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Academic Analytics: The Uses of Management Information and Technology in Higher Education

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ECAR

EDUCAUSE Center for Applied Research

EDUCAUSE is a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology.

The mission of the EDUCAUSE Center for Applied Research is to foster better decision making by conducting and disseminating research and analysis about the role and implications of information technology in higher education. ECAR will systematically address many of the challenges brought more sharply into focus by information technologies.

Contents

Foreword

The EDUCAUSE Center for Applied Research (ECAR) was launched on January 1, 2002, to create a body of research and analysis on important issues at the intersection of higher education and information technology. ECAR is fulfilling its mission through a program of symposia and through the publication of (1) biweekly research bulletins oriented to senior campus functional executives; (2) detailed studies designed to identify trends, directions, and practices in an analytically robust fashion; (3) case studies that showcase campus activities and highlight effective practices, lessons learned, and other insights from the practical experience of campus leaders; and (4) roadmaps and key findings, which present the highlights of detailed ECAR studies for a broader audience. Since ECAR's inception, eight symposia have been held and more than 200 research publications have been issued.

Academic Analytics in Higher Education: The Untamed Frontier

In 2002, ECAR published *The Promise and Performance of Enterprise Systems for Higher Education,* our comprehensive review of the state of adoption and experience with enterprise systems generally and commercially vended ERP systems particularly. What we learned was that higher education had spent an estimated $5 billion on the modernization of enterprise administrative systems (finance, HR, student) in the closing decade of the last century. We succeeded, to a great extent (and with notable exceptions), in implementing these large and complex systems on time and on budget (Kvavik & Katz, 2002, p. 11). Our research on enterprise systems also revealed that "ERP products often cannot generate the reports the institutions need. Many institutions have created data warehouses to solve their reporting and data query needs." (Kvavik & Katz, 2002, p. 15)

This finding was important because it is also clear that many institutions invested in new enterprise systems believing that these major investments would not only enhance the processing of student, financial, and HR transactions but would also vastly improve the quality and timeliness of information in these areas and render information in forms that would facilitate decision making. This disconnect between expectations and actualities colored much of the journalistic reporting on the ERP phenomenon of the 1990s. The message of much of this reporting: higher education has spent much to win a battle, but not yet a war.

What's in a Name?

For researchers, such findings are important and even magical because they bespeak an incomplete story. Indeed, we asked, what then is the state of the practice of reporting, analysis, decision support, and the complex of technologies and techniques that compose what many call *business intelligence*? Before proceeding, we felt the need to consider new terminology. The term business intelligence was coined in the private sector, for the private sector, and it rang hollow to our delicately trained academic ears. Our scope of interest was of course more than business, and, frankly, the idea of intelligence—competitive or otherwise—just felt wrong in the context of the academy (unless, of course, we were referring to the wisdom of our workforce!). A conversation with our colleague Karen Gage of WebCT surfaced new terminology that that firm was considering to describe the same complex of technologies and techniques. WebCT used the term *academic analytics* and graciously encouraged ECAR to use this language to describe the results of our work. Academic analytics, too, is an imperfect umbrella for these activities but, we concluded, a more fitting one for discussion within the academy.

We apologize for any perceived shortcomings in this language, but we know that you understand what we're talking about!

Deepening Study

Having resolved our nomenclature, ECAR set along two paths to create a picture of how higher education was using data warehouses, marts, data extraction, modeling simulation, scorecards, and a variety of other reporting and analysis tools and techniques. In the ECAR study *Good Enough! IT Investment and Business Process Performance in Higher Education,* we found that in general, respondents were more satisfied with transaction processing than they were with monitoring processes. Respondents were even less satisfied with management activities (Kvavik, Goldstein & Voloudakis, 2005). Nearly half of all respondents in 2005 described their reporting and analysis processes as "adequate," and—depending on the process being assessed—as many as one-third characterized these processes as being "at risk." Notwithstanding an easy conclusion that much remains to be done in this area, it was heartening to find that 9 percent of respondents described themselves as "leaders" or "exemplars" as regards the reporting and analysis of enrollment management information. Selective progress has been made along this frontier (Kvavik et al., 2005).

Burrowing deeper still, ECAR moved in late 2004 to undertake a study dedicated expressly to the topic of academic analytics. The report that follows represents the culmination of nine months of research that included a literature review, a quantitative survey of 380 EDUCAUSE member institutions in the United States and Canada, interviews with 25 higher education IT leaders and 2 corporate leaders, and 2 on-site case studies.

Important Findings

The ECAR study *Academic Analytics: The Uses of Management Information and Technology in Higher Education* reinforces earlier findings that most academic institutions rely on their core enterprise transaction processing systems to meet their needs for information and analysis. Most of us are using academic analytics to support transactional and operational reporting and not for what-if analysis, predictive modeling, or alerts. Not surprisingly, areas that incorporate many of the advanced features of academic analytics are those that influence revenue, such as enrollment management and student services. Most of us plan to expand our capabilities in these areas in the next two years.

Importantly, the current ECAR study confirms again that leadership commitment and training are closely associated with institutional investment in these technologies and practices and with respondents' perceptions about a host of positive outcomes. Specifically, a robust academic analytics environment is often associated with leaders who are committed to evidence-based decision making and to ensuring the existence of a well trained cadre of analysts to work with information.

What's in Store?

Academic Analytics: The Uses of Management Information and Technology in Higher Education reveals that higher education's need for access to information is large and growing. The secondary literature in particular describes an environment shaped by (1) rising threats to revenue and downward pressure on costs; (2) increased competition and increasing consumer power and choice; and (3) greater pressure on colleges and universities to demonstrate outcomes. This environment has real implications for those responsible for organizing the academic analytics infrastructure for the institution.

- In tight budgetary climates especially, the institution with the best information and decision-making capacity can win.
- The velocity of decision making will increase as a premium is placed on nimbleness.
- Institutions will need to track, manage, and analyze more data about prospective students and markets, and more institutional information will be expected to be available in the public domain.
- Net generation students, staff, and faculty will have heightened expectations for data access.

This context and these implications suggest what might be characterized as a "burning platform" in this arena. What may be good enough in today's competitive context may, in fact, be inadequate tomorrow. The secondary literature in this area suggests an evolution in practice (and theory) from

- producing canned and ad hoc reports from transaction processing systems, to
- reporting from data marts and warehouses, to
- using sophisticated analytic tools and techniques to analyze data and develop predictive models and assessment frameworks, to
- publishing data from transaction systems to predictive models in order to trigger an alert for some institutions, to
- creating an integrated and autonomic environment in which information is dynamically shared between transaction processing systems and decision engines that in many cases resolve identified issues according to the institution's rules and notifies process owners after the fact.

Higher education—and most other sectors of the economy—are only partially through this journey, and, with each level of progress, new issues of policy and practice are likely to be raised. Are we creating a seamless environment in which decisions are driven from data? Are our models good enough? How do we balance the benefits of profiling things like academic performance, persistence, retention, and so forth with an individual's rights to privacy? These are not new issues. Academic advisors, for example, have balanced such issues for decades, but they can and do assume a different guise under the banner of new technology, new techniques, and new processes. As British columnist Jeremy Clarkson observed—in the wake of machine-generated autonomic glitches in his credit reporting—"this was Skynet and I was John Connor" (Clarkson, 2005).

Many People to Thank

This ECAR study is designed to provide a first fact-based and national perspective of higher education's academic analytics environment that can lead to the improvement of practice for higher education in this important arena. The report furthers the baseline for higher education that begins with the ECAR study of ERP in 2002. It identifies which academic analytics policies, products, and procedures are currently in place. Institutions will be able to compare their investments and practices to those of similar institutions. Emphasis is placed on both the benefits and costs of implementing academic analytics solutions, with a discussion of trade-offs and future trends.

ECAR research studies are the result of a team effort. Philip J. Goldstein was the principal investigator on this research effort and is the primary author of this study. I had the privilege of serving as his sounding board and of speculating in Chapter 9 about the future of the practice in this arena. Phil's research design was developed with a team that included Harvey Blustain, Judy Caruso, Bruce Metz, Judith Pirani, Gail Salaway, John Voloudakis, and me. Two members of this team, Gail Salaway and John Voloudakis, also provided necessary advice and guidance on the survey that was developed in support of this research. Toby Sitko coordinated the production of this study with the team composed of the terrific staff of EDUCAUSE and our external suppliers, whom we really think of as friends and colleagues

Of course, the real team in any ECAR study is the EDUCAUSE community. Our ability to develop a good understanding of practices, policies, and directions in higher education depends on the goodwill of our associates in the community. Literally hundreds of busy IT leaders shared their experiences and expertise on our quantitative survey, and dozens more gave generously of their time in interviews. Vice Chancellor of the University of Alabama Priscilla Hancock; CFO, CIO, and Dean of Libraries at Baylor University Reagan Ramsower; and Vice President of the University of Texas at Austin Daniel Updegrove were particularly helpful in shaping our understanding of this issue. In addition, ECAR fellows enjoyed the widespread support of senior executives and others at the University of Phoenix and the University of California, San Diego, pursuant to our publication of two separate, but complementary, case studies. Robert Kvavik, Associate Vice President of the University of Minnesota and Senior ECAR Fellow, always brings insight to the table and leavens every discussion with wit and wisdom from a career in the service of higher education. Among our corporate friends, Julie Curtis of SunGard Higher Education, Karen Gage of WebCT, and Karen Willett of Oracle were generous with their time and offered perspectives that spanned large customer bases.

Finally, ECAR, while now enjoying the support of more than 360 college and university subscribers, continues to depend on the generous support of a small and dedicated cadre of corporate sponsors. Datatel, HP, Oracle, SunGard Collegis, and SunGard SCT not only provide financial support of ECAR but are also generous with their advice and skilled resources.

This study of academic analytics reminds us that that the opportunities and challenges posed by networked information demand responses that are at once technological and cultural in nature. The story of academic analytics in higher education is ultimately a story of people—technologists, transaction processors, analysts, and decision makers. We learn again that leadership and culture matter deeply in the choices that institutions make about information technologies and the speed with which those choices are adopted. In the case of academic analytics, there may be a vision gap, as these technologies, which are largely mature, have the potential to positively and directly impact core drivers of institutional success, such as student achievement, academic persistence, retention, and admissions selectivity. Dozens of institutions possess this vision and are already quietly demonstrating important outcomes. As course management systems attain the status and stature of enterprise systems, they too will acquire and store volumes of student data that, when combined with other information, can begin to help us more fully understand the student experience around learning.

Academic analytics in higher education remains in its infancy, or perhaps in early childhood. The potential, however, is great, and it is likely that the times will demand more of our data and the systems that manage it. Leadership remains the key. Quite clearly the IT community understands the tools and techniques of academic analytics but rightly awaits a cadre of process leaders who will insist on information that is more accurate, timely, and nuanced and who will provide both the resources and political cover to realize the potential. Knowledge is indeed power, and power, in the end, is embedded in cultures and vested in leaders.

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1
Executive Summary

Science and technology revolutionize our lives,
but memory, tradition, and myth frame our response.
—Arthur M. Schlessinger

The typical college's information systems produce hundreds of management reports and capture sufficient data to create many more. Individual administrators possess additional information in personal or departmental shadow systems. How is this information used? Clearly, the institution requires much reporting just to monitor its routine transactions. The external environment is also a major consumer of institutional information. Regulatory bodies, the Integrated Postsecondary Education Data System (IPEDS), state agencies, and others all require descriptive or operational data from the institution.

Do institutions do more with the data they collect? Are institutions investing more resources in tools that enable them to collect and manipulate management information? Do they use information and analysis to support institutional decision making? These are the core questions this study sets out to answer.

Since the 1980s, higher education has spent hundreds of millions of dollars on administrative technologies. A major intent of many of these expenditures was to improve access to information. Some institutions implemented new enterprise resource planning (ERP) systems. Others invested in data marts, data warehouses, and other technology tools to improve their ability to access and analyze information. Many institutions implemented both ERP and supplemental technologies to improve reporting. What have these strategies accomplished?

For many institutions, the challenge is no longer the lack of access to timely information. Institutions have significantly improved their ability to capture, distribute, and manipulate management information. But having information and using information are two different things. Has higher education changed how it uses information? Are its primary information consumers still external agencies requesting descriptive data, or staff involved in transaction processing?

Technology has enabled more advanced analysis. Like their corporate counterparts, higher education institutions can now model the impact of decisions before they make them. They can build analytical models to predict student achievement or which students are most likely to enroll. They can leverage information technology to produce up-to-the-minute management information that is displayed in easy-to-use, graphical formats. Or, they can integrate data and analysis into their business processes and generate automated responses and alerts if a key metric falls outside a desired range. How widespread has the adoption of these advanced analytical applications been? Who are the adopters, and what have they accomplished?

Academic Analytics

We have adopted the term *academic analytics* to describe this study. It is an imperfect label because it suggests we're not interested in administrative uses of analysis. This is clearly not our intent. At the outset of this study, we anticipated that most users of analytical tools are the administrators who manage the "business" of the institution. However, we found the term academic analytics to be far better than traditional corporate terminology such as business intelligence or data mining. These labels tend to be poor fits for higher education's mission, and they are too jargon-like. Likewise, we wanted a term that conveys our intent to study more than just technology. We did not set out to study data-warehousing or decision-support tools. Rather, we were interested in the applications of these technologies and how they impact institutions. This is a study about how institutional characteristics and management climate and culture impact the use of information.

Technology Platforms

At the study's outset, we hypothesized that most institutions rely primarily on their transaction systems (such as finance or student information systems) for reporting and analysis. This proves to be the case. Among survey respondents, 47 percent report primarily from their transaction systems. The remaining institutions employ a combination of technologies.

Initially, we thought respondents would have one of three technology platforms:

- Level 1: Reporting from transaction processing system only.
- Level 2: An operational data store or single data mart used in conjunction with extract, transfer, and load (ETL) processes and reporting tools.
- Level 3: An enterprise data warehouse or multiple data marts used in conjunction with ETL tools, reporting tools, executive dashboards, or alerts.

By labeling the levels 1 through 3, we offer no prejudgment that level 3 capability is more desirable or effective than that of levels 1 or 2.

After analyzing the survey responses, we realized that many institutions have technology platforms that are between levels 1 and 2 or levels 2 and 3. These institutions are either in a state of transition (as evidenced by their planned investments) or have chosen to stop at an intermediate point between the levels. So, respondents can actually be clustered into one of six technology levels: three primaries and three intermediaries. They are

- Level 1: Reporting from a transaction processing system only.
- Level 2a: An operation data store or single data mart.
- Level 2: An operational data store or single data mart used in conjunction with ETL and reporting tools.
- Level 3a: An enterprise data warehouse or multiple data marts used without ETL tools or advanced reporting tools.
- Level 3b: An enterprise data warehouse or multiple data marts with ETL tools but without online analytical processing (OLAP) or dashboards.
- Level 3: An enterprise data warehouse or multiple data marts used in conjunction with ETL tools, reporting tools, executive dashboards, or alerts.

Figure 1-1 illustrates the distribution of respondents by technology platform type.

As we would expect, institutions with more extensive technology platforms report higher levels of expenditures. We asked respondents to report their aggregate spending for the last five years on academic analytics. Institutions with level 3 capability reported average aggregate costs of $1.3 to $1.4

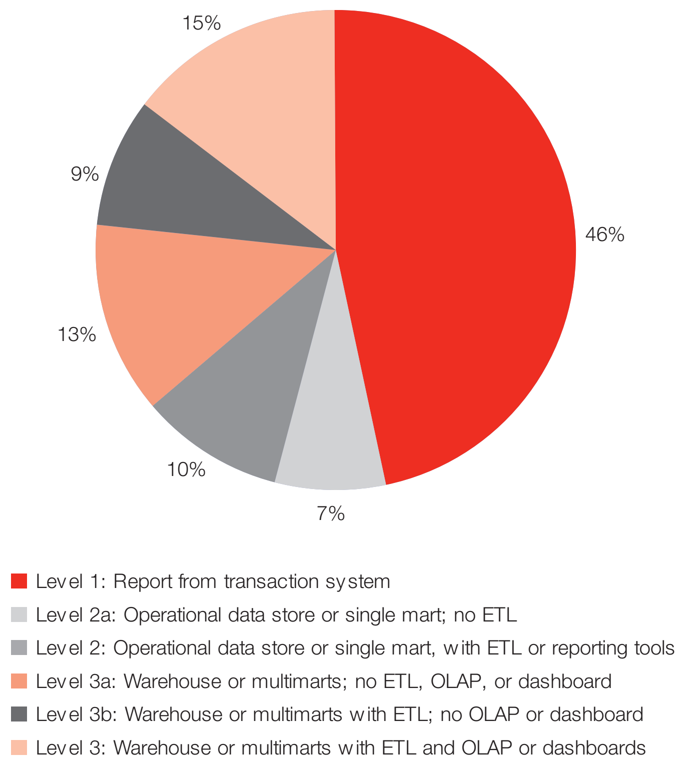


Figure 1-1. Distribution of Respondents, by Technology Platform (N = 350)

million. Comparatively, institutions with level 2 capability reported average five-year costs of $800,000 to $900,000. Institutions approaching level 2 or level 3 reported somewhat lower aggregates costs than those already at the next highest level. We caution that the relatively small numbers of respondents in any one group make it difficult to draw strong conclusions from this data.

Institutions with more extensive technology platforms also report higher satisfaction levels with their academic analytic capability. We asked respondents to assess three different aspects of academic analytics:

- the ability to give decision makers timely access to data,
- the ability to make information widely accessible, and
- their technology tools' ease of use.

Overall, satisfaction increases with the complexity of the technology platform. The most significant jump in satisfaction appears to occur when an institution moves beyond transaction system reporting (level 1). Respondents with near level 2, level 2, or near level 3 capabilities all have fairly comparable levels of satisfaction. Satisfaction increases again significantly for those institutions with level 3 capability. These respondents had the highest average level of satisfaction with timeliness of information access, breadth of information access, and their tools' ease of use. Respondents with near level 3 capability (lacking ETL, OLAP, or dashboards) had lower levels of satisfaction. This suggests that adding sophisticated tools like OLAP or dashboards that make it easier for users to obtain and manipulate data does make a difference.

Note that these criteria measure an institution's satisfaction with the performance of their academic analytical tools, not the outcomes they achieve with them. We draw this distinction because satisfaction with analytical tools' performance depends more on technology level than do the outcomes the institution achieves.

Applications of Academic Analytics

Respondents report the most active and sophisticated use of academic analytics in the central finance, budget and planning, and institutional research functions. We found the least active use in advancement and grants management. Usage in these areas is somewhat higher at institutions with missions that place more emphasis on fundraising and research. Most institutions use their academic analytics to report transaction data and monitor operational performance (such as budget-to-actual results). Only 30 respondents indicated that their primary use of academic analytics was for an advanced application such as predictive modeling or scenario building.

Institutions appear to have chosen different paths for deploying academic analytics. Some report broad deployment but limited use. Others seem to have focused on advanced use in a few key areas. Relatively few have done both. Qualitative interviews suggest that the institution's degree of decentralized authority affects their strategy for how broadly to distribute their analytical systems. The quantitative data suggest that larger, more organizationally complex institutions (for example, those with multiple colleges and multiple revenue streams) are more likely to deploy broadly.

Respondents did report greater instances of advanced academic analytics applications within individual functional areas. Central finance, budget and planning, and institutional research, along with admissions offices, are the most active users of advanced analytics. The primary applications of advanced analytics include modeling strategic decisions, studying enrollment trends, and measuring student retention.

Institutional factors play some role in determining where institutions implement advanced analytics. For example, private bachelor's institutions typically have a highly selective admissions process, often accompanied by revenue-sensitive distributions of financial aid. These institutions are more likely to use advanced applications of academic analytics such as modeling in support of enrollment management. Across all functional areas, three factors significantly impact respondents' ability to implement advanced analytical applications. Respondents with effective user training, strong analytical skills among staff, and leadership committed to evidence-based decision making are more likely to have successfully deployed advanced academic analytics.

Interestingly, technology does not appear to be a factor in whether an institution can implement more advanced applications of academic analytics. We found no statistically significant relationship between a respondent's choice of technology platform and advanced applications in any of the functional areas studied. It appears that issues of management commitment and staff skills are paramount.

Impact of Academic Analytics

Institutions do report that academic analytics has a positive impact on institutional metrics and measures of success in individual functional areas. Overall, respondents agreed that academic analytics improves institutional decision making, helps institutions meet strategic objectives, and provides a competitive advantage to the institution. On average, respondents disagreed, however, that academic analytics helps them reduce the number of shadow systems.

We also asked respondents to assess the impact of academic analytics on their success in five functional areas: finance, human resources, grants management, student services, and advancement. In each area, we asked respondents to indicate their level of agreement, using a five-point scale, that academic analytics improves the outcomes within the functional area. Respondents agreed most strongly that they had improved results in the student area. The mean level of agreement for improved enrollment results was the highest (3.43), followed by improved retention (3.16). The only other outcome with a mean above neutral was improved financial results (3.09).

Respondents had the lowest mean level of agreement in grants management. Even among doctoral institutions, respondents on average did not agree that they had often used academic analytics in the grants management area. Respondents also did not feel strongly that they were improving their results in either the human resource management or advancement areas. Responses do differ by institution type. Private institutions had a significantly better assessment of the impact of academic analytics in the advancement area than did public institutions.

We used regression analysis to identify the factors most strongly associated with an institution's perceived success with academic analytics. We looked at such variables as enrollment, Carnegie class, and control (public versus private), as well as their aggregate spending on academic analytics. We reviewed management and cultural dimensions such as the effectiveness of training, leadership commitment to evidence-based decision making, the strength of staff analytical skills, and the institutional environment. We also assessed whether the institution's choice of technology platform affects overall success. Finally, we evaluated whether the level of sophistication of analysis an institution performs has an impact.

We found the most significant factors to be management factors such as training effectiveness, leadership commitment, and the presence of strong analytical skills among the staff. These variables had the strongest relationship with measures of success. Other important factors include

- whether the technology platform includes a data warehouse,
- the use of analytics to model strategic decisions,
- the use of analytics to forecast demand for courses, and
- the use of analytics to tailor student recruiting strategies.

In addition to the management climate characteristics described above, institutions that use their academic analytics to model strategic decisions, tailor recruiting strategies, or forecast demand for courses report higher success levels on several outcome metrics. Similarly, institutions that employ a data warehouse report greater success at using academic analytics to help the institution meet its strategic outcome. The only other significant relationship between technology and outcomes is that institutions with dashboards (for reporting) have greater success reducing the number of shadow systems.

The Future

It appears we are still relatively early in higher education's adoption of academic analytics. While the technology has been available for many years, institutions are just now beginning to exploit it. Most respondents predict that they will significantly expand their capability in the next two years both in terms of the range of data they have in their data stores and their sophistication of use. Institutions predict that users' increasing appetites for information will drive them to expand their capability. External factors will also play a role as institutions are required to more closely measure student outcomes and provide more data to accrediting bodies.

Technological capabilities likely won't limit what institutions can accomplish with academic analytics. Rather, this will depend on the extent to which staff members develop the skills to understand and manipulate data and the commitment of leadership to embrace data-driven decision making.

2
Introduction

Information networks straddle the world. Nothing remains concealed. But the sheer volume of information dissolves the information. We are unable to take it all in.
—Günter Grass, German novelist and Nobel Prize winner

Anecdote, instinct, or analysis: How does higher education really decide? Higher education is dedicated to fact-based scientific discovery. But does higher education leadership use this same penchant for analysis to make institutional decisions? Insiders often ridicule higher education's inability to make decisions with statements like "a 10-to-1 vote is a tie" or "any decision worth making is worth making twice." But is higher education really devoid of evidence-based decision making?

Decision Making: Instinct Versus Analysis

If higher education managers do rely more on instinct than analysis, this does not make them unique. A May 2002 study by the executive search firm Christian and Timbers found that 45 percent of corporate executives rely more on instinct than data in running their business (Bonabeau, 2003). So, decisions based on intuition and anecdote are not a tendency peculiar to managing in higher education. Rather, they are human nature. In a *Harvard Business Review* article, strategy consultant Eric Bonabeau observed that individuals tend to rely more on instinct as the number of options and the amount of data increase. It becomes almost a defense mechanism to avoid becoming overwhelmed. Kati Weingartner, director of information technology at Arizona State University–Polytechnic, believes that higher education decision makers face the same conundrum as their corporate counterparts. According to Weingartner, the challenge is that "the more data people have to support their thinking, the more things they have to think about."

While deciding by instinct may be a normal human tendency, Bonabeau argues that it is fraught with risk. He argues that intuitive decision makers see old patterns in new problems and miss opportunities to develop new insights and solutions. In addition, intuitive decision makers tend not to explore many alternatives. Finally, intuitive decision making also leads to group thinking in which no one wants to counter the boss's intuition despite the facts. Instead, Bonabeau urges decision makers to use "information technology to help overcome limitations of time and our inherent mental capacity to effectively analyze complex situations" (Bonabeau, 2003, p. 2).

Quest for Information

Institutions, like many corporations, seem to exist at two extremes: Either they are drowning in data that cannot be turned into meaningful information, or they capture information that they cannot extract from their information systems in a timely manner to support decision making. Neither is a satisfactory place to be. For more than a decade, higher education has pursued administrative technology investments in part to improve the availability and utility of management information. The early promise of many ERP implementations was that they would make access to information fundamentally easier. As institutions began to implement ERP, their objectives shifted to more practical matters. ECAR found in its 2002 study of higher education enterprise systems that only 4 percent of institutions surveyed identified providing better management tools "as the single most important reason they implemented an ERP." The most frequently cited reason (42 percent of respondents) was to replace an aging legacy system (Kvavik & Katz, 2002, p. 36).

Either the goal of transforming management took a back seat to more practical needs, or ERP systems alone could deliver the information institutions needed. Dan Updegrove, vice president of information technology at The University of Texas at Austin, believes the latter. According to Updegrove, "Many institutions have spent significant amounts of money in hopes of improving information for planning and management. What they got was new and different transaction processing systems. The data, the user interfaces—and the users—of correct, fast, auditable transaction processing are fundamentally different from those of planning and management tools."

Higher education has continued to pursue the goal of improved management information through other technologies as well. As this study confirms, many institutions implemented data marts or data warehouses along with or in advance of replacing their transaction systems. Still others have followed on their ERP projects with new initiatives to implement better reporting and analysis tools. However, satisfaction still seems elusive. An ECAR study published earlier this year, *Good Enough! IT Investment and Business Process Performance,* looks at institutional satisfaction with the performance of major administrative processes supported by technology, including reporting. That study concludes that institutions are most satisfied with their transaction processes and least satisfied with processes related to management information and analysis. Management reporting (for example, to analyze the sources and uses of funds) along with grants management processes had the lowest mean satisfaction levels in the entire study (Kvavik, Goldstein, & Voloudakis, 2005, p. 13).

While satisfaction with the quality of management information appears low, demand, or the perception of demand, is high. Institutions face increasingly demanding external reporting requirements. In a post-Enron world, boards, state higher education commissions, and system offices are asking for more extensive information on a more frequent basis. Accreditation bodies are shifting emphasis to measures of institutional outcome, with evaluations focusing increasingly on how institutions measure everything from student learning to the implementation of the institutional strategic plan. So, the importance of metrics, data, and analysis seems on the rise. The quest to improve the campus IT infrastructure to respond to this demand continues. Administrative/ERP information systems remained the third most significant issue identified by CIOs in the 2005 EDUCAUSE survey of current issues (Maltz & DeBlois, 2005). It has occupied this position for the last three consecutive years.

Clearly, some institutions are succeeding. The University of Connecticut is harvesting student information and course management system data to build easy-to-use predictive models of student success in courses. The

University of California at San Diego has developed a set of dashboards to provide managers with immediate access to relevant management data and analytical tools. Baylor University has built a financial data warehouse. The University of Minnesota has been recognized by ComputerWorld.com as a business intelligence best practices finalist. These are only a few examples of how institutions are leveraging data to change how they manage and operate the institution.

Study Objectives

The intent of this study is to understand the current state of technology deployment and use in support of reporting, analysis, and decision making in higher education. Throughout this document we use the term *academic analytics* to refer to numerous activities institutions employ to use data to manage the enterprise. We present a compete discussion of terminology in Chapter 3.

In undertaking this study, we sought to meet several objectives. First, we wanted to know what technologies institutions employed to support academic analytics. Second, we wanted to understand who the most active users of data and analytical capabilities were within an institution and what they used them for. Third, we wanted to identify institutions that used their analytical capacity in advanced ways, such as to build predictive models or test scenarios, or had integrated data and analysis into their business processes (for example, automated alerts). Finally, we sought to assess whether institutions that have more fully embraced the use of information and analytics achieved better outcomes.

