

use of analytics were conducted using principal components analysis. As described in

Chapter 3, three different factor analytic methods were attempted in order to reduce the

large amounts of disparate data generated by these questions and distill them into concise

findings that identify the core motivations and priorities for the use of analytics.

Exploratory factor analysis and maximum likelihood analyses both failed to generate

results within 100 iterations, at which point principal components analysis (PCA)

completed successfully and returned valid results.

To conduct the principal components analysis, a varimax rotation method with

Kaiser normalization was utilized for analyses of both the motivations and priorities

variables. The outcomes from the analysis were then used to determine the primary

motivations for institutional investment in analytics and the strategic priorities

respondents believed could most benefit from the use of their analytics programs. The

principal components analysis results are described in detail in the following sections.

Motivations for investing in analytics. Institutions indicated a variety of

primary motivations for investing in analytics on their campuses, many of which reflect a

business-oriented focus, in response to the survey question: "*What are the top 3 factors*

that motivated your institution to invest in institutional analytics?" To prepare these data

for use in principal components analysis of the primary institutional motivations for

investing in analytics, responses to each answer option were recoded into 14 separate

measurable dummy variables indicating whether they were selected by a respondent or

not (see Table 4). These 14 variables were then loaded into PCA to investigate the extent

to which institutional motivations reflected responses to the pressures of academic

capitalism.

Table 4

Primary Institutional Motivations for Investing in Analytics

Institutional Motivations	No. of Institutions
Optimization of Resources	67
Decrease Student Dropout Rate/Improve Retention	59
Demonstrate Higher Ed's Effectiveness/Efficiency to External Audiences	55
Containment/Reduction of Costs	44
Increase Transparency and Sharing/Federation of Data	44
Improve Quality of Administrative Services	43
Understand Demographics and Behaviors of a Changing Student Population	41
Reengineer Business Processes	36
Attract More Students	31
Reduce Time to Degree	21
Revenue Generation	14
Improve Student Course-Level Performance	10
Reach a Different or Broader Segment of Students	7
Improve Faculty Productivity	2

Examining the frequency ranking of primary motivations for investing in their

analytics programs, many motivations related to the corporately oriented, outcomes-

driven drivers of academic capitalism appear in the top half of the list. Five of the top

seven motivations could easily be the goals of a profit-oriented organization, namely:

optimization of resources, demonstrating effectiveness and efficiency to external

audiences, containment and reduction of costs, increasing transparency and sharing of data, and improving the quality of administrative services. The other general area of interest expressed in the identified primary motivations centered on students, including increasing retention and reducing drop outs and understanding the demographics and behaviors of a changing student population. These data do, however, appear to support that on the whole, it is the business and administration interests of universities that are largely driving institutions' decisions to invest in analytics.

Aligning with the findings above, the principal components analysis results on primary motivations for investing in analytics on campus were also generally reflective of reasons for analytics use identified throughout the literature, both in higher education and the business world. Though overall correlations among the variables included in the analysis were generally low, and the Kaiser-Meyer-Olkin measure of sampling adequacy of .568 indicated a mediocre result, Bartlett's Test of Sphericity results of were significant at the .05 level, indicating that the variables are correlated highly enough to make components analysis an appropriate statistical method. A determinant value of .452 showed that there were no concerns about collinearity issues between the variables.

The analysis of institutions' primary motivations for using analytics yielded six components with eigenvalues greater than 1, though independently each explained a relatively low level of variance. Cumulatively, the six components explained just over half (56.3%) of the total variance.

Table 5

Principal Components Analysis Results, Primary Institutional Motivations for Investing in Analytics

	Component					
Motivation	Business Orientation	Student Success	Efficiency	Decentralized Environment	Enrollment Growth	Teaching and Learning
Resources	0.666					
Demographics	-0.649					
Costs	0.617					
DegreeTime		0.762				
Retention		0.516				
Services			0.692			
Business			0.548			
Revenue		-0.493	-0.506			
Productivity				-0.798		
Transparency			0.321	-0.482		
Segment					0.715	
Students					0.676	
Effectiveness						-0.796
Courses	-0.376	0.332				0.504

Using the rotated component matrix (see Table 5) identified coefficients greater than .30 were used to examine groupings and relationships between the variables. The following components were identified as primary motives for the investment in institutional analytics by respondents:

1. *Business orientation*: This component was indicated by the relationship between positive coefficient values for optimization of resources (.666) and containment/reduction of costs (.617), and negative coefficients for understanding changing demographics and behaviors of a changing student population (-.649) and improving course-level student performance (-.376). The prioritization of efficiency and reduced costs over student body makeup and success reflects a corporate-minded intention for the use of analytics at universities, with a focus more on the business functions over people. This could also relate to concerns around variances in college preparation levels for

113

different student populations, and potential of increased support investment needed to ensure success when considering shifting student body makeup.

2. *Student success*: This component was comprised of a combination of positive coefficients for reducing time to degree (.762), decreasing student dropout rate/improving retention (.516), and improving course-level student performance (.332), all of which are regular interests when discussing student success. Additionally, a negative coefficient value for the variable of revenue generation (-.493) supports the focus on student success over a business focus.

3. *Efficiency*: Positive coefficients for improving the quality of administrative services (.692), reengineering business processes (.548), and increasing transparency and data sharing/federation (.321), combined with a negative relationship for generating revenue (-.506) indicate an interest in improving operational functions of the university over financial growth interests, though it is worth noting that it is certainly possible to better an institution's financial state through increased efficiencies and improved business processes. However, revenue growth initiatives such as increasing enrollment, research, or giving, can frequently involve a level of investment in and of themselves and a focus increasing efficiencies over growing revenue may be reflective of institutions being risk-averse in an uncertain economic climate.

4. *Decentralized environment*: Demonstrating a slightly different directional perspective than the other components, the relationship between the negative coefficients for both improving faculty productivity (-.798) and increasing transparency and sharing/federation of data (-.482) could suggest the existence

114

of a highly decentralized campus environment in which people and units are determined to be self-guiding with high levels of autonomy and personal accountability. As such, "monitoring" of activities may not be considered to be an effective or necessary way to engage and support faculty and staff. Another possible interpretation of this perspective is that institutions believe their faculty are sufficiently productive and that information is being shared as needed and appropriate, so there is little concern over forcing methods of accountability using analytics.

5. *Enrollment growth*: This component is based on a positive relationship between both attracting more students (.715) and attempting to reach a different or broader segment of students (.676), both of which indicate an interest in increasing the size of both applicant pools and enrollment levels. Given pressures to serve a more diverse constituency and opportunities for growth in certain populations with traditionally lower college attendance rates such as underrepresented minorities and rural residents, it is logical that the focus on growth would involve targeted expansion of particular demographics.

6. *Teaching and learning*: A positive coefficient for improving student course-level performance (.504) combined with a negative coefficient for demonstrating higher education effectiveness and efficiency to external audiences (-.796) can be interpreted as an indication of an inward focus on teaching and learning over concerns about external constituent concerns. This could reflect the historical academically oriented view of education for the

learning and knowledge creation, an ideal still held by many in the academy,

particularly those resistant to many of the corporatization of higher education.

Examining the results that emerged from the principal components analysis, the themes of academic capitalism and student success as the predominant drivers for institutional investment in analytics identified earlier in this section are further supported. The top two of the six components, explaining a cumulative 20% of variance, were "business orientation" and "student success." Considering both the descriptive and PCA approaches in tandem, it appears that academic capitalism pressures for higher education to function like a business are indeed major motivators for universities' decisions to invest in analytics. However, it is also clear that it is not the only factor, and that student success concerns and interests also contribute to investment decisions.

Strategic priorities that would benefit from analytics. In order to conduct the PCA of the strategic priorities that respondents indicated would benefit from the use of analytics on their campuses, the population was first limited to those who stated there were indeed areas that would benefit. Using theme and keyword analysis, open-ended responses to the following survey question were coded into 18 categories: "*Please specify the strategic priorities at your institution that would benefit from the use of data*." (see Table 6).

Table 6

Institutional Strategic Priorities that Would Benefit from the Use of Data

Strategic Priorities	Number of Institutions
Student Success	76
Strategic Planning	36
Budget and Resource Management	32
Admissions and Enrollment Management	32
Program and Course Planning and Delivery	25
Analytics and Measurement	22
Operations and Process Efficiency	21
Student Diversity	21
Learning Assessment and Outcomes	20
All/Many	18
Student Cost and Debt	15
Space Utilization	14
Enrollment Growth	13
University Outreach, Service, and Engagement	11
Advancement and Fundraising	11
Research Performance and Impact	8
Faculty Recruitment and Quality	8
Understanding External Stakeholder Interests	7

Reflecting similar findings to the principal components analysis for investment motivations, the largest number of institutional responses to the question above were associated primarily with either business or student success-focused efforts. Notably, student success received a much larger number of responses than any other category, roughly double that of the next largest category, strategic planning. Budget and resource management and admissions and enrollment management make up the third and fourth highest priorities institutions identify could benefit from the use of analytics, again reflecting the combination of institutional administration and student-based priorities.

It is worth noting the possibility of "breadth impact" for the top three priorities identified on their appearance at the top of the list. The student success category, which

includes priorities around retention, persistence, time to completion, and graduation rates; early warning systems for struggling students; and career placement and post-graduation outcomes, certainly consists of many areas. Likewise, strategic planning, which includes planning, goals, initiatives, master plan, key performance indicators, quality enhancement plan, and priorities, is also inclusive of a host of components. Even though this is not unique to just these two categories, it is still important to note the potential impact of the large nature of typical university initiatives such as these and the effect that could have on the findings.

Like the motivations PCA, overall correlations among the variables included in the analysis were low and did not clearly indicate any particular associations or expected groupings. The Kaiser-Meyer-Olkin measure of sampling adequacy of .538 indicated a mediocre result, and Bartlett's test results were significant, validating the use of the PCA method. No variable collinearity issues were indicated by the determinant value of .261.

The analysis of institutions' primary motivations for using analytics yielded seven components with eigenvalues greater than 1, with each explaining roughly 7-9% of the variance. Cumulatively, the seven components explained just over half (54.8%) of the total variance.

Table 7

Principal Components Analysis Results, Institutional Strategic Priorities that Would Benefit from Use of Data

			Component				
Priority	Systemic Integration	Public Good	Fiscal Responsibility	Accountability	Business Focus	External Interests	Enrollment Interests
Advancement	0.696						
Assessment	0.598						
Space	0.456						
Diversity		0.755					
Research		0.632					
Planning			0.770				
Analytics			0.546				
Budget			0.526	0.411	0.370		
StudentSuccess				0.734			
ALL/MANY				-0.696			
Faculty					0.728		
Operations					0.649		
Programming	0.368				-0.380		
Growth						0.778	
Stakeholders	0.335					0.518	
Service		0.472				0.492	
StudentCost							0.739
AdmitEnroll							0.678

Using the rotated component matrix (see Table 8) helped identify coefficients greater than .30 to examine groupings and relationships between the variables. The following components were identified as strategic priorities that would benefit from the use of analytics by institutions:

1. *Systemic integration*: This component was indicated by the relationship between positive coefficient values for advancement and fundraising (.696), learning assessment and outcomes (.598), space utilization (.456), program and courses planning and delivery (.368), and understanding external stakeholder interests (.335). The breadth of areas indicated for this component, encompassing everything from revenue generation, to student achievement to awareness of accountability, to the attention of outside audiences suggests a general

acknowledgement of the benefits of using analytics systemically in decision making and planning on campus.

2. *Public good*: This component was indicated by the combination of positive coefficients for interest in student diversity (.755), a focus on engagement and service (.632), and assessing research performance and impact (.472), all of which correspond with positive societal impact and benefits.

3. *Fiscal responsibility*: Positive coefficients for the relationship between strategic planning (.770), general interest in analytics and measurement (.546), and budget and resource management (.526) indicate a general focus on using analytics for responsible fiscal planning and decision-making. This particular component reflects a more business-like mindset for efficiencies in higher education.

4. *Accountability*: Positive coefficients for budget and resource management (.411) and student success (.734), combined with a negative direction for use across all planning efforts (-.696) signals a specific focus honed in on accountability concerns over a more general idea of strategic use across all institutional priorities.

5. *Business focus*: Building on the fiscal responsibility component above, the combination of positive coefficients for budget and resource management (.370), faculty recruitment and quality (.728), and operations and process efficiency (.649) seem to reflect a corporate-like perspective focused around money, human resources, and processes. When evaluated along with the negative coefficient result for the program and course planning and method of delivery (e.g.,

residential vs. online) variable (-.380), this component appears centered on a business mindset more than an academic one.

6. *External interests*: This component is based on a positive relationship between enrollment growth (.778), understanding external stakeholder interests (.518), and institutional outreach, service, and engagement (.492). Additionally, a negative coefficient for space planning and management (-.382) indicates a more externally-focused interest that aligns to some extent with the public good component above.

7. *Enrollment interests*: Positive coefficients for both variables involved in the relationship between understanding the impact of student cost and debt (.739) and admissions and enrollment management (.678) exhibit awareness of the balance between university growth and student cost interests when it comes to university enrollment.

All seven components identified in the PCA yielded similar levels of explanation of variance, ranging from 7.4% to 8.7%. Explaining over half of the total variance, none of the individual components had a noticeably stronger impact than the others. The first component identified, systemic integration, was notable since it implied that many universities saw analytics as benefitting a wide variety of university priorities, anything from fundraising, to learning assessment, to space planning, to understanding external stakeholder interests. Of note, however, was that it included neither the business processes nor student success categories, but rather other areas that did not contain quite as much diversity in content.

The other six components consisted of a mix of priorities, half of which were oriented with pressures related to academic capitalism: fiscal responsibility, accountability, and business focus. Each of these components involved corporately oriented content such as resources and budget, fiscal planning, and operational efficiency and appeared much more cohesive than the systemic integration component.

Unlike the findings on motivations earlier and the frequency distribution of priorities discussed above, only one component appeared to have a student-related identity: enrollment interests. A positive relationship between student cost and debt priorities and admissions and enrollment management, which includes student quality, recruitment, and enrollment management priorities, suggests an interest in keeping cost and debt low for students as an outcome of student success. In particularly, the focus on recruiting quality students combined with interests in keeping costs and debt low could indicate an overall student success focus; helping students progress and graduate in a timely manner.

The results of the principal components analyses for both the motivations for investing in analytics and the strategic priorities that could most benefit from the use of analytics on campus yield support for the assumption that a major driver of institutional use of data and analytics involves responding to pressures of academic capitalism. Though the findings were slightly different between the two, there was consistent evidence of a business mindset in these institutions' responses to both questions, particularly, and unsurprisingly, when it came down to decisions about financial investments in analytics, a business decision at its heart. However, it is also clear that neoliberal demands are not the only driving factor when it comes to institutional

analytics, and that student success also seems to hold high interest when it comes to using analytics in decision making and planning.

Institutional data and analytics prioritization and use. Having established that higher education institutions do appear to view analytics as a valuable tool in responding to many of the demands of academic capitalism through principal components analysis, the next step is to assess the extent to which they are actually prioritizing and using data and analytics on their campuses to do so. To evaluate this, a confirmatory factor analysis (CFA) was conducted to analyze the extent to which institutions appear to be aware of and responding to increasing demands of academic capitalism by employing data and analytics on their campuses.

The original model for analytics as a response to academic capitalism demands (see Figure 3) included six variables selected based on the literature on academic capitalism and analytics theory reviewed in Chapter 2. Employing the Mplus, Version 7 (Muthén & Muthén, 2012) statistical program to conduct confirmatory factor analysis on these six variables, initial results supported a relatively good overall model fit. Examining the methods of assessing fit, most of the original variables were found to be significant to the model (see Table 8, column V.1).

Table 8

Analytics as a Response to Academic Capitalism, Confirmatory Factor Analysis Fit Statistics, Model Runs 1, 2, 3

Fit Statistics	Academic Capitalism, V.1	Academic Capitalism, V.2	Academic Capitalism, V.3
Chi-Square	6.132	3.251	1.889
Degrees of Freedom	9	5	2
Chi-Square (p-value)	0.7267	0.6614	0.3889
RMSEA Estimate	0.000	0.000	0.000
RMSEA Probability <= .05	0.926	0.851	0.561
CFI	1.000	1.000	1.000
TLI	1.032	1.024	1.002
Standardized Estimates (p-value)	AnyBenefit (0.084)	AnyBenefit (0.084)	Concerns (0.010)
	Concerns (0.011)	Concerns (0.010)	UseAnalytics (0.000)
	UseAnalytics (0.000)	UseAnalytics (0.000)	UseData (0.000)
R-Square (p-value)	AnyBenefit (0.388)	AnyBenefit (0.387)	Concerns (0.195)
	Concerns (0.201)	Concerns (0.201)	UseAnalytics (0.000)
	UseAnalytics (0.000)	UseAnalytics (0.000)	UseData (0.000)
	UseData (0.000)	UseData (0.000)	Investment (0.000)
	PriorityUnits (0.936)	Investment (0.000)	
	Investment (0.000)		

An insignificant chi-square value (6.132, p-value = 0.7267) and a RMSEA value of 0.000 for the first model run both indicate that the model appears to be an excellent fit. These results are further supported by a CFI and TLI over one (1.000 and 1.032, respectively). In spite of the overall model fit, however, two variables appeared to be nonsignificant based on their standard estimates' p-values: whether any strategic priorities would benefit from the use of data (AnyBenefit) and the number of units that would consider analytics a priority (PriorityUnits).

That both of these variables were nonsignificant in the model is somewhat surprising, given nearly three-quarters of respondents indicated that institutional analytics were a major priority for some departments, units, or programs or for the institution as a whole. Additionally, 90% of respondents indicated that there were strategic priorities at their institution that could benefit from the use of data. However, it is possible that the high level of agreement on these variables may be the reason for their insignificance, as

124

there is not enough variability to factor into the model. Additionally, a relatively low

number of responses to the PriorityUnits variable could have affected its fit in the model.

Based on these results, the model was run two additional times in attempts to find

a better fit. The second model run (see Table 8, column V.2) entailed first removing the

PriorityUnits variable, which had a notably high R-square p-value at 0.936 in the first

run. This still yielded an insignificant result for the AnyBenefit variable (0.084), and so

the model was run a third time removing both the PriorityUnits and AnyBenefit variables.

Removal of both the PriorityUnits and AnyBenefit variables on the third model

run maintained good model fit with the remaining variables (Concerns, UseAnalytics,

UseData, and Investment). Like the previous two runs, the fit measures continued to

indicate good model fit, and standardized estimates and R-squared results were both

improved (see Table 8, column V.3). An insignificant chi-square value of 1.889 (p-value

= 0.3889) and RMSEA value of 0.000 indicate good model fit, and a CFI result of 1.000

and TLI result of 1.002 also lend credence to verification of the model. Standard

estimates for all variables are significant, with p-values ranging from less than 0.001 to

0.010.

Based on the results of this confirmatory factor analysis on institutional use of

analytics as a response to the demands of academic capitalism, removal of the

PriorityUnits and AnyBenefits variables appears to have greatly improved the model.

The final, accepted results indicate a good model fit overall with four of the initial six

variables included.
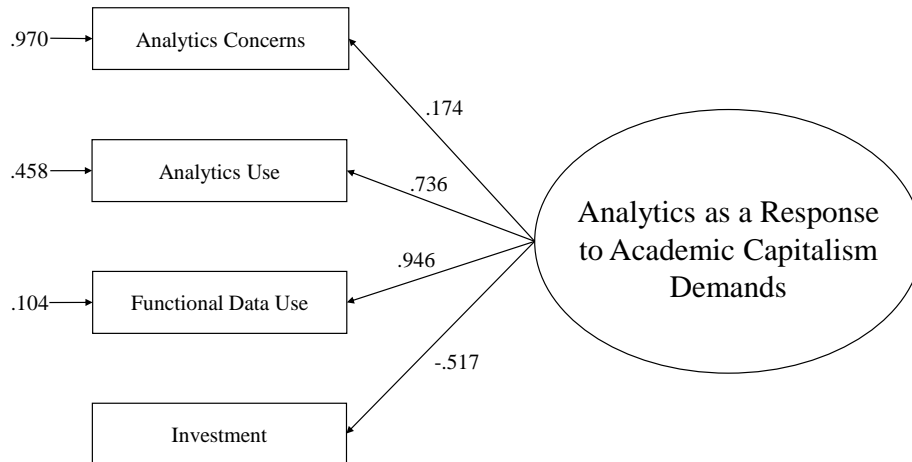
Figure 6. Accepted model, use of analytics as a response to demands of academic capitalism

Unsurprisingly, both the use of data and analytics on campus variables were strongly impacted by the academic capitalism factor in the model, with standardized parameter estimates of .946 and .736, respectively (see Figure 6). Based on the positive direction of both results, it is clear that using analytics to address university strategic initiatives around academic capitalism, as identified in the PCA, influences the level of systemic use of analytics across campus. It is also notable that investment has a negative parameter estimate, opposite the assumed direction of the relationship.

Table 9

Analytics as a Response to the Demands of Academic Capitalism, R-Squared Estimates and Significance

Observed Variable	Estimate	P-Value	Residual Variance
Use Data	0.896	0.000	
Use Analytics	0.542	0.000	
Investment	0.273	0.000	0.727
Concerns	0.030	0.195	

The academic capitalism factor explains a significant amount of the variance of the UseData measurable variable (see Table 9), explaining nearly 90% of how advanced data use is at an institution. Measured on a scale of increasing maturity of data use in decision-making and planning on campus, running from "we do not collect useable data" to "data are collected but are never or rarely used," "we create and use analyses or reports to monitor operations or programs," "we create and use analysis or reports to make projections for programs or groups," through "we create and use analyses or reports to trigger proactive responses," the factor clearly aligns closely and impacts heavily how data are used to inform planning and decision making are at the university.

