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Trend Watch 2016: Which IT Trends Is Higher Education Responding To?

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Introduction

Higher education, technology management, and information technology (IT) itself are evolving rapidly this century. It's a trifecta of change, and change in each area is spurring new growth and adoption in the other areas. With technology offering opportunities to teach and learn asynchronously and creatively, higher education is experimenting with and adopting new technologies and entirely new models of education that better fit today's society. The enormous opportunities that the consumerization of devices and environments provides individuals are overwhelming not only networks but also IT organizations themselves, posing new bandwidth, security, and enterprise architecture challenges. Yet the same flood of technology that burdens also blesses and rescues by offering new ways to deliver services via the cloud and entirely new sources and uses of information through analytics and the Internet of Things.

So many trends, so little time. EDUCAUSE is in its second year of identifying and tracking the influence of major trends on the IT strategy of colleges and universities. We started last year with 15 trends. That simply wasn't sufficient, given the enormity of change higher education is experiencing. Our Trend Watch list virtually doubled this year, to 29 trends in the management and delivery of IT services, personal devices and personalized environments, data and analytics, teaching and learning, security and risk, and the Internet of Things.

These trends have been highly visible, widely discussed, and broadly covered in publications, blogs, and presentations. They were identified or are commonly applied by influential established groups such as the New Media Consortium and Gartner, and they are widely discussed by members in gatherings and online. With so much discussion of the opportunities of personalized learning, the benefits of DevOps, the excitement and peril of the Internet of Things, and the promise of the cloud, it's easy to assume that colleges and universities are adopting these and other new practices en masse. But what is actually in place at our institutions, and which types of institutions are most affected by—or are leveraging—IT trends that occupy so much mindshare? This report presents data on their actual influence on IT strategy in higher education.

Summary

- The three trends exerting the most influence on higher education's IT strategy are (1) moving to the cloud; (2) increasing complexity of technology, architecture, and data; and (3) mobile device diversity (tablets and smartphones from various manufacturers). Each of these trends has either already been incorporated into IT strategy or is a major influence on emerging strategy at more than 6 in 10 institutions.
- The three trends with limited impact (strongly influencing fewer than 20% of institutions) are (1) the Internet of Things; (2) access for all kinds of endpoints and objects, including RFID- and GPS-based devices; and (3) unbundling (of data and content from applications, of content from courses, of faculty roles, etc.).
- The influence of trends on IT strategy is associated with institutional differences in technology adoption more often than with institutional size or Carnegie Classification. Early adopters are generally incorporating these trends most rapidly, and late adopters most slowly. Early, mainstream, and late adopters can be found in roughly similar proportions among all institutional sizes and major Carnegie classes.
- The trends related to analytics and data, on average, have a greater impact on institutions than the other trends, followed by trends related to re-architecting IT foundations and trends related to teaching and learning. Device-related trends have the least impact on IT strategy.

The Trends

We assessed the 29 IT trends via an EDUCAUSE survey in the summer of 2015. The 296 respondents indicated the extent to which each trend was "influencing your emerging IT strategy."[1] Response options were:

- Already incorporated
- A major influence
- A minor influence
- Tracking but no influence yet
- Not at all
- Don't know (unfamiliar with this trend)

The trends fall into six primary categories: analytics and data, teaching and learning, re-architecting IT foundations, security and risk, IT consumerization, and devices. Two other trends, unbundling and sustainability, were also examined.