Additional research questions that this study explores include:

- How does an institution's choice of technology affect the results they achieve with academic analytics?
- How does the institutional environment and management culture impact the ability to implement academic analytics?
- How do the intensity and nature of use of academic analytics vary by functional area?
- What are institutions' plans for expanding their reporting and analytical capabilities?
- What are the drivers for expansion, and how do they vary by institution?
- Does wide dispersion of information and analytical tools change the way managers make decisions?
- Does making information more widely available within an institution create any unintended negative consequences?

These are just some of the questions this analysis seeks to address. In the coming chapters, we present an overview of the use of academic analytics today, review the technology landscape, discuss how institutions have deployed their analytical capability, and examine some of the advanced uses of academic analytics. In the concluding chapters, we look at the outcomes institutions realize from their analytical capabilities and applications and discuss how the use of information and analytical tools may change in the future.

3
Project Design, Terminology, and Methodology

When I examine myself and my methods of thought, I come close to the conclusion that the gift of fantasy has meant more to me than my talent for absorbing positive knowledge.
—Albert Einstein

This chapter presents an overview of the study's design and research methodology. We begin with a discussion of terminology, including definitions of key terms. Next, we review the scope of issues and questions that guided the study. Lastly, we present the quantitative and qualitative methods we used to gather data. Included is a profile of survey respondents.

Academic Analytics

The first challenge we faced in designing this study was what to call it. Our goal was to study the technological and managerial factors that impact how institutions gather, analyze, and use data. The corporate sector calls our topic *business intelligence.* Business intelligence is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions.[1] Other frequently used terms include data mining and competitive intelligence. We rejected these as either too jargon-like or inappropriate to describe how and why higher education uses information.

Other terms such as data warehousing, decision support systems, or simply reporting felt too limited in scope. Our goal was to study not just a particular technology (such as data warehousing) but rather the intersection of technology, application, and institutional culture and climate. Therefore, we needed a broader term. In our survey, we used *reporting, modeling, analysis, and decision support capability* as an all-encompassing set of terms to describe the scope of what we are studying. However, as a label, this is too cumbersome.

We finally arrived at the term *academic analytics* as the encompassing term for our topic. The label was first mentioned to us in a conversation with Karen Gage of WebCT, and we are grateful for her assistance. We feel it conveys the sentiment of what we were most interested in studying: how academic enterprises use information to support decision making. By using the term academic analytics, we are not implying that we are only interested in academic decisions. On the contrary, we are very interested in how institutions use data to make all sorts of financial and operational decisions. Nor are we suggesting that we are studying how faculty use data to perform research. That topic is beyond the scope of this research.

Study Framework

Our study of academic analytics looks at multiple dimensions of the issue. First, we examine what types of technology platforms institutions are using to support academic analytics. How widespread is the use of data marts or data warehouses? Are institutions piecing together their own infrastructure or using reporting and analysis solutions provided by their ERP vendors? We asked survey respondents to identify which technologies they rely on primarily to support academic analytics, including

- enterprise data warehouses,
- single or multiple data marts,
- operational data stores, and
- transaction system reporting.

During our analysis, we confirmed our hypothesis that institutions use a combination of technologies to support academic analytics. In Chapter 5, we identify six levels of technology capability that institutions appear to use to support academic analytics.

Second, we look at institutions' application of academic analytics. How broadly have institutions deployed their capability? How actively is it used? Do some institutions or functions within institutions perform advanced analysis? To support this analysis, we defined five types of academic analytic applications:

- extraction and reporting of transaction-level data,
- analysis and monitoring of operational performance,
- what-if decision support,
- predictive modeling and simulation, and
- automatically triggered business process.

Throughout the study we review the prevalence of these applications and the impact they have on the institutions that employ them.

Finally, we were interested in understanding how culture and climate impact the use of academic analytics. Therefore, we collected data on institutions' management stability, commitment to evidence-based decision making, and the analytical skills of staff. We also looked at characteristics such as Carnegie class, enrollment, and institutional control, as well as the impact of external factors such as the regulatory environment and accreditation.

Methodology

The study uses information from more than 380 institutions collected primarily through a quantitative survey and augmented with qualitative interviews.

Quantitative Data

We designed and e-mailed a quantitative survey to 1,473 EDUCAUSE member institutions. Senior managers at more than 380 institutions completed the survey. Most respondents held the position of CIO or a comparable title indicating that they are their institution's senior IT leader. The survey can be found at the ECAR Web site, <http://www.educause.edu/SurveyInstruments/1004>. Appendix A identifies the institutions that responded to the survey. Survey data is confidential. No data from the quantitative survey is presented that could reveal the identity and specific responses of any participating institution.

We use means and standard deviations in this study. Means are arithmetic averages and measures of central tendency. Standard deviations are measures of dispersion or variability. This means that the larger the standard deviation, the more disagreement exists among respondents. We also did some comparisons of means and regressions analysis to determine the level of correlation among variables. We refer to these analyses but do not present the figures, for reasons of simplicity. Note also that percentages in some tables do not add up to 100 percent because of rounding.

Finally, we urge caution in interpreting these data because of the small number of institutions that reported being users of some technology platforms or advanced applications of academic analytics.

Qualitative Data

We supplemented our survey data with phone or in-person interviews of IT and functional unit leaders who are significantly involved in academic analytics. In all, we spoke with 27 individuals from 21 institutions and 2 corporations. We selected interview participants because they reported important characteristics in their survey responses. The respondents chosen indicated that they

- excelled at training staff to use academic analytics,
- have successfully deployed academic analytics broadly at their institution,
- reported high levels of satisfaction with the outcomes they achieve with academic analytics, or
- were advanced users of academic analytics in multiple functional areas.

These interviews enabled us to deepen our understanding of the factors driving institutions to invest in academic analytics. They provided insight into the factors that drive institutional success. They also offered interesting examples of how institutions are using academic analytics.

Characteristics of Survey Respondents

Figure 3-1 compares the distribution of the institutions that responded by their new Carnegie class, EDUCAUSE membership, and the universe of higher education institutions in the United States. The responding schools more closely mirror the EDUCAUSE membership than the national population of institutions.

A statistical analysis of the data's representation of Carnegie class and EDUCAUSE membership proved inconclusive. The findings do not support the conclusion that the institutions surveyed represent the population as a whole. Nor do they support the opposite conclusion that the respondents fail to represent the EDUCAUSE membership. Neither is a statistically significant conclusion.

The survey responses are weighted toward smaller institutions. Two-thirds (66.3 percent) of respondents are from institutions with student enrollments of 8,000 FTE or fewer. Figure 3-2 depicts the distribution of survey responses by student enrollment.

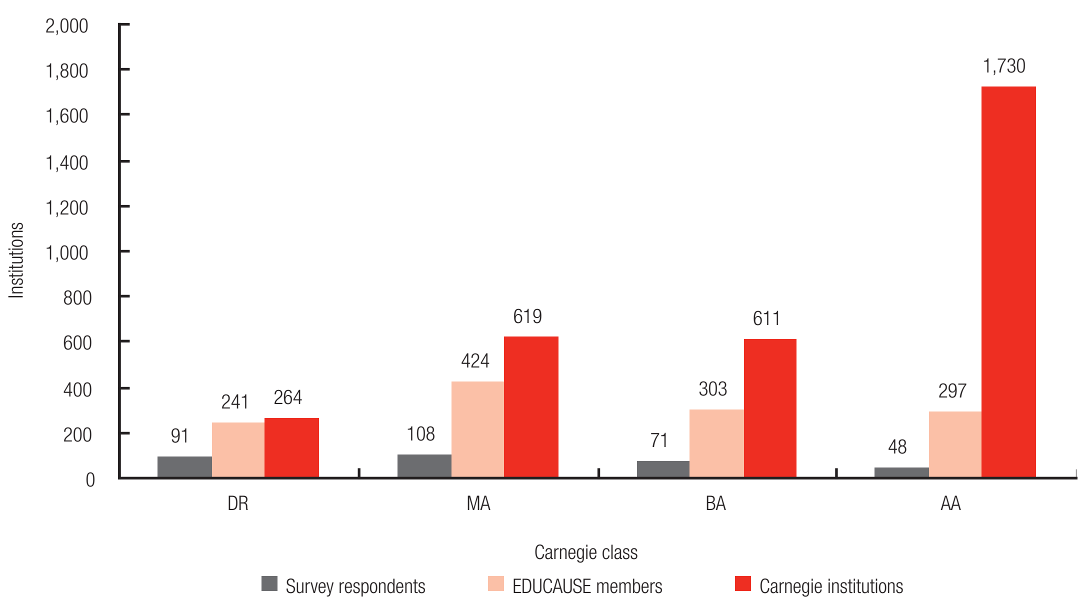
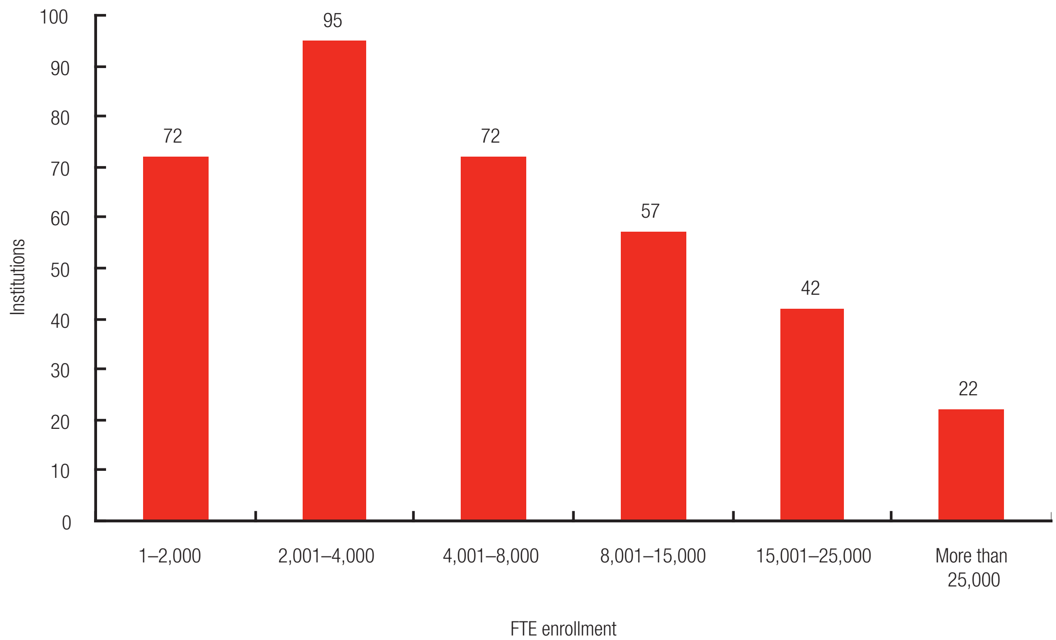


Figure 3-1. Survey Respondents by EDUCAUSE Membership and Carnegie Class

Figure 3-2. Student Enrollments at Institutions Surveyed



The vast majority of respondents were their institution's CIO (73.4 percent), and 97.6 percent worked within their institution's IT organization.

Respondents also represent a range of technology configurations, including some that use data warehouses, some with data marts, and many that use their transaction systems to support reporting and analysis. We discuss the respondents' technology profile more thoroughly in Chapter 5.

Endnote

1. This definition of business intelligence is taken from <http://www.whatis.com/>.

4
The Academic Analytics Landscape

Information is the oxygen of the modern age. It seeps through the walls topped by barbed wire, it wafts across the electrified borders.
—Ronald Reagan

As discussed in Chapter 2, the term *academic analytics* is intentionally broad. It encompasses a range of different technology platforms and functional applications. In fact, institutions have employed multiple strategies to enhance their analytical capabilities. Some distribute capacity broadly but use it for very narrow purposes. Others pursue deep use of analytics in a relatively narrow set of areas. The strategy an institution ultimately pursues is attributable to many factors, including resources, institutional control (public or private), and size.

This chapter explores the current landscape for academic analytics in higher education. We examine higher education's overall capabilities today and how they are expected to change in the future. In addition, we examine those institutions with very limited capability today. We identify the barriers that have slowed adoption of academic analytics and examine respondents' plans for the future. This chapter provides an overview that is complemented by deeper analysis in the two succeeding chapters. Chapter 5 looks in more detail at the technologies in use to support academic analytics. Chapter 6 examines the use of academic analytics.

Key Findings

- The length of time since the initial implementation of academic analytics is not related to the respondent's reported level of capability.
- The majority of respondents rely primarily on their transaction systems for reporting and analysis.
- Fewer than a third of respondents (30.5 percent) have one or more data marts, and 14.3 percent have an enterprise data warehouse.
- Data marts and warehouses are more prevalent among larger institutions with greater organizational complexity.
- The most significant barrier to institutions' upgrading their analytical capacity has been the lack of resources and competing IT priorities.
- Regardless of their present capability, the majority of respondents plan to upgrade their analytical capabilities in the next two years.
- Among institutions without advanced capability, associate's institutions have the strongest plans to upgrade.
- Most institutions report that their funding is aligned with their plans to expand their academic analytical capacity.

Analytical Capacity

Most respondents rely exclusively on their transaction systems' reporting capacity to meet their needs for reporting and analysis. Fewer than one-third (30.3 percent) have a single or multiple data marts, and 14.6 percent have deployed an enterprise-wide data warehouse. Figure 4-1 presents the distribution of respondents' analytical capability by technology platform.

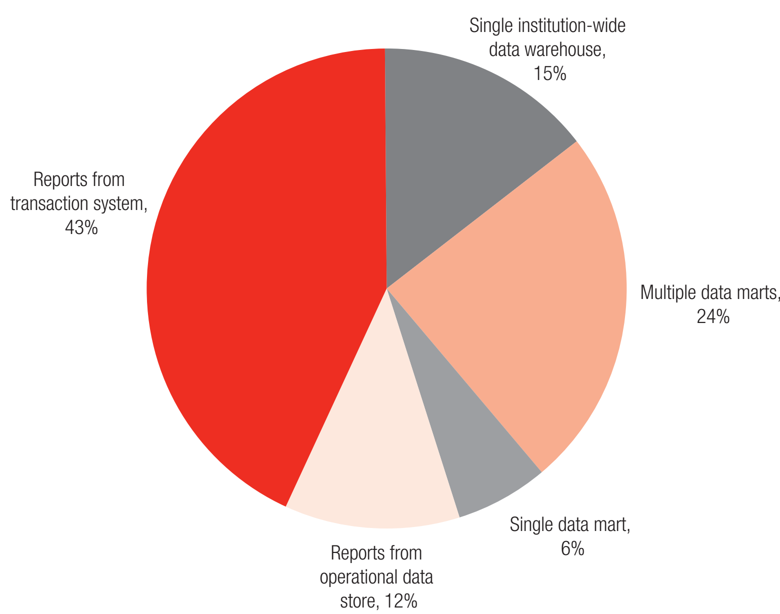
We acknowledge that many institutions actually employ a variety of technologies to provide their analytical capacity. In large institutions, it would not be surprising to find transaction system reporting, a data mart, and a data warehouse all in use. Therefore, we do not see these categories of capability as exclusive. Rather, they could be viewed as stages of capacity wherein later stages include earlier ones. This is not to suggest that more is necessarily better or that all institutions should aspire to a data warehouse. That is the essence of what this research is attempting to understand. We discuss the concept of levels of development of analytical capacity in greater detail in Chapter 5.

The analytical capacity an institution has deployed appears to correlate with both institutional control and size. As Table 4-1 illustrates, a greater proportion of public institutions employ data warehouses or multiple data marts than do private institutions. Conversely, a greater proportion of respondents from private institutions rely on just their transaction system to support all reporting and analysis needs.

It is possible that more public institutions have been driven to create more extensive analytical capacity by their additional regulatory and oversight responsibilities. It is more likely, however, that institutional control is a proxy for another characteristic: size.

When we look at analytical capacity by enrollment size, we see that larger institutions are more likely to have deployed multiple data marts or an enterprise data warehouse. Since more of the respondents with larger enrollments were public, it stands to reason that institutional control and enrollment would tend to behave the same way. In fact, half of the institutions with enrollments over 25,000 students and 31.3

Figure 4-1. Analytical Capacity (N = 376)



percent of those with enrollments greater than 15,000 students have implemented an enterprise-wide data warehouse. As Figure 4-2 illustrates, the converse is also true. A greater percentage of smaller institutions, which tend to be private, rely on their transaction systems for reporting. Relatively few have an institution-wide warehouse.

Again, the potential reasons for a correlation between enrollment size and extent of analytical capacity vary. Larger institutions are inherently more complex to manage. They

Table 4-1. Respondents' Analytical Capacity (N = 367)

Platform		Institutional Control	
		Private	Public
Single data warehouse	Count	15	40
	Percentage	9.4%	19.2%
Multiple data marts	Count	29	57
	Percentage	18.2%	27.4%
Single data mart	Count	10	12
	Percentage	6.3%	5.8%
Reports from operational data store	Count	16	28
	Percentage	10.1%	13.5%
Reports from transaction system	Count	89	71
	Percentage	56.0%	34.1%

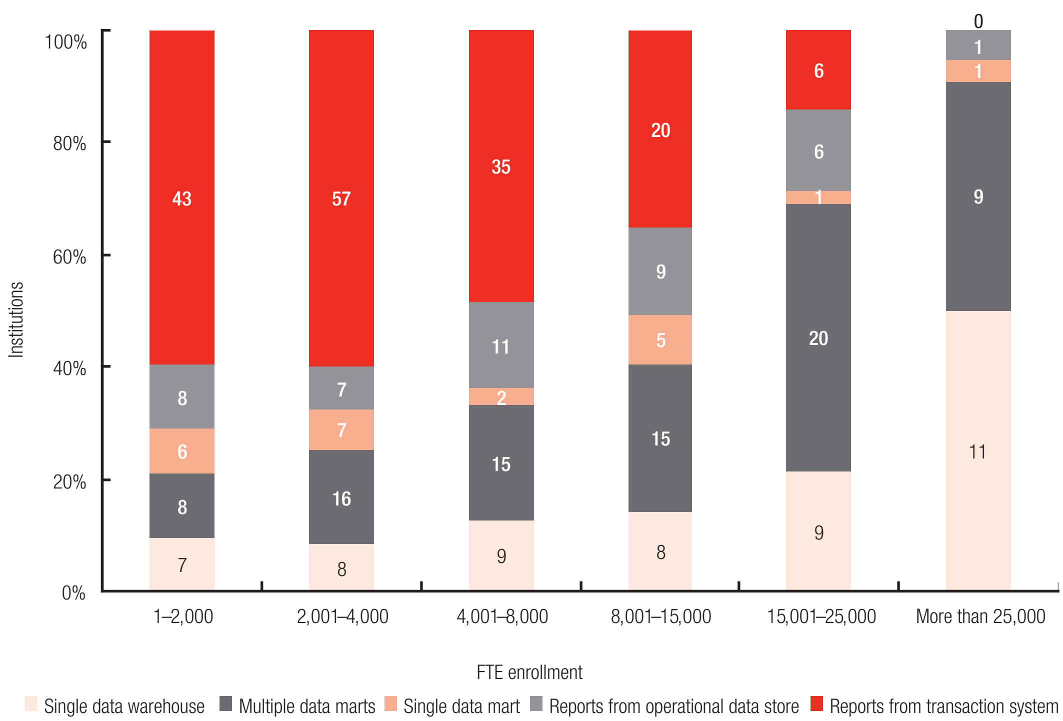


Figure 4-2. Analytical Capacity, by Enrollment (N = 360, Numbers in the bars are the number of respondents)

have a wide variety of programs, student markets, and organizational units to operate. As a result, they may have a greater need to deploy broad institutional capacity for reporting and analysis. Similarly, with the exception of some community colleges, respondents with large enrollments also tend to have multiple collegiate units. This suggests that greater organizational complexity drives the need for enterprise-wide capacity for reporting and analysis in the form of multiple data marts or a data warehouse.

To further understand the factors that potentially explain respondents' differing analytical platforms, we examined whether Carnegie class plays a factor. In fact, there does appear to be a strong association between a respondent's Carnegie class and the analytical capacity they have deployed. More than half (59.4 percent) of the DR institutions surveyed have deployed a data warehouse or multiple data marts. Comparatively, the proportion of master's, bachelor's, and associate's institutions using a warehouse or multiple data marts ranges between 26 and 28 percent. Conversely, the proportion of respondents in each of these Carnegie classes relying just on their transaction systems for reporting ranges between 53 percent (MA) and 60 percent (AA).

So larger, more complex institutions seem to have implemented data marts or warehouses in greater numbers. The following chapter looks more deeply at other factors that may explain why institutions use different technology platforms to support academic analytics.

Investment Drivers

We asked respondents to indicate the primary reasons that drove them to implement their current analytical capability. We presented a list of potential factors and asked them to pick the three most relevant to their institution. Not surprisingly, the factor most frequently identified was to meet decision makers' increased need for information and analysis. This was selected by nearly 90 percent of respondents who have implemented technologies in addition to their transaction systems to support academic analytics.

As Table 4-2 indicates, we found both similarities and differences in the factors that drive public and private institutions to invest in academic analytics. The state of the respondent's ERP system played a significant role for both institution types. Thirty percent of private institutions and nearly 40 percent of public institutions indicated that their imple-

Table 4-2. Factors That Led to Implementation of Academic Analytics

Factor	Private	Public
Provide information to decision makers	90.0%	85.4%
Meet regulatory reporting needs	18.6%	35.8%
Meet board reporting needs	18.6%	19.0%
Provide information to accrediting bodies	15.7%	13.1%
Respond to increased external competition	14.3%	6.6%
Demonstrate outcomes	21.4%	27.0%
Implement along with ERP	30.0%	39.4%
Extend life of legacy system	20.0%	15.3%
Ease transition to ERP	10.0%	16.1%

mentation of advanced analytical capability was tied to the implementation of a new ERP system. For these respondents, the ERP implementation may have provided a singular opportunity to obtain funding to upgrade administrative information systems.

For others, the implementation of a new ERP system may have been an acknowledged precursor to enable advanced academic analytics. Jerome Waldren, CIO at Salisbury University, explains how his institution viewed the relationship between ERP and academic analytics. "There are three years to an implementation. The first is the shock year: you roll it out and everyone realizes that it is different from the old system. In year 2, users start to modify their business practices and figure out how to do business efficiently. Year 3 is the icing on the cake. You can start to introduce advanced applications like business intelligence [academic analytics]."

Some public and private institutions invested in their analysis and reporting capabilities as a strategy to forestall the need to implement an ERP solution. In fact, 20 percent of private institutions and 15.3 percent of public institutions cited the need to extend the life of their legacy transaction systems as a top driver for their investment in advanced analytical capacity. Some public institutions (16.1 percent) also saw their investment in academic analytics as a way to ease the transition to ERP. Among private institutions, 10.0 percent cited this as a top reason.

Where public and private institutions differ is on the importance of regulatory reporting as a driver. Among public institutions, 35.8 percent indicated that meeting regulatory reporting requirements was a top-three driver. Only 18.6 percent of private institutions saw this as a top driver. In some cases, state institutions need to provide more information as a quid pro quo for more autonomy. This is the case for the College of William and Mary in Virginia. Associate Provost Courtney Carpenter explains, "We are transitioning to a new relationship with the state that gives us more autonomy. In exchange, the state requires greater evidence that we are producing student outcomes."

Susan Grotevant, director of information management systems at the University of Minnesota, explains that decreased state funding has spurred the need for academic analytics. "Over the last five years, the university has seen significant cuts in funding from the state. As a result, tuition and research funding have become significantly more important. As money has become tighter and more competitive, interest in information and analysis has grown."

Comparatively, a similar percentage of private institutions (18.6 percent) and public institutions (19.0 percent) identified board reporting as a top driver. The difference in perspective appears to stem from public institutions' need to report to system offices and state government as well as their boards.

While regulatory reporting may currently impact public institutions more than private, the future may hold increased public accountability for both. Reagan Ramsower, CIO and acting vice president for finance and administration at Baylor University, sees the future this way: "Higher education is going to face more accountability, especially the public institution. If institutions continue to increase tuition at rates larger than GDP growth or inflation, the public outcry will become immense. We need to be prepared to operate with fewer resources."

Finally, both public and private institutions saw accrediting bodies and the need to generate outcomes as similar drivers. A comparable percentage of private institutions (15.7 percent) and public institutions (13.1 percent) saw accrediting bodies as a top reason for their investment in academic analytics. Similarly, respondents from both public and private institutions ranked the need to demonstrate outcomes as a top reason. It was selected third most frequently by private institutions as a top factor. Among public institutions, it was the fourth most frequently selected driver.

Timing of Initial Implementation

The elapsed time since respondents began to first implement advanced analytical capability appears to have no relationship with the actual capacity they chose to create. We asked respondents to report how long ago they implemented their first data warehouse, data mart, or other type of advanced analytical capacity. As Figure 4-3 illustrates, the majority of respondents began to implement their analytical capacity in the past five years. Approximately 20 percent (20.8 percent) implemented between six and eight years ago, and another 23.7 percent first implemented a data store of some type nine or more years ago.

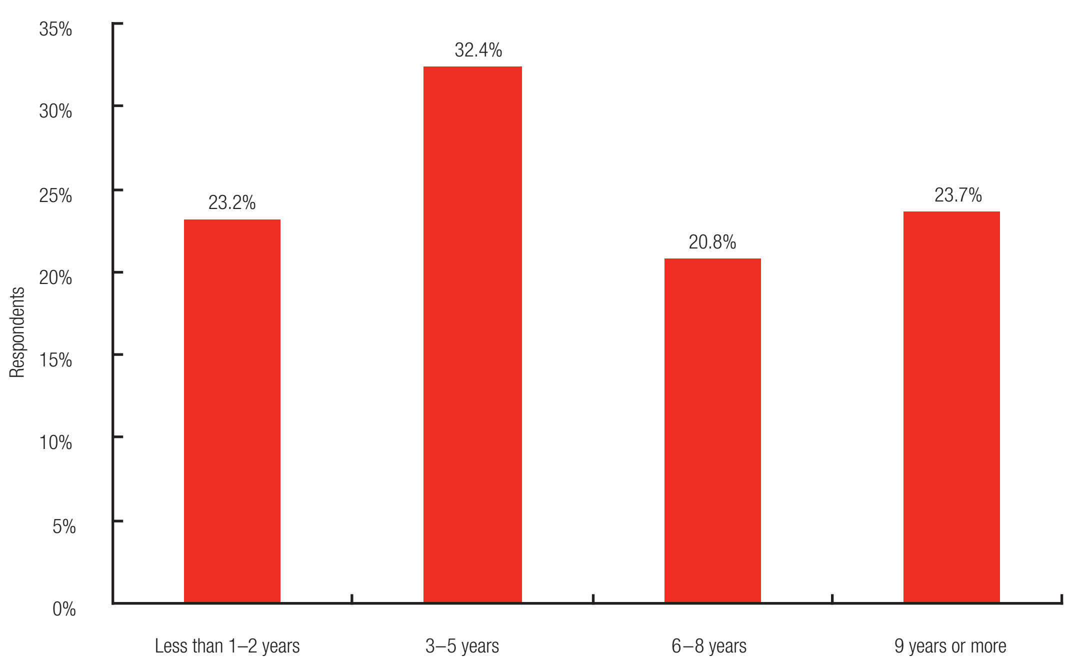
A respondent that began implementation more than five years ago is as likely to have an enterprise data warehouse as an institution that just began implementing in the last two years. Again, other factors appear to take precedence in driving institutions' decisions regarding the capacity they create.

Institutions with analytical capability beyond transaction system reporting also varied in the relative order in which they implemented their systems infrastructure. As Table 4-3 illustrates, more than a third (38.2 percent) implemented their analytical capabilities either before or concurrent with their ERP implementation. Nearly another third of respondents (28.3 percent) implemented after they had completed their ERP systems. Interestingly, 15.1 percent of respondents have not yet implemented an ERP system. This group appears to have followed a strategy of developing their analytical capability in tandem with their legacy transaction processing systems.

Expansion Plans

We asked respondents about their future plans as well. Among respondents with analytical capability beyond their transaction systems, 62.9 percent reported that they would significantly upgrade their capabilities in the next two years. The plans to upgrade capacity were strong among both public and private institutions. Among public institutions, 69.3 percent agreed or strongly agreed that they would make significant upgrades in the next two years. Among private institutions, 50 percent agreed that they would upgrade.

Figure 4-3. Elapsed Time Since First Implementation of Data Warehouse, Mart, or Store (N = 376)



Examining upgrade plans by Carnegie classification, we see that system offices (multicampus public institutions) answered most affirmatively that they would upgrade their capacity (Table 4-4). We asked respondents to use a five-point scale (1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) to indicate their agreement with the statement that they would upgrade their analytical capability significantly in the next two years. The mean responses from all Carnegie classes exceeded 3.00, with the lowest mean being that of BA institutions (3.23). Given the relatively high means and relatively low variance, it is evident that there is a strong commitment to upgrade among system offices and associate's and doctoral institutions. The mean response from MA and BA institutions was closer to neutral, and the variance was higher. This suggests that among these respondents there were equivalent numbers of institutions that somewhat agreed and somewhat disagreed with the statement, indicating less uniformity in their commitment to upgrade. The relatively higher mean response from doctoral institutions, system offices, and associate's institutions may suggest that more-complex organizations (multicollegiate) or institutions with larger enrollments (such as community colleges) have more pressing needs to upgrade their capacity.