The academic capitalism construct is also highly related to the actual breath of analytics use in guidance and support of operational and strategic functions at universities. Over half of the variance in institutional placement on the following scale of the use of analytics on campus is explained by this single factor: "no discussion to date," "considered but not pursued," "experimenting/considering," "in planning," "used sparsely," or "used broadly." Like the maturity of data use at respondent institutions discussed earlier, the breadth of use of analytics in functions appears to be highly influenced by the latent variable of analytics as a response to academic capitalism.

Concerns about the use of data and analytics in higher education loaded at a significantly lower level on the academic capitalism factor than the previous two variables, with a parameter estimate of just 0.174 and an error of 0.970. In addition to the relatively low factor loading, the academic capitalism latent variable only explained about 3% of the variance in concerns about the use of data and analytics in higher education, and it was not found to be significant (p-value = .195). Though the overall

127

indication of these results it that the academic capitalism factor is not highly influential over the level of institutional concern about the use of data and analytics in higher education, there may be problems with the assumptions of this variable impacting this interaction.

As indicated in Chapter 3, this survey question was interpreted in this analysis as representing a negative association with the use of analytics in general, so the model assumption was an expected negative relationship with the academic capitalism factor (i.e., the more concerns the respondent had, the less likely their institution would be to engage in analytical initiatives). Though small, the positive influence of the academic capitalism factor on concerns could indicate the variable actually measures something different, such as thoughtfulness around the use of information and understanding about how it could be used in either positive or negative ways. As the intent of the respondents' answers cannot be assumed in this study, it is possible that multiple interpretations of this variable's meaning of this variable could lessen or change its overall impact in the model, and further exploration into the variable detail (see Appendix A) is suggested in the future.

Finally, the level of institutional investment in analytics was the only measureable variable with a negative relationship in the model, having a parameter estimate of 0.517. Indicating the level of investment universities have made in their analytics programs ("little or none," "minor," or "major"), this is an unexpected outcome based on the literature. Additionally, the academic capitalism factor only explained around 27% of the variance in institutional investment in analytics. It is possible that this variable's response options are too minimalistic and nondescript to truly capture the nuances of

spending pattern differences by respondent institutions. Additionally, as Brooks and

Thayer (2015) noted, "institutions are relatively immature with regard to funding

analytics as an investment" (p. 15), and it may simply be too early to discern true impacts

of this variable at this point in time.

Taken in its entirety, this confirmatory factor analysis appeared to confirm the

final, accepted model with four measureable variables loading on the analytics as a

response to academic capitalism as a factor (Concerns, UseAnalytics, UseData, and

Investment). The extent to which advanced use of analytics on campus exists and the

relative maturity of data use across functions appear to be most highly impacted by the

construct of analytics use as a response to pressures of academic capitalism. Having

returned somewhat unexpected results, though still supported by overall model fit,

additional investigation into the concerns about using data and analytics in higher

education and investment in analytics would be warranted.

Further context provided by the principal components analysis, including motives

for investing in analytics programs and the primary strategic priorities that could benefit

from the use of data and analytics, align the CFA results with specific pressures of

academic capitalism, including institutional efficiency and effectiveness, budget and

resource planning and management, and showing evidence of the value of higher

education to external constituents.

In addition to the alignment with academic capitalism demands, however, the

PCA also revealed that the use of data and analytics at institutions serves a secondary

primary purpose related to student success. University interests related to this area

included admissions efforts around finding both high quality and diverse students,

retention and progression of students through their academic lifecycle, graduation rates, and costs of education and student debt concerns. Even though academic capitalism appears to be a primary driver for the use of analytics on campus in administrative and business-oriented ways, there seems to remain a balance of those views with more traditional educational concern for and interest in the success of students.

Research Question Two: How do institutions more highly motivated by the demands of academic capitalism differ from those less so in the key components of a successful analytics program (leadership, staffing, data and technology infrastructure)?

To assess the relationship between institutional response to academic capitalism and Baer and Campbell's (2012) three components of a successful analytics program, three confirmatory factor analyses were first conducted in order to examine the impact of each of these latent variables (analytics leadership, staffing, and infrastructure) on associated endogenous variables as guided by the literature and theory in Chapter 2 (see Chapter 2, Figure 3, and Appendix A). Examining the relationship with three observed variables for each analysis, the three Baer and Campbell (2012) factors were then analyzed against the academic capitalism factor using regression to further evaluate the overall structural equation model (SEM) as a whole (see Chapter 2, Figure 4).

Analytics leadership component analysis. As shown in Figure 6 below, CFA for the leadership component included three measurable variables: the level of executive leadership involvement (re: the C-suite), the number of leaders involved overall, and whether there was dedicated leadership for analytics initiatives on campus. It is important to note that CFA conducted with three or less variables can appear to have

evidence of perfect model verification in many of the fit indicators, as well as a single

degree of freedom, and therefore analysis must focus more on the significance of the

standardized estimates and the R-squared results.

Upon the initial analysis of the leadership component model, many of the model

fit indicators appeared to indicate the appearance of a perfect fit as defined above.

However, further examination of the results revealed that the residual variance of the

leadership variable was negative (-0.333), and as negative variances are not possible, this

indicated a violation of CFA assumptions. Because the numeric value of the variance

was relatively low, variance for the leadership observed variable was set to zero and the

model was rerun. With this method, it was expected that the leadership variable would

over-identify in its R-squared results, which did occur (999.000).

Results of the second analysis of the leadership component showed that the negative

residual variance issue had been resolved with this method, and fit indicators showed

good model fit (see Table 10).

Table 10

Leadership Component, Confirmatory Factor Analysis Fit Statistics

Fit Statistics	Leadership
Chi-Square	0.446
Degrees of Freedom	1
Chi-Square (p-value)	0.5041
RMSEA Estimate	0.000
RMSEA Probability <= .05	0.607
CFI	1.000
TLI	1.019
Standardized Estimates (p-value)	ExecLeader (0.000)
	Leaders (999.000)
	Dedicated (0.008)
R-Square (p-value)	ExecLeader (0.000)
	Leaders (999.000)
	Dedicated (0.185)

The combination of an insignificant chi-square value (p-value = 0.5041) and RMSEA

value of less than 0.001 support the model fit in this form, which is further confirmed by

a CFI and TLI over 1 (1.000 and 1.019, respectively). Examination of the standard

estimates for the variables where the residual variance was not set to zero (executive

leadership and dedicated leadership) shows significance at a less than 0.001 confidence

level, and while the R-squared results are slightly less supportive in regards to the

dedicated leadership variable (p-value = 0.185), taken as a whole, this model for the

leadership component appears to have an acceptable fit.
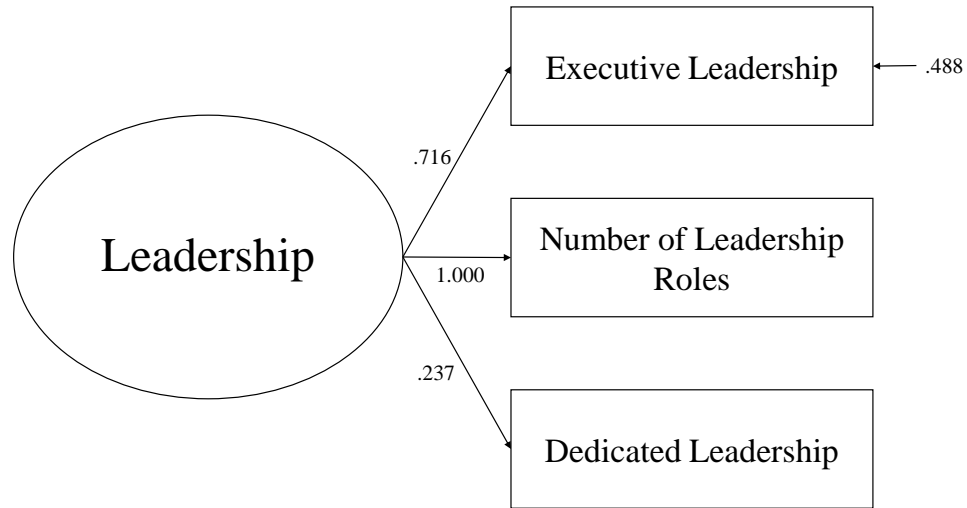
Figure 7. Leadership component of a successful analytics program

Based on the findings of good fit for the leadership model, examination of the standardized parameter estimates indicated that the executive leadership involvement item loaded strongly on the factor at .716 (see Figure 7). This variable indicates the role of executive leadership (i.e., C-Suite) in analytics on their campuses on the following scale: not currently involved in analytics in any major way, support/contributor role, or leadership/sponsor role. Based on the R^2 value of 0.512 (see Table 11), the leadership construct explains just over half of the variance in the executive leadership variable, indicating a strong positive relationship between the two.

Table 11

Leadership Component, R-Squared Estimates and Significance

Observed Variable	Estimate	P-Value	Residual Variance
Number of Leadership Roles	1.000	999.000	
Executive Leadership	0.512	0.000	
Dedicated Leadership	0.056	0.185	0.944

133

Whether an institution had a dedicated leader for analytics initiatives on campus did not load as strongly on the leadership factor with a parameter estimate of only .237. While the good model fit indicated it was appropriate to include this variable in the analysis, the leadership factor explains a very small amount of the variance in the dedicated leadership variable ($R^2 = 0.056$). This finding suggests that the leadership construct is not a good predictor of dedicated analytics leadership on campus, and the model might be improved by the removal of this measurable variable in additional runs.

Finally, because the residual variance of the variable indicating the number of leaders was set to zero after returning a small, negative R^2 value in the initial model run, the variable was subsequently over-identified in the model, as noted earlier in this section. As a result, the factor loading and R^2 values of 1.000 do not allow for better understand of how the leadership construct interacts with this variable. Regardless, the model fit indicates that the number of leaders does have a relationship with the leadership factor and, as such, should remain in the model for further investigation.

Based on the results of this confirmatory factor analysis, the model was found to be a good fit overall, with the level of executive leadership being the most highly predictable measureable variable of the three included in the analysis. Dedicated leadership was less affected by the leadership factor, while further analysis would be beneficial in better understanding the number of leaders interaction within the model.

Analytics staffing component analysis. Investigation of the second component of a successful analytics program (Baer & Campbell, 2012), analytics staffing, involved the analysis of three different variables: current dedicated analytics staff (FTE), the ratio of current staff FTE to additional staff FTE needed, and the extent to which analytics

functions are needed or need to be augmented for optimal analytics services and support.

As noted earlier, analyzing three or fewer measurable variables can yield the appearance

of perfect fit in many of the fit indictors, and that indeed happened in this case (see Table

12). With the Chi-square, degrees of freedom, and RMSEA values all zero, and the CFI

and TLI results both 1.000, it becomes necessary to use the combination of the parameter

estimates and R-squared results to interpret the appropriateness of this model.

Table 12

Analytics Staffing Component, Confirmatory Factor Analysis Fit Statistics

Fit Statistics	Staffing
Chi-Square	0.000
Degrees of Freedom	0
Chi-Square (p-value)	0.0000
RMSEA Estimate	0.000
RMSEA Probability <= .05	0.000
CFI	1.000
TLI	1.000
Standardized Estimates (p-value)	CurrentStaff (0.000)
	StaffRatio (0.000)
	Functions (0.001)
R-Square (p-value)	CurrentStaff (0.010)
	StaffRatio (0.009)
	Functions (0.089)

Results of the standardized parameter estimates and R-squared values all appear

to be statistically significant, most at the .001 level or less (Functions variable is

significant at the .10 level). Relying on these p-values combined with the regression

weights and R-squared values described below to indicate a general fit, these measurable

variables appear to have an acceptable fit in the analytics staffing model. Two of the

three variables included in this model have strong relationships with the staffing factor:

the ratio of current analytics staff to the additional staff needed to optimally provide

analytics services and support and the current FTE of dedicated analytics staff.
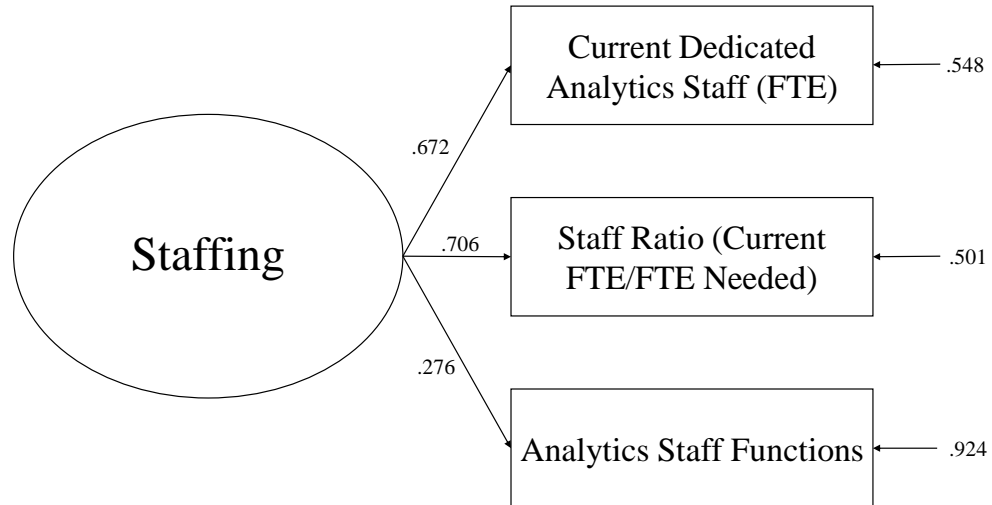
Figure 8. Staffing component of a successful analytics program

The ratio of current staff FTE to needed staff FTE had the highest level of

interaction with the analytics staffing latent variable, with a regression weight of .706

(see Figure 8). In addition to its high regression weight, the staffing construct explained

nearly fifty percent of the variance in the staff ratio variable with an R^2 of 0.499 (see

Table 13). This staff ratio variable, intended to measure the capacity met of analytics

staffing needs on campus, provides an idea of the extent to which analytics programs on

campus are staffed for optimum support and service. The ratio derived from these two

factors yields a higher result for institutions that indicate they are closer to an optimum

service capacity, so the positive direction of this interaction fits model expectations.

Table 13

Analytics Staffing Component, R-Squared Estimates and Significance

Observed Variable	Estimate	P-Value	Residual Variance
Staff Ratio	0.499	0.009	
Current Staff	0.452	0.010	
Needed Functions	0.076	0.089	

With a factor loading of .672, the FTE of current analytics staff has the second strongest relationship with the staffing construct in this model. A significant R^2 of .452 indicates that the staffing latent variable explains roughly 45% of the variance in the current analytics staffing measurable variable. Though this FTE variable appears to be moderately related to the staffing construct, however, it is important to consider the impact of variables outside the model that could impact the meaning of the current staff variable such as institutional size and budget. While analytics staff does appear to be impacted by the staffing factor, additional research is likely warranted to control other variables for possible model improvement.

The third variable in the analytics staffing model is the extent to which additional staff functions (as opposed to staff themselves) are needed or needed to be augmented to optimally provide analytics services and support at your institution. This variable speaks to the optimization of analytics delivery and support performed by staff, such as data analysis, analytics tool training, analytics model requirements gathering and design, and support of technological infrastructure (see Appendix A for all functions). The Functions variable loaded on the analytics staffing factor with a regression weight of .276, less than the other two variables in the model. Additionally, this measured variable had residual error of .924, indicating high likelihood that other variables not included in the model may affect the Function variable. This variable is also much more minimally impacted

by the staffing construct, with that factor explaining only about eight percent of the Function variance. The R^2 of .076 is also not significant below the .01 or .05 levels, though still significant at .10 (p-value = .089). Due to the Function variable's parameter estimate significance, however, there remains reason to keep the variable in the model at this time.

Overall, a relatively good fit for the analytics staffing model was confirmed, with notable impact of the staffing factor on the two variables related to analytics staff FTE in particular. Though the breadth of functions did not load at levels similar to the other two observed variables in the model, it is still important to overall model fit and could be explored further, perhaps using specific functions in place of the aggregated variable as it currently is calculated.

Data and technology infrastructure component analysis. Like the other two confirmatory factor analysis on the leadership and analytics staffing components of Baer and Campbell's (2012) component of a successful analytics program, the CFA model for data and technology infrastructure also involved the analysis of three measured variables: the extent to which institutions collect, store, connect, and use data overall; the number of institutional functions creating, collecting, and using data; and the number of different analytics tools and systems used to support analytics initiatives on campus.

Perhaps the best fit of all three component analyses, the infrastructure confirmatory factor analysis showed a very good fit across all measures (see Table 14), though it is important to remember the impact on the fit indicators with models including three variables or less. As expected with such an impact, the chi-square value and significance and RMSEA estimate and probability were all zero, and the CFI and TLI

were both exactly one. Additionally, the all three of the observed variables included in

the analysis were significant at a 0.00 or greater level, both for the standardized estimates

and R-squared results.

Table 14

Data and Technology Infrastructure Component, Confirmatory Factor Analysis Fit

Statistics

Fit Statistics	Infrastructure
Chi-Square	0.000
Degrees of Freedom	0
Chi-Square (p-value)	0.0000
RMSEA Estimate	0.000
RMSEA Probability <= .05	0.000
CFI	1.000
TLI	1.000
Standardized Estimates (p-value)	CollectData (0.000)
	DataFunctions (0.000)
	Tools (0.000)
R-Square (p-value)	CollectData (0.000)
	DataFunctions (0.000)
	Tools (0.008)

Evaluating the factor loadings of the three measurable variables on the data and

technology infrastructure factor, which evaluates both the technical maintenance of data

systems as well as the creation and maintenance of the data infrastructure itself, all three

variables loaded well on the model (see Figure 9). Two of the variables loaded at .716

(Collect Data and Data Functions/Units), and the third, Analytics Tools, at .451. Despite

the oddity of two different variables loading onto the infrastructure factor with exactly

the same loadings, the data and analysis were both revisited and evaluated for accuracy

and found to be clean and having run successfully. The results appear to be valid.
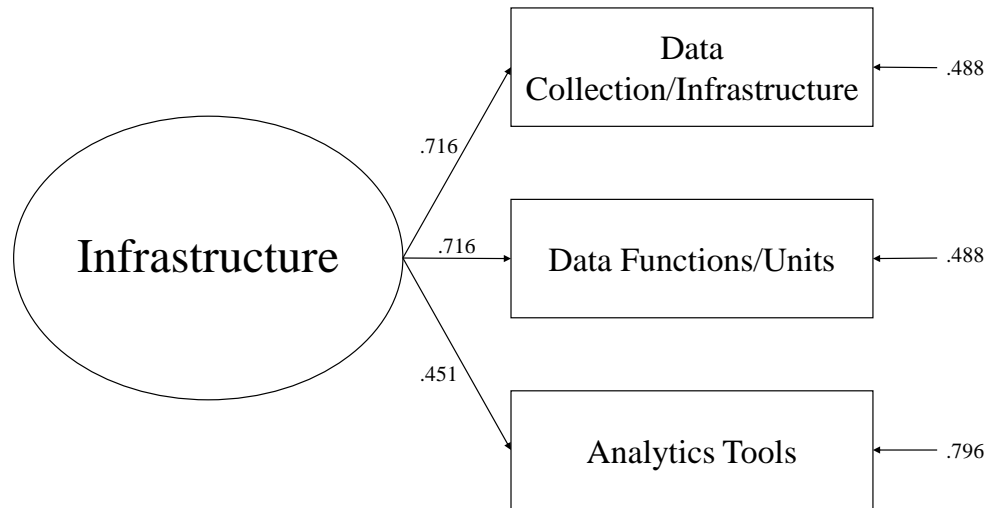
Figure 9. Data and technology infrastructure component of a successful analytics program

The Collect Data variable in this CFA represents maturity of data infrastructures at the university, measuring the extent to which respondent institutions are building and support their data infrastructure through collection, connection, and use of data. Institutions higher on the scale represent those with more mature data infrastructure in place, and therefore a better foundation for analytics and reporting. With its moderate regression weight on the factor loading (.716), the infrastructure construct accounts for just over half of the variance in the Collect Data variable (see Table 15).

Table 15

Data and Technology Infrastructure Component, R-Squared Estimates and Significance

Observed Variable	Estimate	P-Value	Residual Variance
Collect Data	0.512	0.000	
Data Origins	0.512	0.000	
Analytics Tools	0.204	0.008	

The Data Functions/Units measureable variable is another breadth measure, indicating the total number of functions and units on campus that collect and use data and

analyses for either operational or strategic reasons. This variable is intended to ascertain the extent to which data are being collected and used across units and functions at the university. Like Collect Data, the data and technology infrastructure factor explains over half of the variance in Data Functions/Units, which is significant at more than the 0.001 level. Again, these two variables (Data Collection and Data Functions/Units) are based on separate survey questions and represent two different methods of data transformation for inclusion in the CFA, so their similarities are circumstantial. However, it would likely be useful to further examine these two variables and see if there is a relationship between the two that creates such apparent, yet valid in this study, oddity.

Explaining over 20% of the variance, the data and technology infrastructure construct's impact on the Tools variable, representing the number of different data and analytics tools used at the university, is moderate. With a factor loading of .451, the positive relationship between the factor and a variable that could act as a proxy for investment to some extent is not surprising. It is worth noting, however, that there is also an error value of .796, which suggests that further investigation using additional measureable variables might be useful to better understand the relationship between the infrastructure construct and number of data and analytics tools used at an institution.

On the whole, the data and technological infrastructure model appears to be a good fit as proposed. The extent to which institutions collect and manage their data and analysis programs and products on campus is an essential factor in the ability to support a strong analytics program on campus.

Institutional analytics as a response to the demands of academic capitalism and the components of a successful analytics program. The final analysis included in this section examined the relationships among the latent variables confirmed in the earlier confirmatory factor analyses in this chapter, combining all four (analytics as a response to academic capitalism, leadership, staffing, and data and technology infrastructure) into a single model. Examining the relationship between the extent to which institutional responses to academic capitalism differ and the three Bear and Campbell's (2012) components of a successful analytics program can help universities better understand the impact their analytics initiatives may be having on their response to the pressures of higher education today.