Trends Related to Analytics and Data

- **Data-driven decision making:** "Data-driven decision making" is often used as a synonym for analytics. The term emphasizes the purpose, rather than the process and technologies, of analytics. Many analytics initiatives focus on data, tools, and reports. All are necessary inputs into the activity that makes analytics worthwhile: deriving meaning from the data and determining the best actions to take. Data-driven decision making can take many forms. It can be incorporated into existing planning and management activities and processes. It can also be programmed into applications to generate real-time, personalized triggers, alerts, and advice for students, faculty, advisors, and other constituents.
- **Enterprise data management:** An enterprise data management strategy coordinates processes, technologies, and resources related to the increasingly wide variety of data used by institutions. So-called shadow systems often result in multiple data sources and versions that need to be reconciled. Whereas institutions were once able to rely solely on their own internally produced data for strategic decision making (often through enterprise data warehouses), data are now distributed across not only those traditional data sources but also noninstitutional data sources such as social networking systems. Consideration of these hybrid data sources is important in developing a broad institutional data strategy, as is a data governance effort that addresses data quality, security, stewardship, access,

and compliance. New staffing roles and responsibilities may be required to manage this new way of handling data, with greater emphasis on data integration and analysis.

- **Data integration (APIs, etc.):** Data integration is a general approach to complex computing systems that allows information and processing from various independent networked systems to be combined into a single unified service. Application programming interfaces (APIs) provide a standard language, data format, and instruction set so that one software product can link intelligently and interactively to another system. Cloud-based software products and services such as Workday or Amazon provide APIs to, for example, allow students using a campus portal or mobile application to update personal information (held in Workday) or to purchase textbooks (through Amazon) in a single seamless experience that doesn't force the student to log in to multiple software systems or to visit multiple websites.

Trends Related to Teaching and Learning

- **Active-learning classroom design:** Active learning acknowledges that learning entails interaction and engagement—active involvement—with the material. It encompasses a set of techniques and strategies to move from "sage on the stage" slide-and-lecture-focused teaching to pedagogy that engages students in "doing things and thinking about what they are doing."[2] Physical and digital classrooms can enhance or impede active learning, so classroom design needs to consciously acknowledge and focus on creating a supportive environment. The Learning Space Rating System, from the EDUCAUSE Learning Initiative, helps instructional designers and faculty assess and understand how to improve their learning environments so that they facilitate active learning.[3]
- **Flipped classroom:** It sounds so obvious, yet this model of teaching is surprisingly still relatively new. Students with prior exposure to the topic being taught can participate more actively and think more critically in the classroom. The flipped classroom model reverses the learning process, asking students to study material *before* the classroom session so that the class can focus on higher-order engagement with the topics through problem-solving, application of concepts to case studies, etc. This also enables the instructor to better understand and more quickly adapt to students' grasp of and challenges with the material. Technology contributes to this model by providing digital learning tools and environments to facilitate pre-study, including e-books, podcasts, videos, and online community forums.
- **Evaluation of technology-based instructional innovations:** ECAR research on faculty and IT shows that the greatest motivator for faculty to incorporate technology into their teaching is evidence of its benefit to students.[4]

Technology investments are neither easy nor inexpensive, and there are numerous options. Evaluating the pedagogical impact of technology is a useful and responsible way to guide and justify investments in technology-based instruction. In a recent ECAR research bulletin, Chuck Dziuban and Anthony Picciano state, "The increasing impact of instructional technologies will intensify the demand for information about their effectiveness," and they predict increasing use of collaboration and multiple methods of evaluation research.[5]

- **Personalized learning:** Personalization is a concept that attempts to harness today's abundance of data and computational power to identify and analyze individual differences and respond differentially to them. Whether applied to medicine, tastes in entertainment, or learning, personalization is enormously appealing though far from mature, moving beyond simplistic group demographics to individuals. Personalized learning aspires to understand individual students and fit education to each of them to foster success and engagement. Each student has a particular predisposition and background that influences how they learn, what they learn, and how quickly they learn, and of course those qualities interact with the material being learned and the pedagogical techniques used to deliver it. Conceptually, with enough of the "right" data, a learning experience and pathway can be tailored to each student for each subject. The other prerequisites to effective personalized learning include accurate models and learning tools, and opportunities that can deliver effective solutions to each person.