Table 4-3. Implementation Timing of ERP and Advanced Analytical Capability (N = 212)

Timing	Number of Institutions	Percentage of Institutions
Before ERP	31	14.6%
Concurrent with ERP	50	23.6%
After ERP	60	28.3%
Before and after ERP	35	16.5%
No ERP	32	15.1%
Only ERP	4	1.9%
Total	**212**	**100.0%**

Table 4-4. Upgrade Plans, by Carnegie Class (N = 213)

Carnegie Class	Mean	N	Std. Deviation
System	4.33	15	0.724
Other	4.33	3	1.155
AA	4.00	19	1.054
Specialized	4.00	8	0.756
DR	3.84	74	0.980
Canada	3.57	14	1.089
MA	3.38	50	1.210
BA	3.23	30	1.040
Average/Total	**3.69**	**213**	**1.076**

Q: *My institution plans to significantly upgrade its reporting, modeling, analysis, and decision support capability in the next two years. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Funding for Expansion Plans

Respondents appear to have aligned their funding plans with their upgrade strategies. Table 4-5 compares respondents' intent to upgrade capacity with their degree of confidence that they would also increase funding for academic analytics. The first question of the table indicates how respondents view their institutions' plan to invest in academic analytics. The second question shows respondents' mean level of agreement with the statement that their institutions plan to significantly upgrade their analytical capacity. As one would hope, there is a strong relationship between respondents' plans to upgrade capacity and their intention to spend more money on academic analytics in the next two years. Respondents who agree or strongly agree that their institutions will make significant upgrades also agree or strongly agree that their institutions will spend more money. Conversely, those institutions that did not think their funding would increase also did not plan to upgrade their capacity.

Why Institutions Employ Limited Analytical Capacity

We were very interested in understanding why some respondents elected not to implement any advanced analytical capabilities. As noted, many institutions rely on their transaction processing systems for information and analysis. Is it because they lack the complexity to require additional capacity? Or do they view the technology as immature or difficult to implement? Or, is it simply a matter of time resources?

We asked respondents who rely only on their transaction systems for reporting and analysis to tell us whether they plan to expand and what prevents them from doing so. Timing appears to be a very important factor. Nearly half (49.1 percent) of respondents with transaction reporting capacity today said they are planning to expand their capacity in the future. Jerome Waldren explains how his institution is using transaction system reporting as a short-term solution. "We were not ready

Table 4-5. Upgrade Plans Compared to Spending Plans (N = 210)

		Upgrade analytical capacity		
		N	**Mean**	**Std. Deviation**
Allocate more money	Strongly disagree	11	2.27	1.009
	Disagree	58	3.09	1.014
	Neutral	73	3.63	0.921
	Agree	56	4.45	0.570
	Strongly agree	12	4.92	0.289
	Average/Total	**210**	**3.70**	**0.821**

Q: *My institution will allocate significantly more money for reporting, modeling, analysis, and decision support solutions for the next two years. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Q: *My institution plans to significantly upgrade its reporting, modeling, analysis, and decision support capability in the next two years. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

to create a warehouse. In the short term, we developed our own flat files and used our own tools against them. We built them for student areas (such as admissions), so we could use tools like SPSS to develop some reports."

For those who have not yet expanded their capacity, the issue appears to be resources. The two most significant reasons respondents gave for not having implemented more advanced capacity were the prevalence of other IT priorities (42.3 percent) or the lack of sufficient funding (27.6 percent). Both are indicators of constrained resources.

The next most significant barriers relate to institutional culture. In fact, 17.2 percent of respondents who have not upgraded their capability cited lack of support from data owners as a significant barrier. In addition, 11.7 percent cited cultural resistance among their primary reasons for not expanding capacity. Interestingly, only 7.4 percent said that it was too difficult technically to expand their analytical capacity. Respondents did not appear to view data warehouses or data marts as new or unproven technology. Lastly, only 9.2 percent have not expanded their analytical capacity because they do not require additional capacity.

Most Rate Current Capabilities as Insufficient

The majority of respondents acknowledge the need to expand their institution's capacity to perform academic analytics. The primary driver to expand capacity is to meet expanding user needs. More than half of respondents (53.8 percent) report that their current capabilities are not sufficient to meet user needs. In fact, we asked respondents to agree or disagree with the statement "Our current reporting and analysis capability meets user requirements." As Table 4-6 illustrates, we found some variance in satisfaction with analytical capacity on the basis of institutional type. However, respondents across all Carnegie classes report dissatisfaction with their present capabilities. DR institutions reported the largest gap between user needs and current capability, followed by MA and AA institutions. Although BA institutions appear somewhat more satisfied, their mean responses were only slightly greater than neutral to the statement "Current capacity meets user needs." The greatest variance in response came from AA institutions, indicating that some agreed and some disagreed that present capability met needs.

So, the majority of those institutions that reported limited analytical capacity today (that is, they report only from their transaction systems) plan an expansion in the next two years. In fact, only 11.5 percent of respondents with limited capacity today plan to continue the status quo. Interestingly, the strongest commitment to expand the capacity to perform academic analytics is among

Table 4-6. Current Capacity Meets User Needs, by Carnegie (N = 145)

Carnegie Class	Mean	N	Std. Deviation
BA	3.05	41	1.024
AA	2.69	29	1.168
MA	2.43	58	0.920
DR	2.12	17	0.858
Average/Total	**2.62**	**145**	**1.035**

Q: *Our current reporting and analysis capability meets user requirements. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

AA institutions. We asked respondents to agree or disagree with the statement "My institution plans to significantly upgrade its academic analytical capability in the next two years." As Table 4-7 illustrates, AA institutions agreed the most that they would expand their capacity. Doctoral institutions, which report having the least satisfaction with current capability (among those with only transaction system reporting capacity), had the second highest mean agreement. However, the small number of responses prevents us from concluding that these are statistically significant relationships.

Drivers to Expand Capacity

Better information to support decision making and increasingly complex external reporting requirements are driving the need to expand analytical capacity. In this regard, respondents with limited capacity were much like those who have already invested in data marts or warehouses. We asked the respondents with only transaction system reporting capacity today to tell us what factors would drive their need to build additional capacity. The top three drivers selected were the need for information to support decision making (37.9 percent), regulatory reporting requirements (16.9 percent), and increased pressure to demonstrate outcomes (16.1 percent). In addition, 15.1 percent identified the need to provide information to accrediting bodies as a top-three driver.

We also asked respondents to tell us which areas would benefit most if they expanded their analytical capabilities beyond transaction system reporting. Respondents most frequently identified institutional research (29.2 percent), enrollment management (25.8 percent), and central business/finance (22.8 percent) as the most likely beneficiaries of additional capacity. The areas least likely to benefit from expanded capacity are human resources, research administration, and fundraising. These expectations mirror the actual experience reported by respondents who have already deployed advanced analytical capacity (see Chapter 6).

Funding

Finally, institutions appear to be allocating resources to enable the expansion of their academic analytics capability. We asked institutions to agree or disagree with the statement that their institution will allocate significantly more money to support academic analytics over the next two years. Institutions believing strongly that they will expand their capacity in the next two years also report that their institutions will allocate significantly more money to academic analytics (see Table 4-8).

So, most respondents appear to have aligned their funding strategies with their

Table 4-7. Upgrade Plans for Institutions Without Advanced Capability, by Carnegie Class (N = 145)

Carnegie Class	Mean	N	Std. Deviation
AA	4.28	29	1.162
DR	3.88	17	0.993
MA	3.84	58	1.105
BA	3.66	41	1.132
Average/Total	**3.88**	**145**	**1.121**

Q: *My institution plans to significantly upgrade its reporting, modeling, analysis, and decision support capability in the next two years. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Table 4-8. Upgrade Plans for Institutions Without Advanced Capabilities, by Funding Plan (N = 163)

		Upgrade analytical capacity		
		N	Mean	Std. Deviation
Allocate more money	Strongly disagree	16	2.50	1.414
	Disagree	44	3.36	1.014
	Neutral	47	3.98	0.847
	Agree	35	4.29	0.710
	Strongly agree	21	5.00	0.000
	Average/Total	**163**	**3.87**	**1.108**

Q: *My institution will allocate significantly more money for reporting, modeling, analysis, and decision support solutions for the next two years. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Q: *My institution plans to significantly upgrade its reporting, modeling, analysis, and decision support capability in the next two years. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

plans to expand their analytical capability. However, the recent past offers up some degree of caution. We asked this same group of respondents to agree or disagree with the statement that their institution currently provides enough funding to keep pace with user needs for academic analytics. Responses were based on the same five-point scale used previously. The mean response was 2.32 and the variance was 1.004. This suggests that most respondents were already facing shortfalls in funding to meet today's needs. So any additional funding to support expanding capacity will need to be relatively significant.

Summary

Academic analytics appears to be going through a transition. Today, reporting from transaction systems is the most prevalent source of information and analysis. Advanced analytical platforms (such as data marts or data warehouses) are more prevalent among large, complex institutions such as research universities and those with large student enrollments. However, the expected pressures from external and internal demands for information have led most institutions to plan significant expansion of their analytical capabilities. Plans for expansion span institutional types as well as present capability levels.

It appears we are entering an era in which institutions will spend more time and resources to build their capacity to distribute and analyze information. For many, this appears to be a natural progression from their investment in new ERP capabilities. Those investments have provided them with the ability to capture information. The next wave of investment is aimed at improving the ability to extract, distribute, and manipulate that information.

5
Technology Landscape

The real accomplishment of modern science and technology consists in taking ordinary men, informing them narrowly and deeply and then, through appropriate organization, arranging to have their knowledge combined with that of other specialized but equally ordinary men.

—John Kenneth Galbraith

Key Findings

- Transaction system reporting or transaction systems and an operational data store for reporting are the most prevalent technology platforms for academic analytics.
- Nearly three-quarters of respondents predict they will have a data warehouse within the next two years (30 percent have one today).
- Nearly 75 percent of respondents predict that they will have an extract, transfer, and load (ETL) tool, and 65 percent predict that they will have a metadata server within the next two years.
- Most respondents (70 percent or more) use a combination of on-demand reports, scheduled reports, data extracts, and ad hoc queries to distribute and analyze information.
- Comparatively few respondents (16 percent) use online analytical processing (OLAP), dashboards (12 percent), or automated alerts.
- Respondents with larger enrollments and greater organizational complexity are more likely to have implemented more extensive technology platforms to support academic analytics.
- Respondents with more extensive technology platforms report greater aggregate expenditure over the last five years. However, the magnitude of the difference (compared with those having less complex platforms) is small relative to the cost of other major technologies.
- Respondents with more extensive technology platforms (such as data warehouses, ETL, dashboards, and OLAP) report higher levels of satisfaction with their academic analytic capability.
- Sponsorship outside IT and participation of data owners were most frequently identified as one of the three most important success drivers.

Institutions use a variety of technologies to store, extract, and manipulate information. As noted in Chapter 4, respondents' capabilities exist on a continuum from transaction system reporting to enterprise data warehouses. Many respondents employ multiple technologies to distribute and analyze information.

This chapter explores the technologies institutions are using to support academic analytics. Specifically, we examine

- What tools are institutions using?
- How do they extract and distribute information?
- Are there combinations of technologies that respondents commonly use?

Finally, we review how technology choices impact overall cost and satisfaction with academic analytics.

Tools and Technologies

An institution's technology platform for academic analytics often consists of multiple components. These components include

- data warehouses,
- data marts,
- ETL tools,[1]
- data cleaning tools,
- operational data stores—for staging to a data warehouse or data mart,
- operations data stores—for transaction reporting, and
- vendor-supplied reporting solutions.

In addition to these components, institutions employ a range of methods and tools to access the information contained in their data stores. These methods include

- scheduled reports,
- on-demand reports,
- user-defined reports,
- drill-down reports,
- ad hoc queries,
- executive dashboards,[2]
- data extracts to offline tools (such as Excel or Access),
- OLAP tools,[3] and
- alerts generated by monitoring tools.

To understand the current technology landscape, we asked respondents to identify which tools they use today, which they are in the process of implementing, and which they may implement in the next 12 to 24 months. We also asked respondents to tell us if a particular tool was not under consideration at all. We summarize the results in the remainder of this section.

Data Warehouses, Data Marts, and Operational Data Stores

Survey respondents currently use data warehouses, data marts, and operational data stores in almost equivalent numbers. As Figure 5-1 illustrates, 30.0 percent of respondents employing one or more these technologies have an enterprise-wide data warehouse in use, 23.5 percent have a data mart, and 35.3 percent use an operational data store for transaction reporting. Their intended use is primarily at the institution level. Far fewer respondents appear to have intentionally deployed a data mart or data warehouse for use only by a school, college, or department.

About 20 percent of respondents are currently implementing a data warehouse (9.1 percent) or data mart (9.3 percent). Relatively few respondents without data stores, warehouses, or marts are planning to implement them in the next year. This may in large part reflect the tight budget situation at most institutions. Over the next two years, respondents are far more optimistic that they will be expanding their technology platform for academic analytics. In the next 24 months, 28.5 percent of respondents who answered the question anticipate implementing a data warehouse, 23.8 percent anticipate implementing a data mart, and 23.2 percent anticipate implementing an operational data store for reporting.

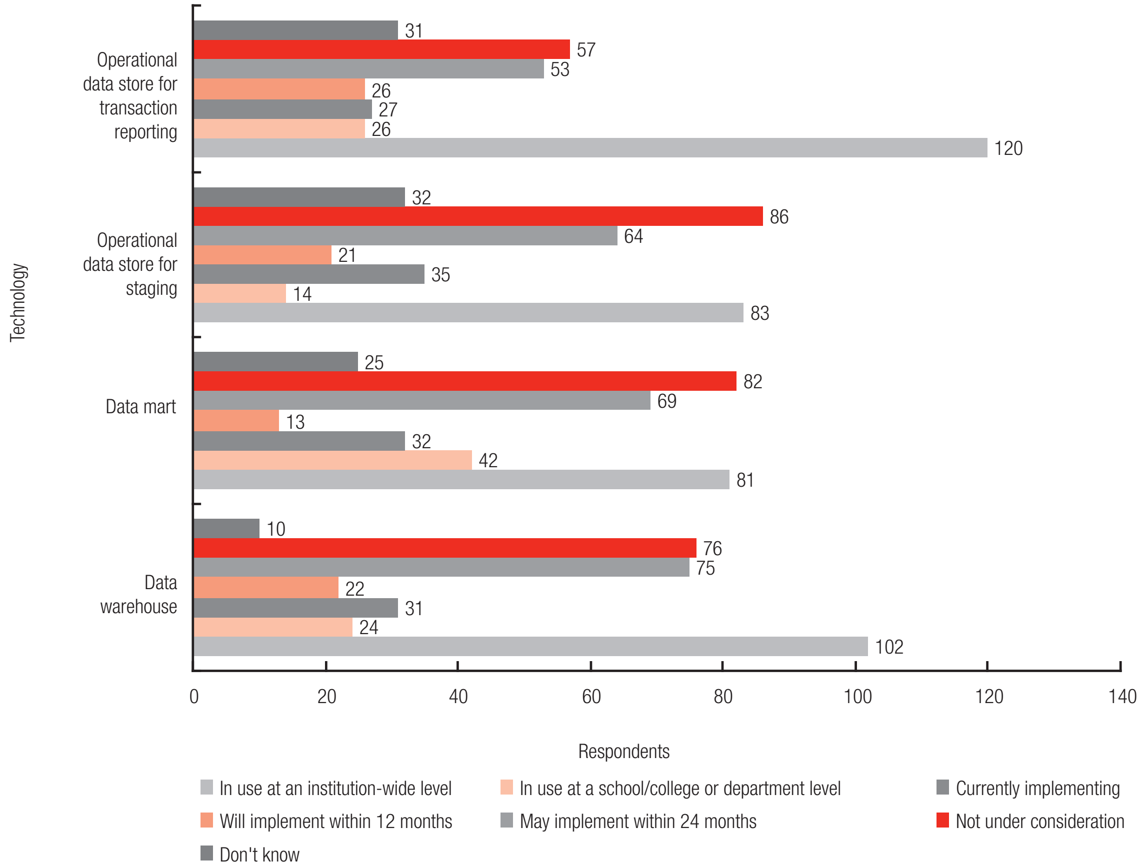


Figure 5-1. Current and Planned Deployment of Technologies

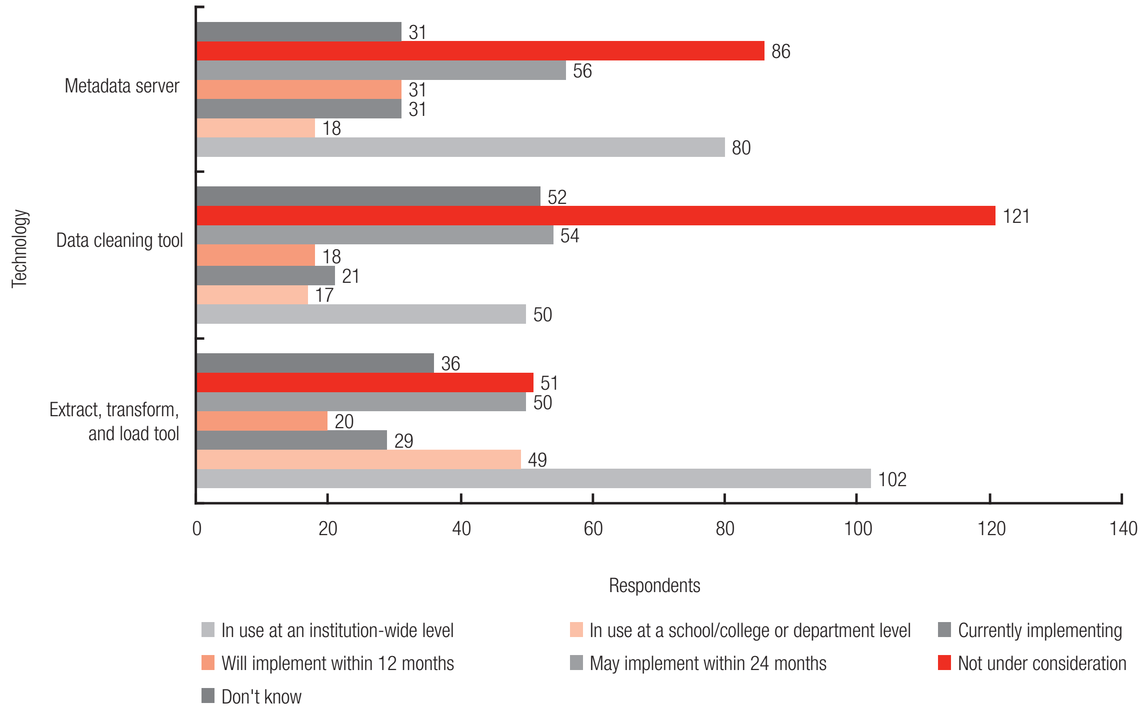
If respondents follow through on their intentions, the presence of data warehouses among respondents will reach 74.7 percent. This would make it the most prevalent technology platform for academic analytics. Data marts would be in place at 68.9 percent of responding institutions. This reinforces the notion that institutions are combining multiple platforms to create their analytical capacity. Interestingly, there appears to be a core group of respondents with no plans to embrace either data warehouses or data stores. In fact, nearly 25 percent of respondents report having no interest in either technology. These mostly smaller institutions plan to continue using their transaction systems for reporting.

Extract and Access Tools

Among tools used to help access and extract data, ETL tools are the most prevalent. ETL tools are in use either institution-wide or at the departmental level at 44.8 percent of institutions. As Figure 5-2 illustrates, an additional 29.4 percent of respondents are implementing or anticipate implementing ETL tools in the next 24 months. We see a similar presence of metadata[4] servers or data dictionaries. Metadata servers are part of the analytical infrastructure for 29.4 percent of respondents. An additional 35.4 percent of respondents anticipate having a metadata server in place within the next two years.

Data cleaning tools do not have as sizable a presence among survey participants. Presently, 20.1 percent of respondents use data cleaning tools. An additional 27.9 percent anticipate implementing data cleaning tools in the next two years. However, this would only bring the total penetration to slightly fewer than half of respondents, compared with 74.2 percent penetration for ETL tools and 64.9 percent for metadata servers.

Figure 5-2. Deployment Status of Technology Tools



Vendor-Supplied Reporting Solutions

We also asked respondents to tell us if they were using a reporting capability supplied by a commercial vendor as part of another application system. This category includes integrated reporting modules provided by ERP vendors. We found that more than a third of respondents (37.5 percent) are using a vendor-supplied reporting solution. This may in part explain the significant number of respondents who indicated that they rely primarily on their transaction system for reporting and analysis.

An additional 31.5 percent are implementing or plan to implement vendor-supplied reporting within the next two years. Many ERP vendors have only recently introduced enterprise reporting modules that complement their base transaction-processing systems. So it is not surprising that one-third of institutions would report that they are considering their implementation. As with warehouses and marts, the penetration of vendor-provided reporting packages could approach 70 percent.

It will be interesting to see if institutions follow through on their intention to embrace reporting and intelligence tools from their ERP vendors. The vendor landscape for ERP in higher education remains in a state of flux. Several vendors have undergone changes in ownership, and more consolidation is anticipated. Many institutions will likely wait to see if this consolidation changes vendors' commitment to tailor their analytical solutions for higher education (for example, to integrate student and advancement data). Without this tailoring, institutions may change strategies and seek third-party vendors that offer analytical tools.

Accessing Information

Respondents have also assembled an array of tools to distribute and analyze information. We asked respondents to identify the methods that users employ to receive information from their analytical systems. Responses seem to fall into three clusters. As Table 5-1 indicates, the most frequently used methods are on-demand reports, scheduled reports, data extracts, ad hoc queries, and user-defined reports. Each of these methods is employed by 70 percent or more of respondents.

Drill-down reports are in the second cluster, used by 43.4 percent of respondents. The third cluster of tools, used by the smallest number of respondents, includes OLAP tools, executive dashboards, and automated alerts generated by monitoring tools. Of third-cluster tools, OLAP is used most frequently, and alerts are used by the smallest number of respondents.

One or more of the third-cluster tools were used by 28.5 percent of respondents. The majority used only one of the three tools. However, 14 institutions used both alerts and OLAP tools. In addition, 11 institutions used alerts and executive dashboards, and another 11 used OLAP tools and dashboards. Only six institutions used all third-cluster tools to disseminate and analyze information.

The use of third-cluster information access tools is dispersed across institution type and size. As Table 5-2 depicts, respondents using these tools span Carnegie class, enrollment size, and institutional control (public vs. private). The number of responses in each subclass is not sufficient to conclude that any significant relationship exists between Carnegie class, size, or control and the use of third-cluster reporting technologies. Areas with apparently higher concentrations, such as doctoral institutions, are potentially misleading because these institutions made up a larger proportion of the survey population.

We found it interesting that size does not seem to be a barrier to an institution's adopting one or more of these technologies. More institutions with enrollments under 4,000 students than those with enrollments over 15,000 use these technologies. Again, the relatively small number of responses makes it difficult to draw any statistically significant conclusions.

Analytical Technology Capability Levels

Our review of the technology landscape made it apparent that many institutions use widely varying combinations of analytical technologies. To further develop our understanding of this landscape and to analyze the relative effectiveness of various technology pairings, we identified some logical technology groupings.

We defined three broad levels of analytical technology capability. These levels are based

Table 5-1. How Users Receive Information (N = 376)

Method	Number	Percentage
On-demand reports	337	89.6%
Scheduled reports	305	81.1%
Data extracts	279	74.2%
Ad hoc queries	271	72.1%
User-defined reports	268	71.3%
Drill-down reports	163	43.4%
OLAP	60	16.0%
Executive dashboards	44	11.7%
Alerts	33	8.8%

Table 5-2. Profile of Respondents Who Use One or More Third-Cluster Reporting Technologies (N = 107)

Control	Private	Public				
Count	44	61				
Percentage	41.9%	58.1%				
Carnegie Class	**DR**	**MA**	**BA**	**AA**	**Other**	
Count	38	25	22	11	11	
Percentage	35.5%	23.4%	20.6%	10.3%	10.3%	
FTE Enrollment	**1–2,000**	**2,001–4,000**	**4,001–8,000**	**8,001–15,000**	**15,001–25,000**	**More than 25,000**
Count	16	24	16	18	14	15
Percentage	15.5%	23.3%	15.5%	17.5%	13.6%	14.6%

on the experience of our research team and to our knowledge do not stem from any existing research. We present them to loosely chart the stages of technology deployment through which an institution may progress. We acknowledge that there is imprecision in the characterizations and that many institutions may exist between levels or across two levels simultaneously (more on this later). However, we believe these groupings are logical technology clusters that enable us to organize and communicate our analysis.

We defined the following three levels:

- Level 1: Reporting from transaction processing system only.
- Level 2: An operational data store or single data mart used in conjunction with ETL and reporting tools.
- Level 3: An enterprise data warehouse or multiple data marts used in conjunction with ETL tools, reporting tools, executive dashboards, or alerts.

By labeling the levels 1 through 3, we offer no prejudgment that level 3 capability is more desirable or effective than that of level 1 or 2. The question of how technology groupings impact outcomes is the essence of this research.

Distribution of Respondents by Technology Level

Of 350 respondents, we can place 249 at one of the three defined levels. The largest numbers of respondents are at level 1 and rely on their transaction system for reporting. As Figure 5-3 illustrates, 163 institutions (46.6 percent) of respondents whose technology level could be identified are at level 1. Far fewer respondents met the definition of level 2; just 34 respondents (9.7 percent) of those whose technology level could be identified reported relying on only an operational data store or data mart combined with ETL and reporting tools as their primary platform for academic analytics. Finally, 52 institutions, or 14.9 percent of respondents, have a technology platform that meets the criteria for level 3.

The large number of respondents with level 1 technology platforms likely include many institutions that extract data from their transaction system for reporting and analysis. For example, Ellen Falduto, vice president and chief information and planning officer at Hartwick College, reports great success using Excel. "The basic query tool resides in the ERP

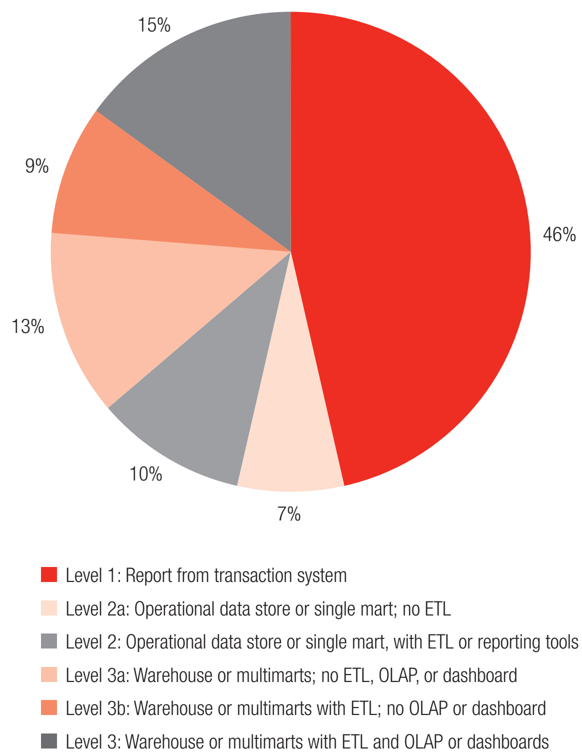


Figure 5-3. Distribution of Respondents, by Technology Platform (N = 350)

system, and users tend to do most of their summary reporting out of it. We have enabled users through a download utility to pull data into Excel, SPSS, or Access. Excel may not be the most sophisticated tool, but users can make it work and understand the analysis. We have looked at more sophisticated decision support tools, but we can produce the same results with common, existing campus-wide supported tools such as Excel."

The three discrete levels account for only two-thirds of survey respondents (66.2 percent). The remainder reside between levels. These institutions are either in the process of moving from one stage to another or have settled at a point that combines aspects of both.

One factor that caused respondents to fall between levels was the absence of an ETL tool. Twenty-six respondents (6.9 percent) fell short of level 2 because they reported having an operational data store or data mart but had not implemented an ETL tool. Similarly, 45 respondents (12.0 percent) reported having a data warehouse or multiple data marts but no ETL tools. As we noted in the prior section, ETL remains on many respondents' to-do list. It is currently being implemented at 7.7 percent of institutions, and another 18.6 percent plan to implement it in the next two years.