Using a combination of confirmatory factor and regression analyses involving the academic capitalism and three component factors, the full model was not found to be a good fit overall based on the fit statistics (see Table 16).

Table 16

Institutional Use of Analytics as a Response to Demands of Academic Capitalism and the Components of a Successful Analytics Program, Confirmatory Factor Analysis Fit Statistics

Fit Statistics	Full Model
Chi-Square	265.581
Degrees of Freedom	60
Chi-Square (p-value)	0.0000
RMSEA Estimate	0.126
RMSEA Probability <= .05	0.000
CFI	0.759
TLI	0.687

After discovering that the leadership variable had a small but negative residual variance indicating that it was violating model assumptions, it was set to zero as in earlier analyses and the model was rerun. A significant chi-square result of 265.581 and RMSEA of 0.126 both indicate that the full model is not a good fit, further supported by CFI and TLI values of 0.759 and 0.687, respectively.

Despite the overall lack of model fit, examining the regression weights for each of the four individual confirmatory factor analyses as they fit within the full model, each still returned significant results for all variables (see Table 17), supporting the findings from their individual assessments earlier in this section. All of the measureable variables except one showed moderate to strong relationships with their factors, with regression weights ranging from 0.465 to 0.875. Only the concerns variable in the academic capitalism CFA had a small standardized estimate at 0.195, though still significant.

Table 17

Institutional Use of Analytics as a Response to Demands of Academic Capitalism and the
Components of a Successful Analytics Program, Standardized Estimates and Significance

	Estimate	P-Value
Academic Capitalism by		
Use Data	0.825	0.000
Use Analytics	0.731	0.000
Investment	-0.645	0.000
Concerns	0.195	0.004
Leadership by		
Number of Leadership Roles	0.875	0.000
Executive Leadership	0.555	0.000
Dedicated Leadership	0.555	0.000
Staffing by		
Needed Functions	0.759	0.000
Current Staff	0.620	0.000
Staff Ratio	0.501	0.000
Infrastructure by		
Collect Data	0.734	0.000
Data Origins	0.690	0.000
Analytics Tools	0.465	0.000
Academic Capitalism on		
Infrastructure	1.006	0.000
Leadership	0.086	0.245
Staffing	-0.070	0.483

Additionally, the size order and direction of the factor loadings within each of the

four analyses remained the same with one exception. The magnitude of regression

weights for the variables included in the staffing CFA changed, with this sub-model now

showing the extent to which additional staff functions (as opposed to staff themselves)

are needed or needed to be augmented to optimally provide analytics services and support

as having the largest interaction with the staffing latent variable at a weight of 0.734. The

current staff FTE measurable variable maintained the second largest standardized

estimate at 0.620, while the ratio of current staff to additional staff, which had the highest regression weight in the independent CFA, fell to last at 0.501.

Having retained the findings of a good model fit for each of the individual confirmatory factor analyses performed earlier, regression analysis of the academic capitalism as a response to the demands of academic capitalism and each of the three components of a successful analytics program was conducted. As seen in Table 17 above, these results varied for each of the three component latent variables.

At first glance, it appears that two out of the three component factors do not have significant relationships with the academic capitalism variable (see Figure 10). Leadership (p-value = 0.245) and Staffing (p-value = 0.483) both appear to have very minimal, insignificant relationships with academic capitalism, with standardized regression coefficients of 0.086 and -0.070, respectively. The relationship between the academic capitalism and infrastructure factors is the only regression returning a significant result, with a p-value of less than .001. However, upon further examination of these results, the regression coefficient suggests a problem with this particular interaction, as coefficients should be between -1 and 1.
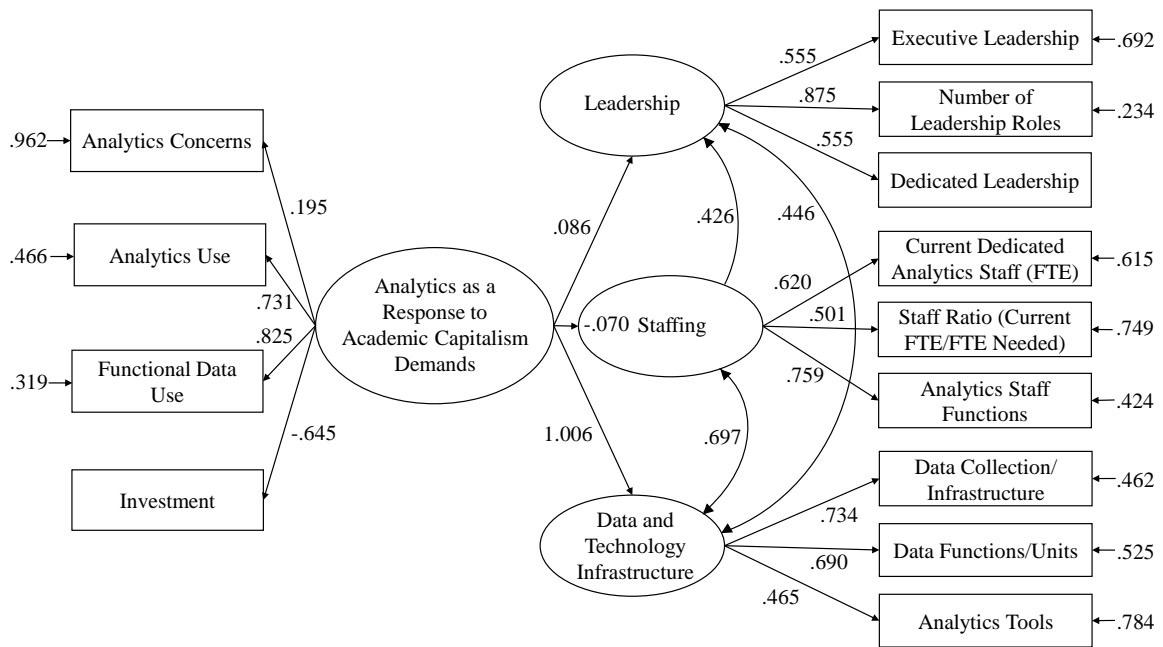
Figure 10. Institutional use of analytics as a response to demands of academic capitalism and the components of a successful analytics program

Because this finding suggests possible collinearity issues, a correlation analysis was conducted to explore further what may be causing this odd result and if it may be contributing to the overall poor model fit. Indeed, a strong and significant correlation was identified between the infrastructure and staffing latent variables (standardized coefficient = 0.658; p-value = less than 0.01). These findings could be the result of a number of possible situations, including that these two latent variables may actually be measuring the same thing, they may be mutually causal, or there may be a factor outside of the model that has not been specified and is influencing both variables.

In an effort to find better model fit despite the appearance of collinearity issues, the full model was extended to incorporate another confirmatory factor analysis based on the three individual component factors (Leadership, Staffing, and Data and Technology Infrastructure) as measurable variables. This new latent variable was then evaluated on its direct relationship with the Academic Capitalism latent variable, as opposed to the

146

analysis earlier, which include the three independent component factors and Academic Capitalism. Neither the confirmatory factor analysis of the three individual components, nor the full model analysis with Components and Academic Capitalism were found to have good model fit. In addition, the apparent collinearity issues between the Staffing and Infrastructure persisted, with a standardized coefficient value of 1.016.

Further, when reviewing the standardized coefficients and R-Squared values for the Staffing and Infrastructure factors as they loaded on the single Component latent variable in this analysis (see Figure 11), both values appeared to have similar relationships with the Components construct. Staffing loaded at 0.811, while Infrastructure loaded at 0.890. Similarly, Staffing explained 66% of the variance in the Component factor, and Infrastructure explained 79%. The similarities between these results continue to support a plausible collinearity issue, and also the possibility that the two factors (Staffing and Infrastructure) are actually together forming a concept separate from Leadership.
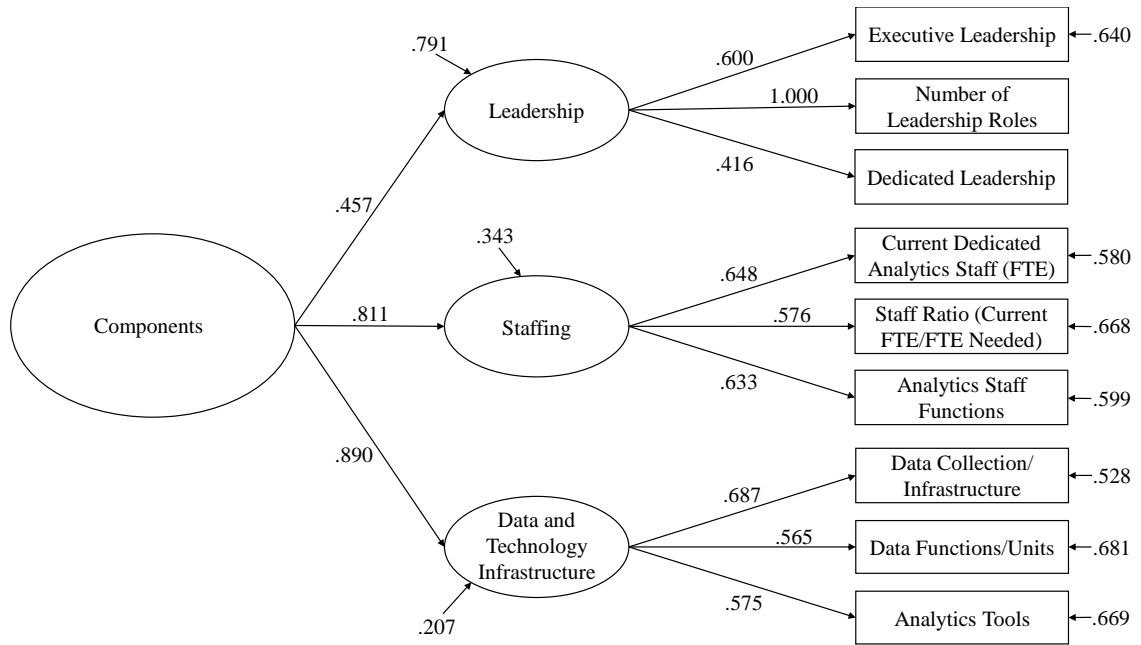
Figure 11. Components of a successful analytics program, multi-level CFA

In order to address this possible relationship between the Staffing and

Infrastructure factors and improve fit of the full model for academic capitalism and the

components of a successful analytics program, confirmatory factor analysis was

performed utilizing these two Baer and Campbell (2012) component factors as

measurable variables. This did not improve fit measures for the full model, despite all

variable loadings appearing to be significant at less than the .001 level. Additionally, the

six original observable variables used in the individual Staffing and Infrastructure CFAs

were examined as a group, at which point the model was not able to compute the standard

errors of the model parameter estimates. Despite each of these efforts to improve the

model fit, the end results remained the same, indicating poor fit for the full analysis

model of the relationship between academic capitalism and the components of a

successful analytics program.

While the overall results of the full model do not appear to be a good fit and are therefore not able to confirm the full structural equation model and answer the associated research question, there is still usefulness in the validity of the individual component results. Though the findings are not able to explore differences between institutions using data and analytics to respond to the demands of academic capitalism at varying levels due to the poor fit of the proposed model, each of the individual CFAs included in this analysis provide useful findings for exploring the state of analytics programs on campuses as they relate to the three components of a successful analytics program.

The Role of Institutional Research in Institutional Analytics

As outlined in Chapter 2, Institutional Research units and staff have a long history of participation in and leadership of data-oriented initiatives in higher education. Throughout the history of the profession, originating at the beginning of the 1700s, the role and duties of Institutional Researchers have been fluid, evolving to meet the changing environment and needs of the higher education climate and culture. In recent years, these changes have been increasingly driven by a more corporately-oriented perspective, driven heavily by factors including increased competition, economic challenges, demographic shifts, external pressures to show value, and increased politicization of higher education. As these shifts have occurred, Institutional Research units have seen increased demand for their services, as well as expansion of their functional role beyond just providing data. Today, increased leadership and support for the use of data and information in decision-making and strategic planning are included in the work of Institutional Research offices.

Research Question Three: To what extent are Institutional Research units and staff contributing to the leadership, staffing, and delivery of analytics programs within their institutions?

Examining the extent to which surveyed institutions reported involvement of their Institutional Research functions in campus analytics efforts, 20% of respondents indicated that an Institutional Research person was dedicated to leadership of such efforts. These Institutional Research leaders most frequently held titles of Director or Dean, and their unit names most frequently included such language as "Institutional Research," "Institutional Effectiveness," "Planning," "Evaluation," "Assessment," "Decision Support," and "Data Analytics." "Institutional Research" and "Institutional Effectiveness" were the two most frequently used terms in the reported titles, with 41 titles including one or both of them.

Over nine in 10 universities indicated that their school has a director of Institutional Research (see Table 18). When asked about the role of their Institutional Research director in analytics at their institution, 96.5% of those schools reported the director is involved in the delivery of analytics, with over half (54%) in a leadership or sponsor role. Another 42.5% reported their Institutional Research director was engaged in a support or contributor role, whereas less than 4% of schools did not have any involvement in institutional analytics by an Institutional Research director.

Table 18

Role of the Director of Institutional Research in Institutional Analytics

Role of IR Director	Freq.	% (total)	% (w/IR Dir.)
Leadership/Sponsor Role	108	50.0%	54.0%
Support/Contributor Role	85	39.4%	42.5%
Not Currently Involved in Any Way	7	3.2%	3.5%
Don't Have IR Position/Area	10	4.6%	-
No Response/Don't Know	6	2.8%	-

When examining the role of Institutional Research Directors by Carnegie classification and control (public or private), the overall trend of high participation in institutional analytics initiatives remains. Respondent institutions report that their Institutional Research Director plays either a support/contributor role or leadership/sponsorship roles in 74%-88% of their schools (see Table 19). Even though some discrepancies appear to exist among some Carnegie classifications, such as the lack of Institutional Research leadership in the sponsor role at public, baccalaureate institutions, it is important to note that small cell sizes can inflate the appearance of variance. Additionally, there may be some impact from non-response bias, particularly for specific Carnegie classifications such as baccalaureate private institutions, of which 17% of the 6 respondents did not answer the question with a valid response. Regardless, Institutional Research leadership clearly has an influential role in their institutional analytics programs at all types of schools.

Table 19

Role of the Director of Institutional Research in Institutional Analytics by Carnegie Classification and Control

Carnegie Classification	No. of Institutions	Missing/Don't Know	Don't Have this IR Position/Area	Not Currently Involved in Analytics in Any Way	Support/ Contributor Role	Leadership/ Sponsor Role
Associates	29	10.3%	6.9%	0.0%	37.9%	44.8%
Baccalaureate, Public	6	16.7%	0.0%	0.0%	83.3%	0.0%
Baccalaureate, Private	43	2.3%	2.3%	7.0%	48.8%	39.5%
Masters, Public	23	4.3%	4.3%	8.7%	43.5%	39.1%
Masters, Private	33	0.0%	12.1%	9.1%	51.5%	27.3%
Doctoral, Public	40	7.5%	0.0%	12.5%	52.5%	27.5%
Doctoral, Private	19	5.3%	0.0%	10.5%	63.2%	21.1%
Other	23	0.0%	17.4%	8.7%	34.8%	39.1%

When exploring the role of the Institutional Research Director in analytics initiatives by institutional size as determined by enrollment FTE, however, there do appear to be some notable differences (see Table 20). The smallest schools appear to have a more advanced role for their directors, with 45% playing a leadership/sponsor role, the highest percentage among all institutional sizes. This could be related to size differences in those schools when it comes to their staffing levels, with possible limited levels of leadership hierarchy placing more influence with directors than they might have at larger institutions with additional leadership roles and levels.

Table 20

Role of the Director of Institutional Research in Institutional Analytics by Full-Time Equivalent Enrollment

Enrollment	No. of Institutions	Missing/Don't Know	Don't Have this IR Position/Area	Not Currently Involved in Analytics in Any Way	Support/ Contributor Role	Leadership/ Sponsor Role
Less than 2,000	40	0.0%	12.5%	7.5%	35.0%	45.0%
2,000-3,999	56	3.6%	5.4%	12.5%	50.0%	28.6%
4,000-7,999	40	12.5%	5.0%	0.0%	42.5%	40.0%
8,000-14,999	32	0.0%	3.1%	6.3%	62.5%	28.1%
15,000+	39	7.7%	0.0%	12.8%	53.8%	25.6%
Missing	9	0.0%	11.1%	0.0%	55.6%	33.3%

Also likely related to institutional staffing size and hierarchical level differences, with the exception of mid-sized (4,000-7,999 FTE), Institutional Research Directors are less likely to be in a leadership/sponsor role as institutional size increases. It is possible that mid-sized institutions may lie outside of this trend because they have more of a balanced student/staff ratio, as their Institutional Research Directors appear to be split fairly evenly between the support/contributor roles and leadership/sponsorship roles. Despite these differences, however, Directors of Institutional Research maintain their high levels of general involvement across all institutional sizes, with at least 79% having a role in institutional analytics initiatives.

As noted in Chapter 2, Institutional Research units are frequently involved, if not responsible for the use of analytics on campus. When asked how analytics services and activities are delivered at their institutions, nearly seven in 10 respondents (68.6%) reported that Institutional Research units or staff were participants in some form, whether alone or with other Information Technology (IT) units or staff (see Table 21). Of those, Institutional Research units and/or staff were solely responsible for the delivery of analytics services at over a quarter (26.9%) of respondent institutions.

Table 21

Delivery of Institutional Analytics Services and Activities

Delivery Method/Unit	Freq.	% (total)
Program Jointly Run by IR and IT	90	41.7%
Program Run by Institutional Research (IR)	58	26.9%
Program Run by Information Technology (IT)	34	15.7%
Program Run by a Dedicated Analytics Center that Includes IR and/or IT	13	6.0%
Don't Know/No Response	13	6.0%
Other Departments or Programs	7	3.2%
Outsource Most or All Analytics Initiatives	1	0.5%
Program Run by a Dedicated Analytics Center Separate from IR and IT	0	0.0%

Information Technology is often the other major player when it comes to institutional analytics, and that bore out in this analysis, as over 15% of respondents shared that their IT units had primary responsibility for analytics delivery. Two out of five (41.7%) reporting institutions used a tandem team of their Institutional Research and Information Technology units and staff to deliver their analytics services and activities on campus. As indicated by the literature reviewed in Chapter 2, this collaboration can be a positive method of delivery of analytic services, with the combination of Institutional Research and Information Technology units and staff being a powerful tandem delivery system for this information (Reinitz, 2015).

Institutional Research units' involvement in the delivery of institutional analytics services and activities on their campuses varies by institution type (see Table 22). Across all Carnegie classifications, analytics are most likely to be delivered jointly by the Institutional Research and Information Technology units and staff, with a third to a half of all institutions in any given classification utilizing this delivery method. The Institutional Research unit and staff are more likely to be solely responsible for running

154

these activities at Associates (35%) and Baccalaureate institutions (33%), than at Masters

or Doctoral institutions (23% and 22%, respectively).   Few schools in any Carnegie

classification are utilizing units or staff outside of Institutional Research and Information

Technology as whole.

Table 22

Delivery of Institutional Analytics Services and Activities by Carnegie Classification

Delivery Method	Associates	Baccalaureate	Masters	Doctoral	Other
Program Run by Institutional Research (IR)	34.5%	32.7%	23.2%	22.0%	26.1%
Program Run by Information Technology (IT)	13.8%	8.2%	14.3%	22.0%	21.7%
Program Jointly Run by IR and IT	48.3%	49.0%	41.1%	33.9%	39.1%
Program Run by a Dedicated Analytics Center that Includes IR and/or IT	0.0%	0.0%	10.7%	11.9%	0.0%
Other Depts/Programs	0.0%	2.0%	3.6%	5.1%	4.3%
Outsource Most or All Analytics Services	0.0%	0.0%	1.8%	0.0%	0.0%
No Method for Delivery	3.4%	8.2%	3.6%	3.4%	8.7%
Not Sure	0.0%	0.0%	1.8%	1.7%	0.0%

Similar to results by Carnegie classification, Institutional Research participation

in the delivery of analytics services and activities varies by institutional size (see Table

23). At institutions with less than 8,000 FTE students, Institutional Research offices and

staff are more likely than their Information Technology colleagues to have sole

responsibility for analytics activities, whereas this trend is reversed at larger institutions

(8,000 FTE or more). As with Carnegie classification, however, the most common

delivery method was a program jointly run by Institutional Research and Information

Technology. Given some of the similar trends between the Carnegie classification and

institutional size results, it is not surprising to find that the two variables do have a weak

positive correlation (correlation coefficient of .325), significant at the .01 level.

Table 23

Delivery of Institutional Analytics Services and Activities by Full-Time Equivalent

Enrollment

Delivery Method	Less than 2,000	2,000-3,999	4,000-7,999	8,000-14,999	15,000+	Missing
Program Run by Institutional Research (IR)	32.5%	28.6%	42.5%	15.6%	15.4%	11.1%
Program Run by Information Technology (IT)	15.0%	14.3%	7.5%	21.9%	23.1%	11.1%
Program Jointly Run by IR and IT	35.0%	35.7%	45.0%	46.9%	41.0%	77.8%
Program Run by a Dedicated Analytics Center that Includes IR and/or IT	0.0%	8.9%	2.5%	9.4%	10.3%	0.0%
Other Depts/Programs	5.0%	3.6%	0.0%	3.1%	5.1%	0.0%
Outsource Most or All Analytics Services	0.0%	0.0%	2.5%	0.0%	0.0%	0.0%
No Method for Delivery	12.5%	7.1%	0.0%	3.1%	2.6%	0.0%
Not Sure	0.0%	1.8%	0.0%	0.0%	2.6%	0.0%

Staffing levels for analytics initiatives on campus vary widely from school to school. Despite the seemingly large number of staff delivering and supporting analytics programs at some institutions (see Table 24), most have a relatively low number of people dedicated to analytics, reporting an average of 5.57 FTE across all university units.