Trends Related to Re-Architecting IT Foundations

- **Moving to the cloud:** Cloud computing is becoming mainstream, with more than 90% of respondents reporting at least a minor influence on IT strategy. For any institution, determining the right mix of cloud and on-premise services is an important decision. A "cloud first" strategy is becoming increasingly common as cloud services offer potentially lower costs and better services, faster deployment, easier upgrades, and immediate scalability. Cloud services may also allow IT professionals to spend less time delivering technology and more time focusing on strategic partnerships with campus functional units. However, moving to the cloud may also necessitate developing new IT roles such as data integration, contract and vendor management, and collaboration with business units—as well as retiring existing roles; therefore, workforce management is an important component of adopting a cloud strategy.
- **Increasing complexity of technology, architecture, and data:** The pace of change in technology continues to increase. As institutions try to keep up, they are finding that the environments they manage are becoming more

and more complex. New technologies need to be incorporated into the environment, older technologies need to be updated, and end users expect it all to work seamlessly. As the IT environment grows, IT complexity grows exponentially.

- **Consolidation/evolution/retirement of historical services into emerging platforms:** Higher education is encumbered by legacy services and applications. Traditional client-server applications have given way to web-based platforms that place much less emphasis on hardware and operating systems and require less storage and memory to operate. Many older, legacy computing systems and services that are traditionally supported on local campus servers can now be replaced by equivalent or better Internet-based services. For example, many universities are replacing their older e-mail list systems, or LISTSERVs, with Microsoft Office 365 Groups, or using Internet-based tools such as Slack or Basecamp to support group collaboration and messaging for both classroom and administrative work groups. These newer systems do not require local server hardware and provide a host of features that can consolidate and replace what once required multiple separate servers and systems.
- **Business process redesign:** Examining and redesigning work processes through business process management can uncover opportunities for greater efficiency, possibly allowing for cost savings or reallocation of resources. For example, business process improvement can decrease the need for customization of enterprise systems and increase alignment between business processes and institutional mission. Because processes tend to span functional unit boundaries, strategies are most successful when they include multiple units at an institution. Business process is more than simply workflow; it encompasses workflow design, systems capabilities, motivation, human resources, policies, rules, funding, and other resources. All should be considered in a business process redesign strategy.
- **Shared services:** Shared services, the provision of a service by one part of an organization or group that had previously been provided by more than one part of the organization, offers an economy of scale that may lead to decreased costs and greater value for the institution. However, attaining that economy of scale can require a large and challenging scope expansion. A shared-services solution differs from centralization in that the former focuses on collaboratively developing business processes and service level agreements that deliver value to the business. Centralization typically emphasizes compliance and control more than service value. Strategies that include leadership engagement, good change management practices, shared governance, and a long-term financial model will lead to greater success in shared services efforts.

- **Changing enterprise system architectures, integrations, and workflows:** Large institutions such as colleges and universities require many enterprise-wide computing systems to support finance, human resources, e-mail, student records, etc. Until recently, universities typically ran those separate software systems on local servers in a university data center. Today, most universities have shifted or are planning to shift to network-based enterprise systems such as Workday or Oracle ERP Cloud. The totality of these large enterprise systems and how they interconnect is called the enterprise system architecture, or ESA, or sometimes just enterprise architecture (EA). Enterprise application integration (EAI) consists of the methods, data standards, and application programming interfaces that enable many different computing systems to effectively share information, to automate data-sharing workflows among computing systems, and to efficiently support task workflows for students, faculty, and staff. The ultimate goal of tight systems integration is to present users with a single interface to accomplish typical tasks rather than force users to interact with many separate computer systems or websites.
- **Service management (ITSM, ITIL):** Common wisdom holds that the three keys to effective IT management are people, process, and technology. The more tangible components of that success formula—people and (particularly) technology—almost invariably receive the most attention. Process has typically received less attention or been ignored entirely. As colleges and universities increasingly expect their IT departments to deliver services and, more important, value, ITSM and ITIL are receiving considerable attention. ITSM stands for IT service management and is the practice of running the IT organization with a focus on delivery of services to constituents in a repeatable, measurable, and proactive way that is aligned with organizational needs. ITIL (information technology infrastructure library) is a framework of service management processes (such as change, incident, and configuration management) to optimize the internal operations of the IT organization. ITIL is a way to operationalize ITSM concepts. Other, complementary processes and frameworks that support ITSM include COBIT (for governance, audit, and compliance), Lean (for continuous improvement), agile (for development), and DevOps (to integrate development and service delivery).
- **Agile approaches to change:** Agile software development calls for adaptive planning, continuous improvement, and rapid and flexible response to change. These concepts can also be applied to change management in general. With the rapid pace of technological advances, the decreasing ability of IT shops to control their users' technology ecosystems, and leadership demands for increased accountability, IT strategies that take an agile approach to change management are critical. The software design