Finally, 30 institutions reported using a warehouse or multiple data marts in conjunction with ETL tools. However, these respondents have not implemented either dashboards or OLAP tools. Therefore, they do not completely fit the criteria for level 3. With this final group in place, we have categorized 353 institutions. The remaining respondents did not provide enough information to enable us to place them in a category.

So respondents actually use six types of technology platforms, the three original levels and three levels that indicate institutions in transition between levels 1 and 2 or between levels 2 and 3:

- Level 1: Reporting from transaction processing system only.

- Level 2a: An operation data store or single data mart.
- Level 2: An operational data store or single data mart used in conjunction with ETL and reporting tools.
- Level 3a: An enterprise data warehouse or multiple data marts used without ETL tools or advanced reporting tools.
- Level 3b: An enterprise data warehouse or multiple data marts with ETL tools but without OLAP or dashboards.
- Level 3: An enterprise data warehouse or multiple data marts used in conjunction with ETL tools, reporting tools, executive dashboards, or alerts.

Institutional Characteristics by Technology Level

To understand what kinds of institutions were most likely to build each level of technology capability, we looked at respondents' characteristics and their corresponding technology platforms. Specifically, we looked at differences by Carnegie class, enrollment, institutional control, and aggregate spending on academic analytics. While some patterns of adoption by institutional characteristics are apparent, they must be viewed cautiously. The relatively small number of respondents in each category makes it difficult to draw statistically certain conclusions in all cases.

Public Versus Private

We note some relationship between institutional control and technology platform type. As previously noted, most private institutions indicated that they report from their transaction system. Conversely, nearly two-thirds of public institutions have a technology capability that is above level 1 (2a or greater). In fact, 44.5 percent of public respondents whose technology level could be classified have capabilities at level 3a or higher. Table 5-3 illustrates the distribution of technology capability by institutional control (public versus private).

Two factors likely explain this difference between public and private institutions. First, within the survey population, more of the respondents that are larger in both size and organizational complexity are public institutions. We hypothesize that larger institutions with multiple collegiate units are more likely to perceive the need for an enterprise data warehouse.

Second, public institutions are driven by external reporting requirements to a far greater extent than private institutions. So, it is also possible that public institutions required the enterprise reporting capabilities offered by a data warehouse to respond to information requests from system offices, state commissions of higher education, and state government.

Table 5-3. Technology Level, by Institutional Control (N = 343)

	Private		Public	
Level	**Number**	**Percentage**	**Number**	**Percentage**
Level 1	89	59.3%	71	36.8%
Level 2a	12	8.0%	14	7.3%
Level 2	12	8.0%	22	11.4%
Level 3a	14	9.3%	29	15.0%
Level 3b	5	3.3%	24	12.4%
Level 3	18	12.0%	33	17.1%
Total	**150**	**100.0%**	**193**	**100.0%**

Carnegie Classification

We also noted some relationship between Carnegie classification and technology level. As Figure 5-4 illustrates, the majority of MA, AA and BA institutions rely on reporting from their transaction system (level 1). This follows our hypothesis that a larger institution is more likely to have the complexity and diversity of operations to warrant an investment in more advanced capability. Fairly similar percentages of AA and BA institutions have capability at or near level 2. Somewhat higher percentages of doctoral and MA institutions have capacity at or near level 2. Finally, the largest percentage of doctoral institutions (58.3 percent) have analytical capabilities at level 3a or higher.

Again, the relatively small number of responses in any single category makes it difficult to form any firm conclusions about the relationship between Carnegie class and technology capability. However, it is interesting to note that nearly a quarter of AA, BA, and MA institutions responding to the survey have capability approaching level 3. This suggests that this capability is not beyond the reach of institutions with typically smaller IT budgets and staffs.

Student Enrollment

A review of student enrollments by respondent further supports the hypothesis that larger institutions have been more likely than smaller institutions to implement additional analytical capability. As Table 5-4 illustrates, more than half of respondents with FTE enrollments below 8,000 have level 1 capability. Conversely, among institutions with enrollments over 15,000 students, 76.6 percent have capability approaching level 3. Finally, among institutions with capability at or near level 2, the greatest concentration appears to be of institutions with 8,000 to 15,000 students.

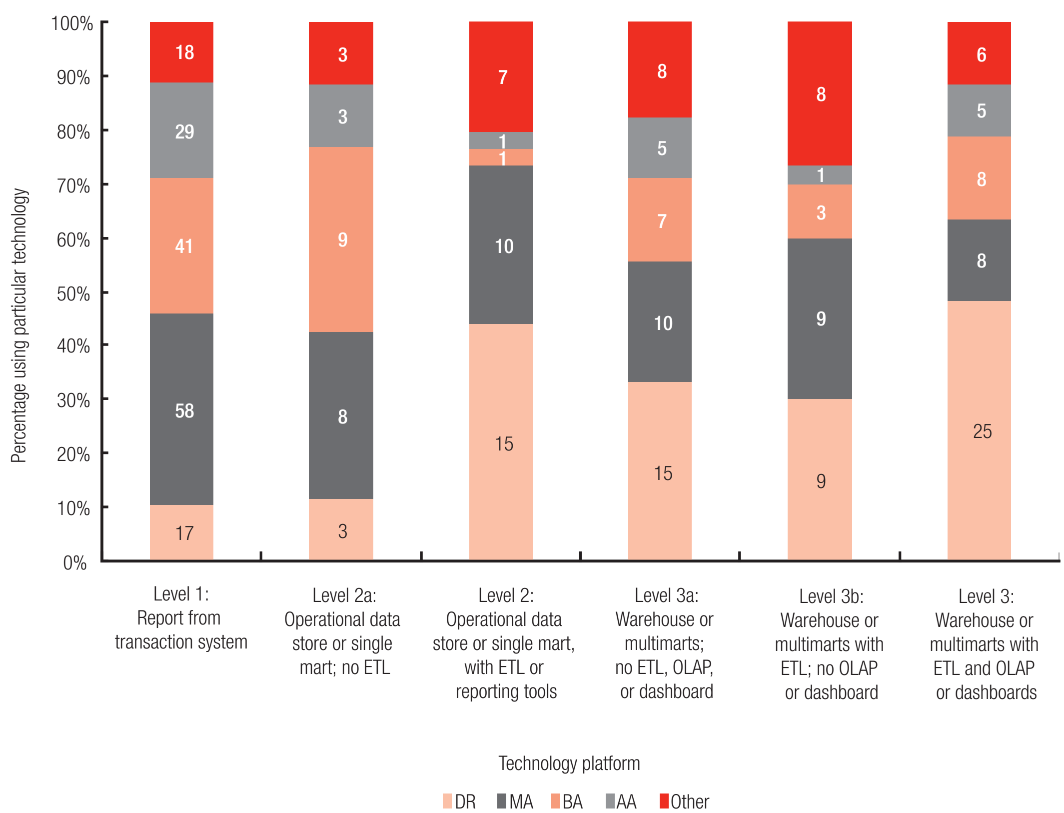


Figure 5-4. Technology Levels, by Carnegie Class (N = 350)

Table 5-4. Technology Capability, by Enrollment Size

FTE Enrollment		Level 1	Level 2a	Level 2	Level 3a	Level 3b	Level 3	Total
1–2,000	Number	43	8	4	6	0	5	**66**
	Percentage	65.2%	12.1%	6.1%	9.1%	0.0%	7.6%	**100.0%**
2001–4,000	Number	57	9	5	8	5	7	**91**
	Percentage	62.6%	9.9%	5.5%	8.8%	5.5%	7.7%	**100.0%**
4,001–8,000	Number	35	5	6	9	6	7	**68**
	Percentage	51.5%	7.4%	8.8%	13.2%	8.8%	10.3%	**100.0%**
8,001–15,000	Number	20	1	10	6	4	8	**49**
	Percentage	40.8%	2.0%	20.4%	12.2%	8.2%	16.3%	**100.0%**
15,001–25,000	Number	6	1	6	8	11	7	**39**
	Percentage	15.4%	2.6%	15.4%	20.5%	28.2%	17.9%	**100.0%**
More than 25,000	Number	0	1	1	8	1	14	**25**
	Percentage	0.0%	4.0%	4.0%	32.0%	4.0%	56.0%	**100.0%**

Summary

As one would expect, institutions that are larger or more complex appear more likely to implement level 2 or 3 technology platforms. These institutions typically have more numerous funding sources, more complex organizational structures, and more diverse academic programs. Kati Weingartner, director of information technology at Arizona State University Polytechnic, explains how being part of a large public institution drives the complexity of reporting and analytical needs. "Our warehouse is lagging behind university changes. We are switching from a central administration view to a college (academic division) view of the world, and data has not been defined or structured for that type of world. Our student population is very fluid and moves from campus to campus. So, the notion of a campus designator isn't as important. We need to come up with meaningful ways to measure, analyze, and predict these movements of students. Also, we are moving toward responsibility center management. Our data structures and reports need to evolve to reflect this very decentralized way of managing."

Similarly, the demands of an institution's regulatory environment and governance appear to drive institutions to implement additional analytics technology. Therefore, a greater proportion of public institutions than private have invested in technology platforms at or near level 3 (data warehouse or multiple data marts). This may be due in part to the more extensive reporting requirements to which these institutions are subject.

So, as one would expect, operational complexity appears to drive additional investments in analytical capability. Whether this additional capability enables level 3 institutions to achieve better outcomes than those at level 1 or 2 will be the subject of Chapter 8.

Implementation Approach

The final aspect of the academic analytics technology landscape that we looked at was the implementation approach. We asked institutions about several aspects of their academic analytics implementation, including

- Who championed their implementation?
- How much have they invested to create their current capability?
- What were their critical success factors?

Project Champion

The initiative to create academic analytical capacity at most institutions came first from the central IT organization. Among respondents with capability beyond transaction system reporting (level 1), 58.6 percent said central IT was the initial champion of their implementation. Institutional research (13.8 percent) and the central finance office (12.9 percent) were the next most frequent champions. For many respondents, IT's role as champion of academic analytics led them to create technical capacity in advance of user demand. In fact, 35.7 percent of respondents agreed or strongly agreed that they had built their capacity in advance of user needs. Not all respondents felt this way. As Table 5-5 illustrates, a slightly higher percentage disagreed, and the remainder were neutral.

We found no significant difference between public and private institutions. The initial champion does not appear to relate to public institutions' additional external reporting requirements.

The IT organization's role as champion of a new technology capability or application is certainly not atypical. In fact, many technologies are adopted in this way. IT is often in the position of bringing a new technology to campus and demonstrating how it can be used to address a user need. Priscilla Hancock, vice provost for information technology at the University of Alabama and vice chancellor for information technology at the University of Alabama System, explained that IT had to be the initial champion at her institution. "We drove the initiative first on the campus and then at the system level. I knocked on doors and showed people the power of what it [academic analytics] could do. We saw academic analytics as a solution and then found the right environments or the right problems to use it for to make an impact."

Since their initial implementation efforts, many respondents reported a shifting or broadening of sponsorship for academic analytics. In fact, 22 percent of respondents report that they now have joint sponsorship between IT and a functional organization. An additional 12.8 percent report that sponsorship of academic analytics at their institutions is now entirely within a functional organization.

The University of Central Florida (UCF) believes it has succeeded in part because

Table 5-5. Many IT Organizations Created Capability in Advance of User Needs (N = 213)

Response	Number	Percentage
Strongly disagree	10	4.7%
Disagree	73	34.3%
Neutral	54	25.4%
Agree	65	30.5%
Strongly agree	11	5.2%
Total	**213**	**100.1%**

Q: *The IT organization has created my institution's reporting, modeling, analysis, and decision capability in advance of user needs.*

of joint sponsorship of its efforts to build academic analytics. IT, institutional research, and other functional areas have all been centrally involved in the implementation. Joel Hartman, vice provost and CIO, believes that implementations of ERP systems, data marts, and warehouses turn data into an institutional asset that must be managed jointly. Hartman explains that UCF has gone through a deliberate process to create a modern data environment. "In the legacy era, the data center ran the hardware and the applications, and the users owned the data. We have essentially flipped this end-for-end. Now, the institution provides the hardware, the departments run the applications, and the institution owns the data. The data are an institutional asset. Their ownership is multidimensional, with many interrelationships. Ownership is institutional and custodianship is done by functional areas."

Investment in Academic Analytics

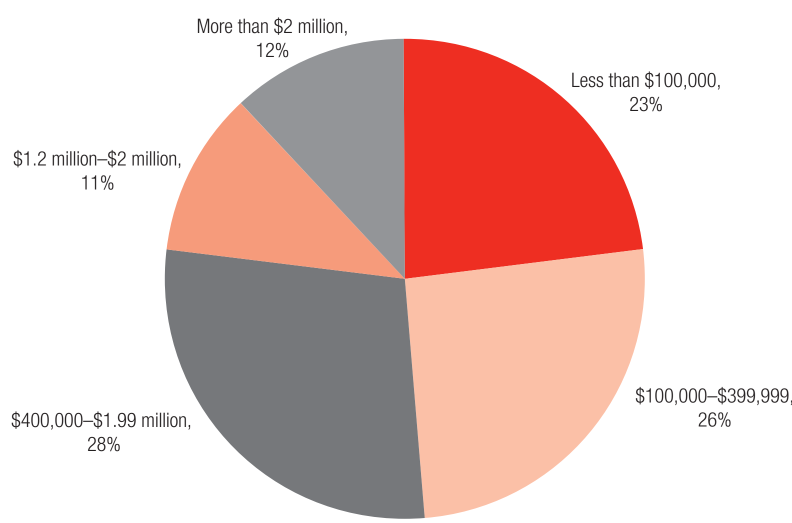
The amount invested in academic analytics varies widely among respondents who report technology platforms beyond level 1. We acknowledge that some of this variance stems from the inherent difficulties in collecting cost data. Our survey did not let us provide a specific definition of what types of costs to include. So, we suspect that institutions used many different methods to estimate their aggregate spending. Some may have accounted only for hardware and software. Others may have included additional costs such as consulting, staff time, or training. Since institutions have implemented their capability over varying periods of time, we asked respondents to tell us the aggregate cost of their analytical platforms over the last five years.

The mean aggregate cost reported by respondents was between $900,000 and $1 million over the past five years. As Figure 5-5 illustrates, some respondents spent considerably more.

In fact, 23 percent of respondents report aggregate expenditures in excess of $1.2 million, with 12 percent spending more than $2 million. Another caution worth noting is that the data represents spending for only the past five years. Nearly one-quarter of respondents reported that they began their implementation of their academic analytics more than five years ago. Therefore, these data are representative of recent spending, not total spending.

We also examined aggregate spending by technology capability level. As one would expect, respondents with more extensive technol-

Figure 5-5. Aggregate Five-Year Cost of Academic Analytics (N = 376)



ogy platforms reported higher aggregate costs. Institutions with level 3 capability reported average aggregate costs of $1.3 to $1.4 million. Comparatively, institutions with level 2 capability reported average five-year costs of $800,000 to $900,000. Institutions with capability approaching level 2 or level 3 reported somewhat lower aggregate costs. Again, we caution that the relatively small number of respondents in any one group makes it difficult to draw strong conclusions from this data.

To the extent that recent costs are an indicator of the magnitude of spending on academic analytics, it is interesting to note that costs among technology platforms do not vary widely. Proportionately, spending to create level 3 capability appears to be 50 percent higher than that needed to create level 1 capability. However, in absolute terms, it appears that the incremental investment is only half a million dollars more (in recent spending). While this is certainly a significant amount of money to many institutions, it is not out of the realm of possibility for most. If this level of incremental investment is fairly accurate, and if institutions with level 3 platforms achieve better results (more on that later), it suggests that institutions could gain significantly more capability for relatively few incremental dollars.

Critical Success Factors

We also asked respondents a series of questions about what drives a successful academic analytics implementation. Respondents were asked to identify the three most important success factors of their initial implementation. Table 5-6 lists each factor, along with the percentage of respondents selecting it as among the three most important.

Respondents most frequently identified sponsorship outside IT and participation of data owners as among the three most important success drivers. The emphasis placed on sponsorship is interesting, given the earlier finding that many projects begin at IT's initiative. Clearly, many respondents felt a need to quickly secure broader sponsorship for their efforts. The importance of participation by data owners is not surprising. Without their participation, it would be difficult for IT to design reports, define data elements, or certify that users understood how to use data. It would be no different from an attempt to implement a student system without the registrar's participation.

Technical implementation issues were deemed somewhat less important. Only a quarter of respondents selected effective tools or a sound data model as among the three most important factors. In fact, many institu-

Table 5-6. Critical Success Factors (N = 213)

Factor	Percentage Selected
Participation of data owners	52.1%
Sponsorship outside IT	46.9%
Adequate funding	33.3%
Effective technical tools	28.6%
Users who manage with data	28.6%
Sound data model	26.3%
Good data	25.8%
Trained user community	23.0%
Clear ROI	3.8%

tions appear to have handled technical aspects of their implementation without any external assistance. Fewer than a third of respondents (30.5 percent) used outside assistance (such as consultants) to help design their data model. Fewer respondents (21.6 percent) relied on outside advisors to select tools or to design their technology platform (16.4 percent). The most frequent use of outside consultants was for training (37.6 percent).

Finally, we asked respondents which success factors have been the most difficult to sustain since their initial implementation. Not surprisingly, maintaining adequate funding was selected most frequently. In fact, half (50.2 percent) identified funding as one of the three most difficult factors to sustain. An equal number of respondents identified maintaining a trained and knowledgeable user community as one of the three most difficult. The third largest percentage (33.8 percent) identified maintaining "good" data as among the three top challenges. Maintaining good data and the user community's knowledge likely go hand in hand. It stands to reason that if the user community's knowledge about the underlying data degrades, then so will the integrity of any analysis that comes from the institution's warehouse or mart.

Technology and Satisfaction

Respondents to our survey employ various technology platforms to support their academic analytics. As we saw earlier in the chapter, using more complex technology platforms requires more investment than reporting with a transaction system or an operational data store. But the incremental investment does not appear to be prohibitive. This led us to ask whether institutions with differing platforms achieve different results. So we asked respondents about their degree of satisfaction with their analytical capabilities. Using a five-point scale, respondents indicated whether they agreed or disagreed with several statements regarding the effectiveness of their academic analytics technology, including

- ease of use,
- ability to provide users with timely access to information, and
- ability to make information widely accessible.

Table 5-7 shows the mean response from all respondents to each statement.

On average, respondents somewhat agreed that their analytical capability gave decision makers timely access to information and made information widely accessible. However, significant numbers of respondents were neutral or in slight disagreement with the statements. Respondents seem less satisfied with their technology tools' ease of use. In fact, on average, respondents somewhat disagreed with the statement that users think their tools are easy to use.

Satisfaction by Technology Platform

We also looked at how responses to each statement differ by technology platform choice. There does appear to be a relationship between a respondent's technology platform and their overall satisfaction with

Table 5-7. Satisfaction with Academic Analytical Tools (N = 371)

Statement	Mean	Std. Deviation
Decision makers have timely access to information.	3.50	0.975
Information is widely accessible.	3.29	1.057
Users think that our tools are easy to use.	2.59	0.906

(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

their analytical capability. The most significant relationships between satisfaction and technology appear to be for levels 1 and 3. Institutions with level 1 platforms (transaction system reporting) were less satisfied with the timeliness of information, access to information, and their tools' ease of use than were respondents with platforms exceeding level 1. Similarly, respondents with level 3 capability had greater satisfaction than respondents with any other platform.

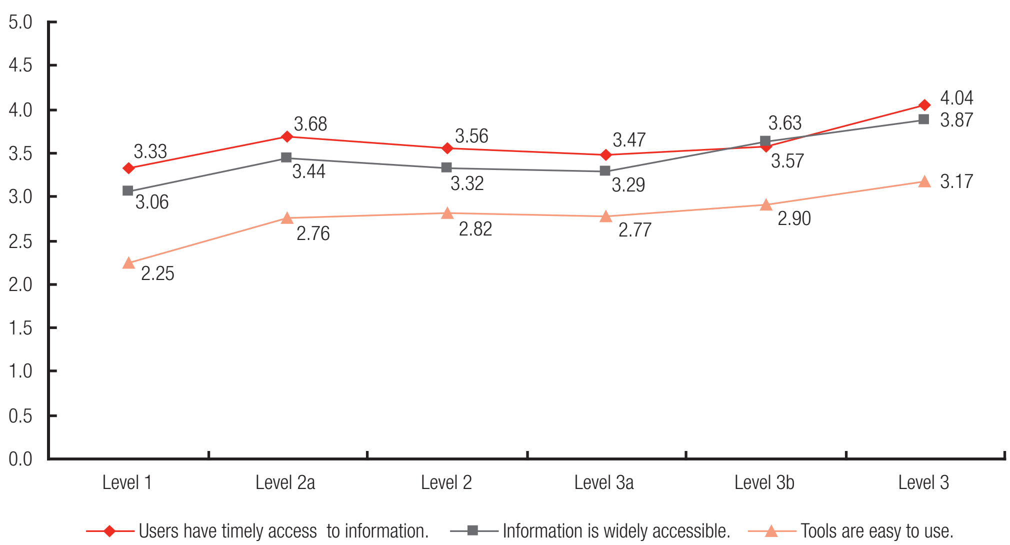
As Figure 5-6 illustrates, respondents' satisfaction with their analytical capacity increases (demonstrated by a higher mean agreement) as their technology level increases. The most significant jumps in satisfaction appear to occur when an institution moves beyond transaction system reporting (level 1). Respondents with near level 2, level 2, or near level 3 capacity all have fairly comparable levels of mean satisfaction.

Satisfaction increases again significantly for those institutions with level 3 capability. These respondents had the highest level of average satisfaction with timeliness of access to information, breadth of access to information, and their tools' ease of use. Respondents with near level 3 capability (lacking ETL, OLAP, or dashboards) had lower levels of satisfaction. This suggests that adding sophisticated tools like OLAP or dashboards that make it easier for a user to obtain and manipulate data does make a difference.

Summary

It does appear that technology platform choice influences an institution's satisfaction with their analytical tools. Respondents with level 3 technology are the most satisfied. Respondents with data warehouses, dashboards, and/or OLAP tools report better access to timely information. They also agree more strongly that their tools are easier to use. While institutions with level 3 capability have spent incrementally more money on average than those with other technology platforms, the magnitude of those expenditures is not too great (relative to other technology investments). This suggests that institutions that already have level 2 or near level 3 technology stand to gain by upgrading to level 3 platforms.

In this chapter we looked at respondents' satisfaction with their analytical tools. In



(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

Figure 5-6. Mean Satisfaction with Analytical Capability, by Technology Platform

Chapter 8, we will look at the institutional outcomes that respondents are achieving with their analytical capability. There we will examine whether an institution that has invested in more complex technology platforms is achieving better institutional outcomes in addition to being more satisfied with their technology tools.

Endnotes

1. In managing databases, *extract, transform, load* (ETL) refers to three separate functions combined into a single programming tool. First, the extract function reads data from a specified source database and extracts a desired subset of data. Next, the transform function works with the acquired data—using rules or lookup tables, or creating combinations with other data—to convert it to the desired state. Finally, the load function is used to write the resulting data (either all of the subset or just the changes) to a target database, which may or may not previously exist (*source:* Oracle.com).
2. In IT, a dashboard is a user interface that, somewhat resembling an automobile's dashboard, organizes and presents information in a way that is easy to read (*source:* CIO.com).
3. OLAP (online analytical processing) is computer processing that enables a user to easily and selectively extract and view data from different points of view. For example, a user can request that data be analyzed to display a spreadsheet showing all of a company's beach-ball products sold in Florida in the month of July, compare revenue figures with those for the same products in September, and then see a comparison of other product sales in Florida in the same time period (*source:* Oracle.com).
4. A metadata repository is a database of data about data (metadata). The purpose of the metadata repository is to provide a consistent and reliable means of access to data. The repository itself may reside in a physical location or may be a virtual database in which metadata is drawn from separate sources. Metadata may include information about how to access specific data, or more detail about it, among a myriad of possibilities (*source:* Oracle.com).

6
Uses of Academic Analytics on Campus

Unobstructed access to facts can produce unlimited good only if it is matched by the desire and ability to find out what they mean and where they lead.
—Norman Cousins, U.S. author

Institutions vary in both who uses academic analytics and how they use it. Some have deployed their capacity broadly and have many active users. Others have focused on smaller user groups. Institutions also vary in how extensively they use their capabilities. Many use their analytical infrastructure as a means to deliver information to monitor operations such as comparing budget to actual performance. Others have begun to harvest information from their analytical systems for more advanced uses such as predictive modeling (for example, of student retention). Use of academic analytics varies not only by institution but also within functional areas as well. Some areas, such as institutional research, have a long history of data-driven analysis. Other areas have used data to a far lesser extent and may in fact use their analytical tools very differently.

Key Findings

- Institutions deploy their academic analytics solutions differently. Some have broad deployment but relatively basic use, while others have narrow deployment and sophisticated use. Relatively few have achieved both broad deployment and sophisticated use.
- Nearly 70 percent of respondents use their academic analytics primarily for transaction reporting.
- Fewer than 10 percent of respondents report that their primary use of academic analytics is for what-if analysis, predictive modeling, or automated alerts.
- The most sophisticated use of academic analytics occurs within respondents' institutional research and central planning and budget functions.
- Respondents with effective training programs achieve significantly greater utilization of their academic analytic applications.

This chapter explores the different ways institutions have elected to deploy and use their analytical capacity. It examines:

- How have institutions deployed their academic analytical capability?
- How do institutions use their capacity, and how does it impact individual functional areas?
- What kinds of information are institutions maintaining in their data stores, data marts, and data warehouses?
- What is the nature of plans to upgrade and expand institutional capacity?

In the next chapter, we look closely at those respondents who indicated they have the most advanced uses of their analytical tools.

Breadth of Use

This section examines two aspects of how institutions deploy academic analytics. It first looks at how actively different institution types use it. Second, it looks at adoption of academic analytics within specific functional areas.

Institutional Deployment

Respondents differ in both how they deploy their academic analytical capability and how they use it. For example, we asked all respondents with capability beyond transaction system reporting whether they deployed their academic analytical capability institution-wide. Using a scale of 1 to 5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), respondents indicated their level of agreement that their deployment was institution-wide. The mean response was 3.39, indicating slight agreement with the statement. The standard deviation exceeded 1.10, however, indicating that many respondents agree and many either disagree with or are neutral to the statement. The responses are not uniform, and they suggest that not all institutions have pursued or succeeded at institution-wide deployment.

We also asked respondents a series of questions about who their most active users are. Among institutions with technology platforms beyond level 1, we found, on average, slight agreement that the active use of academic analytics occurs primarily within a few departments. In fact, on a 1-to-5 scale, the mean response was close to neutral (3.24), and the standard deviation exceeded 1.21. This indicates that many respondents agreed and disagreed with the statement. So, respondents vary in how broadly their solutions have been deployed and how widespread their use has become. Here again, there does not appear to be a strong pattern of how institutions are deploying and using their analytical capacity. Nor does there appear to be a relationship between the breadth of deployment or use and the type of technology platform the institution has adopted.

We do see some relationship between institutional enrollment size, deployment, and use. In general, moderate-sized institutions agree more strongly that their deployment is institution-wide than do either larger or smaller institutions. The largest institutions (enrollments greater than 25,000) appear to be in the middle: They had relatively less agreement that they have deployed their capacity institution-wide, but they disagree the most that use was limited to a few individual departments. For large institutions, the breadth of their operation may make institution-wide use a substantial challenge. However, these same institutions may have many departments actively using academic analytics. Table 6-1 lists the mean responses to each question (deployment and use) by student enrollment.

The deployment approach may depend somewhat on how the institution manages itself. We did not find a statistical relationship between breadth of use and the degree of centralization of an institution's management control. However, we did learn through qualitative interviews that some institutions' management philosophies did influence their deployment strategy. David Weiser, director of information systems and services at Lorain County Community College, explains that broad deployment was the only option for his institution. "Why did we deploy broadly? The best way to explain it is to look at our organization chart. We are a very flat organization. We have a president who is dynamic and delegates authority. There is a lot of distributed authority, and real power exists at the director level."

We also asked respondents to tell us how intensely their analytical systems were used, regardless of deployment strategy. We asked them to agree or disagree with the statement that their analytical tools are used actively by

Table 6-1. Breadth of Deployment and Use, by Enrollment

FTE Enrollment	Academic analytics is used primarily in a few individual departments.			Academic analytics is deployed institution-wide.		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation
1–2,000	3.62	29	0.979	3.17	29	1.136
2,001–4,000	3.50	38	1.225	3.47	38	1.084
4,001–8,000	3.24	37	1.188	3.76	37	1.116
8,001–15,000	3.19	37	1.244	3.41	37	1.117
15,001–25,000	3.25	36	1.228	2.94	36	1.094
More than 25,000	2.50	22	1.225	3.32	22	1.211
Average/Total	**3.26**	**199**	**1.214**	**3.36**	**199**	**1.136**

(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

the majority of eligible user departments. On a 1-to-5 scale, the mean response was 2.53 and the standard deviation was 1.045. So it appears that most respondents on average believe that the majority of their eligible departments are not active users of their academic analytical capacity. Interestingly, we found no significant relationship between the technology level the institution had deployed and their assessment of the intensity of use. So despite the belief that level 3 technology is easier to use, respondents with level 3 technology platforms did not report significantly more or less intensive use of their analytical capability.