Table 24

Dedicated Full-Time Equivalent Analytics Staff, All Units

Analytics Staff	No. of Institutions
0.0	7
0.1-0.99	3
1.0-1.99	26
2.0-2.99	43
3.0-3.99	25
4.0-4.99	17
5.0-5.99	28
6.0-6.99	15
7.0-7.99	8
8.0-8.99	11
9.0-9.99	5
10.0-14.99	13
15+	15

Institutional Research and Information Technology units frequently house the largest portion of the dedicated FTE on campuses, with an average of around two people in each (Institutional Research average = 2.04, Information Technology average= 2.34). Among respondents, the number of full-time equivalent (FTE) Institutional Research staff ranged from zero to 14 and the number of FTE Information Technology staff anywhere from zero to 38 people (see Table 25). Though the sheer number of analytics staff can help indicate how well an initiative is being supported, it is important to note that other factors such as how institutions are organized, their fiscal health, how Institutional Research versus Information Technology work is defined, and the desired scope of services is likely to dictate the size of the staff in these respective areas.

Table 25

Dedicated Full-Time Equivalent Analytics Staff, Institutional Research and Information Technology

	No. of Institutions	
Analytics Staff	Institutional Research	Information Technology
0.0	39	48
0.1-0.99	17	31
1.0-1.99	60	46
2.0-2.99	39	38
3.0-3.99	26	11
4.0-4.99	16	11
5.0-5.99	5	10
6.0-6.99	5	5
7.0-7.99	0	5
8.0-8.99	4	1
9.0-9.99	2	1
10.0-14.99	3	5
15+	0	4

After examining the extent of its leadership guidance and involvement, delivery methods for analytics services and activities on campus, and levels of staff support, it is clear that Institutional Research has an important and significant role in institutional analytics initiatives and programs on the whole. Even though the extent of those roles vary slightly between schools of varying types and sizes in some cases, the Institutional Research profession as a whole can and does contribute significantly to analytics programs in higher education.

Conclusion

Guided by three research questions and using a multiple analytics methods, the research findings presented in this chapter help to understand better institutional analytics in higher education. The next chapter will review these findings in light of the relevant literature and theory contained in Chapter 2, assessing the extent to which institutional

motivations for and use of analytics reflect a response to the demands of academic capitalism; how institutions are supporting their analytics programs in terms of leadership, staffing, data and technology infrastructure; and the extent to which Institutional Research units and staff contribute to the delivery of analytics at their institutions.

CHAPTER FIVE: DISCUSSION, IMPLICATIONS FOR PRACTICE, AND FURTHER RESEARCH

The higher education sector is currently facing an environment unlike any it has seen before. A unique combination of old and new pressures is pushing institutions to think about themselves differently, including their mission and values, resource management and efficiency, the breadth of their stakeholders, and the nature of their commitment to students. An accountability-driven, politically and economically focused environment is forcing universities to think about themselves in the context of business practices, a perspective not historically held when it comes to education (McGee, 2015; Straumsheim, 2016; B. J. Taylor et al., 2013).

Leaders and policy makers in the modern era of postsecondary education wrestle with many and varied demands that compel them to consider their work in this new corporate paradigm, including accessibility, affordability, accountability, sustainability, and differentiation (McGee, 2015). These factors encourage universities to consider their work with an outcomes-focused business mindset, viewing education as a commodity (McClure & Teitelbaum, 2016; McGee, 2015). Further complicated by pressures associated with declining government funding, increasing college costs, decreasing enrollments, and demographic changes, higher education has also taken on a new level of inter-institutional competition (Baer & Campbell, 2012; Calderon & Mathies, 2013; B. J. Taylor et al., 2013; McGee, 2015; Slaughter & Rhoades, 2004; Stiles, 2012). Higher

education, as a whole, continues to advocate the perception of being a public good, with degrees as products that benefit society, particularly for external constituents such as politicians, businesses, and parents (McClure & Teitelbaum, 2016; McGee, 2015).

The increasing focus on accountability, efficiency, and productivity of institutions has heavily influenced what Slaughter and Rhoades (2004) call "academic capitalism," or a "capitalist knowledge/learning/consumption regime" (p. 37). Slaughter and Rhoades (2004) formally define academic capitalism as "the involvement of colleges and faculty in market-like behaviors" (p. 37). Also sometimes termed "neoliberalism," this phenomenon represents "a vision that sees every sector of society as subject to the logics of commodification, marketization, competition, and cost-benefit analysis" (Apple, 2013, p. 6), including higher education. In this corporatized environment, universities must adopt new corporate mindsets and methods that allow them to respond agilely to these rapidly shifting demands and pressures (McGee, 2015). One way that institutions are doing so is through the business-like use of data and information to inform operational and strategic decision-making and planning efforts (Gumport, 2000; McGee, 2015).

This kind of action-oriented decision-making requires "effective action demands that the multiple choice variables be dimensionalized in ways that clarify their points of intersection and highlight required trade-offs" (McGee, 2015, p. 140). In their 2016 aspirational vision for the field, the Association for Institutional Research (AIR) asserted that:

> the demand for data to inform decisions in postsecondary education is greater than ever before. Colleges and universities have significantly increased capacity to collect and store data about student and institutional performance, yet few

institutions have adequate capacity for converting data into information needed by

decision makers. (Swing & Ross, 2016b, p. 3)

This conversion of data into actionable information provides institutions with an

opportunity to be more corporate-like in their thinking by using analytics to

contextualize, visualize, and communicate information that guides strategic planning and

decision-making on their campuses (Baer & Campbell, 2012; Fisher et al., 2014; West,

2012).

Yanosky and Arroway (2015) define analytics as "the use of data, statistical

analysis, and explanatory and predictive models to gain insight and act on complex

issues" (p. 3). Analytics is often linked to the related concept of "business intelligence,"

or BI, which entails "a set of administrative functions and associated software systems

that support planning and decision making by categorizing, aggregating, analyzing, and

reporting on data resulting from transaction-processing systems" (Lang & Pirani, 2016, p.

4). Regardless of the terminology, Baer and Campbell (2012) proposed that there are

three keys to a successful analytics program:

- leaders who are committed to evidence-based decision making,

- staff who are skilled at data analysis, [and]

- a flexible technology platform that is available to collect, mine, and
  analyze data. (p. 57)

These three components most frequently reside in two units on campus: Institutional

Research (IR) and Information Technology (IT), whose functional roles contribute to

analytics initiatives with a powerful combination of data analysis and technical aptitude

(Bichsel, 2012; Reinitz, 2015).

162

Institutional Research, a profession that has evolved over its long history

beginning in the early 1700s to meet the changing needs of postsecondary education, is

"research conducted within an institution of higher education to provide information

which supports institutional planning, policy formation and decision making" (Saupe,

1990, p. 1). The role and duties of Institutional Research began to take their current form

when the function was "institutionalized" in the 1920s (Saupe, 2005, p. 4), shaped by

significant events from that time through current data higher education. The field

continued to evolve with major changes in higher education driven by events like the end

of World War II, introduction of the G.I. Bill, the Civil Rights movement, the 1944

Surplus Property Act, which granted some decommissioned property under WWII

military use to Universities as research facilities, and baby boomers reaching college age

in the 1940s through the 1960s (Brumbaugh, 1960; Calderon & Mathies, 2013; Lanius et

al., 2000; Lasher, 2011; Pierpont, 1948).

Increased interest and oversight from external entities such as accrediting bodies

and legislative entities, as well as multiple economic recessions in the late 1960s and

early 1970s meant that universities were increasingly under pressure to provide evidence

of efficiency and productivity (Foraker, 2014; Lasher, 2011). In 1965, Title IV of the

Higher Education Act, which established the financial aid systems, required institutions

to submit annual data on such topics as institutional costs, admissions, and enrollment

(Braumbaugh, 1960; Lasher, 2011; Saupe, 2005). Introduction of the Higher Education

General Information Survey (HEGIS), a data collection effort that has since become

today's *Integrated Postsecondary Education Data System (IPEDS)*, formalized the

requirements that universities provide data as evidence of their value, effectiveness, and productivity (Foraker, 2014; Lasher, 2011).

Throughout these changes over time, the institutional area of Institutional Research increased their contributions to the organization as the key providers of information and data for reporting purposes, ensuring institutional compliance but also driving their schools towards a more strategic use of data by leadership. As A. J. Brumbaugh noted in his 1960 work *Research Designed to Improve Institutions of Higher Learning*,

> the key to effective administration is the ability of the President and those who work with him [sic] to ask the right questions and then find the right answers. But the right answers to the right questions…must take into account all the relevant, factual data- the kind of data that only institutional research can provide. (p. 2)

Today, the Institutional Research profession has evolved into a strategically-focused, proactive, action-oriented field ready to contribute to institutional data and analytics initiatives and help their schools respond to the current pressures of postsecondary education, including institutional accountability, shrinking resources, and competition (Calderon & Mathies, 2013; Leimer, 2011; McLaughlin & Howard, 2001; J. Taylor et al., 2013; B. J. Taylor et al., 2013).

Increasing and honing more advanced analytical, data visualization, and communication skills, institutional researchers have seen their work expand in size, complexity, and influence (Leimer, 2012). Higher education and its individual institutions are in need of timely, proactive, "actionable intelligence" (Baer & Campbell, 2012, p. 53) that can be provided by institutional researchers through business-oriented

methods such as the use of data and analytics for informed decision-making and strategic planning. These corporate-like initiatives require new ways of thinking about and supporting the use of such information by leadership and staff, as well as increasingly complex technical infrastructure to be optimized (Baer & Campbell, 2012). With these key components in place, universities can harness the power of an analytics program, to respond to the accountability-driven and outputs-focused pressures of academic capitalism (Slaughter & Rhoades, 2004).

The findings of this research are intended to provide a better understanding of the extent to which institutions are taking advantage of these opportunities to address demands of academic capitalism using analytics, whether they are able to support those efforts through Baer and Campbell's (2012) components of a successful analytics program, and the role of Institutional Research in these initiatives. As such, the results discussed in this chapter are guided by the following research questions:

1. To what extent do institutions' motivations for and use of analytics reflect a response to the demands of academic capitalism?

2. How do institutions more highly motivated by the demands of academic capitalism differ from those less so in the key components of a successful analytics program (leadership, staffing, data and technology infrastructure)?

3. To what extent are Institutional Research units and staff contributing to the leadership, staffing, and delivery of analytics programs within their institutions?

This chapter will explore the results presented in Chapter 4 as they relate to relevant literature and theory, address limitations of the findings, and offer ideas for

application. Finally, recommendations will be made for future research that could further explore the topics of this research and increase understanding and applicability in higher education.

Institutional Analytics as a Response to Demands of Academic Capitalism

As noted throughout this research study, higher education institutions currently face a variety of pressures, both internal and external, which impact a wide variety of constituents and stakeholders. The first research question in this study addressed the extent to which institutions are reacting to the pressures of academic capitalism; specifically, the extent to which colleges and universities are using the business-oriented tools of data and analytics to operationally and strategically address these demands.

Motivations and priorities for the use of institutional analytics. Through the investigation of specific motivations for institutional investment in analytics, and the priorities universities believe would most benefit from their use, the findings of this study confirmed that universities were indeed responding to pressures related to academic capitalism; however, this should not be interpreted as the only reason for their investment and interest. Respondent institutions reasons for investing and using analytics to support strategic priorities tended to fall into one of two general perspectives: (1) institutions functioning like businesses and (2) an underlying commitment to students. These two overarching themes frame a variety of more specific reasons for the use of analytics in higher education discussed in the next section, many reflecting core values and components of academic capitalism, and including financial, stakeholder, and environmental drivers.

Fiscal responsibility. Attention to the financially-oriented motives and priorities

for the use of analytics in higher education centers on some of the central corporate tenets

of academic capitalism, including budget and resource management, cost containment,

and quality versus efficiency of services (Slaughter & Rhoades, 2004). Coupled with the

current financial pressures facing institutions, created in part by declining funding and

increasing costs within an environment in which "public funding is based on indicators

and outputs [and there is] emphasis on performance and performance measurements"

(Calderon & Mathies, 2013, p. 79), this seems somewhat unsurprising, and is supported

by the findings from this research. Respondent institutions identified optimizing

resources, demonstrating higher education's effectiveness and efficiency to external

audiences, and containment and reduction of costs as three of their top four motivations

for investing in analytics. This combination of resource and financial management goals,

with the additional need to respond to external constituent interests, indicates that

financial responsibility is indeed likely to be a reaction in part to these demands related to

measuring performance.

Slaughter and Rhoades (2004), however, identified that current neoliberal

pressures specifically "prioritize potential revenue generation, rather than the unfettered

expansion of knowledge, in policy negotiation and in strategic and academic decision

making" (p. 37), yet institutions in this study tended to approach their financially rooted

interests in analytics from more of an operations-oriented efficiency standpoint. As the

original social construct of capitalism is largely defined by production and profit (Ali,

2006; Levy, 2014), Slaughter and Rhoades's (2004) focus on revenue generation here is

in line with this general theory.

As such, respondents' focus on savings over growth appears less rooted in response to the direct pressures of original capitalism, and more as operationally based sound business decisions. Regardless of the method, whether institutions choose profit or efficiencies as their overall motivation, the findings of this study indicate that institutions are using analytics to respond to an outcomes-focused environment with significant economic challenges for higher education institutions (Baer & Campbell, 2012; Calderon & Mathies, 2013; McGee, 2015; Stiles, 2012).

Further examination of just how institutions in this study are primarily interested in using data and analytics for their common day-to-day goals and activities involved in fiscal operations reflects more of the operational business efficiency standpoint than corporate profit motives. The schools in this study were more likely to utilize data and analytics to guide efforts around budget management and reducing or containing costs, and less likely to express interest in their potential for use with revenue generation goals, advancement and fundraising, or research. This focus on efficiency over production could be a reaction to Baumol and Bowen's theory of "cost disease," which proposes that, at its heart, higher education is a service industry, and as a result there is an accompanying perspective that productivity growth is linked to a decrease in quality (Archibald & Feldman, 2004; Baumol, 1967; Baumol & Bowen, 1966; Kimball, 2014).

This perspective of the service orientation of postsecondary education places real constraints on the extent to which universities can pursue revenue generating efforts and still respond to the external pressures for efficiency and outcomes. For example, increasing enrollment to see revenue gains from additional tuition may be perceived by external constituents as risking quality, as:

adding more students to each class can diminish the benefit for each student,

leading to diminished outcomes and lower graduation rates, [whereas] increasing

the number of courses a professor teaches would reduce research or community

service, both of which are outputs of higher education. (Archibald & Feldman,

2006, pp. 3-4)

Given this theory of cost disease and the environment universities today find themselves

in, particularly from the perspectives of external stakeholders, the findings of this study

may indicate that these institutions are striving to balance the capitalistic pressures for

revenue generation with current efficiency and quality demands.

Another possibility for institutional focus on savings and efficiencies over

financial growth may be linked to limited revenue generation opportunities in higher

education due to the soft nature of the "product" of knowledge, and societal perspectives

that it is still very much a private good benefitting graduates through economic,

occupational, and status increases more than benefitting the public (Marginson, 2004;

McClure & Teitelbaum, 2016; McGee, 2015; Slaughter & Rhoades, 2004; Vilorio, 2015).

Regardless of the reasons, however, respondents' recognition of the value of using data

and analytics to inform activities such as resource optimization, providing quality

services, reengineering business processes, and space utilization and prioritization,

indicated an awareness of the benefit of fiscal management through non-revenue

generating methods common in the corporate world, such as understanding cost-benefit

ratios (Apple, 2013; Slaughter & Rhoades, 2004).

As such, perhaps the fiscally heavy emphasis of "academic capitalism" (Slaughter

& Rhoades, 2004) based in original capitalism literature is too heavily focused on the

aspects of growth and profit, and should instead incorporate more extensively the idea of the balance of production with sensible business practices when considered in the higher education paradigm. Given the constraints for revenue growth and cost balance in higher education noted above, it seems viable that universities should be recognized by stakeholders as much for their smart efficiency and cost savings processes as for actual revenue generation under the academic capitalism perspective.

Based on the findings discussed above, Slaughter and Rhoades' (2004) theory of academic capitalism as it relates to financial pressures could be refined in two ways. The first possibility relates to the differentiation of revenue versus expense methods of cost control and fiscal responsibility in postsecondary education. With the original theory of capitalism largely defined by its profit focus (Ali, 2006; Levy, 2014) and the limited capability of postsecondary education as a service industry to create profit without decreasing quality, we should instead use language of "academic corporatization" instead of "academic capitalism."

Because universities differ in context, mission, values, and how they use data for local decision making, the broader "corporatization" concept allows for an expanded view of these pressures and their appropriate responses within the unique environment and workings of higher education, incorporating such values as cost-benefit balance as an equally acceptable way for institutions to respond to modern demands. Additionally, the idea of "corporatization" may be more appealing to academics than "capitalism," as it is less profit-focused and reflects the possibility of being able to respond to modern neoliberal pressures in ways that still align with traditional higher education values.

The other possibility for lessening the focus on the revenue generation aspect of capitalism is to view the concept on a risk continuum, with gradations of academic capitalism representing institutional responses ranging from a "risk averse" approach of cost savings and efficiency improvement to a "risk is acceptable" approach of profit through activities like increased research portfolios, community partnerships, and innovation in areas such as patent development.

Through a model of cost savings through efficiency and process improvement over revenue generation techniques, institutions in this study did demonstrate overall awareness of business-like fiscal pressures resulting from the "blurring [of] boundaries between the for-profit and not-for-profit sectors" (Rhoades & Slaughter, 2004, p. 37). Given Baumol and Bowen's (1966) theory of cost disease and the implications of limited growth without decreasing quality, we may be well served to approach academic capitalism from a more general corporate operations perspective than from traditional capitalism theory.

Accountability. Respondent institutions also expressed the importance of accountability as a primary driver for their investment in and use of analytics. Reflecting strong awareness of the accountability demands from entities external to postsecondary education such as accrediting bodies and legislators (Calderon & Mathies, 2013; Foraker, 2014; Lasher, 2011), institutions expressed strong interest in using data to demonstrate higher education's effectiveness and efficiency to external audiences, the third most frequent reason they identified for investing in analytics. In a politicized environment "where public funding is based on indicators and outputs,…[having] a heavier emphasis on performance and performance measurements" (Calderon & Mathies, 2013, p. 79), the

171

use of data to show value and progress to stakeholders is a key use of analytics by these schools.

Even though it was not possible from this analysis to determine the extent to which providing evidence of efficiency and accountability to external constituents was a responsive versus proactive effort on the part of the institutions, it is noteworthy that interest in understanding external stakeholder interests was only identified as a analytics priority by seven of the 216 respondents. This could suggest the possibility of a disconnect or miscommunication between executive leadership, who likely experience the brunt of societal and organizational pressures for accountability on a daily basis, and those responsible for the delivery of analytics services on their campuses.

Respondents to the EDUCAUSE survey were predominantly from the Information Technology and, to a lesser extent, Institutional Research fields, the same units that most frequently deliver analytics services on campus (Bichsel, 2012; Reinitz, 2015). If institutional leadership's accountability-focused goals and needs are not clearly communicated to respondents, then it is possible that analytics are underutilized at the institution as result. This could result in the use of data and analytics remaining primarily oriented toward traditionally required data provision efforts such as annual reporting to the Integrated Postsecondary Education Data System (IPEDS), a mandated activity if universities want access to financial aid funding (Foraker, 2014; Lasher, 2011). Because Institutional Research functions grew "out of the mandate for institutions to report statistical information to governments" (Calderon & Mathies, 2013, p. 81), such a disconnect could mean they remain in the mode of reacting to mandatory reporting

demands versus supporting institutional strategic goals, and explain this study's findings of low interest in understanding external stakeholder interests.

Demonstrating efficiency and effectiveness to constituents, whether proactive or responsive in nature, is certainly an activity of corporate nature, aligned with the pressures of academic capitalism (McClure & Teitelbaum, 2016; McGee, 2015). Business entities share similar pressures with their own consumers, as well as to organizational boards and regulation bodies. Investment in institutional analytics to support external accountability demands reflects a corporate orientation to higher education, speaking to a societal view of higher education as a public good and knowledge as a commodity (McClure & Teitelbaum, 2016; McGee, 2015). As a product, stakeholders, particularly those external to the institution, have a vested interest and investment in its workings (McGee, 2015) that require universities to provide evidence of value.

Competition. Much like the corporate world of businesses, institutions in the current higher education environment have faced increasing levels of competition in recent years, for anything from resources to recognition to personnel (Stiles, 2012). One central area of postsecondary education that has seen a significant increase in the level of competition has been student admissions and enrollment, impacted by declining enrollments at degree-granting institutions in recent years (National Center for Education Statistics, 2016). Competition for students has increased drastically due to a variety of factors, such the combination of population and demographic changes and variations in enrollment rates driven by influencing factors such as economic recession (National Center for Education Statistics, 2016).

In response to these challenges, respondent institutions in my study indicated that they are indeed turning to data and analytics to help address some of these admissions and enrollment concerns. This orientation is a smart use of their analytics programs, as "today, it seems, if a college doesn't have someone…who understands concepts such as logistic analysis [and] predictive modeling,…it had better go find someone who does" (Gose, 1999, para. 7). Using data strategically for admissions and enrollment activities, including both growth and composition of their student body, respondents identified attracting more students and reaching a broader segment of students as motivations for their investment in analytics. Additionally, strategic priorities around student diversity are driving investment in analytics at respondents' institutions with a goal of better understanding the demographics and behaviors of changing student populations and reaching a broader segment of students.