strategies of flexibility and continuous improvement are finding their way into efforts related to strategic planning, desktop management, IT governance, and infrastructure planning. In addition, institutions that are working to develop a culture of innovation may find that agile approaches increase cost-effectiveness.

- **Changing vendor-institution relationships (moving from a transactional relationship to a strategic relationship; bypassing IT to work directly with business-area leaders):** Solution providers' touchpoints and relationships with colleges and universities are getting both broader and deeper. Technology vendors have been selling directly to faculty, staff, and departments for many years, generally complicating matters for IT departments. In the past, however, vendors' products were hardware or software that resided at the institution and created support and licensing challenges (and, most recently, security challenges as well). As cloud-based services and applications proliferate, it is becoming common to move institutional data off site, creating additional risk and expense with data and workflow integrations as well as compliance-related complications. All this can exacerbate what has often been an adversarial relationship between many IT departments and solution providers. A converse trend exists whereby solution providers are increasingly eager for strategic partnerships with institutions as they focus on consulting and on selling services and expertise in addition to the less lucrative hardware and software. The experience of a capable vendor can be enormously useful to an IT leader who is trying to implement analytics for the first time, invest in automated detection and mitigation security tools, adopt a cloud-first strategy, or install a new alumni customer relationship management (CRM) system. But even this trend has a dark side for IT leaders: Many vendors are increasingly bypassing the CIO and working directly with leaders of business areas such as alumni, HR, or student success.
- **DevOps movement to bring development and operations staff together to better manage an end-to-end view of an application or an IT service:** DevOps efforts usually emphasize people over tools, focusing on building a collaborative relationship between development and operations staff to improve efficiency and provide better service. Strategies may include streamlining operations by automating and standardizing repetitive tasks and creating self-service applications. An institutional strategy that considers DevOps can take advantage of past work and save time on testing, potentially freeing resources for other activities. Lack of a current standard definition can create confusion, and the DevOps implementation that works for one institution may not work for another. A strategy that adopts a simplified definition can be a good starting point for developing a common understanding for developers and operations staff.

- **Incorporating open standards into enterprise IT architecture:** It is not efficient to reinvent the means, methods, and planning language needed to get complex computing systems to work together in a seamless way to support business processes. Therefore, most enterprises adopt an existing framework or standard for how complex business workflows, data architectures, and communications standards between systems will work to produce a truly integrated computing environment. For example, The Open Group Architecture Forum framework for enterprise architecture is a widely adopted set of standards, methods, terminology, business workflow descriptions, and tools for standardizing systems-planning language and methods and for avoiding dependence on proprietary vendor solutions ("vendor lock-in").