The reality may be that it just takes time for the use of academic analytics to take hold in an institution, no matter how intuitive the tools. For example, in 2003, the University of California at San Diego introduced a tool called MyDashboard to enable users to create reports from local departmental information and the institutional data warehouse (a full case study of UCSD has been prepared as a companion to this study). On the basis of feedback provided to ECAR, UCSD users view MyDashboard as intuitive and easy to use. However, it has not been adopted at a uniform pace across user areas. Some have been slow to adopt MyDashboard. One participant in an ECAR interview observed, "People are resistant to change and slow to adopt innovations, however promising. Perhaps innovation doesn't occur because people have no time to convert to a new system and insufficient motive to make time to do so."

Use by Functional Area

To deepen our understanding of how institutions use their analytical capability, we asked respondents to tell us their three most active and three least active user departments. As Table 6-2 illustrates, the users that respondents most frequently selected as most active were central finance, central admissions, and institutional research. This is not surprising, as these areas tend to be more facile with data and analysis. The least active areas were department chairs and their staffs, deans and their staffs, and central human resources.

Respondents report that central research administration and central fundraising are also relatively inactive users of academic analytics. Admittedly, these two areas are particularly sensitive to institution type and mission. So, we looked at the question of active use by research administration in relation to Carnegie class. Likewise, we looked at the relative activity of central fundraising by insti-

Table 6-2. Top Three Most Active and Least Active User Areas

Area	Most Active	Least Active
Central business/finance	66.5%	4.8%
Admissions/enrollment management	63.3%	2.7%
Institutional research	57.2%	6.1%
Central academic/student services	45.7%	5.1%
Dean/dean's staff	15.4%	39.1%
Central fundraising	12.5%	21.8%
Central HR	10.1%	31.1%
Department chair/chair's staff	8.0%	57.2%
Central research admin./grants management	3.2%	29.8%
School-based admissions	0.8%	15.7%
School-based fundraising	0.5%	23.4%
School-based grants management	0.5%	26.1%

tutional control. We found that even among doctoral institutions, 16.5 percent reported that central research administration staff were among their least active users. Nearly a third of master's institutions (33.3 percent) reported similar findings. So even among more research-intensive institutions, use by research administration staff is relatively low.

We expected use by advancement staff at private institutions to be higher. Since private giving is a more significant revenue stream for most private institutions, they would tend to place a greater emphasis on fundraising and invest greater resources in their advancement function. As anticipated, we did see a difference between respondents from private and public institutions. Just 10.7 percent of private institutions reported that their central advancement staff members were among the least active users of academic analytics. Conversely, 29.8 percent of public institutions reported that their central advancement users were among the three least active.

We also tested whether the technology platform type an institution deployed had any relationship to which user areas became the most active. We did not find any significant relationship between the two. It appears that institution type and a functional area's historical use of data have more impact on the area's intensity of academic analytics usage.

Lastly, we examined the role of effective training in promoting the use of academic analytics. As one would expect, we found that respondents who reported that their training was more effective also reported more active use of their analytical capability. As Figure 6-1 illustrates, respondents who agreed that their institution provides effective training also agreed to a greater extent that the majority of eligible users actively used their analytical capability.

Qualitative interviewees also cited training as a major factor in promoting effective usage. According to Joseph Sawasky, associate vice president at the University of Toldeo, training and success were linked at his institution. Sawasky explains that "the data warehouse did not experience critical mass of use, nor did the institution derive real value from the data

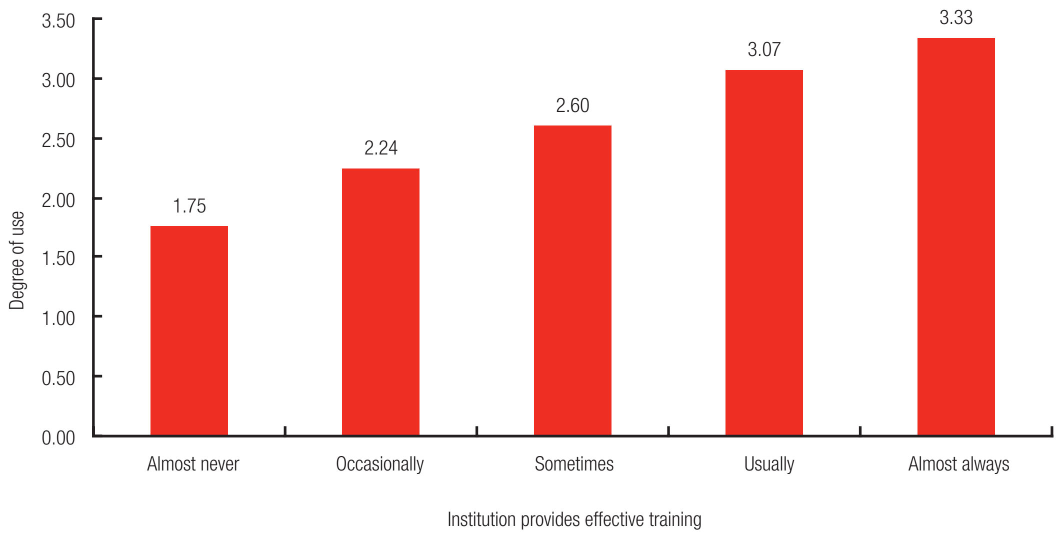


Figure 6-1. Degree of Use of Academic Analytics, by Effectiveness of Training (N = 368)

Q: *Reporting, modeling, analysis, and decision support tools are used actively by the majority of eligible user departments. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

warehouse, until we put together our training program for end users."

Institutions face a two-part challenge. They must train users in a new tool and train them to use the data. Susan Foster, vice president of information technologies at the University of Delaware, notes that the latter type of training can be a formidable challenge. "We chose a tool that is fairly easy to use; that has not been the problem. The problem has been getting end users to not only learn a new tool, but to understand the data they are working with." Delaware has had to adapt its training program to meet this reality. Foster goes on to explain that her university has "recognized that different people learn in different ways and have different cognitive strengths. A three-hour training session is often not the most effective way to train employees."

Data Sources

Our analysis also looked at the kinds of information institutions include in their academic analytics systems. ERP systems (or legacy administrative transaction systems) are the predominant data sources for respondents' data stores or warehouses. Most respondents with analytical capability beyond level 1 (transaction system reporting) include data from their student and financial systems in their data marts or warehouses. Table 6-3 lists the major sources of data that institutions with analytical capability beyond level 1 draw from when importing to their data stores or warehouses.

Data from human resource systems is also included in three-quarters of respondents' warehouses or data stores. Despite the relatively low intensity of use by human resource departments, institutions do incorporate personnel data in their marts or warehouses. This may indicate that other user areas (such as institutional research or academic affairs) perform analysis with this data.

Significantly fewer respondents reported having data from non-ERP systems in their warehouses or stores. Fewer than 40 percent of institutions included data from their advancement system (36.2 percent), and fewer than 30 percent included data from their grants management system (27.7 percent). Among doctoral institutions, fewer than half (47.3 percent) of respondents had grants management data included in their stores or warehouses.

Table 6-3. Information Contained in Data Stores or Warehouses (N = 213)

Source	Percentage
Student information system	93.0%
Financial system	84.5%
Admissions	77.5%
HR system	73.7%
Advancement	36.2%
Course management system	29.5%
Ancillary systems (e.g., housing)	28.2%
Grants management	27.7%
Department-/school-specific system	22.5%
Comparative peer data	20.2%
Feeder institutions (high schools)	9.4%

Data from course management systems is included in the stores or warehouses of 29.5 percent of respondents. A slightly higher proportion of public institutions (33.6 percent) than private institutions (24.3 percent) have course management data in their data store. Similarly, a greater proportion (40.5 percent) of moderately sized institutions (4,000 to 8,000 students FTE) reported having course management data in their data stores.

The percentage of both smaller and larger institutions with course management data ranged between 22.7 percent and 32.4 percent (see Table 6-4). If, as respondents anticipate, improving retention, demonstrating outcomes, and accreditation are the significant drivers of academic analytics, we would expect these percentages to significantly increase. Institutions will need the ability to look at data from their student information systems, course management systems, advising databases, and other sources to understand patterns in retention or student achievement.

Jack Suess, vice president of information technology at the University of Maryland, Baltimore County, describes how retention is driving his institution's expansion of academic analytics. "We just recently began some analysis about retention. This is an area where we have demonstrated results from using higher-level analytics. The university appointed a task force that is using a new data mart to attack the problem. There are a lot of databases around campus that provide clues; by bringing them together in a data mart we were able to look at both academic and nonacademic factors related to first-year retention and see a fuller picture and look at focused subpopulations."

Data Currency

We also asked respondents to tell us if they felt they refreshed the data in their data stores more frequently than users required. Many report that they have created a capacity to refresh data that outpaces users' needs. Nearly half of respondents (49.3 percent) reported that they usually or almost always refresh their data more frequently than required. Another 26.3 percent reported that they sometimes refresh their data more often than required. If institutions have overbuilt their capacity to keep data current, it does not appear to have had a significant impact on costs. In fact, institutions that refreshed their data more frequently than users needed did not report a significantly higher level of five-year aggregate spending on their academic analytic solution.

Finally, we compared respondents' assessments of their data refreshing frequency with their assessment of their overall reporting capacity. As Table 6-5 illustrates, institutions that exceeded user needs for data freshness did not have a significantly higher opinion of their overall reporting and analysis capability.

One of the University of Alabama's lessons learned from their experience implementing academic analytics is that accurate data is more valuable than more frequently refreshed data. Vice Provost for Information Technology Priscilla Hancock reflects, "We refresh data every 20 minutes, but we don't need it. I prefer robustness over frequent refreshing."

Expansion Plans

We also asked respondents to indicate their plans to integrate additional data into their existing stores and warehouses. Respondents with advanced capabilities (beyond transaction reporting) show a strong commitment to expand the data in their various stores. This parallels a similar level of commitment to expand among those institutions with more basic capability. Respondents were asked to use a five-point scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) to indicate their agreement with the statement "My institution plans to integrate

Table 6-4. Inclusion of Course Management Data in Data Stores or Warehouses, by Enrollment (N = 213)

FTE Enrollment	Percentage with CMS Data
1–2,000	27.6%
2,001–4,000	28.9%
4,001–8,000	40.5%
8,001–15,000	32.4%
15,001–25,000	27.8%
More than 25,000	22.7%

Table 6-5. Frequency of Data Refresh and Satisfaction with Academic Analytics (N = 213)

Information is refreshed more frequently than required.	Extensive reporting capability	Effective tools to analyze data
Almost never	3.63	3.50
Occasionally	3.03	3.33
Sometimes	3.11	3.25
Usually	2.97	3.13
Almost always	3.49	3.68
Average	**3.16**	**3.32**

(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

with our reporting, modeling, analysis, and decision support tools in the next two years." The mean response was 3.86, indicating that respondents agreed on average that they would integrate more data sources. In fact, 78.4 percent of respondents either agreed or strongly agreed with the statement.

We found no significant differences in expansion plans among respondents with different levels of technology platforms. All have a fairly similar degree of agreement that they would be integrating additional data sources. Expansion plans also do not vary significantly by either institutional enrollment or Carnegie class.

Depth of Use

We saw in the prior section that institutions have different experiences regarding the breadth of use of their academic analytics. Here we examine differences in the depth of use of academic analytics. In our survey, we defined a hierarchy of five stages of academic analytics use:

- Stage 1: Extraction and reporting of transaction-level data.
- Stage 2: Analysis and monitoring of operational performance.
- Stage 3: What-if decision support (such as scenario building).
- Stage 4: Predictive modeling and simulation.
- Stage 5: Automatic triggers of business processes (such as alerts).

We hypothesized that institutions move through these stages as the sophistication of their academic analytics increases. Our thought was that institutions with stage 4 or 5 academic analytics applications would be among the most advanced users. We expected to find few examples of institutions with these advanced applications.

We believed that most institutions start by using their academic analytics platforms to report transaction-level data or to analyze operational performance. This would include monitoring budget to actual financial performance or course enrollments. Institutions with more advanced academic analytics applications would begin to integrate their capabilities with planning, decision making, and business processes. These institutions would use information to forecast decisions using what-if analysis (stage 3). Stage 4 institutions harvest their information and analytical capacity to build predictive models and simulations. These could include enrollment forecasts or models that predict student learning outcomes. Finally, at stage 5, institutions have integrated information and business processes. These institutions use their academic analytics to automatically trigger a business process or event. For example, if a student drops a class, an appointment with an advisor is automatically scheduled.

Joel Hartman, vice provost for information technologies and resources at the University of Central Florida, describes how UCF is moving through a maturation process similar to the five stages we identified. "We envision a pyramid of use. At the first layer, we have operational reporting of daily data. Layer 2 is the data warehouse. It will integrate data from many sources. It will use OLAP cubes and be the official source of longitudinal data analysis. Layer 3 is the final piece, data mining. This last layer will be added when the data warehouse is well established."

We expected to find most institutions' use to be at stage 1 or 2. In fact, this proved to be the case. We asked respondents to tell us the primary use of their academic analytical capability. As Table 6-6 illustrates, nearly 70 percent reported that their primary use was for reporting transaction-level data (stage 1). Only 8 percent of respondents reported that their primary use was at stage 3 or higher.

We found no significant relationship between the type of technology platform a respondent employed and their application of

Table 6-6. Primary Use of Academic Analytics (N = 376)

Use	Number	Percentage
Stage 1: Extraction and reporting of transaction-level data	263	69.9%
Stage 2: Analysis and monitoring of operational performance	51	13.6%
Stage 3: What-if decision support (e.g., scenario building)	6	1.6%
Stage 4: Predictive modeling and simulation	7	1.9%
Stage 5: Automatic triggers of business processes (e.g., alerts)	17	4.5%
Not active users	32	8.5%
Total	**376**	**100.0%**

that technology. Respondents with level 2 or level 3 technology platforms were no more likely to have the primary use of their academic analytics include predictive modeling or automated alerts. In fact, 11 of the 17 respondents who reported that their primary application of their academic analytics capability is at stage 5 (automated alerts) used their transaction system as their primary reporting platform.

We do not conclude from this that technology platform does not in any way relate to the technology's potential applications. The small number of respondents makes it difficult to be conclusive about the technology platform's importance. Further, respondents may have interpreted each stage differently. We examine the group of institutions that did report stage 3, 4, or 5 applications of their technology in detail in Chapter 7.

Application by Functional Area

To further our understanding of how institutions use their capacity for academic analytics, we asked respondents to report the primary use by each major functional area. The functional units we focused on were all central administrative units and included

- advancement,
- business and finance,
- budget and planning,
- institutional research,
- human resources,
- research administration, and
- academic affairs.

As Table 6-7 illustrates, the majority of respondents report that their primary use is to report transaction-level data. Not surprisingly, institutional research used predictive modeling most frequently, and budget office users most frequently used decision support. These academic analytics applications align most favorably with the missions of these two units. These data also confirm our earlier findings that advancement, research administration, and human resources were among the least active users of academic analytics.

It is not clear from the survey why these areas are particularly inactive. In general, the research administration and human resource areas trail other administrative processes in their level of performance. A prior ECAR study, *Good Enough! IT Investment and Business Process Performance in Higher Education,* found that institutions were least satisfied with the performance of their HR and research administration processes. In the case of research administration, fragmented organizational structures and significant decentralized control make these processes difficult to change. It is possible that these same forces have slowed the adoption of analytical capabilities. The human resource area appears to lag other processes in garnering technology investment (Kvavik et al., 2005, pp. 46–50, 60–64).

Table 6-7. Primary Application of Academic Analytics by Functional Area

Use	Advancement/ Fundraising	Business and Finance	Budget and Planning	Institutional Research	Human Resource	Research Administration	Academic Affairs
Stage 1: Extraction and reporting of transaction-level data	56.9%	68.4%	49.6%	48.8%	62.2%	45.0%	52.8%
Stage 2: Analysis and monitoring of operational performance	11.0%	17.0%	19.6%	28.4%	7.8%	10.3%	18.2%
Stage 3: What-if decision support (e.g., scenario building)	2.3%	1.9%	13.5%	4.1%	0.6%	0.9%	4.7%
Stage 4: Predictive modeling and simulation	3.1%	3.0%	9.6%	11.6%	1.1%	1.7%	5.2%
Stage 5: Automatic triggers of business processes (e.g., alerts)	3.7%	2.5%	0.6%	7.1%	1.9%	1.1%	2.2%
Not active users	22.9%	7.1%	7.2%	0.0%	26.4%	41.0%	16.9%
Total	**100.0%**	**100.0%**	**100.0%**	**99.9%**	**100.0%**	**100.0%**	**100.0%**

Finally, the relatively high number of inactive users in the advancement area may reflect their greater outsourcing of the analysis function. In fact, 28.7 percent of respondents reported that their institution's advancement function routinely contracts with an outside firm to analyze data. This is a fairly typical practice in both the advancement and enrollment management areas and may in fact have depressed their demand for in-house academic analytics.

Summary

Academic analytics usage by functional area does not differ significantly by institutional size, control (public or private), or Carnegie class. In general, the relatively small number of respondents in the survey using their analytical capability for applications beyond transaction or operational reporting makes it difficult to conclude that no relationship exists among these institutional factors. One could certainly argue that a research university will become more interested in advanced academic analytics applications for research administration than would a private, bachelor's institution. Similarly, private institutions might become more interested in the predictive modeling capability for their advancement function than would a public institution. An institution's mission and competitive characteristics simply alter the potential benefits it can realize from expanding its use of academic analytics in different functional areas.

The usage patterns could also be attributable to how institutions have phased their academic analytics implementation. Institutions may have focused first on working with areas that have more data-driven cultures and needs, such as finance and institutional research. This would enable them to gain early successes by working first with more experienced users with strong knowledge of the institution's data. We did not find, however, a strong relationship between the length of time respondents have had their academic analytical capability in place and the breadth and depth of use by area.

Finally, individual functional areas' local culture and leadership may play an important role in academic analytics adoption. Functional areas such as admissions and institutional research have both the need and the capacity to perform advanced analysis. We would expect these to be among the first to recognize the need for advanced analytical capability and to be its early adopters. There should be fewer cultural barriers to adoption in these offices, where there is a user base already skilled in analysis. As we will see in the next chapter, the skill of the user base is one of the most important factors in an institution's ability to achieve advanced uses of its analytical capacity.

7
Advanced Applications of Academic Analytics

Analysis as an instrument of enlightenment and civilization is good, in so far as it shatters absurd convictions, acts as a solvent upon natural prejudices, and undermines authority; good, in other words, in that it sets free, refines, humanizes, makes slaves ripe for freedom. But it is bad, very bad, in so far as it stands in the way of action, cannot shape the vital forces, maims life at its roots. Analysis can be a very unappetizing affair, as much so as death.

—Thomas Mann, German author and Nobel Prize winner

As discussed in Chapter 6, most institutions use their analytical capacity primarily to report transactions or to monitor operational performance. Relatively fewer institutions use their academic analytics for advanced applications such as scenario building, predictive modeling, or automated alerts that integrate information with their business processes. In all, only 8 percent of respondents reported that their *primary* institutional use is one of these advanced applications.

While this group of respondents is relatively small, they potentially represent the way many institutions will be using their academic analytical tools in the future. So, we wanted to understand in more detail who these respondents are and how they are using academic analytics. This chapter analyzes the advanced use of analytics at the institutional level and by functional area. Specifically, we look at how institutional characteristics, management climate and culture, and technology platforms impact advanced use.

Key Findings

- Only 30 respondents report that their institution's primary use of academic analytics is for what-if analysis, scenario building, predictive modeling, or alerts.
- Advanced uses of academic analytics are more prevalent within a functional area.
- Respondents report advanced applications of analytics most frequently in finance and student services and least frequently in grants management and advancement.
- Differences in respondents' institutional missions and profiles, such as control, Carnegie class, and enrollment, impact in which areas they pursue advanced analytics.
- It appears that institutions that are more tuition driven use their analytical capabilities more frequently to support student retention.
- Having staff skilled at analysis is a critical characteristic of respondents with advanced applications of academic analytics.
- Other important factors include leadership committed to evidence-based decision making, effective training, and a stable or dynamic institutional environment.
- There is not a significant relationship between a respondent's choice of technology platform for academic analytics and their ability to implement advanced applications.

Profile of Advanced Users

This section examines the factors differentiating respondents who indicated that their institutions are advanced users of academic analytics. These respondents told us that their institution's primary use of academic analytics was for what-if analysis, scenario building, predictive modeling, or generation of automated alerts.

Institutional Characteristics

In considering the institutional profile of respondents with advanced academic analytics applications, we examined several items, including institutional control, enrollment, Carnegie class, aggregate spending on academic analytics, and the length of time since the institution first implemented its analytical capability. As Table 7-1 illustrates, we found the following characteristics:

- 42.9 percent began implementing their academic analytical capability between six and eight years ago;
- 58.3 percent report spending less than $400,000 on academic analytics over the past five years;
- nearly half (48.2 percent) have enrollments of fewer than 4,000 students;
- respondents are distributed fairly evenly across all Carnegie classes; and
- nearly two-thirds (62.1 percent) are public institutions.

Additional comments on these findings:

- The higher proportion of public institutions with advanced capability is not altogether surprising, given that more

Table 7-1. Institutional Characteristics of Respondents with Advanced Academic Analytics (N = 30)

Time Since Initial Implementation	Less than 1–2 years	3–5 years	6–8 years	9 or more years		
Institutions with Advanced Application	7.1%	21.4%	42.9%	28.6%		
Aggregate Five-Year Spending	**Less than $100,000**	**$100,000 to $399,999**	**$400,000 to $1.99 million**	**$1.2 million to $2 million**	**More than $2 million**	
Institutions with Advanced Application	33.3%	25.0%	16.7%	8.3%	16.7%	
FTE Enrollment	**1–2,000**	**2,001–4,000**	**4,001–8,000**	**8,001–15,000**	**15,001–25,000**	**More than 25,000**
Institutions with Advanced Application	24.1%	24.1%	17.2%	13.8%	13.8%	6.9%
Carnegie Class	**DR**	**MA**	**BA**	**AA**	**Other**	
Institutions with Advanced Application	20.0%	16.7%	23.3%	20.0%	20.0%	
Control	**Private**	**Public**				
Institutions with Advanced Application	37.9%	62.1%				

of the survey respondents (56.7 percent) were public institutions.

- The aggregate spending by respondents was for the past five years only. This likely does not reflect respondents' total spending to create their academic analytic capability, as nearly half began their implementation six to eight years ago or longer.
- The distribution of respondents by Carnegie class does not mirror the distribution of overall survey respondents. A smaller percentage of doctoral institutions report advanced capabilities (20 percent) than are present in the overall survey population (28.6 percent). Conversely, associate's institutions constitute a larger percentage (20 percent) than are present in the overall survey population (15.1 percent).

Among respondents, the advanced use of academic analytics happens at both small and large institutions. Often, we think of advanced technology uses only being within the grasp of larger institutions with greater resources. At least among the survey respondents, this does not appear to be the case. Of course, the relatively small number of respondents makes it impossible to conclude with certainty that the same trends would hold for all institutions.

Management Climate

To further understand the patterns of advanced uses of academic analytics, we also examined several different dimensions of respondents' management climate. We asked respondents to describe their institutions in terms of degree of decentralization, commitment to data-driven decision making, and the relative turbulence of the campus environment. We observed the following characteristics among respondents:

- A greater proportion of respondents with stable or dynamic environments had advanced applications of their academic analytical capability than did those with either volatile or unstable environments.[1] In fact, 90 percent of respondents who reported advanced uses also reported stable or dynamic environments. Comparatively, 83.1 percent of all respondents reported that their institutional environments were stable or dynamic.
- Managerial control at the majority of institutions with advanced academic analytics applications was fairly evenly distributed among those that were somewhat decentralized, balanced (between centralization and decentralization), and somewhat decentralized. This approximated the distribution of respondents' managerial control as a whole.
- Nearly 50 percent of respondents with advanced academic analytics applications agreed or strongly agreed that administrative staff at their institutions were skilled at analyzing data.
- Seventy percent of respondents with advanced academic analytics applications also agreed or strongly agreed that their institution's leadership is committed to evidence-based decision making.

Again, the relatively small number of respondents makes it difficult to reach any firm conclusions regarding the management climate of institutions with advanced academic analytics uses. While we found no statistically significant relationship between many of the management climate factors and the advanced use of academic analytics, this absence could be attributable to the small number of responses. The strongest apparent relationship is between the advanced use of analytics and administrative staff being skilled at analyzing data.

The presence of staff members skilled in analysis appears to be a significant differentiator of respondents with advanced uses of their analytical capacity. This relationship makes sense. What-if analysis, predictive modeling, and scenario building require staff skill sets beyond knowing how to use technology tools. Users must have a deep understanding of their data and more advanced analytical skills. Ted Bross, associate director of administrative information systems at Princeton University, tells us that his institution is focusing much training and professional development on this issue. "I think the biggest bang for us is for people to get comfortable with their own data. I don't think that people understand what it is that they have." Bross continues, "I believe that most of the reporting done at Princeton is used for operational or tactical purposes. I hope as people get comfortable with this, they will build their own set of reports and make some strategic use of it." Clearly, he believes his institution must become more skilled at analysis before it can become an advanced user of academic analytics.

Interestingly, respondents with advanced uses of academic analytics at the institutional level did not have a significantly different assessment of their training programs than other respondents. We compared both groups' mean responses to two statements about their training. The first asked about the effectiveness of their training programs. The second asked if they certified users' knowledge before granting them access to systems. Respondents were asked to assess both using a five-point scale. Table 7-2 illustrates the mean responses of both groups.

On average, both groups evaluated their training effectiveness very similarly. In fact, the advanced users had a slightly lower average assessment of the effectiveness of their training and user certification programs. However, these differences were so small they were insignificant.

These results suggest that institutions that are advanced academic analytics users did not build their staff skills through training. It is possible that the more advanced users were even tougher graders of their training programs than the rest of the survey population. Or, it may be that their staff's analytical skills enabling them to be advanced users were already present at the institution prior to the advanced analytics implementation.

Chris Laidlaw, director of administrative information systems at Williams College, reports that strong analytical skills are a by-product of how his institution managed reporting in their pre-ERP legacy system. "We already had a great structure and strength in place for user reporting. In our legacy system, we had a person in each major administrative area who used FOCUS to do their local reporting. The users had strong analytical skills and they are still here. IT worked with them to learn the relational database world."

So, many early adopters of advanced analytics may have leveraged dedicated staff positions and in-house analysis skill sets. The depth of their analytical skills may have enabled them to quickly learn new tools and move to more advanced uses of academic analytics. For the majority of institutions, the challenge will be to create similar knowledge in their existing staff through training.

Technology Platform

Lastly, we looked at the type of technol-

Table 7-2. Advanced Applications of Academic Analytics and the Effectiveness of Training

Primary Use	Provide Effective Training (N = 372)	Certify That Users Understand the Data (N = 368)
Transaction or operational reporting	2.80	2.39
What-if modeling, or alerts	2.73	2.10

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

ogy platform used by institutions reporting that their primary use of academic analytics is for what-if analysis, predictive modeling, or alerts. Somewhat surprisingly, nearly half of the respondents with advanced applications report that they primarily use their transaction system for reporting and analysis. The next largest percentage (26.7 percent) reported having multiple data marts.

One would expect that a majority of respondents with advanced uses of academic analytics would have invested in a data warehouse or possibly one or more data marts. As in the prior categories, we caution the reader not to conclude that advanced applications do not require additional technology capability. First, the small numbers of respondents make it difficult to draw any firm conclusions from the data. Second, significant variability in how institutions defined the uses of their academic analytics may have impacted the responses. More than half the respondents who report having advanced applications did so because they used the information in their analytical systems to automatically trigger alerts or business processes. It is possible that some respondents chose this capability level because they interpreted automatic triggers to be equivalent to the business process workflow capability in their ERP systems. This would in part explain the relatively large number of respondents with only transaction system reporting.

Using the technology platform levels described in Chapter 5, we see a similar result. As Figure 7-1 shows, half of respondents with advanced uses reported level 1 capability (transaction system reporting).