This critical use of information in planning and decision-making for today's schools opens up new uses for institutional data, not only for the potential financial returns from larger enrollments, but also as a response to capitalistic pressures around accountability. Accountability was identified as one of the top five drivers in modern higher education (McGee, 2015). When it comes to institutional competition, accessibility is not simply defined by traditional, undergraduate student trends or standard diversity indicators such as race, ethnicity, and gender, but also to serving changing student consumer markets; a view with extremely capitalistic undertones. As Peterson (1999) noted, institutions need to understand:

> various segments of the postsecondary relearning markets for both degree and
> non-degree, nontraditional, and older student consumers; on which postsecondary

institutions and non-postsecondary institutions are offering postsecondary learning experiences for those markets; on the varied strategies and methods for delivering postsecondary learning on and off campus; on the new forms of technology-based delivery,… and on the forms of strategic alliances, joint ventures, and other inter-institutional linkages developed to deliver post-secondary education. (p. 101)

Even though the reported use of analytics in admissions and enrollment planning for strategic growth and diversification of their student body in response to increased competition meets an obvious immediate institutional information need, these kinds of data are also useful to the operational and functional management of universities. For example, understanding the direct impact of tuition dollars on institutional revenue can inform decisions around tuition levels and financial aid needs and approaches (Gose, 1999; Maltz, Murphy, & Hand, 2007), analyzing student body size can help determine space needs for infrastructure like dorms and classrooms (Haughey, 2007), and understanding the academic preparation of new freshmen can inform planning around student needs (Paxton & Perez-Greene, 2001). Since analytics can benefit both operational and strategic decision-making and planning in postsecondary education as described here, it therefore has tremendous potential value across a wide and diverse group of campus stakeholders, from executive leaders to student services staff to facilities management units.

Though competition exists for much more than just students, respondents to the EDUCAUSE survey indicated admissions and enrollment-oriented planning and decisions are the primary competition-related effort driving their investment in and use of

analytics on their campuses. However, both of the components of academic capitalism described above, financial responsibility and accountability, have obvious linkages to competition involving resources and reputation and as such, the interwoven nature of many of these neoliberal demands is clear.

Student success. In addition to the motivations and priorities around the use of analytics discussed above, which clearly reflect a business orientation focused on money, stakeholder interests, and competition, academia's core instructional mission appears to remain an important factor in universities' use of analytics. Student success and outcomes appeared to be areas of interest when it came to respondents' reasons for investing in and using analytics on their campuses. Reflecting retention of the core academic mission of postsecondary education, what Rhoades and Slaughter (2004) called "the unfettered expansion of knowledge" (p. 37), amidst neoliberal pressures to run colleges more like a business suggests that institutions still value students as a key stakeholder, and learning as a purpose while still responding to outcomes-oriented demands like performance-based funding.

Despite this apparent appreciation of student needs and interests, however, the focus on student success and outcomes cannot be identified as a solely student-oriented interest. Recent research suggests that learning outcomes-focused initiatives were less of a driver for the use of analytics in higher education today than those focused on institutional outcomes (Arroway et al., 2016). The findings of this research identified an interesting disconnect between the perceptions and motives of survey respondents as it related to the potential use of analytics to assess learning outcomes. Though respondents indicated there was potential value in using analytics for these kinds of academic efforts,

their institutional motives for investing in analytics were not closely tied to the goal of improving student course-level performance.

As we consider this apparent disconnect, however, it is important to acknowledge that these results may be particularly biased by the makeup of the survey population. Because the respondents were generally Chief Information Officers or other data and analytics staff in Information Technology and Institutional Research units, they likely have little to no active role in curricular and learning-focused efforts on their campuses. As part of the "academic side" of institutions, the perspective of administratively oriented Information Technology and Institutional Research respondents may not fully account for interest in using analytics to support assessment at the university level.

As curriculum and pedagogy interests and efforts still largely remain in the purview of faculty, it is therefore critical to engage them in any conversations and initiatives involving the use of analytics to assess learning outcomes. Because four-year institutions make up the majority of respondents in the survey population, the faculty at these schools are particularly likely to be dictating how curriculum is assessed and how to best support their students. Engaging faculty in conversations and activities involving the adoption of analytics as an academic assessment tool, perhaps as one of many tools to increase the likelihood of buy-in, will be necessary for institutions that desire using analytics for initiatives such as improving course-level performance. One particular approach to getting faculty buy-in may involve appealing to the student-oriented nature of academia, encouraging comfort with measurement of outcomes through focus on the success and wellbeing of the individual student over the success of the organization.

177

Regardless, the evaluation of student success outcomes as a key component of the higher education accountability demands discussed throughout this research, even with much less focus on student learning outcomes, suggests that analytics use in this realm is as much a factor in responding to demands related to academic capitalism, if not more so. Student success measures are at the heart of a number of the metrics universities are regularly evaluated on when it comes to resource decisions, such as retention rates, graduation rates, and student debt (Lahr et al., 2014; Lasher, 2011). Though data and analytics around these measures can assist with institutional decision-making and planning around activities such as "early warning systems" for students before they are at risk of dropping out, they are as much part of institutional performance evidence (Arroway et al., 2016; Baer & Campbell, 2012; U.S. Department of Education, 2016).

In sum, the findings discussed in this section support the idea that the use of analytics to understanding student success outcomes, including learning assessment to a lesser extent, are more indicative of neoliberal pressures from external constituents than academic interests in student learning. As such, the academic capitalism perspective seems to encourage the view that students are "valued not as learners and individuals who will become a part of the fabric of society, but as little economic engines whose knowledge will fuel an economy, and whose tuition becomes essential for institutional economic vitality" (Hursh & Wall, 2011, p. 564).

The gray areas of academic capitalism. The findings from this study appear to indicate that higher education institutions are indeed responding to demands and pressures related to academic capitalism with their data and analytical efforts.

Given the competitive, resource-strapped, accountability-focused environment institutions currently exist in, it is logical that they would respond to these business-like pressures with business intelligence tools and approaches (Baer & Campbell, 2012; Jones, 2015; Lang & Pirani, 2016; McGee, 2015; Stiles, 2012). However, there remain "gray areas" that complicate the interpretation of the findings from this research when it comes to the drivers of academic capitalism discussed above and their relationship with the academic mission of universities.

When it comes to the specific pressures academic capitalist perspectives are placing on postsecondary institutions as discussed above (fiscal responsibility, accountability, competition, and student success), it remains difficult to distinguish each as an independent construct. The four areas of demand are closely interwoven, sharing many of the same data components and analysis techniques when it comes to addressing and supporting them. In particular, accountability and competition have significant overlap with the two other areas of financial responsibility and student success.

For example, as noted earlier, typical student success measures are often used as core accountability metrics in reporting to external constituents, and competition involves student success when weighing the quantity versus quality aspects of an incoming class. Likewise, one can ask if competitive enrollment growth initiatives are related to the ideal of education accessibility, or driven more by the financial implications of additional tuition revenue? The relationships between the four identified areas of academic capitalism are complex, making it challenging to assign specific analytics motives or strategic priorities to one or another.

To explore these complex relationships as postsecondary institutions investigate approaches to the use of analytics on their individual campuses, it may be useful for them to view these four areas of academic capitalism demand on a matrix schema on which they can map their specific institutional demands and goals. Using a visual planning technique as this, supported by the findings of this research and relevant literature, can help universities identify the highest potential returns on investment in employing analytics and target specific areas of maximum impact. It is, at its core, an analytical approach to the effective use of analytics in higher education.

A second "gray area" involved in the study of academic capitalism involves not just the complex relationships between the neoliberal demands themselves, but also the extent to which these capitalistic pressures interface with the traditional mission and values of higher education. When universities are using analytics to evaluate data points such as time to degree or graduation rates, though it may be mandated by accreditation bodies or legislative instruction, are there also potential benefits to be derived by their such as lower student debt after graduation when they complete in a timely manner? (H. Johnson, Mejia, Ezekiel, & Zeiger, 2013).

Similarly, does the use of data to support creation of diverse student and faculty bodies only matter because it shows movement on diversity metrics for accreditors, or because student experiences and success are improved when they feel they are represented in their faculty (K. R. Johnson, 2011)? Universities may find it valuable to conduct outcomes and environmental studies from both administrative and academic perspectives to truly understand the impacts from their use of analytics. It is possible that

institutions may not even be aware of some of the results they are measuring with data if they were not part of the original "question."

The concept of academic capitalism is clearly complex when one considers the interactive nature of its various drivers, complicated even further by the murky relationship with classic academic mission interests. The results of this study provided evidence of four major drivers of academic capitalism demands, fiscal responsibility, accountability, competition, and student success, though the extent to which these are truly "capitalistic" remains somewhat in question. Is the nature of the current higher education environment truly capitalism-oriented, or more driven by corporate-like management activities such as balancing of costs and revenue or responding to consumer and stakeholder demands? Despite this complexity, however, it is difficult to argue that neoliberal pressures are not directly impacting higher education in the current political, economic, and social higher education environment, and that analytics clearly has a role to play in helping institutions respond to these demands that sometimes contradict their core values.

Use of data and analytics as a response to the demands of academic capitalism. The previous section discussed the ways in which institutions are responding to the multiple demands of academic capitalism, including pressures of fiscal responsibility, accountability, competition, and student success. This section now turns to the extent to which these institutions are taking advantage of data and analytics to contribute to strategic planning and decision-making on their campuses. Guided by the literature on the effective use of data and analytics in university planning and initiatives, six measurable variables derived from 2015 EDUCAUSE analytics survey questions

181

were assessed as to their relationship with the concept of effective use of analytics to address the pressures of academic capitalism identified by the respondent institutions. This section reviews the literature and theory, which guided the selection of each of these variables for inclusion in the confirmatory factor analysis, as well as discussion of the findings from this analysis.

Postsecondary institutions today are constantly subjected to the push and pull of rapidly changing demands, which are often created by forces outside of the direct control of universities and to which the must learn to navigate in a flexible and agile manner (Gumport, 2000; McGee, 2015). As a result of this instability, institutional leadership must work to create a shared understanding of the specific pressures which exist within their unique environment, what demands are they are trying to respond to, both inside and outside of their institutions, and exactly what questions they are trying to answer (Bichsel, 2012).

As Bichsel (2012) explained, the most effective use of data and analytics happens when "leaders start with a strategic question before consulting or collecting data, not the other way around" (p. 17). As such, the finding that institutions' are aware of these strategic priorities and understand the benefit from the use of analytics on their campuses is a critical sign that institutions are indeed employing their analytics programs in ways that attempt to respond to the pressures identified earlier.

It is natural, given the perception of the academy by some "as dinosaurs (behind the times) and academic staff as the men in their ivory towers (out of touch with reality)," for individuals on campus, administrative and faculty alike, to be discomforted by the prospect of being asked to change and meet new demands driven by academic capitalism

(Chandler, 2013, p. 250). Concerns around the use of data and analytics in higher

education, particularly when it comes to neoliberal pressures reflecting a consumer-like

focus on universities, abound; and it is these concerns that are often the root of reluctance

to adopt analytics as a positive and useful resource for responding to these changing

demands (Weimer, 2013). As such, the expectation of this research was the higher the

level of general concern about the use of analytics and the more specific concerns

expressed by institutions, the less likely those schools are to embrace the use of analytics

in their strategic planning efforts. Essentially, the findings highlighted how concerns

were seen as having a negative relationship with the institutional use of data and analytics

as a response to the demands of academic capitalism.

As institutions begin to become more comfortable with the idea of using data for

strategic purposes, the development of a business intelligence platform to support data

reporting and analytics can be of great use in and of itself, centralizing extensive amounts

of disparate data from across campus into a single place, and preparing it for ease of

reporting and visualization (Lang & Pirani, 2016; West, 2012). However, the generation,

collection, and consolidation of the data themselves are not an indication that universities

are using analytics to drive decision-making (Jones, 2015; Koch, 2015; Lang & Pirani,

2016). It is the application and use of the knowledge generated through analyzing and

visualizing data that pushes postsecondary institutions towards analytics maturity,

including both breadth and depth of that use across interests and initiatives, and the extent

to which universities are using it in broad, strategic, and proactive ways (Bichsel, 2012;

Gupta et al., 2015; Jones, 2015; Koch, 2015; Reinitz, 2015).

It is, of course, to be expected that different schools are at different places when it comes to maturity and comfort of using data and analytics on their campuses. Institutions in this study fell along a wide spectrum when it came to their reported use of data and analytics, from no use at all to using them broadly to trigger proactive responses to anticipated needs or demands. Using survey data guided by the literature on analytics maturity like that discussed above, this study was able to assess the extent to which respondent institutions differ in breadth of use of analytics, with responses ranging from considering use, to experimenting, to using it either sporadically or broadly across units and functions. Additionally, the maturity of use was assessed, from no use, to operational and monitoring purposes, to more sophisticated analyses of projections to trigger proactive responses to pressures. Using these two variables in this analysis, as well as the raw number of departments, units, or programs that consider institutional analytics a major priority, I examined both the systematic use of data and analytics across campus, and the nature of the approaches to using the information, and how each reflects the level of institutional responsiveness to the academic capitalism drivers discussed earlier.

Finally, how institutions choose to spend their money in response "market pressures" of various kinds, including interests around areas like academic quality, research productivity, or cost and student debt, can be an indication of what strategic goals and interests a school prioritizes at any time (Jacob, McCall, & Stange, 2013, p. 4). As recently as 2016, Brooks and Thayer noted that "institutions are [still] relatively immature with regard to funding analytics as an investment, investing in analytics training, and funding at levels sufficient to meet institutional needs" (p. 15). Based on this assertion, this study assumed that the level of investment in institutional analytics at

schools, in combination with the other elements discussed above, seemed a reasonable indicator of the extent to which analytics are being used to respond to pressures of the modern higher education.

Using confirmatory factor analysis to assess the effect of the strategic use of analytics in response to neoliberal pressures on each of the variables discussed above, this study assessed the fit of the proposed model (see Chapter 3, Figure 3) three times in total, with results showing excellent fit in all three runs. Despite this finding, however, the additional model improvement was pursued based on findings related to the lack of significance of some measureable variables. Most surprisingly, the institutional understanding that data would benefit strategic priorities at their institutions, as well as the number of units that would consider analytics a priority were both found to have insignificant relationships with the strategic use of analytics factor.

This lack of significance may be due to the high level of agreement of responses to these two survey questions, as approximately 75% of respondents indicated analytics were a major priority for some units, whereas 90% reported that there were definitely strategic priorities that could benefit from the use of data. Because the use of confirmatory factor analysis assumes variability for each endogenous measure, the results may not be representative of unimportance of these factors in institutional use of analytics, but more a reflection of consistency in the respondent institutions' responses.

Upon removal of these two variables from the model, yielding a new proposed model with four measurable variables, the model retained the excellent fit found earlier. Based on the literature around the breadth and complexity of data and application of analytics as a key factor in the strategic use of institutional analytics discussed earlier in

185

this section, it is logical that these two measurable variables were strongly affected by the construct of strategic use of analytics as a response to the demands of academic capitalism.

When it came to how data are being used across functional areas of the respondent institutions, the positive direction of the direct relationship indicated that as universities increase their strategic use of analytics, they were then more likely to be collecting and using data to create increasingly complex and proactive responses to the demands of academic capitalism. In fact, strategic use of analytics in response to neoliberal pressures explained nearly 90% of the variance in the nature of institutional use of data on respondent campuses. Similarly, as the strategic use of analytics factor increased, it was also likely to have a positive, direct effect on the breadth of analytics use across areas and functions of the university, explaining over half of the variance in that measurable variable. Both of these findings are highly consistent with the literature on the topic reviewed earlier, which informed the selection of these variables for inclusion in the model.

When it came to the impact of strategic use of analytics in response to the demands of academic capitalism and the level of concern institutions expressed about the use of data or analytics in higher education, the findings were in the opposite direction of what was expected based on the literature. Specifically, the proposed direction of the relationship between these variables was expected to be negative, with higher values for the strategic use of analytics construct reflecting lower levels of concern based on the scale of minor, moderate, and major concern. However, the results of this study instead

found just the opposite; a direct, positive impact of the use of analytics factor on concerns about the use of data and analytics in higher education.

Despite this interesting and unexpected finding, the nature of the relationship was found to be relatively minimal overall, as the use of analytics factor explained only 3% of the variance in concerns. As such, it is possible that the amount of concern about the use of data and analytics in higher education is not a good fit in this model, in spite of overall model fit, or that there may be a faulty assumption made in this study about the expected relationship between the factor and measureable variable. For example, it may be possible that the level of concern is actually indicative of awareness of the arguments against using data to measure higher education "outputs," and as such, institutions who are using analytics to respond to neoliberal pressures are therefore more prepared to respond to potential pushback from campus constituents.

Finally, this analysis yielded a second surprising finding, one which contradicted the literature to date as well on the level of investment as an indicator of institutional priorities. Based on that literature, the strategic use of analytics construct was expected to have a positive relationship with the level of investment in institutional analytics, indicating that the more likely institutions were to be using data to attend to neoliberal pressures, the more likely they then were to invest in their analytics programs. Despite what appeared to be a fairly simple relationship, the strategic analytics use factor was instead found to have a negative effect on investment, and a moderate one at that.

One notable point in the literature may contain a possible explanation for this finding. Brooks and Thayer (2016) shared that the level of investment in analytics in higher education as an investment is still relatively immature, and this practice may

187

indicate that it is simply too early to assign this factor as a meaningful variable in the model. This outcome is further supported by the relatively low number of respondents, less than one in five, who indicated that their institutions have made a major investment in analytics at this point in time. It is also possible that the financial constraints on postsecondary institutions and the neoliberal demands for fiscal responsibility discussed earlier are impacting this relationship, as schools may be interested in using analytics, but not yet comfortable with assigning priority funding to the efforts. Though it certainly bears watching as the use of analytics matures in higher education in general, investment at this time does not seem to be a particularly useful indicator of institutional interest in analytics.

The results from the analyses discussed in this study so far, first on the demands of academic capitalism that respondent institutions are facing, then on the extent to which they are using analytics to respond to those pressures, suggest that the two factors are indeed related. The construct of the extent of use of data and analytics in institutions appears to be most exhibited in the breadth of use across units and functions, as well as the complexity and maturity of data analyses and applications. As such, universities who exhibit higher levels of response to academic capitalism demands are likely to be using analytics in more ways, more areas, and with more of a strategic focus in their planning and decision making. Further research may be warranted on the nature of concerns about the use of data in higher education and the level of investment in analytics programs in future studies.

Key Components of a Successful Institutional Analytics Program

As higher education institutions choose to invest in and prioritize analytics programs as a means to meet the changing demands they face, particularly as they are already functioning within a resource-stressed postsecondary environment, it is critical for them to understand the varying ways in which they can approach their analytics initiatives for maximum success and impact. As noted throughout this study, Baer and Campbell (2012) proposed three overall characteristics of a successful "analytics program":

- leaders who are committed to evidence-based decision making,

- staff who are skilled at data analysis, [and]

- a flexible technology platform that is available to collect, mine, and analyze data. (p. 57)

This study considered each of these characteristics as a factor or component that can influence the impact of their analytics initiatives, and confirmatory factor analyses was used to analyze variables associated with these larger concepts based on the literature. The results of each of these three analyses are discussed in the following sections.

Analytics leadership. The leadership factor in this analysis is based on Baer and Campbell's (2012) assumption that "leaders who are committed to evidence-based decision making" are critical to having a successful institutional analytics program (p. 57). This leadership construct was conceptualized in three ways: level of leadership in the institution, leadership with a dedicated role in institutional analytics programs, and

the overall breadth of involvement as measured by the number of leaders involved in the use of analytics in decision-making and planning on their campuses.

Executive leaders (the "C-suite") are ultimately responsible for driving the direction of their institutions, including assessment of the current needs and demands and assessment of the strengths and weaknesses of their schools. Executive leadership asks the strategic questions that drive the use of analytics on their campuses, and are responsible for leading the type of culture change frequently associated with the use of data and analytics in higher education (Bichsel, 2012; Reinitz, 2015). As such, the executive leaders can be some of the most influential participants in the use of analytics to drive planning and decision-making (Bichsel, 2012). They are not merely an end-user, but can actively champion the use of data and analytics on their campuses, set an example on how to do so effectively, and provide evidence of the benefits of an analytical culture (Baer & Campbell, 2012; Reinitz, 2015; Yanosky & Arroway, 2015).

In addition to the importance of executive leadership, however, it is also critical to have breadth of leadership involvement across the institution to maximize and optimize analytics initiatives (Bichsel, 2012; Yanosky & Arroway, 2015). Successful institutional analytics programs require collaboration among leaders across the campus and in a variety of positions to drive both the operational and strategic facets of these initiatives, all the way from conceptualization to implementation to application (Reinitz, 2015; Yanosky & Arroway, 2015).

Finally, regardless of the level and amount of leadership involved in institutional analytics programs, it is important to have dedicated leadership with clear responsibility for guiding any program to success. The psychology theory of "diffusion of

190

responsibility" purports that "the presence of others changes the behavior [sic] of the individual by making them feel less responsible for the consequences of their action" (Beyer, Sidarus, Bonicalzi, & Haggard, 2017, p. 138). Dedicated leadership turns responsibility into accountability, and leadership into a leader (Wick, 2014). Without accountability, initiatives such as analytics programs can easily fall prey to the old adage of when everyone is responsible, no one is responsible (Wick, 2015).

Guided by the literature and theory reviewed above, survey questions from the 2015 EDUCAUSE analytics survey determined to represent the three aspects of leadership (Appendix A) were used as measurable variables in a confirmatory factor analysis to assess the impact of Baer and Campbell's (2012) leadership construct on each. The results yielded a good model fit with varying levels of impact between the three endogenous variables.

Of the three variables related to the leadership construct, executive leadership was found to have a strong, direct positive relationship, with the leadership construct explaining over half of the variance. This finding suggests that respondent institutions with high levels of the leadership factor are more likely to have executive leadership engaged in their analytics programs, with the positive direction indicating that the executive leadership is more likely to be in a leadership or sponsor role, as opposed to just supporting role or not at all involved.

While the model fit indicated that dedicated leadership was appropriate for inclusion, the leadership factor had much less influence on the dedicated leadership measureable variable than executive leadership. Just over a third of respondent institutions identified having a dedicated analytics leader on their campus, but the

leadership factor explained only about 6% of the variance in this measured variable. This finding suggests that even though it appears appropriate to include the dedicated leadership endogenous variable in the overall model as defined in this study, it could be useful to examine a model that omits it to better understand the low level of impact by the leadership construct.

