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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.

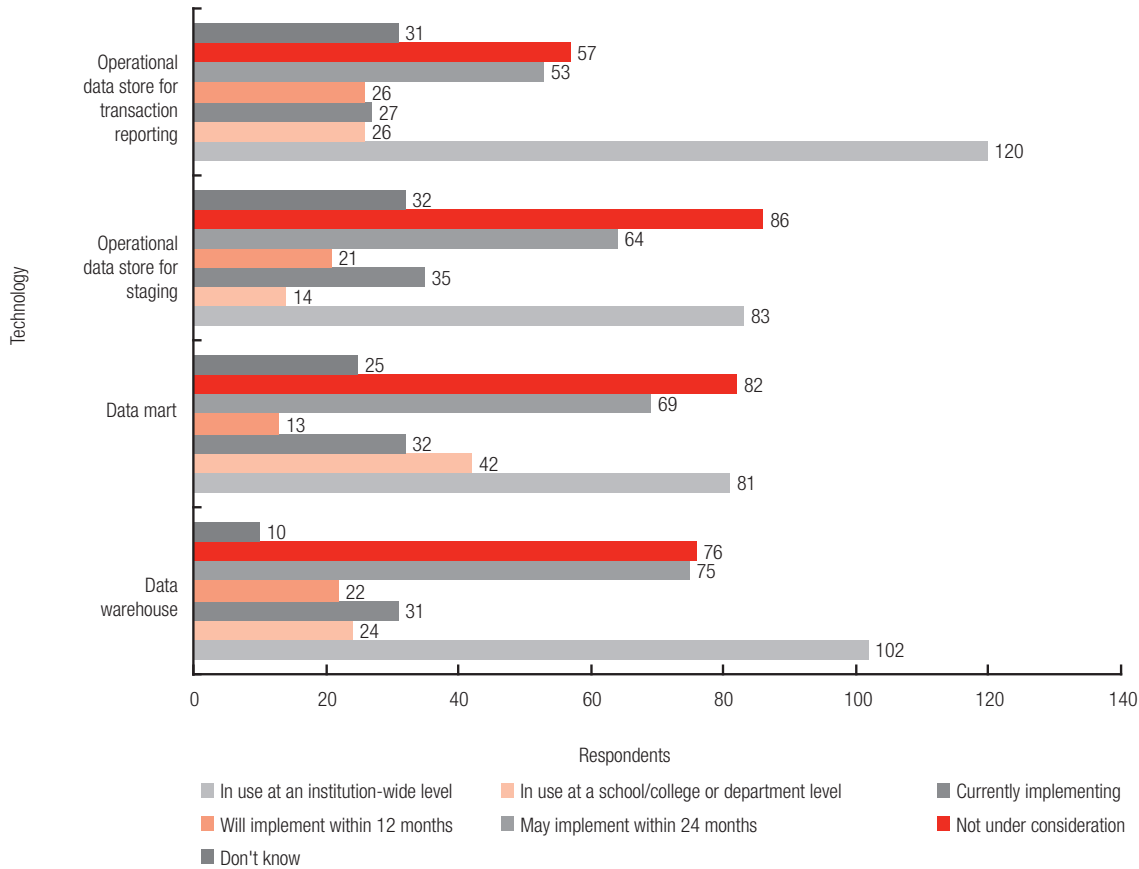


Figure 5-1.
Current and Planned Deployment of Technologies

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.