Trends Related to Security and Risk

- **Incorporating risk-management approaches into IT strategy and service delivery:** "Risk management" is a term used to describe complex activities whereby an organization identifies and assesses its risks and then creates a plan for addressing those risks. The major outcome of most traditional risk-management processes is the identification of risks to IT assets and data according to a matrix based on likelihood and impact (e.g., low, medium, and high) and development of a plan for addressing those risks in a way that makes sense for the underlying organization. A 2014 ECAR study found that 81% of institutions do not consider IT risk in their institution's strategic plan.[6] Yet, risk management is a detailed, thoughtful process that can also help institutions identify, analyze, and prioritize the risks that may impact their ability to meet strategic goals. As IT strategy and service delivery models evolve beyond traditional offerings, addressing IT risk more strategically involves focusing on IT's impact on the achievement of institutional goals rather than on the simple identification of risks related to physical inventories of assets in isolation.[7]
- **Approaching security from a device perspective instead of an enterprise system perspective:** A 2013 ECAR study on the consumerization of technology found that extending enterprise systems for mobile access was an essential or high priority for over half of the institutions surveyed.[8] The growth in user-provisioned technologies has continued since 2013, and in the 2015 ECAR study of students and information technology, smartphone ownership among students exceeded laptop ownership for the first time.[9] Approaching security from a device perspective means accounting for the explosion of mobile device use on campus and adopting campus information security policies and procedures for that explosion. As users bring personally owned devices on campus and use those devices to access

all manner of institutional services and data, campus information security policies will need to adopt technology- and device-agnostic approaches that focus on protecting institutional data, no matter how those data are accessed.

Trends Related to IT Consumerization

- **Mobile device diversity (tablets and smartphones from various manufacturers):** An increasing user appetite for mobile devices accompanies the ubiquity of social media and the increase in personal cloud use. Given that many mobile devices are personally owned, the institution has very little say in what hardware or software users purchase, complicating the support that IT departments can provide. End users rely increasingly on their personal clouds for storage, and the line between personal and institutional computing is blurring. In addition, comprehensive testing across this diversity of devices is impossible, yet end users expect mobile-friendly form factors that work across all devices for websites, applications, and publications. Finally, IT strategies need to consider a variety of security and risk-management issues that include growing instances of intrusions and loss, inadequate security and credentialing for data storage, and exposure risks for personal and institutional financial information.
- **Growing ubiquity of social media:** With widespread adoption of cell phones and other mobile devices, combined with increased use of social media, students and faculty alike come to campus as members of their own preexisting social media communities. The growing ubiquity of social media is changing communication patterns and expectations, and end users are accustomed to instant information that is directly relevant to the individual. Institutions can take advantage of this trend by considering how social media differ from traditional media—for example, in their immediacy, usability, and reach—and by building media, communications, alumni, institutional advancement, and other strategies with those characteristics in mind. Strategies should also address privacy concerns and the potential for teaching and learning applications.
- **Increasing adoption of personal clouds:** Just as social media are increasingly important to end users, so is the use of personal clouds for end-user data storage, content sharing, and synchronization. Users expect seamless access to their files and data from any device, anywhere, anytime. Often these are institutional data, raising issues of security, compliance, data recovery, preservation, and privacy. It is becoming increasingly difficult to mandate the use of institutional storage space, and institutional

strategy needs to consider data issues related to personal clouds, training to help users understand their responsibilities, and appropriate support strategies.

- **Teleworking for faculty, staff, and IT staff:** The search for talent is heating up as lower unemployment increases competition to find and engage the most capable professionals. Quality of life is becoming more important to all generations. The option to work at least some of the time from home can be a strong incentive, helping attract and retain the best talent. Technology has reduced many barriers: Better connectivity and easier access to institutional resources make it possible for individuals in some roles to be just as productive at home (wherever that may be) as on campus.
- **Reduced reliance on service desk as the primary model for support (includes shift to self-help, automated provisioning, BYO support, etc.):** Knowledge management and automation are enabling IT organizations to provide alternatives to supplement the traditional call or walk-in center model of service desk support. This helps offload growing demand for IT support, as faculty, staff, and students increasingly want to access institutional resources from their personal devices and environments. Support staff are challenged to keep up with all the complexities of supporting so much variety. Web- or app-based self-help is also an efficient way to supplement the hours of the help desk to provide institutional communities with support 24/7.