Unfortunately, this study is unable to assess the exact nature of the relationship between the leadership factor and the number of leaders in institutional analytics efforts at respondent schools due to the over-identification of the number of leaders variable in the model. That said, the good model fit still indicates that Baer and Campbell's (2012) leadership construct does have a direct, positive effect on the number of leaders in analytics, but these results cannot be interpreted as reporting on the strength or nature of the impact.

The results of this study, guided by literature and theory on analytics and leadership as reviewed earlier in this section, confirm the proposed leadership model loading three measurable variables on the leadership latent variable: level of leadership in the institution, dedicated leadership, and the overall breadth of involvement as measured by the number of leaders involved in the use of analytics in decision-making and planning on their campuses. Baer and Campbell's (2012) leadership component of a successful analytics program has a notable effect on the extent and nature of executive leadership in analytics initiatives, suggesting that programs with higher levels of "leadership" are more likely to benefit from the influence of their executive leadership as advocates and champions of the use of data and analytics in institutional decision making and planning (Baer & Campbell, 2012; Bichsel, 2012; Reinitz, 2015; Yanosky &

192

Arroway, 2015). Dedicated leadership was far less impacted by the leadership construct, and it was unable to ascertain the exact nature of the relationship between the construct and the number of leaders in analytics programs, but the overall model fit confirmed that, based on the literature, these two variables are affected by Baer and Campbell's (2012) leadership construct in some manner. In sum, the findings of this study confirm the literature in indicating that leadership is indeed an important component in successful analytics programs, particularly "C-suite" leadership and championing.

Analytics staffing. Baer and Campbell's (2012) second component for a successful analytics program, "staff who are skilled at data analysis," was also modeled using confirmatory factor analysis. The CFA included three measureable variables based on the EDUCAUSE survey questions and were selected with guidance of related literature, namely: the current level of staff dedicated to analytics, as measured by FTE; the ratio of current staff to additional staff that institutions believe they still need for optimal delivery of analytics services, also measured by FTE; and the extent to which the analytics functions these analytics staff perform are needed or need to be augmented for optimized delivery of analytics services on campus (p. 57). For the purposes of this study and based on related literature on analytics-oriented skills, Baer and Campbell's (2012) original staffing construct was broadened in the model, extending the concept from its limited focus on analysis skills to include a more holistic set of skills necessary for analytics efforts based on other literature on analytics staffing and skills.

At the EDUCAUSE/NACUBO 2015 Administrative IT Summit, Jack Phillips, CEO of the International Institute for Analytics "cautioned against underestimating the value of talent to developing a successful analytics initiative and to fostering the cultural

change it requires, [and] suggested that the ideal skills set is a combination of quantitative methods training, technology understanding, and communication" (as cited in Reinitz, 2015, p. 10). As such, this study envisioned technological skills for collection and maintenance of data holdings and communication and interpersonal skills for visualizing and translating data into knowledge as additional required skills of analytics staff in any institutional effort (Fisher et al., 2014; Kirby & Floyd, 2016; Reinitz, 2015; Yanosky & Arroway, 2015). The selection of survey questions to represent these staffing endogenous variables in the model was informed by this more inclusive set of skills analytics staff bring to the table.

Analytics staff and the skills they bring to interpreting data are critical to the support of any institutional data-driven initiative, and to some extent are considered even more important than the analytics tools or technology themselves (Reinitz, 2015). A survey of Institutional Research offices conducted by the Association for Institutional Research (AIR) in 2015 revealed that even though Institutional Research units and staff frequently have a significant role in their university's analytics efforts, their staffing levels are usually small, averaging about three staff, one of which leads the unit (Bichsel, 2012; Reinitz, 2015; Swing et al., 2016). As their analytics responsibilities have expanded, staffing levels have not growth to account for the changing expectations, and "many [analytics] participants [are] overwhelmed at the idea of beginning an analytics program given their current workloads" (Bichsel, 2012, p.17). It is clear that with the increase in analytics program support as a duty added onto typical Institutional Research duties, or those of Information Technology staff, having the proper number of staff is crucial.

Additionally, understanding the extent to which the current staff can or cannot

meet the capacity for analytics support being asked of them is important so staffing can

be augmented as needed to perform the expected duties at the expected level.

Respondents to the EDUCAUSE survey indicated that in order to meet their analytics

staffing needs, some departments would need to as much as double the number of staff

from current levels (Yanoksy & Arroway, 2015). Because actual number of staff

certainly varies by institution, the idea of appropriate capacity for supporting their

analytics programs effectively was accounted for in the Baer and Campbell's (2012)

staffing model by including an endogenous variable calculated as the ratio of current

analytics staff to needed analytics staff ratio for optimal delivery of services.

As noted at the beginning of this section, the skills and knowledge analytics staff

need in order to perform the diverse roles involved in delivery of institutional analytics

efforts go well beyond data analysis, and as such, the staffing construct as a whole was

expanded to include technical and communication-related skills in addition to analysis

(Baer & Campbell, 2012; Kirby & Floyd, 2016). The diverse set of skills involved in

analytics delivery means that it is nearly impossible to find a single individual who

possesses the full breadth of data analytic abilities necessary to meet institutional needs

(Baer & Campbell, 2012; Kirby & Floyd, 2016). Appropriate staffing of analytics

programs at universities, therefore, often requires a combination of staff with a variety

and range of skills, perhaps located in different units and roles across campus (Baer &

Campbell, 2012; Kirby & Floyd, 2016; Yanosky & Arroway, 2015). Because of the

diverse nature of skills needed and the many functions analytics staff perform, it is

important to assess not just the number of staff involved in analytics programs, but also

the extent to which they can appropriately perform the breadth of roles needed to best understand the impact of Baer and Campbell's (2012) staffing construct.

Informed by the literature above, three measureable variables from the 2015 EDUCAUSE survey (Appendix A) were included in a confirmatory factor analysis to assess their relationship with the now expanded staffing factor proposed by Baer and Campbell (2012). Initial results from this analysis showed good model fit overall, with two of the three variables loading strongly on the staffing construct. In the model proposed in this study, the staffing factor had the strongest effect on the analytics capacity variable, with fully half of the variance in this measurable variable explained by the staffing factor. The positive direction of the interaction indicates that the stronger the staffing construct, the more likely universities are to be at the optimum service capacity for the delivery of analytics on campus.

Also supporting the strong influence of the staffing construct, the actual number of FTE staff involved in institutional analytics programs is directly and positively affected by the factor. Nearly half of the variance in the number of analytics staff is explained by the construct, indicating that any growth in the level of Baer and Campbell's (2012) staffing component of a successful analytics program should be accompanied by growth in the number of analytics staff FTE at the institution.

The final measurable variable included in the staffing model, essentially the optimization of analytics delivery and support had a noticeably smaller interaction with the staffing factor as compared to the two other endogenous variables included in this model. The Baer and Campbell (2012) staffing construct had a positive, direct effect on the functions variable, which indicated the extent to which needed functions were already

196

in place and whether more were still needed. Even though this measurable variable did fit nicely in the model, it is less relevant as this staffing factor only explains about 8% of its variance. Additionally, a high level of residual error on the functions variable indicated that there are potentially additional variables outside of the model that are interfering in its direct relationship with the staffing construct. Further research may find it valuable to investigate other potential variables that could be involved in this model, despite the good model fit found in this study.

This study assessed the construct of staff with the necessary skills for supporting a successful analytics program, which included an expanded set of expectations for these staff as compared to Baer and Campbell's (2012) more limited construct. The results revealed that the overall model, which was proposed based on analytics staff and the role of these individuals outlined in the literature described earlier in this section, was a good fit and that two of the three measurable variables had a strong relationship with the staffing factor. Baer and Campbell's (2012) staffing construct has a positive influence on the actual staffing level of institutional analytics programs, as well as the extent to which those staff are able to meet the capacity needed at their schools.

Even though the model did include assessment of the staffing factor's impact on the extended view of necessary skills and functions for analytics staff, unfortunately, this model did not clearly confirm this relationship. In addition to the low level of impact the staffing construct had on the functions variable, there was also the suggestion that influence from variables outside of the proposed model could be complicating the apparent direct relationship, and as such, further research on additional staffing variables should be pursued to attempt model improvement.

Data and technology infrastructure. The final confirmatory factor analysis conducted in this section of the study analyzed the impact "a flexible technology platform that is available to collect, mine, and analyze data" had on variables measuring specific data and technology infrastructure components (Baer & Campbell, 2012, p. 57). Three observable variables for inclusion in the analysis were created from the 2015 EDUCAUSE survey data, with their selection informed by the literature. These variables included the extent to which institutions collect, store, connect, and use data itself; the breadth and complexity of how those data are used to create analyses or reports to inform decision making and planning; and the number of analytics tools and programs used to support the analytics initiatives on campus. The use of the term "infrastructure" in this study represented the whole of the support system for analytics at the institution, including integration of data into systems such as data warehouses in ways that support ease of reporting, and increasing the potential use and application of the information that is created in decision making and planning efforts (Schoenecker, 2010, p. 85).

The heart of an analytics program includes the capability to bring together data of varying types from siloed data systems, finding ways to create a cohesive, sophisticated data foundation allowing for the creation of logical data connections and the gleaning of new, information that may not be intuitive based on the raw data (Baer & Campbell, 2012; Bichsel, 2012; Yanosky & Arroway, 2015). The first measureable variable included in the analysis represented the extent to which respondent institutions are actually performing this kind of data infrastructure preparation and to what extent institutions are building a business intelligence platform to support their analytics initiatives (Koch, 2015). Specifically, this analysis entailed the extent to which their data

are systematically collected, connected, and used on campus, creating a strong data foundation for analytics.

Also included in this model is a variable intended to assess the breadth of use of data analysis and reporting across functions of the university and the complexity of that use, moving the focus from data to analytics. Institutional data frequently lives in the aforementioned "silos" on campus, and it is only when these silos are broken down and the data are shared that they can become useful at the institutional level (Baer & Campbell, 2012; Bichsel, 2012; Koch, 2015). The focus of this reporting and analytics component of the proposed infrastructure model is on the actionable results that come from "interpreting and visualizing data to make useful business-oriented decisions…allow[ing] for rapid analysis for decision making, developing insights, and communicating those insights' results" (Fisher, et al., 2014, p. 22). Essentially, this variable represents the sophistication of the reporting infrastructures, as opposed to the data foundations they are built upon.

The third observed variable utilized in this infrastructure model focuses on the true technological component of analytics programs, namely the actual tools universities use to support their initiatives, including enterprise resource planning (ERP) platforms, data warehouses, data analysis software, and visualization and communication tools (Baer & Campbell, 2012; Fisher et al., 2014; Huynh et al., 2009; Koch, 2015; Stocker, 2012; West, 2012; Yanosky & Arroway, 2015). With powerful combinations of these kinds of technologies and tools, analytics leadership and staff can put needed customizable, relatable information in front of the stakeholders, providing them with collected, prepared, organized, and analyzed data for decision making (Stocker, 2012).

These three endogenous variables, outlined above and situated within the literature that informed their selection from the EDUCAUSE survey questions, were included in a confirmatory factor analysis of the data and technology infrastructure construct. This analysis yielded the best model results among the three Baer and Campbell (2012) component analyses discussed earlier. Results from the analysis indicated that the model had good fit, and that all three variables were at least moderately impacted by the infrastructure factor.

Over half of the variance in the extent to which institutions were creating strong data foundations was explained by the data and technology infrastructure construct. Similarly, the data and analytics infrastructure factor also explained over half of the variance in the sophistication of reporting infrastructures built to inform decision making and planning at respondent institutions.

Variance in the number of analytics tools and programs used to support analytics initiatives on campus was less impacted by differences in the infrastructure factor than the other two variables, but over 20% of its variance was still explained and it remained a valuable addition to the model as far as fit went. Because it did have a larger error value than the other variables, however, it would be useful to explore the extent if there are other variables outside of the model that are impacting it and affecting its relationship with the infrastructure factor.

Overall, the data and technology infrastructure results appeared to yield the best model fit among of the three confirmatory factor analyses conducted on the components of a successful analytics program as identified by Baer and Campbell (2012). It is worth noting, however, that some of the measurable variables in this particular analysis are

rooted in more complexly designed survey questions, and future research could explore ways to parse out the involvement of specific types of data collection, preparation, and use included in the first two measured variables.

Responding to Academic Capitalism with a Successful Analytics Program

The overarching purpose of this study was to assess the extent to which institutions are using analytics programs to respond to growing and changing demands of academic capitalism facing higher education today, so that they are able to examine the current status of their programs as to their leadership, staffing, and infrastructure and identify opportunities to make the most of their analytics efforts. This final section examines the model with respect to the relationship among the disparate findings discussed above and situates the findings within the existing literature base.

In this analysis, the exogenous variables confirmed in the earlier CFAs on the three components of successful analytics program as posited by Baer and Campbell (2012; leadership, analytics staffing, and data and technology infrastructure) were used instead as endogenous variables and loaded onto the analytics as a response to the demands of academic capitalism factor as confirmed in the first CFA. Examining the relationship between the use of analytics construct and the three components as measurable variables, the overall model was, unfortunately, not found to be a good fit.

Despite the poor model fit, all of the component sub-models and their measureable variables held their significance (see Chapter 4, Table 16). Further investigation of the relationships between all variables included in the model yielded evidence of collinearity issues, which when further explored confirmed a high level of correlation between the analytics staffing and data and infrastructure variables. This

result, in turn, suggested that there may a higher order factor to consider, based on the relationship between these two endogenous variables or perhaps even those in their sub-model CFAs. Additional analyses of each of these possibilities, however, were unable to return a viable model solution.

Even though all previous analyses discussed earlier in this chapter were found to be a good fit independently, unfortunately, the full structural equation model (see Chapter 4, Figure 10) was unable to be confirmed by this research study. A variety of reasons for this lack of fit are possible, each of which provides an opportunity for future research and is discussed in more detail in coming sections. When considering possible reasons for the failure to confirm fit of the full model, there were statistical indicators that some variables, possibly including both the original measurable variables derived from the survey questions as informed by the literature, as well as the latent variables that were confirmed and then used in this last analysis, could be highly correlated or indicate the existence of higher order factors unidentified in the proposed model.

Additionally, the selected survey questions for inclusion in these analyses, as well as the transformation techniques to prepare them for inclusion reviewed in Chapter 3, may be interpretable in ways outside of those suggested in this study. Despite the framework provided by the related literature, many of the survey questions are detailed and multi-leveled, which provides opportunities to select and transform them differently depending on how the researcher interprets and applies the literature and theory. There also exists the possibility of factors outside of the model that were not specified, and which are impacting the others.

This study yielded useful findings from the individual model results even though the full structural equation model did not confirm definitively the relationship between universities' use of analytics in response to the demands of academic capitalism and the extent to which they are optimizing the potential of those analytics programs through appropriate and sufficient leadership support, analytics staffing, and data and technology infrastructure. Confirming the models for each of the three Baer and Campbell (2012) components of a successful analytics program provided a better understanding of the relationship between those constructs and how they might be evidenced on campuses. Furthermore, the findings allow for better understanding of the pressures postsecondary institutions are facing in the current political, economic, and social higher education environment; pressures that appear to be highly related to the demands of academic capitalism, or reframed here as "academic corporatization" as discussed earlier in this chapter.

The Role of Institutional Research in Institutional Analytics

As discussed throughout this study, Institutional Research, a data and analytics-driven field dedicated to "research conducted within an institution of higher education to provide information which supports institutional planning, policy formation and decision making" (Saupe, 1990, p. 1), has evolved throughout its history to meet diverse institutional needs in rapidly changing higher education environments. Over multiple centuries, it has undergone substantial instances of "role innovation" (Sluss et al., 2011, p. 518) as it has morphed from its origins of institutional self-study, to studying student engagement, to accountability-focused reporting, to supporting strategic planning and

decision-making with a relatively recent focus on actionable intelligence (Baer &
Campbell, 2012; Leimer, 2011; McLaughlin & Howard, 2001).

This role innovation has occurred as Institutional Research leaders and staff have
taken on a wider set of goals and behaviors, and undergone task revisions in which their
job duties and skill sets have changed in order to adapt to new organizational
expectations and demands (Sluss et al., 2011). In the contemporary era of Institutional
Research, reflecting roughly the 1980s until the present, these roles have evolved in
response to the pressures postsecondary institutions have faced around the facets of
academic capitalism noted earlier in this chapter: fiscal responsibility, accountability,
competition, and student success. As such, the role of modern Institutional Research
units and their staff appears "closely associated with marketing and competitive behavior
[in higher education]…[and] institutional researchers are working across a spectrum from
an emphasis on internal performance and improvement to an emphasis on external
performance and competition" (J. Taylor et al., 2013, p. 64). As such, the field appears to
be continuing the historical pattern of adapting to current postsecondary needs and
demands, and it is important to understand the implications of these changes for
Institutional Research units, leadership, and staff.

Working within this current higher education paradigm, Institutional Research
units and staff offer a valuable resource for universities seeking to respond to the
demands of academic capitalism (McLaughlin & Howard, 2001). The field's most recent
evolution has seen its focus become increasingly strategic and proactive, requiring
complex statistical and analytical skills such as modeling and advanced visualization

techniques (Leimer, 2011; J. Taylor et al., 2013) to support data and analytics initiatives on campus.

Responding to the evolving needs of their universities, ones which often require a more proactive rather than reactive response, Institutional Research units and staff wield statistical power through complex analyses involving modeling and advanced visualization techniques, which can benefit institutional decision-making and planning and help institutions respond to today's postsecondary pressures (Leimer, 2011; J. Taylor et al., 2013). Simultaneously, the historic Institutional Research accountability-driven data provision role allows universities to remain compliant and current with more traditional reporting requirements related to accountability pressures of academic capitalism, which did not disappear during these times of role innovation (Lasher, 2011; Nichols, 1990; Peterson, 1999; Sluss et al., 2011).

In addition to these more advanced data manipulation and analysis roles, today's institutional researchers are increasingly looked to for interpretation and communication of data, transforming it from data points to information and knowledge that help inform decision-making and planning on their campuses. Exemplifying what Terenzini called "organizational intelligence," Institutional Research units are now frequently asked to interpret and provide insight on the information they collect, manage, and analyze, drawing upon their skills in combination with institutional knowledge and environmental context (Coughlin & Howard, 2001; Terenzini, 1993, p. 23). This job function is unsurprising, as institutions responding to modern demands of academic capitalism require more than just data; they need information that has been interpreted and

translated, and in some cases, even for proposed recommendations based on it (Leimer, 2011).

As Leimer (2011) noted, the capacity for Institutional Research units and staff to engage in this more complex and advanced role in their schools' institutional analytics initiatives is heavily reliant on having the necessary resources in the units. Nicholson (1984) called this change in work functions "work role transitions" (p. 172). Institutional Research role transitions are driven primarily by the needs of a changing organization, and perhaps less so by the desires of the individual worker. Ultimately, individuals may experience role ambiguity, which can lead to employee stress, dissatisfaction, burnout, and turnover (English, 2006; Nicholson, 1984; Sluss et al., 2011).

The increased expectations of analytics-driven roles related to the current higher education environment can strain the Institutional Research function in which these units are highly engaged in analytics efforts; thus, it is critical to know the extent to which Institutional Research units and staff are leading and participating in the delivery of those services (Leimer, 2011). Leimer (2011) shared that:

> interpreting data and making recommendations is more time-consuming and requires greater knowledge of the institution and the issue at hand than does producing and disseminating data tables…[conflicts between] increased requirements for data and management, inadequate staffing, budget cuts, [and] organizational alignments [can] make the role unfeasible. (pp. 6-7)

Despite these increased expectations, today's Institutional Research offices remain relatively small, most averaging just three staff (Swing et al., 2016). This study found an even lower number of staffing in Institutional Research units, with an average of only

206

two dedicated to analytics efforts on their campuses. Office size has not changed in recent years, and in fact, some have even shrunk (Bichsel, 2012; Swing et al., 2016). Because institutional leadership often does not understand the staffing needs required to support a successful analytics program, Institutional Research units and staff can become overwhelmed by the addition of analytics duties as part of their evolving roles (Bichsel, 2012).

When assessing the role of Institutional Research in the delivery of institutional analytics programs as framed by Baer and Campbell's (2012) framework for the components of a successful analytics program, this study revealed that Institutional Research staff and skills are heavily utilized. Though few institutions have established a formal Chief Data Officer (CDO) position to lead analytics initiatives at this point in time (Reinitz, 2015), the findings of this study show that Institutional Research leadership plays a significant role in their schools' analytics programs at respondent institutions.

Most frequently a Director-level position, which exists at most schools, Institutional Research leaders nearly always hold a leadership role in analytics initiatives as either a leader/sponsor or supporter/contributor. The literature framing modern Institutional Research leaders as "knowledge brokers, linking those who need the knowledge to those who possess it" (Delaney, 2009, p. 37) was supported by the results of this study. Peterson (1999) argued that the expectation of Institutional Research was to not only:

> inform institutional leaders, but assist them in developing the new roles and
> strategies for the institution in this new industry, to become the institution's

source of expertise on this new industry paradigm, its dynamics, and its

implications for the institution. (p. 101)

The findings of this study clearly confirm the leadership role Institutional Research units

are playing in guiding institutional analytics initiatives in higher education, particularly at

smaller schools as discovered in this study. This outcome could be a symptom of limited

Institutional Research staffing resources in general, which underscores the leadership

exhibited by those directing Institutional Research units. Beyond leadership, it is also

important to understand the role that Institutional Research staff play in their universities'

analytics programs, given the limited size and relative lack of, if not declining, growth of

Institutional Research office sizes discussed earlier in this section.

Literature on the topic of staffing in Institutional Research units has indicated that

institutional researchers are increasingly asked to play a larger role in their universities'

analytics, but the findings of this study revealed that the overall staffing levels of

Institutional Research units remain somewhat anemic given these expectations (Bichsel,

2012; Reinitz, 2015). Institutional Research staffing levels varied across institutions, but

in general remained relatively low, with an average of only two Institutional Research

FTE involved in the delivery of institutional analytics services across campus.