Again, the relatively large proportion of respondents with level 1 technology platforms and advanced academic analytics applications is striking. Our hypothesis was that institutions with advanced uses of their analytical capacity would also have more complex technology platforms to support it. It is possible that there is not a strong link between a sophisticated technology platform and its sophisticated application. It is possible that sophisticated analytics depends more on training, staff skills, and management culture. Finally, re-

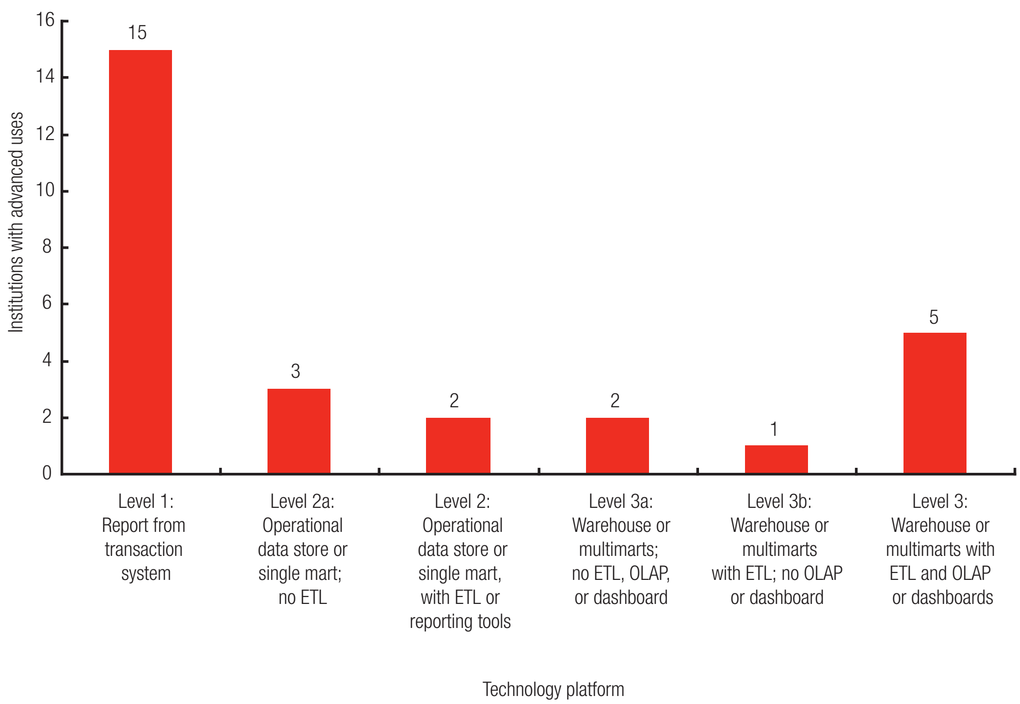


Figure 7-1. Number of Respondents with Advanced Uses, by Technology Platform

spondents may have interpreted differently what defines a level 1 technology platform. Some may have advanced warehouses and analytical tools purchased from their ERP vendor and integrated with their transaction system. This would not be an unusual technology platform for an institution to use to support its analytical needs. It is possible that some respondents with this technology configuration consider themselves to have a level 1 technology platform.

Advanced Applications by Functional Area

To further understand how institutions use their academic analytical capabilities, we looked at advanced uses by functional area. We asked respondents to agree or disagree with a series of statements regarding the advanced application of their analytical capacity in the following functional areas:

- finance,
- grants management,
- student services, and
- advancement.

Looking at particular functional areas helps us to analyze the characteristics of institutions that have made significant progress in targeted areas. In contrast, the group of respondents discussed in the prior section indicated that they were advanced users at the institutional level. While we expect some overlap in the composition of these two groups, we anticipate that there will be more respondents that are advanced users in a particular function than at the institutional level.

Finance

We asked respondents about two applications of their academic analytics capability in the finance area. First, we asked if they monitored operational performance such as budgeted expenditures versus actual expenditures. Second, we asked if they automatically alert appropriate officials when a financial indicator falls outside a desired range. Institutions were asked to respond using a five-point scale (1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always). The first statement represents a stage 1 or 2 application of academic analytics. The second is an example of a more advanced academic analytics application (stage 5).

As anticipated, more respondents monitor operational financial performance than generate automatic alerts tied to financial indicators. The majority of respondents (57.4 percent) agreed that they sometimes or usually (mean 3.65) use their academic analytics to monitor operational financial performance. Comparatively, the mean response for use to generate automated alerts was 2.37. Fewer than a quarter of respondents (22.1 percent) said that they usually or almost always generate automatic alerts.

We then examined the profile of those respondents that indicated they usually or almost always use an advanced academic analytics application (in this case, alerts) in the finance area. Once again, we looked at institutional characteristics, management climate, and technology. Among institutional characteristics, only one factor appears to be a significant differentiator of institutions that have advanced applications.

We found a significant relationship between the length of time an institution has had their analytical capability and the likelihood that they frequently use it to generate automatic financial alerts. As Table 7-3 illustrates, the longer a respondent has had their academic analytical capability, the greater their agreement that they use it to generate financial alerts. Institutional control, enrollment, and Carnegie class did not appear to be significant differentiators. This supports our earlier observation that institutions must become more familiar with their data before they can embrace an advanced use such as

Table 7-3. Use of Automatic Alerts for Financial Indicators, by Time with Advanced Analytics (N = 204)

Time	Mean	N	Std. Deviation
Less than 1–2 years	2.00	48	1.255
3–5 years	2.11	66	1.139
6–8 years	2.53	43	1.386
9 years or more	2.62	47	1.407
Average/Total	**2.29**	**204**	**1.302**

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

incorporating alerts into business processes.

As one would expect, a respondent's management climate does appear to have an impact on advanced use of academic analytics in the finance area. We found a relationship between several characteristics of climate and the advanced use of academic analytics for finance (to generate alerts). The effectiveness of training, the analytical skills of administrative staff, and the institutional commitment to evidenced-based decision making are all positively correlated with the frequency with which an institution uses its analytical capability to generate automated alerts for finance.

Leadership is an important component to adoption of more advanced analytics in the finance area. Regan Ramsower, CIO and interim chief financial officer at Baylor University, explains how his role in finance has enabled him to encourage adoption of academic analytics. As CFO, Ramsower created a modeling tool to develop and process funding requests for new initiatives. Ramsower says, "It is a requesting system that has the multiyear costs broken down by various areas. It uses workflow to automatically route the request through affected areas before it comes to finance for a decision. The requestor gains knowledge along the way and can constantly reassess whether the project is worth it." Ramsower now approves all requests through this system.

In addition to the importance of leadership, we found a relationship between the stability of the campus environment and the use of advanced analytics for finance. Similarly, respondents with more centralized management control also were more likely to generate automated alerts for financial indicators (see Table 7-4).

As Table 7-4 illustrates, institutions with stable or dynamic climates also report using their analytics to generate alerts more frequently than institutions with volatile or unstable cultures.

There appears to be no significant relationship between the advanced application of academic analytics in the finance area and the technology platform the institution uses. As we saw in our analysis of respondents with advanced analytics applications at the institutional level, respondents who generate financial alerts do so with various technology platforms. Among the 81 respondents who usually or almost always generate finance alerts, the greatest number (45.6 percent) generate reports directly from their transaction system. The next most common technology platforms were multiple data marts (24.7 percent) and a single data warehouse (16 percent).

Grants Management

In the grants management area, we sought to learn the extent to which institutions use their academic analytics capability to sup-

Table 7-4. Use of Automatic Alerts for Financial Indicators, by Managerial Control and Institutional Environment (N = 367)

Managerial Control	Mean	Institutional Environment	Mean
Very decentralized	1.93	Stable	2.45
Somewhat decentralized	2.05	Dynamic	2.49
Balanced	2.63	Volatile	1.90
Centralized	2.49	Unstable	1.70
Highly centralized	2.51	—	—
Average	**2.37**	**Average**	**2.37**

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

port both pre- and post-award management of research grants. Specifically, we asked about the use of automated alerts if a pre- or post-award metric falls outside a target range or to announce when a new funding opportunity becomes available. As Chapter 6 discussed, few respondents reported that their central research administration staff members are active users of advanced academic analytics of any kind. So, we would expect relatively few to be using automated alerts in this way.

In fact, this is the case. Among all respondents, fewer than 10 percent reported that they usually or almost always generate automated alerts either to monitor performance metrics or to notify appropriate officials when a new research grant becomes available. Table 7-5 summarizes the mean response to each statement.

We found that institutions with advanced analytics use in grants management had similar profiles to those with advanced use in finance. This is not surprising, given that the applications we asked about in the grants management area relate directly to the financial management of a grant. Institutional factors did not appear to be significant differentiators. While doctoral institutions reported a slightly higher mean frequency of advanced use for alerts (see Table 7-6), it was not a statistically significant difference. Institutional size and the length of time they have had their academic analytical capability also did not appear to be a significant differentiator among institutions.

As in the finance area, characteristics of the respondent's management climate do appear to be a significant differentiator. Training program effectiveness, staff analytical skills, and management's commitment to evidence-based decision making all appear to have a relationship with the advanced use of academic analytics.

Respondents with more effective training, greater staff analytical skills, and more extensive management commitment also report more frequent use of alerts for pre- and post-award grants management. We also saw a relationship between the degree of turbulence in the institutional management climate and the use of advanced analytics: Institutions with stable or dynamic climates were more frequent users of advanced analytics in grants management. This apparent relationship makes sense. ECAR's study of business process effectiveness, *Good Enough! IT Investment and Business Process Performance in Higher Education,* found grants management processes to be among the lowest-performing administrative processes and the most difficult to change

Table 7-5. Use of Automated Alerts in Grants Management (N = 352)

Use	Mean	Std. Deviation
Automatic alert when a pre-award research administration/ grants management metric falls outside a desired range	1.77	1.077
Automatic alert when a post-award research administration/ grants management metric falls outside a desired range	1.80	1.144
Automatic alert when new research grant opportunities become available	1.66	1.020

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

Table 7-6. Use of Advanced Analytics in Grants Management, by Carnegie Class

Carnegie Class	Use Alerts for Pre-Award (N = 359)	Use Alerts for Post-Award (N = 358)	Use Alerts for New Grant Opportunities (N = 356)
DR	1.90	1.95	1.86
MA	1.65	1.63	1.55
BA	1.77	1.94	1.64
AA	1.80	1.66	1.41
Other	1.75	1.77	1.75

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

(Kvavik et al., 2005, pp. 63–64). It seems hardly surprising that an institution with an unstable climate would be poorly positioned to introduce advanced analytics use in an area such as grants management that is inherently resistant to change. Table 7-7 lists the mean response to advanced analytics use in grants management by characteristics of management climate.

The advanced use of analytics in the grants area appears to have no relationship to the type of technology platform the institution uses. We found no significant difference in the use of advanced analytics for grants management between institutions with levels 1, 2, or 3 technology platforms. The same is true of institutions with near level 2 or near level 3 capability. In fact, among respondents that "usually" or "almost always" use alerts for pre-award indicators, 45.5 percent have level 1 (transaction system reporting) platforms. Among those with alerts for post-award indicators "usually" or "almost always," 33.3 percent have level 1 technology platforms.

Advancement

In the advancement (fundraising) area, we wanted to understand how institutions use data to shape and implement their fundraising strategies. We asked respondents the extent to which they use their analytical tools to identify potential donors or to tailor fundraising appeals to individuals. Fairly significant numbers of respondents do use their academic analytics to support the advancement area. One-third reported that they sometimes or almost always use their analytical capability to identify potential donors. Fewer institutions (24.2 percent) report using analytics to tailor their fundraising appeals to donors. Table 7-8 lists the average responses from institutions, using a

Table 7-7. Use of Advanced Analytics in Grants Management, by Management Climate

Characteristic	Scale	Use Alerts for Pre-Award	Use Alerts for Post-Award	Use Alerts for New Grant Opportunities
Effective Training	Almost never	1.43	1.37	1.46
	Occasionally	1.64	1.73	1.59
	Sometimes	1.74	1.67	1.60
	Usually	2.06	2.15	1.80
	Almost always	2.14	2.29	2.10
Institutional Environment	Stable	1.78	1.81	1.63
	Dynamic	1.88	1.96	1.75
	Volatile	1.40	1.37	1.51
	Unstable	1.55	1.30	1.45
Staff Highly Skilled	Strongly disagree	1.33	1.12	1.44
	Disagree	1.47	1.41	1.33
	Neutral	1.78	1.81	1.75
	Agree	2.04	2.14	1.89
	Strongly agree	2.11	2.33	1.56
Committed to Evidence-Based Decision Making	Strongly disagree	1.64	1.57	1.79
	Disagree	1.38	1.34	1.21
	Neutral	1.62	1.66	1.51
	Agree	1.80	1.82	1.73
	Strongly agree	2.40	2.51	2.16

Q: *My institution uses academic analytics to automatically alert appropriate officials when a pre-award research administration/grants management metric falls outside of a desired range.*

Q: *My institution uses academic analytics to automatically alert appropriate officials when a post-award research administration/grants management metric falls outside of a desired range.*

Q: *My institution uses academic analytics to automatically alert appropriate officials when new research grant opportunities become available.*

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always; scale applies to three questions above)

Table 7-8. Uses of Academic Analytics in Advancement (N = 355)

Use	N	Mean	Std. Deviation
Identify potential donors	361	2.78	1.271
Tailor fundraising appeals for individual donors	356	2.53	1.270

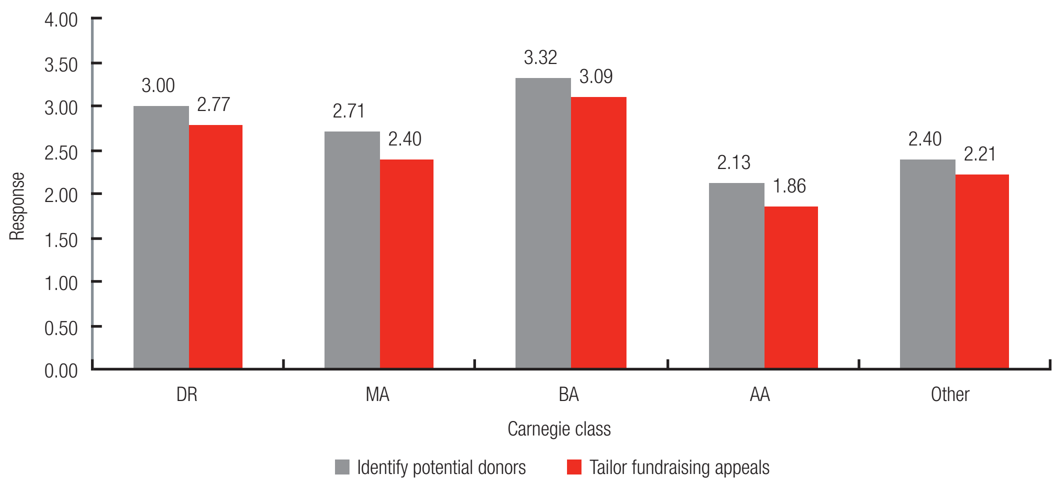
(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

five-point scale.

As expected, institutional factors play a strong role in determining a respondent's use of advanced analytics in the advancement area. One would expect only those institutions with significant fundraising operations to derive enough benefit from sophisticated data-driven fundraising strategies to warrant creating them. Typically, fundraising is a more significant revenue stream for private, bachelor's, and master's institutions. In addition, some larger doctoral institutions with a large number of alumni (especially with professional degrees) also have large, sophisticated fundraising operations.

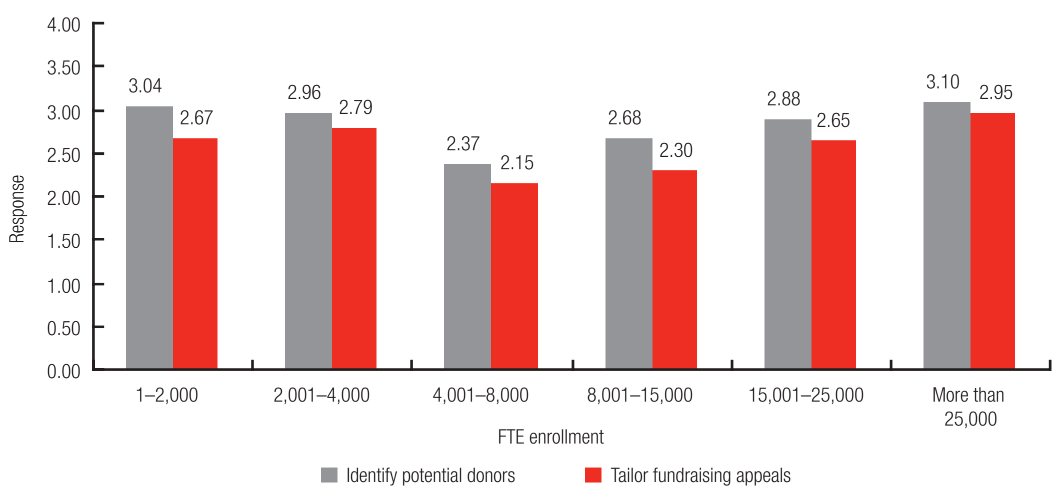
Private institutions use their analytic capacity more frequently than public institutions to identify donors and tailor fundraising strategies. The mean response among private institutions was 3.19 (to identify donors) and 2.94 (to tailor strategies). Comparable responses from public institutions were 2.50 and 2.25, respectively. As Figure 7-2 illustrates, bachelor's institutions on average were the most frequent users among Carnegie classes. They had a mean response of 3.32 (identify donors) and 3.09 (tailor fundraising appeals). The next highest mean responses were from doctoral institutions.

As Figure 7-3 illustrates, there also appears to be a relationship between enrollment size



(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

Figure 7-2. Use of Advanced Analytics in Advancement, by Carnegie Class (N = 379)



(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

Figure 7-3. Use of Advanced Analytics in Advancement, by Enrollment (N = 379)

and use of advanced analytics in fundraising. This relationship follows that of Carnegie class. Smaller and very large institutions are more frequent users than moderate-to-large institutions. It is also possible that both enrollment size and Carnegie class are serving as a proxy for institutional control. Many of the private institutional respondents are smaller bachelor's institutions. Fundraising is generally a more prevalent revenue stream for private institutions than for public institutions.

Finally, we see a relationship between the length of time a respondent has had their analytical capacity and the frequency with which they report advanced fundraising uses. The mean response from institutions that have had analytical capability for more than nine years was 3.11 (identify donors) and 2.96 (tailor fundraising). Conversely, respondents with capability for three to five years had a mean response of 2.65 and 2.55, respectively. As observed previously, many institutions may begin their implementations in central finance or institutional research. Advancement may be among the later recipients of advanced analytical capacity.

Several aspects of management climate also appear to relate to use of advanced analytics in advancement. The two strongest relationships appear to be with the effectiveness of training and the proficiency of staff analytical skills. A stable or dynamic management climate appears also to have a relationship with increased use of analytics in fundraising, although not as strong as for finance or grants management. Unlike the other areas, leadership's commitment to evidence-based decision making does not appear to relate strongly to advanced analytics in advancement. It appears that the advancement area is less sensitive to the overall institution climate and leadership culture. Advancement divisions often function with great independence (in public institutions, they are often organizational, separated from the main institution) and have unique cultures and leadership styles. Table 7-9 summarizes the impact of several factors related to respondents' management climates.

As with other functional areas, we found no significant relationship between technology platform in use and respondents' use of advanced analytics in advancement. Among institutions reporting that they "usually" or "almost always" use their analytical tools to identify potential donors, the largest number (45.8 percent) use their transaction system for reporting. The second largest percentage of respondents (26.7 percent) use multiple data marts.

Student Services

In the student area, we focused on the use of academic analytics in student recruitment and retention. We asked respondents to tell us if they use modeling, what-if analysis, or alerts to improve admissions results, plan interventions if students are at risk of dropping out, and forecast demand for courses. Using a five-point scale, respondents told us how frequently they use their analytical capability to create alerts or perform predictive modeling to improve aspects of enrollment management and retention.

Table 7-10 shows the mean responses to each statement regarding the use of academic analysis in enrollment management and retention. With one exception (identifying students at risk academically), the mean responses are all below 3 ("sometimes"). In the enrollment management area, respondents use their analytical capability more frequently to identify prospective students than to tailor recruiting strategies or to forecast demand. The highest mean frequency of use was to identify prospective students who are strong candidates for admissions (mean of 2.95). The lowest mean frequency was for tailoring recruiting strategies to individuals (2.38). The standard deviations are all greater than one for this series of statements. The highest stan-

Table 7-9. Use of Advanced Analytics in Advancement, by Management Climate

Characteristic	Scale	Identify Potential Donors (N = 361)	Tailor Fundraising Strategies (N = 356)
Effective Training	Almost never	2.19	1.96
	Occasionally	2.63	2.33
	Sometimes	2.81	2.65
	Usually	3.16	2.86
	Almost always	3.10	2.80
Environment	Stable	2.88	2.67
	Dynamic	2.86	2.59
	Volatile	2.25	2.02
	Unstable	2.50	2.15
Management Control	Very decentralized	2.63	2.41
	Somewhat decentralized	2.83	2.60
	Balanced	2.85	2.61
	Centralized	2.76	2.45
	Highly centralized	2.76	2.55
Staff Skilled at Analysis	Strongly disagree	1.76	1.65
	Disagree	2.56	2.27
	Neutral	2.76	2.49
	Agree	3.13	2.90
	Strongly agree	2.67	2.56
Commitment to Evidence-Based Decisions	Strongly disagree	2.00	1.93
	Disagree	2.75	2.27
	Neutral	2.66	2.45
	Agree	2.87	2.66
	Strongly agree	3.02	2.74

Q: *People use my institution's academic analytics to identify potential donors.*

Q: *People use my institution's academic analytics to tailor fundraising appeals for individual donors.*

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always; scale applies to two questions above)

dard deviations are for the two statements pertaining to the use of automated alerts (for an academic intervention or enrollment metrics). This suggests that respondents are not in agreement regarding their use of alerts. We likely have a group of respondents that uses them quite frequently and a group that hardly uses them at all.

In student retention, respondents on average use their academic analytics more

Table 7-10. Use of Academic Analytics in Enrollment Management and Retention

Enrollment Management (N = 356)	Mean	Std. Deviation
Automatically alert appropriate officials when an enrollment metric falls outside a desired range	2.75	1.449
Forecast future demand for courses	2.50	1.176
Identify potential students who are the strongest prospects for admissions	2.95	1.312
Tailor a recruiting strategy for an individual prospective student	2.38	1.283
Retention (N = 362)	**Mean**	**Std. Deviation**
Identify students who may be at risk academically	3.14	1.217
Alert an appropriate official when an academic intervention with a student is warranted	2.56	1.319

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

frequently to create models and analysis to identify students who may be at risk academically. Fewer respondents have integrated this analysis into their business processes to automatically alert appropriate administrators or faculty if a student requires a counseling session or other academic intervention. About 45 percent of respondents (45.4 percent) "usually" or "almost always" use their analytics to identify students who may be at risk, and 28.9 percent generate alerts with similar frequency.

The University of Connecticut is at the forefront of using academic analytics to improve student retention. Registrar Jeff von Munkwitz-Smith explains how. "UConn is extracting student information and putting it into a database of information to study student retention. The goal is to predict which students are most likely to be at risk. Factors under consideration include high school background, where they live on campus, and participation in freshman seminars."

Similarly, the University of Minnesota is a leader in the adoption of academic analytics to predict demand for courses. The university has recently been named a finalist for a ComputerWorld.com business intelligence award for its use of academic analytics to model and monitor demand for courses. According to Sue Grotevant, director of information management systems, the university has developed a set of analytical reports that enable its colleges to model demand for courses and to identify ways to configure more cost-effective course schedules.

Nearly 30 percent of respondents report that they frequently generate automated alerts for academic interventions. This seems quite a large percentage. We did not anticipate that this many institutions would have done the analysis required to target specific events that are early indicators of a student who is at risk and requires counseling. We thought even fewer would have deployed the capacity to generate automated alerts. It is possible that respondents may have widely varied capabilities in this area. For instance, many may have the ability to use the workflow in their ERP systems to alert a counselor if a student drops or fails a class. Alternatively, relatively few may have created automated alert systems that incorporate multiple triggering events tied to data-driven analysis of student outcomes and retention.

Among institutional characteristics, the strongest relationship is between advanced applications in enrollment management and both Carnegie class and control. These characteristics relate directly to an institution's admissions strategy and selectivity. Private institutions and bachelor's institutions, which tend to be both more selective and more enrollment driven, reported higher mean frequencies for the use of advanced analytics. Table 7-11 contains the mean responses by Carnegie class to the enrollment management-related questions.

The use of advanced analytics for enrollment management is not an exclusive interest of private institutions. Interest among public institutions will grow as competition for students—especially in underrepresented populations—grows. M. Paige Borden, University of Central Florida director of institutional research and university data administrator, describes an initiative under way in enrollment management at that institution. "The implementation of our data warehouse will help our recruiting significantly. We will be able to isolate ideal applicants more easily and tailor our marketing strategy. We will be able to make better determinations as to how to spend our limited resources and be able to better measure our results."

For advanced analytics applications to support retention, the only significant relationship with an institutional characteristic appears to be with Carnegie class. On average, bachelor's institutions have the highest frequency of analytics use to identify students who may be at risk academically (3.40). Associate's and master's institutions have similar mean responses (AA = 3.24, MA = 3.23). Doctoral institutions had the lowest mean frequency (2.76). So it appears that institutions that are more tuition driven use their analytical capacity more frequently to support retention strategies.

Among characteristics of management climate, training efficacy, staff skills, and leadership commitment to evidence-based decision making are the most significant differentiators of institutions that use their analytical capability to support enrollment management. Training, staff skills, and leadership commitment also appear to relate to the frequency with which respondents use advanced analytics to support retention. Table 7-12 illustrates the mean response to statements segmented by characteristics of the respondents' management climate.

Unlike some of the other functional areas, in the student area there appears to be no relationship between advanced analytics application and either the stability of the environment or the degree of centralization

Table 7-11. Advanced Use of Academic Analytics for Enrollment Management, by Carnegie Class (N = 362)

Carnegie Class	Alert appropriate officials when an enrollment metric falls outside a desired range	Forecast future demand for courses	Identify potential students who are the strongest prospects for admissions	Tailor a recruiting strategy for an individual prospective student
DR	2.55	2.36	3.03	2.38
MA	2.81	2.68	3.07	2.63
BA	2.69	2.39	3.33	2.60
AA	3.02	2.55	2.04	1.71
Other	2.82	2.50	2.85	2.17

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

Table 7-12. Use of Advanced Analytics for Retention, by Management Characteristic

	Identify students who may be at risk academically	Alert officials when an academic intervention is warranted
Effective Training	**Mean**	**Mean**
Almost never	2.50	1.93
Occasionally	3.08	2.51
Sometimes	3.18	2.63
Usually	3.38	2.74
Almost always	3.90	3.19
Staff Members Are Skilled at Analysis	**Mean**	**Mean**
Strongly disagree	2.28	1.67
Disagree	2.83	2.11
Neutral	3.15	2.63
Agree	3.47	2.92
Strongly agree	3.89	3.56
Leadership Is Committed to Evidence-Based Decision Making	**Mean**	**Mean**
Strongly disagree	2.50	1.93
Disagree	2.83	1.96
Neutral	3.06	2.46
Agree	3.23	2.71
Strongly agree	3.55	3.06

of management control.

As in the finance, advancement, and grants management areas, there appears to be no relationship between advanced analytics applications and technology platform for enrollment management. Interestingly, there does appear to be a relationship between advanced analytics applications to support retention and technology platform. However, it is not the relationship one would expect. Institutions that primarily report from their transaction system reported a higher frequency of use of advanced analytics for retention. Respondents with more complex technology platforms report less frequent use in support of retention. As Table 7-13 indicates, the second highest frequency of use was among respondents with either an operational data store or multiple data marts.

Summary

An institution's technology platform does not appear to limit its ability to implement advanced applications of academic analytics in targeted functional areas. As we saw in this chapter, respondents with transaction system reporting as well as those with data marts or warehouses appear able to implement advanced uses of their data in individual functional areas. Staff skills, training, and an overall

Table 7-13. Use of Advanced Analytics for Retention by Technology Platform

Primary Technology Platform	Identify students who may be at risk academically	Alert an appropriate official when an academic intervention is warranted
Single data warehouse	2.83	2.10
Multiple data marts	3.05	2.52
Single data mart	2.73	2.48
Reports from operational data store	3.05	2.38
Reports from transaction system	3.39	2.79

(1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)

commitment from management to use data appear to be more significant predictors of an institution's advanced use of data in its operations. Finally, where an institution makes the most use of its advanced analytics appears in part to be dictated by its mission and strategy. The relative importance of grants management, student retention, and fundraising differ by institution type. The presence of advanced academic analytics applications in these functions follows institutional priorities.