Trends Related to Devices

- **Internet of Things:** The number of computers and servers connected to the Internet is being dwarfed by the number of other physical objects with embedded Internet-capable technology. Gartner estimates that the IoT will encompass more than 20 billion devices by 2020, a fourfold increase from 2015.[10] Two-thirds of those devices will be consumer-level devices. This enormous change will increase bandwidth needs, contribute to privacy and security challenges, introduce new computation needs, and potentially provide enormous opportunities for institutions. Perhaps the most obvious opportunities initially will be in automating and enhancing infrastructure management. But wearables and other person-based devices offer the potential for learning more about people's behavior, particularly if they begin to automatically interact with institutional applications. Considerable opportunities may present themselves for researchers, particularly in biomedicine and social sciences. No "killer thing" has surfaced for teaching and learning. Yet.

- **Access for all kinds of endpoints and objects, including RFID- and GPS-based devices:** Internet connectivity is already built in to many mobile devices, most notably cell phones and tablets. The Internet of Things is bringing even more embedded computing devices to our networks, including RFID- and GPS-based devices, with implications for data management strategies that will be needed to handle the increased volume of data from a complex mix of disparate devices. Not only do institutions need to consider data management and integration strategies, but they also need to ensure that their networks and their service desks are adequately provisioned to support this large variety of devices and that their information security policies and practices evolve to reflect this increase in volume and types of data.

Other Trends

- **Green technology/sustainability:** Green, sustainable technology strategies may call for standards for computer power usage, changes to power and HVAC systems in data centers, or even the development of a cloud-first strategy to decrease data center use. These strategies may be driven both by the need to decrease costs and by the desire to be good environmental stewards.
- **Unbundling (of data and content from applications, of content from courses, of faculty roles, etc.):** Unbundling is a trend of our age as alternatives emerge to traditional structures for delivery of publications, entertainment, education, healthcare, retail items, and more. Unbundling has implications for education models (micro-courses, competencies, custom courses and degrees), analytics (models developed from multiple data sources), academic roles (potential faculty futures with separate teaching and advising tracks), and the educational life cycle as students move in and out of and among institutions, other education delivery providers, and experiences that develop new skills and competencies.

Findings

Trends are different from established practices. Trend is defined as "a general direction in which something is developing or changing."[11] Our data show that, in accordance with the definition, few institutions have *already* incorporated even the most widespread trends into their institutional practices. Only five trends approach the status of being an established practice; the following trends are incorporated at more than 15% of institutions:

- Moving to the cloud (25% of institutions)
- Mobile device diversity (tablets and smartphones from various manufacturers) (20%)
- Shared services (17%)
- Flipped classroom (17%)
- Consolidation/evolution/retirement of historical services into emerging platforms (16%)

We were interested in what is going to happen with these trends, as well as what is in place today. So to analyze the developing influence of the trends, we characterized a trend as "influential" if it was already incorporated into IT strategy or exerting a major influence over emerging IT strategy. We used that characterization to classify the trends into four levels of influence.

- **Most influential:** Trends that were already incorporated or exerting a major influence on emerging IT strategy in 61% or more of institutions
- **Taking hold:** Already incorporated or exerting a major influence on emerging IT strategy in 41–60% of institutions
- **Worth understanding:** Already incorporated or exerting a major influence on emerging IT strategy in 21–40% of institutions
- **Limited impact:** Already incorporated or exerting a major influence on emerging IT strategy in 20% or less of institutions

The influence of the trends ranged widely (see figure 1). Moving to the cloud is influencing the greatest proportion of institutions. It is already incorporated or exerting a major influence in three out of four (76%) of institutions. At the lowest level of influence, two trends are a major influence on or already incorporated into IT strategy at barely more than 1 in 10 institutions:

- Access for all kinds of endpoints and objects, including RFID- and GPS-based devices (important at 12% of institutions)
- Unbundling (of data and content from applications, of content from courses, of faculty roles, etc.) (important at 11% of institutions)