This limited staffing size is not to say that Institutional Research alone is

responsible for delivery of these services, as respondents in this study noted how they

frequently work in tandem with others on campus at some institutions, most often

Information Technology staff (Bichsel, 2012; Reinitz, 2015; Yanosky & Arroway, 2015).

Pointedly, the findings of this study highlighted that at least two out of every five

respondent institutions were using both units to run their analytics programs. However,

208

even when the Institutional Research and Information Technology offices work in

tandem to deliver analytics services at their institution, a "powerful collaboration"

opportunity given the technology and analysis-oriented skill set available between the

two, analytics staffing levels remain low across institutions, with just over two

Information Technology FTE contributing to delivery of analytics services on average,

and roughly five and a half FTE across all campus units (Reinitz, 2015, p. 13).

The low levels of staffing dedicated to supporting institutional analytics programs

creates the potential for great instability for these initiatives, as staff supporting them may

become frustrated, stressed, and more likely to leave their universities. In a role that

increasingly relies as much on institutional and environmental knowledge as much as

technical and analytical skills, understaffing Institutional Research units comes with great

risk of loss of institutional knowledge, arguably much more difficult to replace than just

the skill sets lost (Parise, Cross, & Davenport, 2013). As "knowledge brokers" (Delaney,

2009, p. 37), this risk has a ripple effect beyond the Institutional Research unit itself, as

Parise et al. (2013) explain further:

> Brokers are people who have links across subgroups in a network. They may not
>
> have the greatest number of connections, but they possess a disproportionate
>
> ability to help an organization capitalize on opportunities requiring the integration
>
> of disparate expertise. With their knowledge of the expertise and terminology of
>
> different groups, brokers often play the key role of technical translator. That role
>
> also applies on a cultural level because brokers typically understand and
>
> appreciate the differences in values and norms across different groups, such as
>
> between manufacturing and research and development. Having such a perspective

is why brokers are so effective in spotting and exploiting opportunities that

require integration. (para. 23)

Based on the findings of this study, bolstered further by related literature on the

involvement of Institutional Research units, leadership, and staff in institutional analytics

programs, it seems clear that the field plays a pivotal role in their schools' response to the

demands of academic capitalism. A profession increasingly oriented around helping their

institutions proactively engage with constituents and stakeholders on issues around fiscal

responsibility, accountability, competition, and student success, the importance of

ensuring Institutional Research offices have sufficient resources to play this role and

given the support necessary to do so seems obvious (Lasher, 2011).

Implications for Practice

 The findings of this study have a number of possible applications for institutions

seeking to start or improve their ability to respond to the demands of academic capitalism

through the use of analytics. The results of the confirmed models provide institutional

leaders with guidance for informed decision making around the leadership, staffing, and

data and technology infrastructure of their analytics programs, as well as the possible

integration of and interaction with their Institutional Research units and staff as part of

those efforts.

Since Slaughter and Rhoades original conceptualization of "academic capitalism"

in 2004, the country has experienced one of the most significant recessions in history

from 2008-2014. A 2016 study revealed that "states have cut per student spending by 21

percent between fiscal years 2008 through 2014…and while many states have begun to

reinvest in the past few years, only two states spend as much as they did before the

recession" (Young Invincibles, 2016, p. 5). Postsecondary education, though now coming out of the Great Recession, has simply not rebounded from the disinvestment that occurred during these years.

In addition to facing relatively stagnant Great Recession levels of student funding today, enrollment often increases during times of recession (Barr & Turner, 2013; Bettinger & Williams, 2014; Leonard, 2013; B. T. Long, 2014), allowing for schools to stem some of their financial pain through increased available tuition funds, but also creating resource challenges around absorbing larger student bodies with less fiscal resources to hire more faculty and create more space (Barr & Turner, 2013). Termed "cyclical enrollment" (Barr & Turner, 2013, p. 170), however, these trends tend to reverse as the economy improves, and students enter or return to the workforce. As this happens, the additional tuition dollars begin to disappear, and institutions begin to bump up against a ceiling of reasonable college cost prohibitive to further tuition increases.

Another consequence of enrollment increases during times of recession is financial instability created for the students as they take on student loans that become challenging to repay post-recession when employment rates are just recovering and salaries can be lower (Barr & Turner, 2013; Bettinger & Williams, 2014; B. T. Long, 2014). These recession-driven changes, both for institutions and students alike as higher education cycles into and out of this most recent recession, provide both the opportunity for and necessity of the use of analytics in higher education to address many of the challenges noted here, many of which reflect pressures of academic capitalism discussed throughout this study.

Having identified key relationships between Baer and Campbell's (2012) components of a successful analytics program and the measured variables included in each of their factor models, university leaders can use the findings of this study in a manner reflective of the values of academic corporatization discussed earlier in this chapter; specifically, the focus on sensible business practices aimed at creating efficiency and reducing expenses. Based upon understanding the nature of the relationships between the measured leadership, staffing, and infrastructure-related variables and their associated analytics program components, institutions can pinpoint specific opportunities to enhance their analytics initiatives. Furthermore, they can direct the benefits of their analytics initiatives more efficiently and effectively towards addressing the specific challenges facing their colleges today, many of which are due to neoliberalism.

For example, a smaller sized institution may find that limited capacity for additional human resources spending and a relatively flat leadership hierarchy are prohibitive to their interest in hiring a new Chief Data Officer as a dedicated analytics leader. As one of the measurable variables observed as having a relationship with Baer and Campbell's (2012) leadership construct, the inability to hire a new dedicated leader at this school may instead be overcome by shifting responsibilities of an already existing position to establish that role as now having dedicated analytics leadership duties. Based on the findings of this study it seems reasonable, if not likely, that the school's Director of Institutional Research might be recruited to take on these duties, as the role was found to be regularly involved in analytics leadership.

Alternatively, should this role change approach not be feasible due to lack of ability to expand or change the current role, the institution could instead seek to enhance

their analytics leadership through a different measureable variable associated with Baer and Campbell's (2012) leadership construct. Because the findings of this study also identified the importance of executive leadership championing and use of analytics as having a strong relationship with the leadership construct, campus leaders can instead commit to making the use of data and analytics a more systemic and applied part of their organizational accountability activities. One example of systemic use could be requiring units to set and evaluate measurable, quantitative performance metrics as part of their annual planning and review process. An example with more of an applied focus may be to ask the Director of Institutional Research, whose role as described earlier was not changed to become the dedicated analytics leader but still functions to support analytics, to conduct a study on the factors of student success to inform an early warning system.

The ability to use the model results to pinpoint specific, tactical areas to address can be useful not only when it comes to the components of a successful analytics program (Baer & Campbell, 2012), but also as a method for institutions to assess their individual, specific higher education environment and classify their primary pressures as they relate to the demands of academic capitalism identified in this study. For instance, if a university is in a state with performance-based funding, they may want to focus their analytics efforts on responding to the pressures of accountability. Alternatively, if an institution has a highly competitive peer group challenging them for students and faculty, they may find it more valuable to dedicate analytics to competition-oriented goals such as funding faculty startup packages or financial aid to attract high quality students.

In order to think about the assessment of priorities and goals and the possibilities for the application of analytics to support these in ways like those described above,

institutional leadership would benefit from perspectives not always intuitive to higher education or taught as standard disciplinary practice in general. Change management and strategic planning, critical skill sets and knowledge bases for understanding how to use data and analytics to create effective change, are often learned on the job in academia, particularly in cases where leaders began as faculty. The ability to "play the long game," recognizing that change must be intentional and is frequently an iterative process requiring guidance, patience, collaboration, and accountability is essential for successful change.

Additionally, a combination of visionary and action leadership is necessary, and leaders will do well to consider the full "question suite" as they determine where analytics can be most useful and how to employ it. It is not enough to know "what" the end goal is. Scott (2003) proposes that successful change management requires leaders to ask not just "what" (What is the end goal?), but "how" (What is the plan, in this particular case, for the use of analytics to support this effort?). Building on this idea, leaders should also be asking the other "W" questions: "where" (What is the environment in which we are trying to make these changes happen?), "why" (What are the forces compelling change?), and "who" (Which units, people, skills, roles, etc. need to be involved?). This holistic perspective will allow institutional leaders to best strategically guide analytics use in support of their goals and mission.

Finally, this study confirmed that Institutional Research units, including their leadership and staff, are a valuable resource for institutions interested in effectively using analytics in any capacity. The findings of this study revealed that Institutional Research is indeed a major player in analytics initiatives, both in leading them and as part of the

delivery of analytics to their campus. Institutions may find it useful, therefore, to examine the work that their Institutional Research units are performing and the extent to which more advanced data analysis, visualization, and translation skills exist and are being utilized in support of institutional decision-making and strategic planning. For example, if a university discovers that their Institutional Research staff are primarily dedicated to responding to traditional reporting functions and minimally or not at all performing more advanced statistical analyses to inform strategic initiatives, they can assess if the opportunity exists to increase more analytics-oriented activities by way of changing current Institutional Research roles or hiring new analytics staff with specific skill sets.

Because institutional researchers, including both leadership and staff, were found in this study to be highly involved in campus analytics programs, ensuring that their skill sets and knowledge base are up to date and relevant to their particular institution is critical. This can be challenging due to the multi-pronged nature of modern Institutional Research as a technical, analytical, and interpersonal profession. In a field that has evolved to meet current higher education challenges and demands, but has not necessarily left its historical responsibilities behind, it is unlikely that all training, education, and development needs can be met in a single opportunity.

In addition, the breadth and variety of Institutional Research professional development needs can be particularly problematic given the current financial stress of many institutions, which may limit the amount of work-funded development opportunities available. As a result, institutional researchers will benefit from being transparent and vocal when it comes to ensuring institutional understanding of what their

skills and knowledge base takes to maintain. In some cases, they may have to even personally seek out, and perhaps even pay for, additional development opportunities such as Institutional Research certificate programs and technical user groups.

Despite efforts to attain as much professional development and learning as possible, it remains the case that the skill sets and knowledge base for institutional researchers remains widely varied, encompassing technical, interpersonal, and leadership, aspects. It is rare that one person can fulfill all roles (the "unicorn" of the profession), so it could be useful to think about how to harness dimensionalized roles to best support analytics initiatives as a whole. Building a team of analytics contributors with skills and knowledge from diverse set of disciplines and experiences can support an analytics program in ways unlikely to be fulfilled by one or two individuals. This could include everything from database developers, to data analysts, to communications experts, to higher education academics, to strategic planners and change management experts. Harnessing as many of the dimensions of analytics support, delivery, and application, and doing so within the context of the specific environment, needs, and resources will strengthen the overall analytics foundation at any institution.

Given that the use of analytics in higher education is still relatively new in general, institutional researchers are in a unique position to act as experts in critical institutional matters. Even when their analytics roles are more support-oriented than leadership-oriented, institutional researchers have potential for significant impact and involvement in institutional initiatives through their ability to translate data into knowledge. Because Institutional Research staff now frequently function as "knowledge brokers" (Delaney, 2009, p. 37), they therefore have the capability to lead institutional

analytics initiatives both formally and informally, as analytics leaders and brokers of needed information. Swing and Ross (2016a) acknowledge this power in their idiom, "data don't speak for themselves, and they never talk to strangers" (p. 10). Because of this capacity for impact, institutional researchers should feel a sense of responsibility, pride, and value as they aid their institutions in responding to the pressures of modern postsecondary education, and act as their own champion whenever possible.

The results of this study provide a multitude of opportunities for postsecondary institutions to support and improve their analytics programs in response to the demands of academic capitalism faced by so many schools today. The ability to identify a variety of approaches utilizing a matrix of combinations of leadership, staffing, and technology, higher education institutions have available to them the ability to customize their analytics programs to address their specific needs within their particular environment. The findings of this study can inform those efforts.

Limitations

Caution should be exercised in generalizing the results of this study across all postsecondary institutions. Framed by literature and theory predominantly focused on traditional, not-for profit institutions in the United States, the analyzed population was restricted to institutions aligned with these selection criteria (see Table 1). International, Canadian, and for-profit respondent schools were not included in this study.

Additionally, the makeup of the survey respondent population was not fully representative of U.S., not-for-profit higher education institutions as a whole, and the findings of the study may not be generalizable across all institutional types and sizes (see Table 3). Specifically, smaller institutions (less than 2,000 FTE enrollment) were

significantly underrepresented compared with the total population of all schools that report data to the Integrated Postsecondary Data System (IPEDS). Alternatively, large schools (15,000 or more FTE enrollment) were somewhat overrepresented in the respondent population. Variances also existed among respondent schools from different Carnegie classes (see Table 2). Associates colleges were underrepresented, as were "other" Carnegie classes such as special focus and tribal institutions. Public, doctoral respondent institutions, on the other hand, were overrepresented in the population.

An additional limitation of this study relates to the survey population of the original 2015 EDUCAUSE Analytics Survey, which was based on EDUCAUSE member institutions with most respondents representing Information Technology units. Due to this population composition, the possibility for bias in perspectives on and experiences of the use of technology and analytics in higher education exists. Because EDUCAUSE is a paid membership organization, universities who opt-in are assumed to have a verifiable interest and likely investment in technology infrastructure and use, which could skew the findings of this study.

In addition, the impact of institutional factors such as location and institutional control (public vs. private) on the specific academic capitalism pressures faced by individual universities is not taken into account in this study. The assumption that all respondent institutions face the same set and level of demands cannot be confirmed based on the results of this study alone. As a result, limitations exist in the generalizability to all higher education institutions as to the specific demands they find themselves pressured by.

In addition to possible population bias, distillation of the original survey data down to simple, measureable variables for use in this study's structural equation model is likely to have removed some of the nuances that may have yielded different results. Some nuances existing in the data as originally collected may be lost in this analysis, and caution is encouraged around interpretation of findings at too granular a level. Additionally, researcher bias around the interpretation of relevant literature and application to survey questions selected and their transformation could impact the findings of this study if it were to be conducted by another person.

Recommendations for Future Research

There are numerous ways that this study could be built upon in future research, both using the data analyzed in this study and other, new quantitative and qualitative opportunities for further exploration of the topic of analytics in higher education. Based on the inability to confirm the structural equation model, it seems evident that there is much to explore in this data still. Searching for the existence of other factors unaccounted for in this study, and the relationships between the measures beyond as they were defined here could help improve the models and successfully attain good model fit.

Given the removal of much of the detail in the survey data to prepare it for use in the structural equation model proposed in this research, there also exists bountiful opportunities to provide additional depth of knowledge around the topics discussed here. Examining the actual applications of analytics as they pertain to institutional functions, units, and strategic goals would provide a better understanding of the exact nature of analytics use in higher education in general.

In addition, future research would do well to account for more of the institution-specific factors influencing and framing the use of institutional analytics. For example, evaluation of institutional documents such as strategic plans, missions, and goals, as well as policy research on more regional issues such as state performance-based funding, political control, and industry and workforce trends would inform a more localized understanding of the nature of analytics use in higher education.

There also exists a significant amount of investigative opportunity to further understand the nature of the Institutional Research role in the current higher education environment facing the pressures of academic capitalism, and institutional ability to keep up with the analytics trends when it comes to reliance on Institutional Research as a resource. The increased professionalization of the field in response to changing demands appears to be bringing the work in line with the larger business analytics mindset, blurring the line between the two with the exception of the context.

Important considerations about higher education's ability to entice and keep institutional researchers given pay and salary increase challenges in higher education should be considered, including the extent to which Institutional Research can sustain its leadership capacity with growing concern over baby boomer retirements. Does Institutional Research have the capability, or the time to "grow its own" and create analytics leadership pipelines? And with the growing number of Institutional Research certificates offered, is it education or experience that bring more value when it comes to effective Institutional Research involvement in institutional analytics programs?

The work still to be done to understand the rapidly changing pressures facing postsecondary education today and in the future is expansive. These suggestions for

further research are just some of the many ideas for increasing breadth and depth of this understanding, providing institutions with information to make good strategic decisions about their own strategic analytics initiatives.

Conclusion

Higher education today faces an environment unlike any it has seen before, with pressures from stakeholders both inside and external to the academy challenging postsecondary institutions to think more like businesses. Unprecedented levels of competition and accountability abound, and schools are increasingly turning to business tools and methods in response, including the use of analytics to guide strategic planning and decision-making on their campuses. This study was undertaken to explore questions around the nature of analytics use at universities, how schools can optimize their analytics programs to support their institutions goals and respond to their specific demands, and whether the Institutional Research profession is undergoing another evolution driven by postsecondary changes, as it has done throughout its history.

Though the proposed structural equation model in its entirety was unable to determine if institutions using analytics to address demands rooted in academic capitalism, or academic corporatization as suggested in the earlier discussion, are providing the leadership, staffing, and infrastructural supports Baer and Campbell (2012) assert are essential to a successful analytics program, the findings of this research still provide value in helping universities evaluate and understand their own environments and analytics initiatives. This research determined that leadership provides a critical linchpin to the ways in which analytics are used on campus, and institutional researchers are witnessing a change in role as more complex analytics are required for strategic planning

221

and actions. Using the findings, institutions can examine their own environments, including their specific pressures, and assess if there are strategic was to use analytics to respond based on the four areas identified earlier in this chapter: fiscal responsibility, accountability, competition, and student success.

Institutions can also use the results of this study to investigate the nature of their analytics programs when it comes to the three components of a successful analytics initiative. By assessing the state of affairs when it comes to their analytics leadership, staffing, and data and technology infrastructure, the results from the confirmatory factor analyses reviewed in Chapter 4 give institutions a customizable approach to optimizing their analytics programs. Whether this is increasing executive leadership involvement, adding additional staff to meet the necessary capacity for delivery of analytics, or encouraging proactive use of analyses systemically throughout the school, many opportunities exist to increase the efficacy of analytics in higher education.

Institutional use of analytics can be a powerful tool in responding to modern postsecondary pressures identified throughout this study. While it is still early in the adoption of this business-oriented approach to planning and decision-making in higher education, "universities have troves of data related to institutional performance and are hoping to discover new efficiencies, cost savings, or revenue streams, [and are] enthusiastic about the potential of analytics" (Brooks & Thayer, 2016, p. 3). As schools continue to adapt to rapidly changing demands, and time allows for actual results from analytics use to emerge, schools will be better able to strategically approach their challenges in ways that strengthen their universities and benefit their diverse group of internal and external constituents and stakeholders.

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APPENDIX A: SURVEY QUESTION AND LITERATURE MAP

Research Question	Analysis Method	Survey Question	Relevant Theory/Literature
Inclusion Criteria	**Descriptive Analysis**	N/A. Respondent descriptor variables.	N/A
		N/A. Respondent descriptor variables.	
1. To what extent to institutions' motivations for and use of analytics reflect a response to the demands of academic capitalism?	**Principal Components Analysis (PCA)**	What are the top 3 factors that motivated your institution to invest in institutional analytics?	Ali, 2006 Apple, 2013 Archibald & Feldman, 2006 Arroway, Morgan, O'Keefe, & Yanosky, 2016 Baer & Campbell, 2012 Baumol, 1967 Baumol & Bowen, 1966 Bichsel, 2012 Calderon & Mathies, 2013 Coughlin & Howard, 2013 Foraker, 2014 Gose, 1999 Haughey, 2007 Hursh & Wall, 2011 Johnson, 2011

		Please specify the strategic priorities at your institution that would benefit from the use of data.	Johnson, Mejia, Ezekiel, & Zeiger, 2013 Jones, 2015 Kimball, 2014 Lang & Pirani, 2016 Lasher, 2011 Levy, 2014 Maltz, Murphy, & Hand, 2007 Marginson, 2004 McClure & Teitelbaum, 2016 McGee, 2015 Paxton & Perez-Greene, 2001 Peterson, 1999 Reinitz, 2015 Slaughter & Rhoades, 2004 Stiles, 2012
	Confirmatory Factor Analysis (CFA)- Academic Capitalism	Would any strategic priorities at your institution benefit from the use of data, regardless of whether data are actually being collected or used for analytics now?	Bichsel, 2012 Brooks and Thayer, 2013 Chandler, 2013 Gumport, 2000 Gupta, Goul, & Dinter, 2015 Jacob, McCall, & Stange, 2013 Jones, 2015 Koch, 2015 Lang & Pirani, 2016 McGee, 2015 Reinitz, 2015
		Indicate which response best describes the use of analytics in each of the following areas at your institution. (no discussion to date; considered but not pursued; experimenting/considering;	

237

		in planning; used sparsely; used broadly; don't know)	Weimer, 2013 West, 2012
		Provide your best estimate of how data are being used in various functional areas of your institution. (we do not collect useable data; data are collected but are never or rarely used; we create and use analyses or reports to monitor operations or programs; we create and use analysis or reports to make projections for programs or groups; we create and use analyses or reports to trigger proactive responses)	
		To what extent do you see the following as concerns about the use of data or analytics in higher education? ("not a concern"; "minor concern"; "moderate concern"; "major concern"; "don't know")	
		Which departments, units, or programs consider institutional analytics a major priority?	
		What level of investment has your institution made in institutional analytics?	
2. How do institutions motivated by the	**Confirmatory Factor Analysis**	Choose the option that best describes the role that each of the following positions	Baer & Campbell, 2012

demands of academic capitalism differ from those less so in the key components of a successful analytics program (leadership, staffing, technological infrastructure)?	(CFA)- Analytics Leadership	plays in institutional analytics at your institution. (don't have this position/area; not currently involved in analytics in any major way; support/contributor role; leadership/sponsor role; don't know)	Beyer, Sidarus, Bonicalzi, & Haggard, 2017 Bichsel, 2012 Elena, 2011 Reinitz, 2015 Stiles, 2012 Wick, 2014 Wick, 2015 Yanosky & Arroway, 2015 Yanosky & Arroway, 2015
		What other areas or positions not listed above have leadership roles in institutional analytics at your institution?	
		Does your institution have a dedicated institutional analytics leader?	
	Confirmatory Factor Analysis (CFA)- Analytics Staffing	How many current staff (FTE) are dedicated to providing analytics services and support at your institution?	Baer and Campbell, 2012 Bichsel, 2012 Fisher, Drucker, & Czerwinski, 2014 Kirby & Floyd, 2016 Reinitz, 2015 Swing, Jones, & Ross, 2016 Yanosky & Arroway, 2015
		How many more staff (FTE) would your institution need in order to optimally provide analytics services and support?	
		Identify which staff functions are needed or needed to be augmented to optimally provide analytics services and support at your institution.	