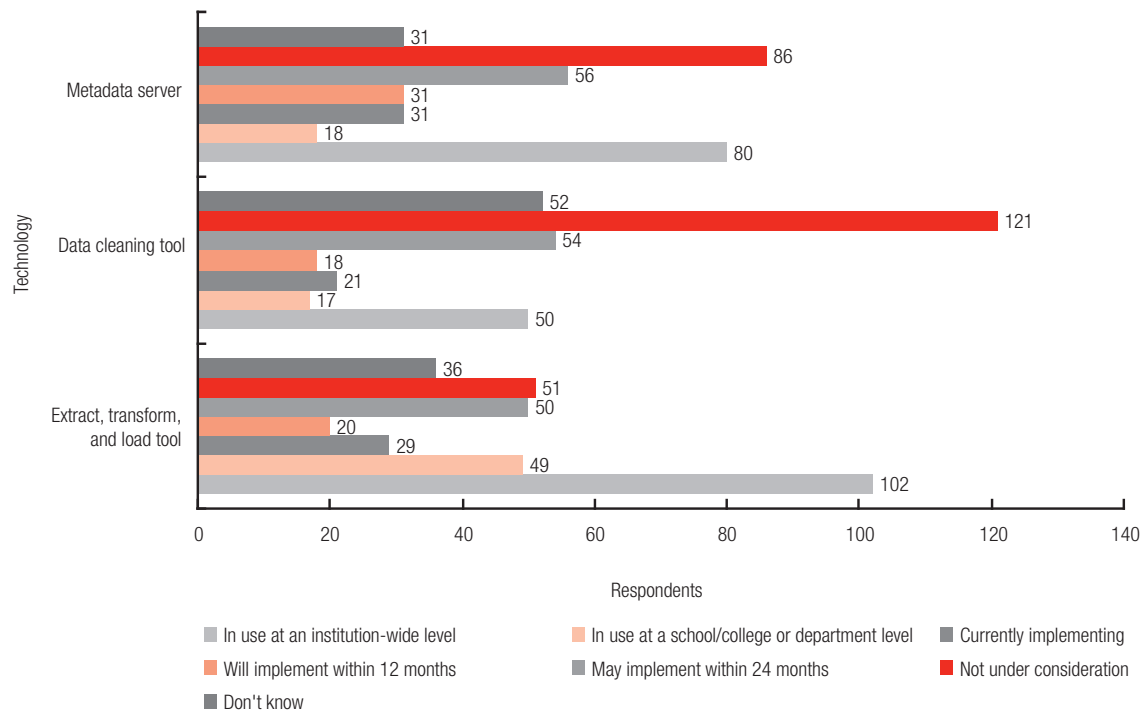
Extract and Access Tools

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 metadata⁴ 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

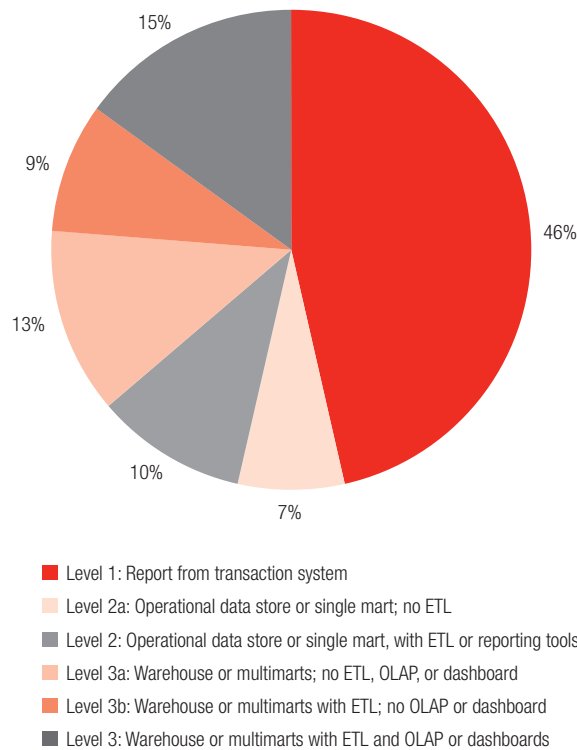


Figure 5-3.
Distribution of Respondents, by Technology Platform (N = 350)

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)

Level	Private		Public	
	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 interest-

ing 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.