Given the importance respondents placed on outcomes, assessment, and retention, we would expect the student area to see the greatest growth in advanced analytics applications in the future. It stands to reason that institutions will seek greater capability in areas directly tied to student recruitment and retention. The University of Connecticut's Jeff von Munkwitz-Smith summarizes it this way: "We are sitting on a huge amount of data that we do not use, especially [data in] the student information system. Having more tools for predicting their success and advising students beforehand where they need to put in more effort will ultimately help institutions improve retention and graduation rates."

Endnote

1. The survey statement posed to respondents was, "The environment at my institution can best be described as stable, dynamic, volatile, or unstable." This variable has proven significant in several ECAR studies.

8
The Impact of Academic Analytics

Success isn't everything, but it makes a man stand straight.
—Lillian Hellman

We have looked at how institutions deploy and use their academic analytics. We have discussed the range of technologies they use and looked at advanced users of academic analytics. In this chapter, we examine how all these factors come together to benefit an institution. This chapter explores

- how academic analytics is impacting institutional measures of success,
- what impact the use of academic analytics has on outcomes in specific functional areas or processes,
- how an individual's decision making is supported by academic analytics, and
- whether any adverse outcomes result from implementing greater analytical capabilities.

At the conclusion of this chapter, we discuss which institutional, managerial, and technological factors appear most related to an institution's success with academic analytics.

Key Findings

- Respondents report the most success using academic analytics to improve institutional decision making and to help meet strategic institutional objectives.
- Respondents report the least success leveraging academic analytics to reduce the presence of shadow systems.
- Within functional areas, respondents report the greatest success using academic analytics to improve results in student retention and enrollment management.
- Within functional areas respondents have had the least success leveraging academic analytics to improve their grants management results.
- Most respondents believe that staff skilled at using academic analytic applications make better decisions but do not receive additional opportunities for career advancement.
- Management factors such as effective training, leadership commitment, and staff analytical skills appear more related to achieving successful outcomes than institutional characteristics or an institution's choice of technology platform.

Outcomes: An Overview

This section looks at respondents' assessment of how academic analytics contributes to their institutions' success. We asked respondents to evaluate success in three categories:

- institutional outcomes,
- outcomes by major function, and
- individual outcomes.

In addition, we asked respondents if their institutions recognized any adverse impacts from their implementation of advanced analytics. We describe the results below.

Institutional Outcomes

To assess how respondents are impacted by the use of academic analytics, we asked them to indicate their agreement with the following statements:

- My institution's academic analytics capability is helping to meet strategic objectives.
- The current academic analytics capability has significantly improved decision making at my institution.
- The current academic analytics capability has significantly reduced the presence of shadow systems at my institution.
- Academic analytics provides a competitive advantage to my institution.

We asked respondents to indicate their level of agreement with each statement. Table 8-1 lists the results.

Respondents agreed the most that academic analytics helps their institutions meet their strategic objectives. Respondents agreed the least that academic analytics was significantly reducing the presence of shadow systems on campus.

Priscilla Hancock, vice chancellor at the University of Alabama, shares her perspective on why academic analytics holds the promise of helping institutions to better meet their strategic objectives. "Institutions cannot succeed in environments where departments hold data and run reports for users. You cannot do what-if analysis in an environment where there is a long turnaround time to get data. You need information right before your eyes when you're thinking."

Overall, respondents' mean level of agreement with three of the four statements was above neutral. Respondents disagreed, on average, only with the notion that academic analytics had significantly reduced their reliance on shadow systems.

The University of California at San Diego has found that reducing shadow systems takes time and a supportive culture. Assistant Vice Chancellor for Information Technology Elazar Harel explains, "You need a culture that encourages information sharing and collaboration. Then as tools get more powerful, departments become less inclined to use shadow systems."

Functional Area/Business Process Outcomes

We asked respondents to assess their use of academic analytics in five functional areas: finance, human resources, grants management, student services, and advancement. In each area, we asked respondents to indicate their level of agreement that academic analytics improves their outcomes within the functional area. In finance, we asked respondents if their analytics improved the institution's financial results. In human resources, we asked if they were able to manage their workforce more productively. In grants management, we asked if respondents are able to obtain additional grant funding or manage their

Table 8-1. Institutional Outcomes from the Use of Academic Analytics (N = 356)

Impact of Academic Analytics	Mean	Std. Deviation
Helping to meet institutional strategic objectives	3.29	0.971
Significantly improved decision making at my institution	3.14	0.955
Significantly reduced the presence of shadow systems	2.83	1.186
Providing a competitive advantage to my institution	3.10	0.961

(1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

grants more effectively. In the student area, we asked about the effectiveness of admissions results and student retention. Finally, we asked respondents if academic analytics helps to achieve improved fundraising results.

Table 8-2 lists respondents' mean level of agreement with each statement. Respondents agreed most strongly that they had improved results in the student area. The mean level of agreement for improved enrollment results was the highest (3.43), followed by improved retention (3.16). The only other outcome with a mean above neutral was improved financial results (3.09). This seems consistent with our earlier observation that more respondents use their analytical capability to support finance or student services than other areas.

Respondents had the lowest mean level of agreement in grants management. Even among doctoral institutions, respondents on average did not agree that they had used academic analytics to improve results in the grants management area. The mean response among doctoral institutions to the statement that they had improved their ability to manage grants was 2.85. The mean response among doctoral institutions was even lower (2.55) for "improve ability to obtain grant funding."

Respondents also did not feel strongly that they were improving their results in either the human resource management or advancement areas. Responses do differ by institution type. Private institutions had a significantly better assessment of their use of academic analytics in the advancement area than did public institutions. The mean response from private institutions to the statement "my institution has improved its fundraising results" was 3.29, compared with 2.66 for public institutions. As expected, institutional differences do matter in advancement. Private institutions seem more likely to create and use advanced analytics in the advancement area. It stands to reason that they would see a greater impact from the use of those tools.

Individual Effectiveness

The final set of outcomes we assessed was how individual users benefit from academic analytics. Specifically, we were interested in respondents' assessment of how academic analytics users improve as decision makers. Also, we wanted to understand if staff skilled at using academic analytics fare better in their careers. Table 8-3 displays respondents' mean level of agreement with both metrics of individual effectiveness.

Respondents on average agree that individuals skilled at using their institution's analytical tools do make better decisions. However, they did not agree that they get more opportunities for advancement in

Table 8-2. Improved Outcomes from Academic Analytics, by Function (N = 354)

Outcome	Mean	Std. Deviation
Improved the institution's financial results	3.09	0.928
Managed its workforce more productively	2.78	0.928
Managed grants effectively	2.61	0.984
Improved ability to obtain grant funding	2.47	0.962
Improved admissions/enrollment management results	3.43	1.012
Improved fundraising results	2.93	1.087
Improved student retention results	3.16	0.952

(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

Table 8-3. Use of Academic Analytics and Individual Effectiveness (N = 361)

Statement	Mean	Std. Deviation
Users of academic analytics make better decisions than those who do not.	3.65	0.857
Staff members skilled at using academic analytics receive more opportunities for career advancement.	2.84	0.963

(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

their careers. This could indicate that higher education is not yet placing enough value on analytical skills in its workforce. Or, it could be indicative of the broader challenge that institutions face to create a career path for administrators.

Ted Bross, associate director of administrative information services at Princeton University, cautions that institutions cannot always predict who will become users of academic analytics. He observes that it is not always managers who become the most active users. "When we gave our training program class to departments, sometimes the managers were not interested in the analytical tools. They believed that they had staff to perform analysis. Conversely, some of the clerical staff who solely used to run precanned reports by putting in a parameter loved the new tools and liked to run their own reports and queries. It threw us completely for a loop."

We did note that among respondents whose leadership is committed to evidence-based decision making, staff skilled at analysis appear to have greater opportunities for advancement. As Table 8-4 illustrates, the highest mean agreement was among those respondents who agreed (3.13) or strongly agreed (2.90) that their leadership was committed to evidenced-based decision making.

The effectiveness of a respondent's training program also appears to be related to individual outcomes. As one would expect, institutions that felt they routinely offer strong training also believe that individual academic analytics users make better decisions. Table 8-5 illustrates that as respondents' assessment of their training grows more positive, so does their assessment of users' decision-making capabilities.

As discussed in Chapter 7 and reinforced later in this chapter, the analytical skills of staff appear to have an important relationship with an institution's use of academic analytics. If, as respondents indicated, the future will require more institutions to spend more money on more advanced analytical capabilities, similar investments will be needed in staff development.

Institutions will need to invest more in developing staff analytical skills and will need to work proactively to retain those staff having high levels of ability. At some institutions, this is beginning to happen. Nick Backsheider, associate executive director for educational technology and planning at Auburn University, reports that his institution has seen a shift in staff recognition. "People who previously were ignored have been recognized as important in a data-driven decision-making world."

Adverse Impacts

It appears that improving the availability of information and analytical tools does help institutions improve outcomes. We also wondered if it creates any unintended, adverse consequences. Does widespread information access increase internal competition in an unhealthy manner? Does greater visibility into the impact of decisions make managers less decisive? Despite investments in enhancing

Table 8-4. Staff Advancement Where Leadership Is Committed to Evidence-Based Decision Making (N = 364)

		Opportunities for career advancement		
		N	Mean	Std. Deviation
Evidence-based decisions	Strongly disagree	14	2.00	1.109
	Disagree	48	2.71	0.874
	Neutral	99	2.55	0.860
	Agree	155	3.13	0.910
	Strongly agree	48	2.90	1.057

Q: *My institution's leadership is committed to evidence based decision-making. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Q: *Staff members who are skilled at using academic analytics receive more opportunities for career advancement. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Table 8-5. Effective Training and Better Decision Making for Academic Analytics Users

		Better decision making		
		N	Mean	Std. Deviation
User training	Almost never	52	3.23	1.131
	Occasionally	91	3.49	0.887
	Sometimes	108	3.70	0.727
	Usually	88	3.85	0.617
	Almost always	21	4.19	0.928

Q: *The institution has provided effective training to users of academic analytics. (1 = almost never, 2 = occasionally, 3 = sometimes, 4 = usually, 5 = almost always)*

Q: *Users of my institution's academic analytics make better decisions than those who do not. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

the capability to broaden data availability, are staffs still strongly resisting its distribution?

We asked respondents to indicate their level of agreement with a series of statements about potential adverse impacts from investments in academic analytics. Table 8-6 lists the mean response to each statement.

In general, respondents either slightly disagreed or were neutral to the idea that they were experiencing any adverse impacts. Most responses were clustered around slight disagreement or slight agreement with the statement. In fact, the only statement for which the mean response indicated slight agreement was the statement that managers still make decisions primarily on instinct. Respondents, on average, disagreed that managers become less willing to make decisions or more competitive with one another for resources when information becomes more widespread.

For those experiencing resistance, patience and time may be their best ally. Bob Clapp, vice president of information technology at

Table 8-6. Potential Adverse Impacts of Academic Analytics

Statement	N	Mean	Std. Deviation
People at my institution have strongly resisted making data widely available.	364	2.77	1.024
Broader access to data makes managers less willing to make decisions.	364	2.32	0.818
Broader access to data only increases internal competition among units for resources.	362	2.41	0.861
Despite the availability of data, most managers still make decisions primarily on instinct.	364	3.13	0.921

(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

Le Moyne College, reflects on his experience implementing academic analytics and reminds us that change rarely happens quickly. He said, "Nothing goes as fast as you want it. It's almost never the technology that slows you down; it is the people associated with it. At most institutions, the same people have been doing the same things for a very long time, so sometimes change can be difficult."

Interestingly, a manager's willingness to use data to make decisions appears to be related to how committed institutional leaders are to analytically driven decisions. Respondents with leadership committed to evidence-based decision making disagreed more strongly that their managers are instinctual decision makers. It seems, if leadership demands evidence-based decisions, that managers follow their example (or requirement). Table 8-7 illustrates respondents' mean agreement with their managers' reliance on instinct in comparison with their assessment of leadership's commitment to analytical decision making.

Conversely, the effectiveness of an institution's training does not appear to relate to the extent to which its managers rely on instinct. Finally, there appears to be no relationship between a respondent's belief that the availability of more data makes managers less decisive and either the effectiveness of training or leadership commitment.

Leadership commitment to evidence-based decision making also appears to relate to the level of residual resistance respondents report to making data widely available. Respondents who report that their leadership is not committed to evidence-based decision making also report that they continue to face resistance to making data widely available. As Table 8-8 illustrates, the converse is also true.

Effective Use of Academic Analytics

In our survey, we identified four overarching outcomes that institutions seek to achieve from their investment in academic analytics:

- help meet institutional strategic objectives,
- improve decision making,
- reduce the presence of shadow systems, and
- leverage analytics to create a competitive advantage.

As we discussed in the opening of this chapter, respondents in aggregate were in slight agreement that their academic analytics helps them to advance each of these objectives. The only exception was the ability of academic analytics to reduce the presence of shadow systems. Respondents did not agree as extensively that they were making progress on this objective.

Table 8-7. Instinctual Decision Making and Leadership Commitment to Analytics (N = 364)

		Instinctual decisions making		
		N	Mean	Std. Deviation
Evidence-based decisions	Strongly disagree	14	4.14	0.663
	Disagree	47	3.66	0.891
	Neutral	99	3.18	0.873
	Agree	156	2.94	0.844
	Strongly agree	48	2.79	0.944

Q: *My institution's leadership is committed to evidence based decision-making. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Q: *Despite the availability of data, most of our managers still make decisions primarily on instinct. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Table 8-8. Leadership Commitment and Resistance to Making Data Widely Available

		Availability of data		
		N	Mean	Std. Deviation
Evidence-based decisions	Strongly disagree	14	3.93	0.917
	Disagree	48	3.40	0.939
	Neutral	99	2.82	0.973
	Agree	155	2.62	0.921
	Strongly agree	48	2.19	1.003

Q: *My institution's leadership is committed to evidence based decision-making. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

Q: *People at my institution have strongly resisted making data widely available. (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*

As noted, respondents do not agree with all four statements to the same degree. To help better understand these differences and to identify factors that appear most important to successful outcomes, we performed a series of regression analyses. Specifically, we looked for relationships between variables that describe a respondent's institutional profile, management climate, technology infrastructure, and application of advanced analytics and the outcomes they achieved. We discuss our findings below.

Institutional Characteristics

We found no relationship between institutional characteristics and any of the four outcome variables. The institutional characteristics we evaluated include Carnegie class, institutional control (public versus private), enrollment, aggregate five-year spending on academic analytics, and the length of time the institution has had its academic analytics. None of these factors explain any significant differences in the outcomes that a respondent achieves with their academic analytics. So, while looking at institutional differences can help us understand how an institution deploys its analytical capacity and where it seeks to become an advanced user, they do not appear related to a respondent's degree of success.

Management Climate

In the area of management climate, we examined five factors: the degree of turbulence in the institutional climate, the degree of centralization of management control, the level of staff skills in analysis, training effectiveness, and leadership commitment to evidence-based decision making. Several of these factors appear to have a strong relationship with a respondent's success. Providing effective training, having staff skilled in analysis, and the presence of leadership committed to evidence-based decision making all have a positive relationship with successful institutional outcomes. Table 8-9 lists the primary and secondary factors of management climate that appear related to successful outcomes.

The importance of training and the strength of staff skills are two of the strongest variables in the entire study. Among institutions that reported great training success, a common theme was a methodical approach. Joseph Sawasky, associate vice president at the University of Toledo, describes his institution's experience. "Training was the 'Ah-ha' after the technology was implemented. We thought the tool was so intuitive when we deployed it that users would not require much training. But after a couple of years of deployment, we decided to take an instructional design approach: analyze the needs; talk to focus groups; design, develop, and implement the material; and evaluate it. The instructional design approach really paid off for us."

Institutional climate was a secondary factor in determining a respondent's success at using academic analytics to help meet institutional strategic objectives. Respondents with stable or dynamic environments had more success than those with turbulent or unstable climates. This mirrors findings in other ECAR studies that have confirmed that institutions with turbulent or unstable climates struggle to derive value from their technology investments.

Technology

We also analyzed whether an institution's choice of technology platform had a signifi-

Table 8-9. Management Climate Factors and Successful Outcomes

Outcome	Primary Factor(s)	Secondary Factor
Meet institutional strategic objectives	Effective training	Institutional environment stable or dynamic
	Staff skilled at analysis	
	Leadership commitment	
Improve decision making	Effective training	
	Staff skilled at analysis	
	Leadership commitment	
Reduce presence of shadow systems	Effective training	
	Staff skilled at analysis	
Create competitive advantage	Effective training	
	Staff skilled at analysis	

cant bearing on the outcomes they achieve. We examined each of the technology platforms defined in Chapter 5 to see if they explain any portion of a respondent's success with each of the four institutional outcome measures. We found relatively few significant relationships between technology platform and degree of success.

There does appear to be a positive correlation between the use of a data warehouse and meeting institutional strategic objectives. Respondents with a data warehouse reported more success at supporting their institution's ability to meet its strategic objectives than either respondents with data marts or respondents who report primarily from their transaction systems. Perhaps the institution-wide view a warehouse provides helps further the development and implementation of institutional strategic objectives. Comparatively, reporting from a data mart or transaction system may be effective at meeting unit objectives but less effective at supporting institutional objectives.

For reducing the presence of shadow systems, two technologies appear to make a more significant difference. Respondents who use executive dashboards have more success at eliminating shadow systems, as have those who report from an operational data store. Since dashboards deliver information to users in a form that is easy to understand and use, it stands to reason that they would lessen users' need for shadow systems.

North Shore Community College has had significant positive user feedback from its implementation of dashboards. Vice President for Administration and Finance Janice Forsstrom explains, "We have created a number of dashboard-type things for executive management. It displays registration data for credit and not-credit courses. Leadership looks at pie charts on a daily basis to monitor progress. You can look at any semester, credit, non-credit, online, and non-online courses. People love this tool. A visual presentation of information where people do not have to create a report seems to be very popular and useful."

This convenience may influence users to discontinue their reliance on shadow systems for reporting. It is not clear why the use of an operational data store is more associated with reducing the use of shadow systems than any other technology.

We found no significant relationship between a respondent's technology platform and their perceived success at improving decision making or creating a competitive advantage from the use of analytics.

Advanced Analytics Applications

Finally, we examined how an institution uses its analytical capability. Specifically, we looked at whether institutions with advanced applications such as alerts, predictive modeling, or scenario building report better institutional outcomes. We found some relationships between advanced uses of academic analytics and the four outcome areas. Foremost among these is the use of academic analytics to model decisions. Respondents who use their academic analytics to model strategic decisions report greater success with all four institutional outcome measures. Other advanced applications that appear related to improved outcomes are the use of analytics to forecast demand for courses and tailor recruiting strategies for individual students.

Table 8-10 lists the primary and secondary factors that appear related to reports of successful outcomes.

The strong association between a respondent's use of their analytical capability to model strategic decisions and improved decision making makes sense. This application of academic analytics seems fundamental to improving decision making, advancing

Table 8-10. Uses of Academic Analytics and Successful Outcomes

Outcome	Primary Factor(s)	Secondary Factor(s)
Meet institutional strategic objectives	Forecast demand for courses	Generate alerts for fundraising metrics
	Model strategic decisions	Monitor operational performance
Improve decision making	Model strategic decisions	Monitor operational performance
	Forecast demand for courses	
Reduce presence of shadow systems	Model strategic decisions	
	Tailor recruiting strategies for students	
Create competitive advantage	Model strategic decisions	Advanced use by the central budget office

strategic outcomes, and creating a competitive advantage.

Three other advanced applications of analytics also appear related to successful outcomes. Each involves the use of advanced analytics within an individual functional area. Respondents who use academic analytics to tailor recruiting strategies or to create alerts tied to fundraising metrics report greater success at reducing the presence of shadow systems and meeting institutional objectives, respectively. Similarly, institutions with budget offices that use analytics for what-if analysis and modeling report more success at leveraging their analytical capacity to create competitive advantage.

It is not altogether clear why these three particular applications appear to have a significant correlation with successful outcomes and others do not. It is possible that the use of alerts in advancement brings about improved fundraising results, which in turn furthers strategic outcomes. However, it is not clear why this would be a more important relationship than, for instance, leveraging alerts in finance or student retention. It could be that all three factors are mirroring the results from using analytics to model strategic decisions (which we have already observed to be a significant factor).

Strongest Overall Relationships

The preceding section discussed the relative importance of key drivers in four different categories. Here we discuss the factors that appear to have the strongest relationship with successful outcomes regardless of category. Using regression analysis, we evaluated all factors that appear to have a significant relationship with the four successful outcomes. From this analysis, we were able to identify seven variables that appear most significant to successful outcomes:

- a technology platform that includes a data warehouse,
- use of academic analytics to model strategic decisions,
- use of academic analytics to forecast demand for courses,
- effective training,
- administrative staff skilled at analysis,
- leadership committed to evidence-based decision making, and
- use of academic analytics to tailor student recruiting strategies.

Each of these variables has a significant relationship with at least one of the four measures of institutional outcomes. In addition, four of the variables have a significant relationship with at least three of the success metrics. The four variables are

- effective training (related to all four success metrics),
- administrative staff skilled at analysis (related to all four success metrics),
- leadership committed to evidence-based decision making (related to three success metrics), and
- use of analytics to tailor recruiting strategies (related to three success metrics).

These four variables appear to be most important to a respondent's reported success with academic analytics.

Summary

For academic analytics, just as in many other technology discussions, the technology itself is a relatively small part of the story. Management factors play a more significant role in an institution's successful use of academic analytics than does the choice of technologies supporting it. Effective training, having staff skilled at analysis, and a leadership commitment to using data are all more significant to success.

This is not to say that technology is unimportant. It provides a valuable infrastructure on which to build analytical applications. Institutions with more extensive technology platforms (including, for example, a data warehouse, OLAP, and ETL) do report greater satisfaction with their ability to move information around the institution in a timely manner and with tools that are easy to use. Ideally, an institution would be able to bring together advanced technology and advanced staff capability. However, if one must choose, it appears that emphasis should be placed on building staff analytical skills and knowledge of the data.

As with other technology investments, institutions would be wise to align their technology infrastructure with leadership's commitment to using it. Institutions without leadership committed to using data in decision making will find it difficult to have managers at any level resist the temptation to make instinctual decisions. Regardless of the technology's sophistication, managers will continue to "follow their gut."

Ironically, the barrier to widespread adoption of sophisticated academic analytics may turn out to be not the technology's cost but rather the cost to recruit, develop, and retain staff with the necessary analytic skills. Unless all future managers come to their positions with greater skills, institutions will be forced to either develop these skills in house or place dedicated analysts in major administrative units. Jerome Waldren, CIO at Salisbury University, predicts that the latter will come to pass. He foresees a future in which power will reside in relatively few administrative staff skilled at analysis. "I think that casual use (of academic analytics) will grow even more, but what will happen is that the level of expertise to use these tools will not be as high," Waldren told us. "Key functional staff in units—superusers—are going to have the power even more than before."

If Waldren's vision of the future comes to pass, it will be an ironic ending to many of the changes brought about by process redesign. Reengineering projects changed process to eliminate the need for "process navigators." Process navigators were typically veteran administrative staff who understood the informal processes of the institution. Without a navigator as their agent, faculty, students, and staff found it difficult to transact routine business. Academic analytics may now give rise to the "information navigator," without whom sophisticated access to information is impossible.

9

Academic Analytics in the Future of Higher Education

Management *means in the last analysis the substitution of thought for brawn and muscle, of knowledge for folklore and superstition, and of cooperation for force.*

—Peter F. Drucker

Winter Semester, 2011

Still awash in the mild adrenaline aftertaste from Farber's exciting victory over Wazamatta U., Jared planted himself in front of his computer. It was high season for registration, and Jared was a bit unprepared. He was partially finished with the second semester of his freshman year. While he still didn't know what he wanted to major in, he was thinking more and more of pharmacy school. Pharmacists make a good living, he thought, and can work pretty much wherever they want to. He knew that the college had a good pharmacy program. Six years—ouch! He'd gotten a B in first semester general chemistry but figured he hadn't worked too hard and could pick up the pace (and his grade point average). Of course he was really off the rails this semester, if you could call cheerleading for the #1 Huskies, getting a girlfriend, and rushing for a fraternity "off track."

Jared plowed through the online catalogue. He figured he'd better start working on his pharmacy prerequisites in earnest. Organic chemistry, calculus...yikes! After a couple of hours he was tired and a bit frustrated. When he tried to register over the Net, he kept getting notices suggesting that he sign up for some primer classes. He had to admit that the system was pretty smart, but he didn't like hearing that students who got a B- in general chemistry often get a C or lower in organic chemistry. Was this Amazon or Farber College? He knew he'd just have to work harder and perhaps cut back on his extracurricular activities next year. He toggled through the registration system's alerts and pressed "Enter." The adrenaline was all but gone and it was getting late. Maybe he could borrow his roommate's new XBox 360.[1] Before he could get up to see, he got an IM from his advisor, Professor Gregory. The note just said, "Let's get together this week to discuss your course schedule next year. How about Tuesday at 3:00 p.m.?" Of course, Professor Gregory knew Jared's schedule, so…

Geoff Gregory had been ready to hit the hay. He had delivered a lecture and administered two labs today and was bone tired. He was about to close his e-mail when a notification from the college's advisor network dropped into his in-basket. He smiled and wondered, does e-mail really drop into in-baskets? The alert advised him that Jared Taylor was skating on academic thin ice. His 2.8 GPA, work-study track record, and extracurriculars might sustain Jared over the long haul, but Geoff knew that Jared would need to make major adjustments if he wanted to take the course load that he had just registered for—especially if he wanted to be admitted to the pharmacy program. The college's new advisor management system was sure nice. Based on a lot of consultation with the faculty and some pretty tricky modeling advice from some of the statistics faculty, the system was able to use aggregate historical student academic performance data to model and predict an individual student's likely success in a given course. The system factored in a student's past grade performance, course load, work-study commitments, and other things. It wasn't perfect, but the system could at least send red flags to overworked academic advisors so that they could intervene with at-risk students *before* they hit the wall. In the end, the decisions still remained with the students, but Geoff was pretty effective at helping students steer a path to success. Even better, Geoff could not remember the last time he was caught by surprise by a student who chose to leave the institution because of academic performance. You can't keep all students in school, he thought, but you can help quite a few! He'll see Jared next week. Geoff reminded himself how hard it was to be a freshman!

When Norma Denton got to her office at 7:45 that morning, she did what she did first thing every morning (after getting her morning coffee, of course): she logged onto Farber's Financial and Accounting Notification System (FANS) to monitor and evaluate the prior day's activity. FANS and its companion FADSS, the Financial and Accounting Decision Support System, made it possible for financial analysts like Norma to monitor the college's financial health through activity, trends, and other indicators. It was pretty slick. This morning, FANS listed problem student accounts. On the one hand, FANS brought together student billing information from parking, the library, the bookstore, the bursar's office, meal cards, and so forth. This was powerful. FANS made it possible to present students with a unified electronic bill for all services provided on campus and made it easy for students to integrate this information with their loan information and to make payments online. On the other hand, in concert with FADDS, FANS made it possible—using sophisticated financial models—to understand when a student (or vendor, donor, or other) was at risk of becoming financially overextended. Norma knew all too well that students arrived at the college with widely divergent experiences with money and that despite the college's best efforts, some students got themselves into financial trouble. The student module of FADDS was primarily there for the students' benefit. The system would provide them with alerts when spending levels appeared to be risky and then allowed easy what-if calculations to give students better understanding and control of their finances. FANS notified financial and academic advisors, making it possible to intervene before problems could snowball. Norma also knew that many of the college's dropouts left for financial reasons. Of course the underlying logic of FADDS and FANS also gave the controller's office a great handle on financial activity in other areas as well. "Forewarned is forearmed," Norma was fond of saying.

Norma was really proud of FANS and FADDS, since she had led the project team in the controller's office that had worked with the Department of Information Technology (IT) to develop it. But Norma couldn't really take credit for the idea. Bob Brown, the college's dean of admissions and enrollment management, was the real pioneer. Back in 2005, Brown responded to President Farnsworth's goal of elevating the academic reputation of the college by essentially reinventing the admissions process. Bob persuaded Elliot Jones in the statistics department to develop a mathematical model to predict which high school students in the college's market were likely to apply to Farber, to accept the college's offers of admission and financial aid, and to graduate within six years of their initial enrollment. Elliott brought some of his senior graduate students to the modeling exercise, and over time, they produced some rather remarkable models by using large quantities of historical prospect, admissions, and retention data. Since implementing these models, the college has been able to target its admissions efforts in a more focused and personalized fashion. This kept the college's admissions costs level while making it possible for the number of applications to rise in just three years. Farber's admissions selectivity rose noticeably. The yield of applicants who actually enrolled has steadily risen, and retention rates for the class of 2012 appear to be on track for considerable improvement from past years. Yes, Bob simultaneously earned the respect of the college's president, trustees, provost, and the business officer!