	Confirmatory Factor Analysis (CFA)- Data and Technology Infrastructure	Check which option on the scale below best describes how your institution collects, stores, and/or uses the types of data listed below. (we do not collect useable data; data are collected but not connected; data are systematically collected and connected; data are systematically connected and used; don't know)	Baer & Campbell, 2012 Bichsel, 2012 Fisher, Drucker, & Czerwinski, 2014 Huynh, Gibbons, & Vera, 2009 Koch, 2015 Schoenecker, 2010 Stocker, 2012 West, 2012 Yanosky & Arroway, 2015
		Provide your best estimate of how data are being used in various functional areas of your institution. (we do not collect useable data; data are collected but are never or rarely used; we create and use analyses or reports to monitor operations or programs; we create and use analysis or reports to make projections for programs or groups; we create and use analyses or reports to trigger proactive responses)	
		Please describe other areas in which your institution is using large data sets to inform or provide insight into strategic initiatives or broad questions.	
		What analytics tools, software, or application packages are essential to providing institutional analytics services and	

		solutions at your institution?	
3. What is the role of Institutional Research in institutional analytics programs?	**Descriptive Analysis**	Does your institution have a dedicated institutional analytics leader?	AIR, 2015 Baer & Campbell, 2012 Bichsel, 2012 Delaney, 2009 English, 2006 Lasher, 2011 Leimer, 2011 McLaughlin & Howard, 2001 Nichols, 1990 Nicholson, 1984 Parise, Cross, and Davenport, 2013 Peterson, 1999 Reinitz, 2015 Saupe, 1990 Sluss, van Dick, & Thompson, 2011 Swing, Jones, & Ross, 2016 Taylor, Hanlon, & Yorke, 2013 Terenzini, 1993 Yanosky & Arroway, 2015
		What role does the Director of Institutional Research play in institutional analytics at your institution?	
		How are analytics services and activities delivered at your institution?	
		How many analytics staff (FTE) are in IR/IT?	

ECAR

Analytics Survey 2015

Thank you for participating in this ECAR survey on the state of analytics in higher education. Analytics is one of higher education's three biggest current IT-related issues, and the results of this survey will inform the analytics-related products, services, and programs EDUCAUSE brings to the higher education community over the next few years.

ECAR assessed the state of analytics in 2012; the 2015 study is a continuation of that work, with focus areas in learning analytics and institutional/business analytics. For the purposes of this survey, please consider the following operational definitions:

- **Analytics:** The use of data, statistical analysis, and explanatory and predictive models to gain insights and act on complex issues
- **Learning analytics:** Analytics intended to enhance or improve student success
- **Institutional analytics:** Analytics intended to improve services and business practices across the institution

Please read each question carefully and indicate your response. A PDF of the survey (http://net.educause.edu/ir/library/pdf/SI/esi1504.pdf) can be consulted before responding to the online survey. In addition, the survey may be saved after partial completion and completed in multiple sessions.

We estimate it will take approximately 30 minutes to complete the survey. This survey should be completed by the EDUCAUSE primary representative or by appropriate management or staff under the direction of the EDUCAUSE primary representative. Search for the primary representative of your institution here.

Please complete this survey by June 7, 2015.

Note: Only EDUCAUSE researchers will have access to institutionally identifiable data collected in this survey. Partner researchers at Gartner and EUNIS will have access to de-identified (anonymized) survey results. Aggregated results, as well as a list of institutions participating in the survey, may be included in reports, publications, or other products of this research, but they will not contain any information that could be used to identify an individual or a particular institution. If you have any questions about this survey please contact survey@educause.edu.

Section A: About You

Your name. *Required.* _____

Your e-mail address. *Required.* _____

What is the job title of the primary person completing this survey? *Required.*

Your institution. *Required.* _____

Section B: The State of Analytics at Your Institution

1. Choose the option that best describes the role that each of the following positions plays in *LEARNING ANALYTICS* at your institution.

	Don't have this position/area	Not currently involved in analytics in any major way	Support/ contributor role	Leadership/ sponsor role	Don't know
President/chancellor	( )	( )	( )	( )	( )
Chief academic officer (CAO) or provost	( )	( )	( )	( )	( )
Chief learning officer (CLO) or equivalent	( )	( )	( )	( )	( )
Student success leader	( )	( )	( )	( )	( )
Chief information officer (CIO) or equivalent	( )	( )	( )	( )	( )
Chief data officer (CDO) or equivalent	( )	( )	( )	( )	( )
Director of institutional research	( )	( )	( )	( )	( )
Chief analytics officer or equivalent	( )	( )	( )	( )	( )
Chief financial officer or chief business officer (CFO/CBO)	( )	( )	( )	( )	( )

1a. Does your institution have a dedicated *LEARNING ANALYTICS* leader?

( ) No

( ) Yes, this person's title is: _____

1b. What other areas or positions not listed above have leadership roles in *LEARNING ANALYTICS* at your institution?

_____

_____

_____

2. Choose the option that best describes the role that each of the following positions plays in *INSTITUTIONAL ANALYTICS* at your institution.

	Don't have this position/area	Not currently involved in analytics in any major way	Support/ contributor role	Leadership/ sponsor role	Don't know
President/chancellor	( )	( )	( )	( )	( )
Chief academic officer (CAO) or provost	( )	( )	( )	( )	( )
Chief learning officer (CLO) or equivalent	( )	( )	( )	( )	( )
Student success leader	( )	( )	( )	( )	( )
Chief information officer (CIO) or equivalent	( )	( )	( )	( )	( )
Chief data officer (CDO) or equivalent	( )	( )	( )	( )	( )
Director of institutional research	( )	( )	( )	( )	( )
Chief analytics officer or equivalent	( )	( )	( )	( )	( )
Chief financial officer or chief business officer (CFO/CBO)	( )	( )	( )	( )	( )

2a. Does your institution have a dedicated *INSTITUTIONAL ANALYTICS* leader?

( ) No

( ) Yes, this person's title is: _____

2b. What other areas or positions not listed above have leadership roles in *INSTITUTIONAL ANALYTICS* at your institution?

_____

_____

_____

3. How are analytics services and activities delivered at your institution?
( ) Program run by institutional research (IR)
( ) Program run by information technology (IT)
( ) Program jointly run by IR and IT
( ) Program run by a dedicated analytics center separate from IR and IT
( ) Program run by a dedicated analytics center that includes IR and/or IT
( ) Other departments or programs
( ) Outsource most or all of our analytics activities
( ) No method for delivering analytics services and activities
( ) Not sure how analytics services and activities are delivered at my institution

3a. Please specify any other departments, units, or programs that deliver analytics services at your institution:

_____

_____

_____

4. Identify which staff functions are needed or need to be augmented to optimally provide analytics services and support at your institution.

	Not in place; not needed	Not in place; needed	Already in place; no more needed	Already in place; more needed	Don't know
Data architecture	( )	( )	( )	( )	( )
Data cleaning	( )	( )	( )	( )	( )
Data management	( )	( )	( )	( )	( )
Data governance	( )	( )	( )	( )	( )
Data organization	( )	( )	( )	( )	( )
Data analysis	( )	( )	( )	( )	( )
Visual data communication	( )	( )	( )	( )	( )
Verbal data communication (e.g., reporting or telling stories with data)	( )	( )	( )	( )	( )
Statistical analysis	( )	( )	( )	( )	( )
Creation of predictive models and outputs	( )	( )	( )	( )	( )
Analytics tool training	( )	( )	( )	( )	( )
Development of user experiences and interfaces	( )	( )	( )	( )	( )
Technical management of analytics applications and infrastructure	( )	( )	( )	( )	( )
Translation of priorities and decision-making needs into analytics models	( )	( )	( )	( )	( )
Leadership for analytics initiatives	( )	( )	( )	( )	( )
Analytics initiatives management	( )	( )	( )	( )	( )
Analytics vendor liaison	( )	( )	( )	( )	( )
Analytics liaison for faculty, staff, and administrators	( )	( )	( )	( )	( )

4a. Are other analytics functions needed at your institution that are not mentioned above? If so, please specify:

_____

_____

_____

5. **How many current staff (FTE) are dedicated to providing analytics services and support at your institution?** *Numbers can be reported up to two decimal places (e.g., 6, 4.5, or 8.25). If no staff are dedicated to providing analytics services and support, enter "0." "Analytics services and support" would include, for example, business intelligence, reporting, database administration, and data analysis. Include all of the institution's analytics staff, including central IT, distributed IT, and other analytics professionals across the institution.*

_____

5a. Of the FTE reported in question 5, how many analytics staff (FTE) are in:

Central IT: _____

Distributed IT: _____

IR: _____

Library: _____

Finance unit: _____

Administrative unit: _____

Academic unit: _____

5b. Does your institution employ analytics staff in other departments/units not listed above?

( ) No

( ) Yes. Which departments/units? _____

5c. How many analytics staff (FTE) are in these other departments/units?

_____

6. **How many more staff (FTE) would your institution need in order to optimally provide analytics services and support?** *Numbers can be reported up to two decimal places (e.g., 6, 4.5, or 8.25). If no additional staff are needed, enter "0." If unable to estimate, leave blank.*

_____

6a. What (if any) staffing positions are considered priority hires to support your institution's analytics agenda?

_____

_____

_____

Section C: The Use of Data at Your Institution

1. Check which option on the scale below best describes how your institution collects, stores, and/or uses the types of data listed below.

Please refer to these clarifications:

1 = <u>Data are collected but not connected </u>to other sources (due to format or location) for analytics purposes.
2 = <u>Data are systematically collected for analysis purposes and can be connected </u>to other systems and used to feed reports, dashboards, analytics systems, etc.
3 = <u>Data are systematically used in analysis </u>and are regularly used in reports, dashboards, and analytics systems.

	We do not collect usable data. 0	Data are collected but not connected. 1	Data are systematically collected and connected. 2	Data are systematically connected and used. 3	Don't know
Admissions system	( )	( )	( )	( )	( )
Advancement/fundraising system	( )	( )	( )	( )	( )
Customer relationship management system (admissions or recruiting focus)	( )	( )	( )	( )	( )
Customer relationship management system (alumni or donor focus)	( )	( )	( )	( )	( )
Customer relationship management system (other focus)	( )	( )	( )	( )	( )
Facilities management system	( )	( )	( )	( )	( )
Financial aid system	( )	( )	( )	( )	( )
Financial management system	( )	( )	( )	( )	( )
Human resources system	( )	( )	( )	( )	( )
IT service desk management system	( )	( )	( )	( )	( )
Learning management system	( )	( )	( )	( )	( )
Library system	( )	( )	( )	( )	( )
Procurement system	( )	( )	( )	( )	( )
Room scheduling system	( )	( )	( )	( )	( )
Housing system	( )	( )	( )	( )	( )

Student information system	( )	( )	( )	( )	( )
Integrated planning and advising services system	( )	( )	( )	( )	( )
National institutional surveys (e.g., BCSSE, CCSSE/NSSE, CIRP/YFCY)	( )	( )	( )	( )	( )
Students' behavioral data (e.g., website visits, card swipes)	( )	( )	( )	( )	( )
Students' geospatial data	( )	( )	( )	( )	( )

1a. Please describe any other data or system your institution uses for analytics that was not specified above.

_____

_____

_____

2. Provide your best estimate of how data are being used in various functional areas of your institution. Select all that apply.

	We do not collect usable data.	Data are collected but are never or rarely used.	We create and use analyses or reports to monitor operations or programs.	We create and use analyses or reports to make projections for programs or groups.	We create and use predictive analyses or reports that may trigger proactive responses.
Student learning (real-time or on-demand assessment and feedback)	( )	( )	( )	( )	( )
Student learning (learning outcomes, course completion)	( )	( )	( )	( )	( )
Student degree planning	( )	( )	( )	( )	( )
Undergraduate student progress (retention, graduation, etc.)	( )	( )	( )	( )	( )
Graduate student progress (retention, graduation, etc.)	( )	( )	( )	( )	( )
Enrollment management, admissions, and recruiting	( )	( )	( )	( )	( )
Cost to complete a degree	( )	( )	( )	( )	( )

Time to complete a degree	( )	( )	( )	( )	( )
Instructional management (which courses need to be offered, number of sections, staffing needs)	( )	( )	( )	( )	( )
Other student objectives	( )	( )	( )	( )	( )
Progress of institutional strategic plan	( )	( )	( )	( )	( )
Alumni/development/institutional advancement	( )	( )	( )	( )	( )
Central IT	( )	( )	( )	( )	( )
Facilities	( )	( )	( )	( )	( )
Finance and budgeting	( )	( )	( )	( )	( )
Procurement	( )	( )	( )	( )	( )
Human resources	( )	( )	( )	( )	( )
Library	( )	( )	( )	( )	( )
Faculty research performance	( )	( )	( )	( )	( )
Faculty teaching performance	( )	( )	( )	( )	( )
Faculty promotion and tenure	( )	( )	( )	( )	( )
State/federal/accreditation reporting	( )	( )	( )	( )	( )

3. Are there any other areas not specified in the previous question in which your institution is using large data sets to respond to strategic initiatives or broad questions?
( ) No
( ) Yes

3a. Please describe other areas in which your institution is using large data sets to inform or provide insight into strategic initiatives or broad questions.

_____

_____

_____

_____

4. What analytics tools, software, or application packages are essential to providing
INSTITUTIONAL ANALYTICS **services and solutions at your institution?**

_____

_____

_____

5. What analytics tools, software, or application packages are essential to providing *LEARNING ANALYTICS* **services and solutions at your institution?**

_____

_____

_____

Section D: Priority of, Concerns About, and Future Plans for Analytics

1. What priority does your institution place on *LEARNING ANALYTICS*?
( ) Major institutional priority
( ) Major priority for some departments, units, or programs but not for the entire institution
( ) An interest of the institution but not a priority
( ) Intentionally not a priority or interest
( ) Little awareness, and therefore not a priority or interest
( ) Don't know

1a. Which departments, units, or programs consider *LEARNING ANALYTICS* a major priority?

_____

_____

_____

2. What priority does your institution place on *INSTITUTIONAL ANALYTICS*?
( ) Major institutional priority
( ) Major priority for some departments, units, or programs but not for the entire institution
( ) An interest of the institution but not a priority
( ) Intentionally not a priority or interest
( ) Little awareness, and therefore not a priority or interest
( ) Don't know

2a. Which departments, units, or programs consider *INSTITUTIONAL ANALYTICS* a major priority?

_____

_____

_____

3. Indicate which response best describes the use of analytics in each of the following areas at your institution.

	No discussion to date	Considered, not pursued	Experimenting /considering	In planning	Used sparsely	Used broadly	Don't know
Student learning (real-time or on-demand assessment and feedback)	( )	( )	( )	( )	( )	( )	( )
Student learning (learning outcomes, course completion)	( )	( )	( )	( )	( )	( )	( )
Student degree planning	( )	( )	( )	( )	( )	( )	( )
Undergraduate student progress (retention, graduation, etc.)	( )	( )	( )	( )	( )	( )	( )
Graduate student progress (retention, graduation, etc.)	( )	( )	( )	( )	( )	( )	( )
Enrollment management, admissions, and recruiting	( )	( )	( )	( )	( )	( )	( )
Cost to complete a degree	( )	( )	( )	( )	( )	( )	( )
Time to complete a degree	( )	( )	( )	( )	( )	( )	( )
Instructional management (which courses need to be offered, number of sections, staffing needs)	( )	( )	( )	( )	( )	( )	( )
Other student objectives	( )	( )	( )	( )	( )	( )	( )
Progress of institutional strategic plan	( )	( )	( )	( )	( )	( )	( )
Alumni/development/institutional advancement	( )	( )	( )	( )	( )	( )	( )
Central IT	( )	( )	( )	( )	( )	( )	( )
Facilities	( )	( )	( )	( )	( )	( )	( )
Finance and budgeting	( )	( )	( )	( )	( )	( )	( )
Procurement	( )	( )	( )	( )	( )	( )	( )
Human resources	( )	( )	( )	( )	( )	( )	( )
Library	( )	( )	( )	( )	( )	( )	( )
Faculty research performance	( )	( )	( )	( )	( )	( )	( )
Faculty teaching performance	( )	( )	( )	( )	( )	( )	( )
Faculty promotion and tenure	( )	( )	( )	( )	( )	( )	( )
State/federal/accreditation reporting	( )	( )	( )	( )	( )	( )	( )

4. What level of investment has your institution made in *LEARNING ANALYTICS*?

( ) Major investment

( ) Minor investment

( ) Little or no investment

( ) Don't know

4a. Rank the top 3 factors that motivated your institution to invest in *LEARNING ANALYTICS*.

_____Attempt to reengineer business processes

_____Attempt to optimize resources

_____Attempt to improve the quality of administrative services

_____Attempt to contain or reduce costs

_____Attempt to generate revenue

_____Attempt to demonstrate higher education's effectiveness/efficiency to external audiences (parents and students, government, media, etc.)

_____Attempt to create greater transparency, sharing/federation of data

_____Attempt to reduce students' time to degree

_____Attempt to attract more students

_____Attempt to reach a different or broader segment of students

_____Attempt to understand the demographics and behaviors of a changing student population

_____Attempt to decrease student dropout rate or improve retention

_____Attempt to improve student course-level performance

_____Attempt to improve faculty productivity

5. What level of investment has your institution made in *INSTITUTIONAL ANALYTICS*?

( ) Major investment

( ) Minor investment

( ) Little or no investment

( ) Don't know

5a. Rank the top 3 factors that motivated your institution to invest in *INSTITUTIONAL ANALYTICS*.

_____Attempt to reengineer business processes

_____Attempt to optimize resources

_____Attempt to improve the quality of administrative services

_____Attempt to contain or reduce costs

_____Attempt to generate revenue

_____Attempt to demonstrate higher education's effectiveness/efficiency to external audiences (parents and students, government, media, etc.)

_____Attempt to create greater transparency, sharing/federation of data

_____Attempt to reduce students' time to degree

_____Attempt to attract more students

_____Attempt to reach a different or broader segment of students

_____Attempt to understand the demographics and behaviors of a changing student population

_____Attempt to decrease student dropout rate or improve retention

_____Attempt to improve student course-level performance

_____Attempt to improve faculty productivity

6. Would any strategic priorities at your institution benefit from the use of data, regardless of whether data are actually being collected or used for analytics now?

( ) No

( ) Yes

6a. Please specify the strategic priorities at your institution that would benefit from the use of data.

_____

_____

_____

7. To what extent do you see the following as concerns about the use of data or analytics in higher education?

	Not a concern	Minor concern	Moderate concern	Major concern	Don't know
The data used for analytics aren't always accurate.	( )	( )	( )	( )	( )
The data will be misused; wrong conclusions will be drawn.	( )	( )	( )	( )	( )
Student privacy rights will be breached.	( )	( )	( )	( )	( )
Faculty privacy rights will be breached.	( )	( )	( )	( )	( )
Staff privacy rights will be breached.	( )	( )	( )	( )	( )
Analytics solution providers (vendors) will have access to data.	( )	( )	( )	( )	( )
Analytics solution providers (vendors) will claim to own and will profit from analytics models/algorithms/solutions based on our data.	( )	( )	( )	( )	( )
We must have an exit strategy/contingency plan when changing vendors becomes necessary.	( )	( )	( )	( )	( )
Institutions will be reliant on blackbox algorithms to inform decisions about students, faculty, or strategic priorities.	( )	( )	( )	( )	( )
Institutions will be dependent on the quality of vendor algorithms that they don't fully understand.	( )	( )	( )	( )	( )
Government regulations will be imposed, requiring more reporting on performance metrics.	( )	( )	( )	( )	( )
Government regulations will be imposed, requiring reporting on questionable/flawed performance metrics.	( )	( )	( )	( )	( )
Institutions won't be able to afford to implement analytics effectively.	( )	( )	( )	( )	( )
Institutions that don't invest in analytics will be at a significant strategic disadvantage.	( )	( )	( )	( )	( )
There will not be a sufficient return on investment; the money would be better spent elsewhere.	( )	( )	( )	( )	( )
What we do in higher education can't be measured.	( )	( )	( )	( )	( )
The higher education community doesn't know how to use data to make decisions.	( )	( )	( )	( )	( )
This is another means of running higher education like a business, and that's the wrong model for higher education.	( )	( )	( )	( )	( )

8. Please rank order the analytics benchmarking comparisons that would be of most value to your institution.

Comparison of my institution...

_____...over time
_____...to an ideal
_____...to our peer institutions
_____...to our aspirational peer institutions
_____...to industry

9. If you have any comments regarding your personal use of analytics, your institution's use of analytics, or the content of this survey, please share them here.

_____

_____

_____

_____

10. May we contact you to obtain clarification or further insight into some of your responses?
( ) No
( ) Yes

Thank You!

Thank you for participating in ECAR's survey on analytics! Aggregated responses to this survey will be analyzed and published in multiple reports that are planned for release in 2015. Thank you for being a part of this important research.

Please contact ECAR if you have any questions about this survey or our analytics research. Bookmark the ECAR Analytics Research Hub to find relevant ECAR analytics resources.

Vita

Molly O'Keefe was born in Charlotte, North Carolina on June 25, 1975. She graduated from Illinois State University with a Bachelor of Science degree in Sociology in 1997 and a Master of Science degree in Sociology in 2004. She currently works at the University of North Carolina- Chapel Hill, Gillings School of Global Public Health as the Assistant Dean of Strategic Analysis and Business Intelligence. She has one daughter, Melinda, who has been the inspiration for all of her education throughout her academic career.