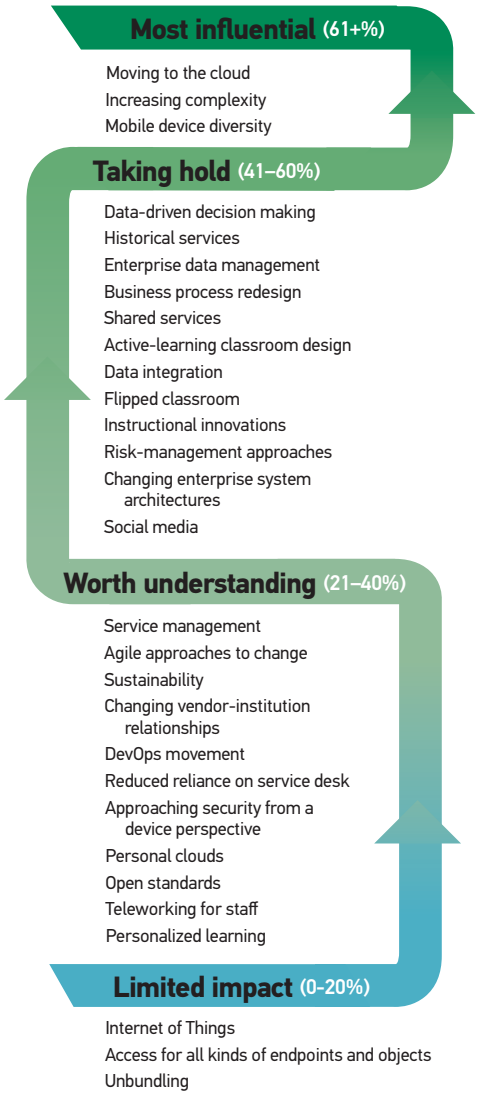

Figure 1. Trends and their influence on IT strategy: All institutions

Every trend is exerting some level of influence, if only a minor one, over most institutions' emerging IT strategy. We also calculated the percentage of institutions reporting that a trend had no influence at all over their IT strategy. The five trends that institutions most frequently reported having *no influence at all* are:

- Access for all kinds of endpoints and objects, including RFID- and GPS-based devices (not influencing IT strategy at all at 26% of institutions)
- DevOps movement to bring development and operations staff together to better manage an end-to-end view of an application or IT service (20%)
- Internet of Things (20%)

- Teleworking for faculty, staff, and IT staff (20%)
- Unbundling (of data and content from applications, of content from courses, of faculty roles, etc.) (19%)

As mentioned on page 5, we classified the trends into six major categories. (Refer to pages 5–14 to see which trends were classified into each category.) The trends related to analytics and data are exerting the most influence at institutions, and device-related trends have the least impact (see figure 2).