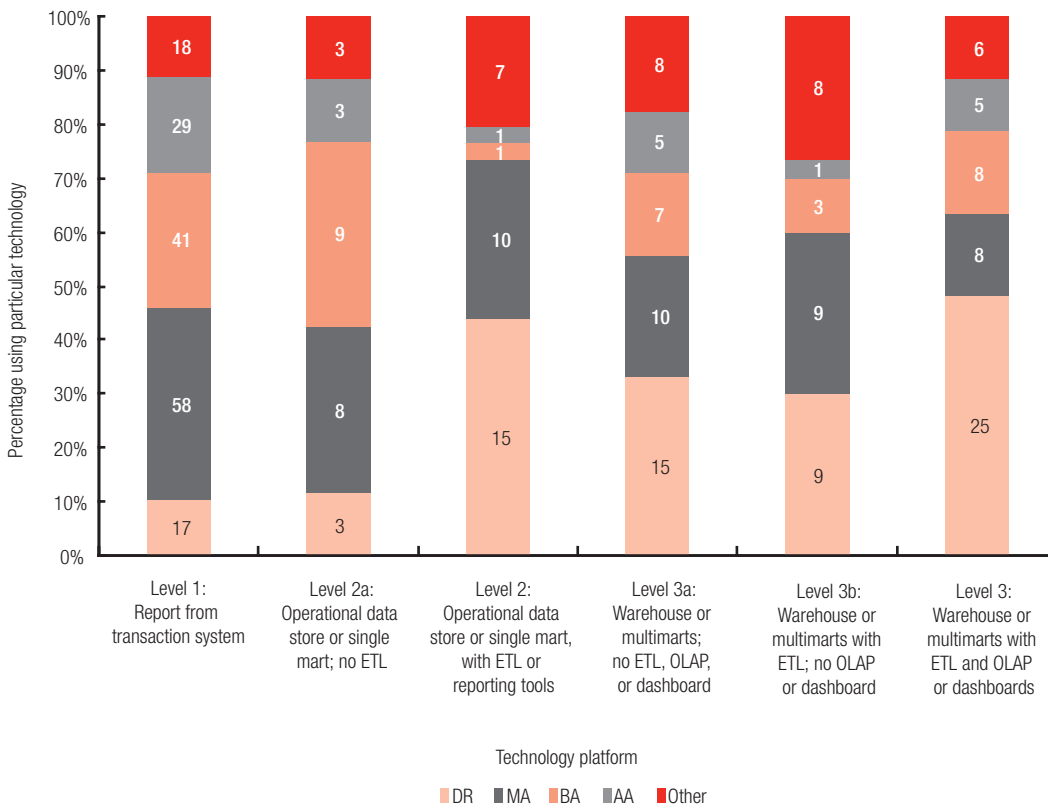


Figure 5-4. Technology Levels, by Carnegie Class (N = 350)

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

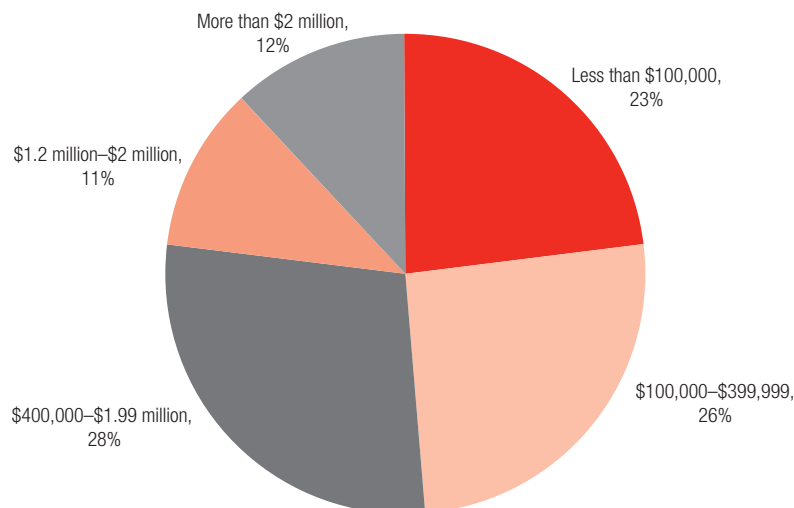
include. So, we suspect that institutions used many different methods to estimate their aggregate spending. Some may have accounted only for hardware and software. Others may have included additional costs such as consulting, staff time, or training. Since institutions have implemented their capability 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

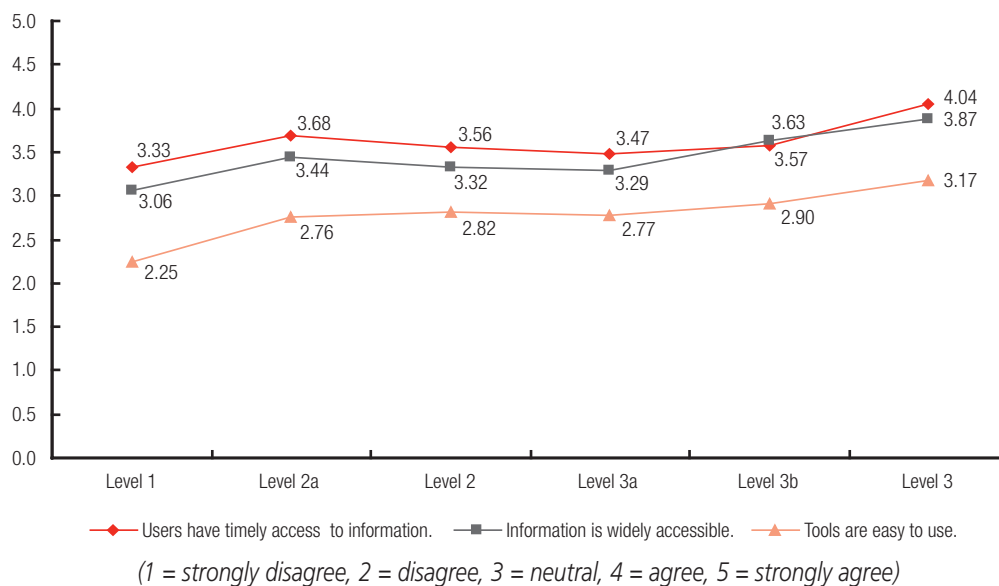


Figure 5-6.
Mean Satisfaction with Analytical Capability, by Technology Platform

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*).