While the work that Bob did for Farber admissions was not easy, it was not as hard as implementing the enterprise resource planning (ERP) system had been. In fact, having a relatively current student information system made the work much easier. The most interesting thing about Bob's work was that the logic of this approach caught fire at the institution. It didn't hurt, of course, that the president loves data (or that Bob was now the College's executive vice president)! Today, most administrators at Farber talk about analytical models, alerts, scorecards, data warehouses, online analytical processing, and other tools and activities that are making it possible to manage important elements of the institution's mission more effectively.

Higher Education in Context

Long the envy of the world, higher education in the United States begins with the establishment of the College of William and Mary and of Harvard University in the 17th century. While initially the sinecure of the economic and social elite of the colonies, American higher education evolved quickly much in the way the United States evolved. And that is no surprise, due to the pivotal role played in both evolutions by Thomas Jefferson. Jefferson wrote to David Harding in 1824, "In a republican nation whose citizens are to be led by reason and persuasion and not by force, the art of reasoning becomes of first importance." Jefferson believed that diffusing education and knowledge would be the preeminent method of establishing the roots of the democratic ideal and of elevating the human condition.

Jefferson was most certainly right, and both the successful spread of democracy and the rise to preeminence of U.S. higher education are testimony. Higher education's recent past in the United States has been breathtaking. The participation of high school graduates in U.S. postsecondary education is at record levels. More than 30 percent of the Nobel Prizes since 1904 have been awarded to graduates of—or practitioners at—American universities. U.S. higher education has enjoyed more than a decade of increasing research funding from its major research sponsors, the National Science Foundation, and the National Institutes of Health. U.S. colleges and universities have enjoyed rising enrollments over this same decade and remain the educational destination of choice by for students from other nations who seek a postsecondary education in another country.

Higher Education Trends in 2005

Despite this illustrious history, many believe that a perfect political and economic storm is forming around U.S. higher education. The educational landscape overall is becoming more complex. Changes in institutions, markets, and the environment of higher education are all contributing to the stormy conditions facing U.S. higher education.

Noncredit instruction is growing, presenting new competition, new sources of revenue, and new business pressures. By 2014, student enrollments in every U.S. higher education market are expected to decline. While demand for scarce spots at U.S. "medallion" institutions becomes more and more frenzied, private institutions below this level of prestige wage a quiet price war, and fewer and fewer students pay the "sticker price" for a college education. Financial support at the state level—long the backbone of public postsecondary education—has eroded steadily, and many public universities are renegotiating their state governance compacts to recognize a deep transition from "state" universities, to "state-assisted" universities, to "state-located" universities. Most state research universities now derive less than 30 percent of their funding from their respective state governments. As baby boomers begin to retire to reduced incomes, the gifts to universities are likely to slow until this generation begins to plan for bequests. And the giving patterns of the so-called me generation are not yet known.

The consumer context for higher education is changing deeply. Two key higher education stakeholders—government and industry—are demanding greater accountability and transparency from higher education. These demands surface in the form of pressures to redefine accreditation processes, the triumph of rankings of all kinds, the increasing linkage of funding with variety of report cards, and so forth. At the direct consumer level, change is also apparent and dramatic. Students, particularly those in community college, are said to "swirl"; that is, to customize and personalize their undergraduate education by grazing on the offerings of anyone and everyone who offers instruction, credit, credentialing, and certification in cyberspace. These students are assembling their own degrees, and creating institutional loyalty amidst the swirl is not an easy thing to do. For-profit educators like the University of Phoenix grow at rates five times that of conventional institutions by focusing on

- easy transfer of prior coursework,
- mastery of the accreditation process,
- targeted curricula that are focused on employment skills,
- strong links with students' corporate employers, and
- standardization and continuous process improvement.

The conditions that create a possible storm are also perfect for stimulating the growth of new capabilities among colleges and universities (see Table 9-1). In these storm settings, colleges and universities will likely:

- Focus on new sources of revenue. Noncredit instruction is likely to continue to grow as institutions seek to establish and secure niches like executive education, continuing legal and engineering education, and so forth.
- Place more importance on "time-to-market" issues and hence practices that affect the velocity of decision making.
- Adopt sophisticated technical capabilities for collecting, mining, analyzing, simulating, and presenting information.
- Place a higher premium on analysis in general and on quantitative analysis in particular, especially in revenue centers such as admissions, sponsored research, development, continuing education, and so forth.
- Develop leadership cadres that are more focused on institutional economic performance and that, in turn, will foster cultures of evidence focused on evidence-based decision making, accountability, and information transparency.

Colleges and universities, like most cultural institutions, are political organizations. Described by many as adhocracies, or organized anarchies, higher education is characterized

Table 9-1 Key Shifts Ahead

PAST	PRESENT	FUTURE
Canned reports	Online data	Real-time, personalized data
Pro forma reports	Interactive spreadsheets	Models
Just-in-case data	Just-in-time data	Scenarios in advance
No data	Opaque data	Transparent data and systems
Political culture	Professional culture	Culture of evidence
Institutional accounting	Institutional controls	Institutional accountability

by problematic goals, unclear technology, and fluid participation (Weick, 1984). Leaders in higher education are political leaders who traditionally "discover preferences through action more often than [they] act on the basis of preference" (Cohen & March, 1974).

The complexity of the current and evolving environment is likely to overwhelm organizations and governance that are based on problematic goals, unclear technology, and fluid participation. While fluid participation in higher education governance is likely an immutable and beneficial idiosyncrasy of higher education, the future is likely to witness a shift in the business and IT infrastructure from one that is based largely on what data you have to one based on what you know. Concurrently, this infrastructure and culture will likely shift (or perhaps has already shifted) from being organized around amassing data and capabilities just in case something happens to one that provides services and data just in time. Indeed, the longer-term shift will move further, from just-in-time capabilities to those that anticipate change and are either predictive or self-actuating (autonomic). In the same vein, complexity in the higher education environment has generally resulted in complexity in our data and systems. If the watchword of the current regulatory environment is transparency, higher education data and systems for analytics and planning are opaque. Answering basic questions about the sizes of our workforces or student bodies too often results in time-consuming ad hoc projects and eventually in footnoted reports. To accent this problem, one noted higher education executive answers the question, "How many people work at the university?" by stating, "About half!"

The business and academic literature and this study's quantitative and qualitative data suggest that higher education may be ripe for a near-term breakthrough in this arena. Factors promoting a breakthrough include:

- A great many colleges and universities have implemented new enterprise transaction systems. This effort not only results in new technologies that are better able to interact with academic analytics systems and tools but also in improved data. Indeed, the data and research suggest that the costs of advanced analytics are dominantly in staff training and in data administration, and some of these costs have already been incurred.
- The technologies associated with advanced institutional analytics are mature and robust. They are commercially supported at prices well below those of the enterprise transaction systems that they lever. While these capabilities demand staff expertise and technical resources, these requirements are smaller by far than those associated with enterprise transaction systems.

- The state of the practice in this arena *outside* higher education is impressive. Consumer sites like Amazon demonstrate how the acquisition and management of customer information can be used to personalize interactions with the organization and to broaden and deepen consumer choices and loyalty. Similarly, political campaigns mine and analyze voter data impressively to target prospective campaign supporters. All of this suggests that the expertise needed to place new capabilities in the service of higher education exist—perhaps in abundance.
- Presidents, provosts, business officers, registrars, and trustees are increasingly comfortable with data and may become impatient when access to comprehensible information or sophisticated analysis is limited, constrained, or nonexistent.

The Future Is Now

The remarkable thing about the story of academic analytics seems to be that the time for the future is really now. It is clear that the next generation of faculty, staff, and students will enter the academy with heightened expectations for data access. They will want more data, will want it faster, and will want to be able to manipulate data themselves. It is also likely that higher education, like all organizations and institutions, will be expected to place more and more information into the public domain in the spirit of openness, transparency, and accountability. This pressure may manifest itself as a press for a continuously available (and up-to-date) annual reports and for Web sites that provide data and tools so that public policy makers, regulators, parents, marketers, and others can kick the institution's virtual tires. These external and internal pressures for information are conspiring with the increasing robustness and usability of the tools of analytics to increase the number of potential users of these capabilities who possess the skills needed to perform meaningful analyses. In this kind of future, at least two things must happen:

- The institution's leadership must itself become respectful of data and astute in using data to inform institutional decisions; and
- Institutions must devote time, effort, and resources to *information architecture*, to *workflow*, and to *data management*. Institutional leaders, working with IT, will need to grapple with greater standardization of data sources and definitions. This activity is substantial and includes defining an *information ecosystem* and philosophy that reconciles central systems and so-called shadow systems; rethinking the need for *information intermediaries* whose primary tasks are to reconcile and interpret complex and often contradictory data sources; and resolving in a meaningful way the age-old question of whose data is authoritative.

To a great extent, the future environment for academic analytics is likely to look much like today's idealized vision (see Figure 9-1).

To some extent, the promise of a robust environment for academic analytics is a promise that is within reach. In general, higher education has performed much of the heavy lifting and has made many of the required investments in contemporary transaction systems. The implementation of new ERP systems, of Web access, and of portals necessitated some degree of grappling with the institution's data model and with the data itself. While horror stories abound of institutions with more than 20 different definitions of students or FTE residing in institutional systems, many colleges and universities are slowly rationalizing these environments. New and exciting technologies such as role-based authorization will add purpose to this effort, as will less exciting but more pressing issues like IT security.

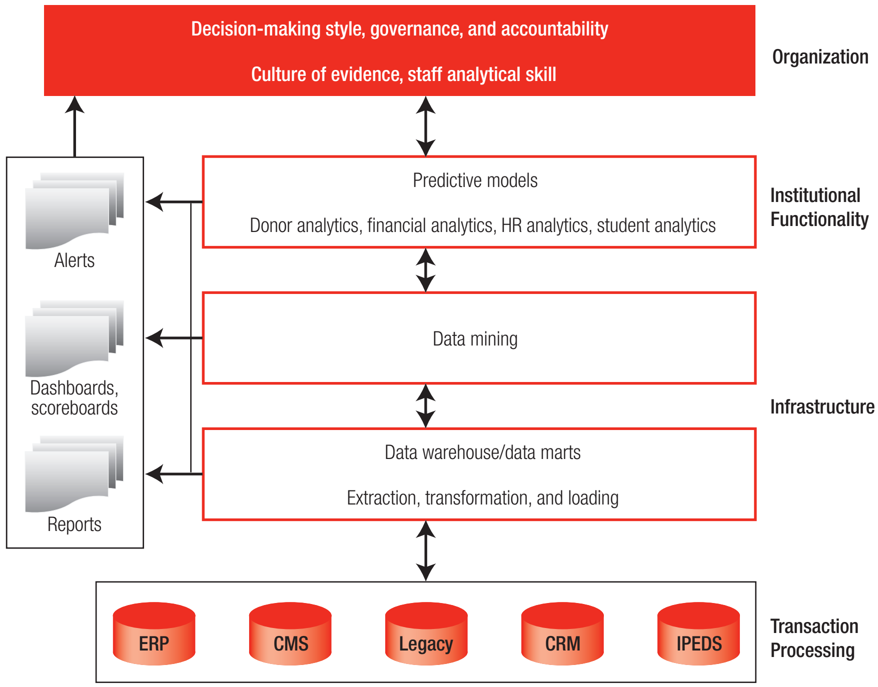


Figure 9-1 Elements of the Future Academic Analytics Environment

With a contemporary or well-architected enterprise systems environment, broadly understood data models, clear business rules, and reasonably clean data, the promise of the future academic analytics environment is within reach. The technologies and techniques of academic analytics are well understood, mature, and financially and technically accessible. Quite simply, data from enterprise system can be extracted, transformed, and loaded into data warehouses and marts. These data can be mined using increasingly sophisticated enterprise data-mining tools and positioned for analysis using a variety of robust and well established analytical tools. Historical transaction data—including data from course management systems—can be used to develop models that can predict current and future stakeholders' behaviors and outcomes.

In this area of endeavor, the limits on the future appear to have less to do with the shortcomings or inaccessibility of a technical infrastructure than with a failure of imagination, user proclivity, or urgency. In the end, the promise of academic analytics is bound up with institutional vision for and ideas about core institutional issues such as admissions selectivity, grants productivity, student success, academic persistence, retention, and so forth. Standing between higher education practice today and an agreeable vision are those who own responsibility for these institutional outcomes (process and outcome owners) and those who understand the capabilities of today's extraction, warehousing, mining, analytical, and reporting tools (process and outcome reformers).

In fact, what bars the door may be more basic:

- our legacy as institutions with problematic goals, unclear technology, and fluid participation; and
- our difficulty in organizing institutional effort around key institutional processes and outcomes.

Who at our institutions, for example, is administratively responsible for student success? Is this a faculty role? A counseling role? Is the dean of students responsible? What about the provost? Could the Panhellenic Council be part of the issue? What about parents? The point is that institutional processes and outcomes like success, persistence, and retention are complex in the extreme and are inherently multifaceted. Likely at most institutions there is no one who will raise his or her hand to say, "I am responsible for this." It is difficult, therefore, to find a user for the IT organization to work with.

Compounding this complex organizational problem is the adhocratic culture of the academy. In environments where anecdotes trump data, little time, money, or effort is spent developing data or developing sophisticated techniques for analyzing it. This may be in part a chicken-and-egg problem. Leaders who have spent a career in an industry bereft of good data, good tools, and good analysts have resigned themselves to leading by rushing to the front of the longest parade on campus or by responding to the institution's loudest voice. Staff, whose leaders seem indifferent to the facts or distrustful of data, are in no position to unilaterally ignite a new procedural and technical fire. The chicken-and-egg dilemma may explain why the successes we find in this area are often closely associated with an individual who owns a manageable piece of the institutional mission and who has a vision of using information in new ways to conduct that mission. Real progress in admissions at Baylor University or in managing student retention at the University of Minnesota or student success at the University of Connecticut began with an individual's vision and fanned out from there.

In any case, several essential messages about the future of academic analytics are clear:

- Our stakeholders will demand it.
- The tools are mature and financially and technically accessible.
- Success will have more to do with organizational capacity (analysis, model making, decision making) than with technical capacity.
- Our workforce and leadership need to be engaged and trained.
- Evidence-based decision making must be valued and modeled by our leaders.

Fine Print for the Future

Academic analytics in all likelihood has an important and enduring place in the future of higher education. If necessity is the mother of invention, then growing stakeholder, economic, enrollment, and other pressures will inspire early adopters to seek market advantage through better data mining, analysis, and modeling. The application of so-called business intelligence and analytics in the private sector has been an important and steady source of success for many. The promise of this agreeable future is not without challenge or peril. Specific challenges will include:

- *Data governance.* At many colleges and universities, the responsibility for managing essential information is dispersed among central and local (school or college) units. Data are subject to differing standards of description, differing security standards, differing access policies, and so forth. Assembling and integrating models or profiles of students, alumni, suppliers, grantors, donors, and others will require the implementation of new federated data management practices and new technologies.
- *This is Skynet, I am John Connor.* While the future of academic analytics consists, in part, of a vision of institutional processes that are managed autonomously through a complex of technologies, models, data, and decision rules, we are all aware of the limits of these capabilities and of the reasoning that underlies them. British humorist Jeremy Clarkson tells an all-too-familiar story of analytics and autonomic processes run amok: "I recently bought something and then decided I

didn't want it. So I sent it back and the money was reimbursed to my credit card company. I then telephoned the credit card company and asked it to put the money back in my bank account. I even had the sort code to hand and everything. 'Yes,' said the girl, 'I can do that, no problem at all.' But there obviously was a problem because a couple of days later I attempted to buy some petrol. My card wasn't rejected but I was made to talk to someone at the credit card company who wanted to know my mother's maiden name and all sorts of other impertinent things. Then I bought some shoes and the same thing happened, so I telephoned the credit card company to ask why, all of a sudden, I'd become Osama Bin Laden. 'Aha,' said a man, 'it's because you are in credit with us.' This was baffling for two reasons. First, why was I in credit with them when I'd asked them to put the money in my bank, and why should being in credit cause them to think I needed a telephone frisking every time I bought a packet of fags? I therefore asked the man if he'd be so good as to move the money. I even made it plain that if he failed I'd come round to his place of work and insert something fairly chunky up his bottom. This obviously appealed because the next day, while using the card to buy some flowers, I was asked once again for my mother's maiden name. So I called the credit card company and spoke to someone else, who said I was in credit, a highly unusual situation and one that makes them think I may be laundering drug money. Yes, well, since I'm not Pablo Escobar, could they perhaps put the money in my bank account? 'Yes,' said the man, who I knew would not do any such thing. And could they stop asking silly questions every time I bought anything? 'No,' said the man. 'Your name's been flagged on the computer and I'm afraid I can't turn that off.' 'Well, would you find someone who can turn it off?' It seems not. The whole thing is completely automated. And there is no one, not even the Queen, who can get into the program and make alterations" (Clarkson, 2005).

- *Privacy and access.* Higher education institutions, because of our role as arbiters of a culture, have a special responsibility to implement new capabilities self-consciously and responsibly. Genuine debate within the academy that strives to balance the possible with the desirable (or even the ethical) needs to occur. While it is unarguably valuable to use student, prospect, or patient data to tailor institutional offerings for them, is it appropriate or ethical to use the same information to tailor fundraising solicitations? Under what circumstances can or should variables like race and ethnicity factor into our models of student or prospect success? When is an autonomic process intrusive, and what are the protocols for ameliorating defects that will inevitably be uncovered? Where is an institution's locus of intervention? Are intelligent, autonomous systems to be organized as a part of staff-enabled processes (for example, counselors) or as a part of processes that serve the end consumer directly (self service)? These are open questions and philosophical questions that will likely cut quickly to the core of deeply held institutional beliefs.

Conclusion

The outlook for academic analytics in the future of higher education is exceedingly bright. The time for these capabilities is right. Colleges and universities need better data to make better decisions. The technical capacity to do this is here and within reach. The primary constraints on an agreeable future are in the cultures of our institutions and the behaviors and predispositions of our leaders. While most colleges and universities muddle through complex problems with small changes to the status quo, notable exceptions are evident.

The technologies of academic analytics, in concert with a leadership that is committed to evidence-based decision making, a cadre of analysts who are trained in the technologies and in analytical techniques, and a culture that has debated and negotiated the rules of engagement surrounding the collection, modeling, and profiling of key stakeholder groups' data, are collectively in a position to dramatically and beneficially impact core institutional academic processes and outcomes. Information technologies are in a position to help students succeed, boost academic persistence and performance, enhance our effectiveness in winning grants and gifts, and other key activities. And best of all, the potential to realize this vision is here today at a financial price most can afford. The challenge of change, as is often the case, is imbedded in our culture, our governance, and in our capacity to suffuse the technology with a vision and with our passion for our mission.

Endnote

1. XBox 360 is a trademark of the Microsoft Corporation.

Appendix A

Institutional Respondents to the Online Survey

Alpena Community College
Amherst College
Appalachian State University
Aquinas College
Arcadia University
Arizona State University East
Auburn University
Austin Community College
Azusa Pacific University
Babson College
Baker University
Barnard College
Bates College
Baylor University
Bemidji State University
Berklee College of Music
Bethany Lutheran College
Bethel University
Bethune-Cookman College
Binghamton University
Bishop's University
Bloomsburg University of Pennsylvania
Board of Regents of the University System of Georgia
Brandeis University
Brazosport College
Bridgewater State College
Brown University
Caldwell College
California Maritime Academy
California State Polytechnic University, Pomona
California State University, East Bay
California State University, Fullerton
California State University, Sacramento
Canisius College
Carleton College
Carleton University
Cecil Community College
Central Michigan University
Charleston Southern University
Chesapeake College
Christopher Newport University
Cincinnati State College
Cleveland State Community College
Cochise College
Colby-Sawyer College
Colgate University
College Misericordia
College of Lake County
College of Saint Catherine
College of the Holy Cross
The College of New Jersey
College of Saint Scholastica
Collin County Community College District
Colorado Christian University
Colorado State University–Pueblo
Columbus State University
Concordia University at Austin
Concordia University, Portland

Connecticut College
Coppin State University
Cornell University
Creighton University
Dakota Wesleyan University
Dallas County Community College District
Dartmouth College
Davenport University
Delta State University
Denison University
DePauw University
Dickinson College
Dominican University
Douglas College
Drake University
Drew University
Drexel University
East Tennessee State University
Eastern Iowa Community College District
Eastern Michigan University
Eastern Washington University
Eckerd College
Edison College
Elmhurst College
Elon University
Embry-Riddle Aeronautical University
Emory University
Empire State College SUNY
Emporia State University
Fairfield University
Fielding Graduate University
Florida State University
Fordham University
Franklin W. Olin College of Engineering
George Fox University
Georgetown University
Georgia Perimeter College
Georgian Court University
Gettysburg College
Glendale Community College
Gonzaga University
Grand Valley State University
Great Basin College
Guilford College
Hamilton College
Hamline University
Hampshire College
Hampton University
Harford Community College
Harper College
Hartwick College
Holy Family University
Houston Baptist University
Houston Community College
Hudson County Community College
Hudson Valley Community College
Humber College Institute of Technology and Advanced Learning
Humboldt State University
Idaho State University
Illinois College
Illinois Wesleyan University
Indiana State University
Indiana University
Indiana University East
Indiana University Kokomo
Indiana University Northwest
Indiana University of Pennsylvania
Indiana University Southeast
Indiana University-Purdue University Indianapolis
Ivy Tech State College Central Office
Jackson State Community College
John Brown University
Judson College
Kentucky Community & Technical College System
Kenyon College
LaGrange College
Lake Michigan College
Lakeland Community College
Lawrence University
Le Moyne College
Lewis & Clark College
Lincoln Land Community College
Lincoln Memorial University
Linn-Benton Community College
Loma Linda University
Lorain County Community College
Louisiana State University

Loyola College in Maryland
Luther College
Manhattan College
Mansfield University of Pennsylvania
Maricopa Community College District
Marist College
Marquette University
Massachusetts College of Art
McGill University
Medicine Hat College
Mercy College
Mercyhurst College
Messiah College
MGH Institute of Health Professions
Miami Dade College
Miami University
Michigan State University
Middle Tennessee State University
Middlebury College
Midland College
Minnesota State Colleges and Universities
Mississippi State University
Mississippi Valley State University
Monmouth College
Montana State University–Bozeman
Montgomery College Central Administration
Montgomery County Community College
Morgan State University
Mount Allison University
Mount Aloysius College
Murray State University
Muskegon Community College
New York University
Nipissing University
North Carolina School of the Arts
North Central Texas College
North Harris Montgomery Community College District
North Shore Community College
Northeastern State University
Northeastern University
Northern Arizona University
Northern Kentucky University
Northwestern College
Norwich University
Oakland University
Oberlin College
Ohio Northern University
The Ohio State University
Ohio University
Okanagan University College
Oklahoma Baptist University
Oklahoma Christian University
Onondaga Community College
Our Lady of the Lake University
Pace University
Pellissippi State Technical Community College
Plymouth State University
Pomona College
Presbyterian College
Prince George's Community College
Princeton University
Purdue University
Raritan Valley Community College
Reed College
Rensselaer Polytechnic Institute
Rhode Island College
Rhode Island School of Design
Rice University
Roane State Community College
Roberts Wesleyan College
Rochester Institute of Technology
Roosevelt University
Rowan University
Russell Sage College, The Sage Colleges
Rutgers, The State University of New Jersey
Saint Anselm College
Saint Augustine's College
Saint Louis University
Saint Mary's College of California
Saint Mary's University of Minnesota
Saint Michael's College
Salisbury University
Salve Regina University
Sam Houston State University
Samford University
San Juan College
Santa Fe Community College
School of the Art Institute of Chicago
Schreiner University

Scottsdale Community College
Seattle Pacific University
Simmons College
Sinclair Community College
Skidmore College
Sonoma State University
South Dakota School of Mines & Technology
South Dakota State Board of Regents System Office
South Dakota State University
Southeastern Louisiana University
Southern Methodist University
Southern Oregon University
Southwestern University
St. Francis College
St. Lawrence University
St. Ambrose University
St. Mary's College of Maryland
State Fair Community College
Stony Brook University
SUNY College at Cortland
SUNY College at Plattsburgh
SUNY College of Technology at Alfred
Sweet Briar College
Texas Christian University
Texas State Technical College Marshall
Texas State Technical College Waco
Texas State University–San Marcos
Texas Wesleyan University
Trinity College
Trinity University
Union College
Union County College
United States Military Academy
Universidad Carlos Albizu
University & Community College System of Nevada
University at Buffalo
University College of the Fraser Valley
University of Alabama at Birmingham
University of Arkansas for Medical Sciences
University of Baltimore
University of British Columbia
University of California, Berkeley
University of California, Irvine
University of California, Los Angeles
University of California, Riverside
University of California, San Diego
University of California, San Francisco
University of California, Santa Barbara
University of Central Florida
University of Cincinnati
University of Colorado at Boulder
University of Dayton
University of Delaware
University of Detroit Mercy
University of Florida
University of Hawaii
University of Indianapolis
University of Kansas
University of Kansas Medical Center
University of Kentucky
University of La Verne
University of Louisville
University of Manitoba
University of Mary Washington
University of Maryland, Baltimore County
University of Memphis
University of Miami
University of Michigan–Ann Arbor
University of Minnesota
University of Minnesota Duluth
University of Missouri System
University of Montana–Western
University of Nebraska
University of Nebraska at Omaha
University of New Brunswick
University of New Mexico
University of North Carolina at Charlotte
University of North Carolina, Office of the President
University of North Dakota
University of North Texas HSC at Fort Worth
University of Notre Dame
University of Oklahoma
University of Oklahoma Health Sciences Center
University of Ottawa
University of Puerto Rico at Ponce

University of Puget Sound
University of Rhode Island
University of Richmond
University of Rochester
University of San Francisco
University of South Carolina
University of South Florida
University of Southern Mississippi
University of St. Thomas
University of Tennessee at Chattanooga
University of Texas at Arlington
University of Texas at Austin
University of Texas at San Antonio
University of Texas at Tyler
University of Texas HSC at San Antonio
University of Texas System
University of Texas–Pan American
University of the Pacific
University of Toledo
University of Toronto
University of Vermont
University of Victoria
University of Virginia
University of Washington
University of Washington, Bothell
University of West Florida
University of West Georgia
University of Winnipeg
University of Wisconsin–La Crosse
University of Wisconsin–Milwaukee
University of Wisconsin–Platteville
University of Wisconsin–Stout
University of Wisconsin–Whitewater
University System of Maryland
University System of New Hampshire
Urbana University
Vermont State Colleges
Villanova University
Virginia Tech
Volunteer State Community College
Washington University in St. Louis
Weber State University
Webster University
Wellesley College
Wesleyan University
West Virginia School of Osteopathic Medicine
West Virginia State University
Western Carolina University
Western New England College
Wheaton College
Whitman College
Widener University
Willamette University
William Woods University
Williams College
Winona State University
Wittenberg University

Appendix B

Interviewees in Qualitative Research

Arizona State University, Polytechnic
Kati Weingartner, Director, Information Technologies

Auburn University
Nick Backsheider, Associate Executive Director, Office of Information Technology

Baylor University
Reagan Ramsower, Vice President for Information Technology and Acting Vice President for Finance

The College of William and Mary
Courtney Carpenter, Associate Provost
David Trott, Administrative Liaison

Hartwick College
Ellen Falduto, Vice President and Chief Information and Planning Officer

Le Moyne College
Robert Clapp, Vice President of Information Technology

Lorain County Community College
David Weiser, Director, Information Systems and Services

North Shore Community College
Janice Forsstrom, Vice President for Administration and Finance

Princeton University
Ted Bross, Associate Director, Administrative Information Services

Salisbury University
Jerome Waldren, Chief Information Officer

SAS
Mark Milliron, Vice President, Education Practice

SunGard SCT
Judy Luzeski, General Manager, Information Access Solutions

University of Alabama
Priscilla Hancock, Vice Provost for Information Technology and Vice Chancellor for Information Technology

University of California, San Diego
Elazar Harel, Assistant Vice Chancellor for Administrative Computing and Telecommunications, and Chief Information Officer

University of Central Florida
M. Paige Borden, Director, Institutional Research and University Data Administrator
Joel Hartman, Vice Provost for Information Technologies and Resources

University of Connecticut
Jeff von Munkwitz-Smith, Registrar

University of Delaware
Susan Foster, Vice President, Information Technology

University of Maryland, Baltimore County
Jack Seuss, Chief Information Officer

University of Minnesota
Sue Grotevant, Director of Information Management Systems

University of Nebraska at Omaha
Bret Blackman, Director, Administrative Services

The University of Texas at Austin
Cathy Lester, Associate Director, Office of Accounting
Dan Updegrove, Vice President, Information Technology
Fred Fredrich, Associate Vice President and Controller

University of Toledo
Joseph Sawasky, Associate Vice President

Williams College
Criss Laidlaw, Director, Administrative Information Systems

Appendix C

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