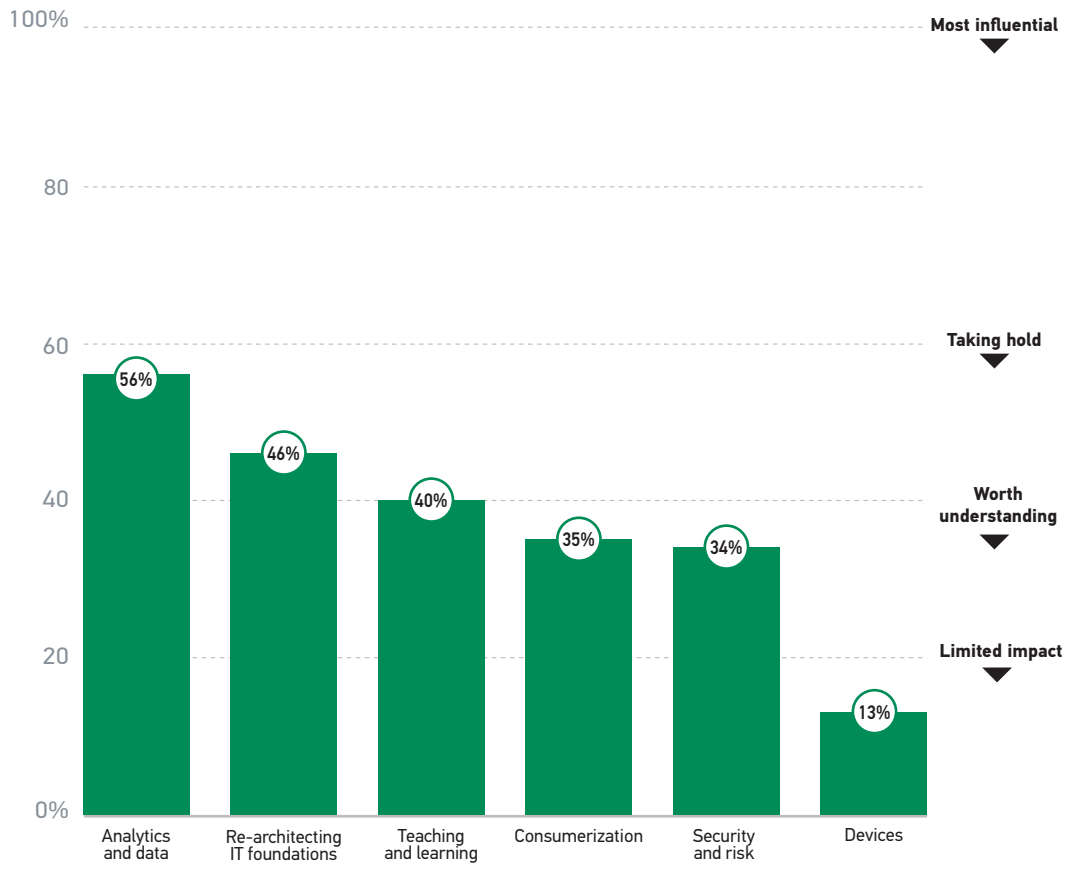

Figure 2. Average influence of trends within each category

Institutional Differences

We found institutional differences, as measured by Carnegie Classification, institutional size, or approach to technology adoption (early, mainstream, or late adopters), in the influence of most of the trends.[12]

The influence of a few of the trends varies with Carnegie Classification (seven trends) or institutional size (four trends) (see figures 3–13). Both agile approaches to change and service management vary by both institutional size and Carnegie Classification. Agile approaches to change is of *limited impact* at private master's institutions and institutions with 2,000–3,999 FTEs; *worth understanding* at associate's, bachelor's, and public doctoral institutions and institutions with fewer than 2,000 or 4,000–7,999 FTEs; and *taking hold* at public master's and private doctoral institutions and institutions with more than 8,000 FTEs. The influence of service management increases with institutional size. It is one of the *most influential* trends at the largest institutions (15,000+ FTEs) but only of *limited impact* at the smallest institutions (fewer than 2,000 FTEs). Service management has the most influence at public master's and all doctoral institutions, where it is *taking hold.*

DevOps is of *limited impact* only at institutions with 2,000–3,999 FTEs. DevOps is *worth understanding* at all other institutional types. The influence of increasing complexity rises with institutional size—it is *taking hold* at institutions with fewer than 4,000 FTEs and *most influential* at institutions with 8,000 FTEs or more.

Access for all kinds of endpoints is *worth understanding* at public master's and private doctoral institutions but has *limited impact* at other types of institutions. Approaching security from a device perspective has *limited impact* at associate's institutions but is *worth understanding* at other types of institutions. Increasing adoption of personal clouds is *taking hold* in public master's institutions; *worth understanding* in associate's, bachelor's, and private doctoral institutions; and of *limited impact* in private master's and public doctoral institutions. Open standards is having *limited impact* at associate's and private master's institutions but is *worth understanding* at other types of institutions. Risk management approaches are *worth understanding* at associate's and private master's institutions; *taking hold* at bachelor's, public master's, and public doctoral institutions; and *most influential* at private doctoral institutions.

Trends by Institution Size

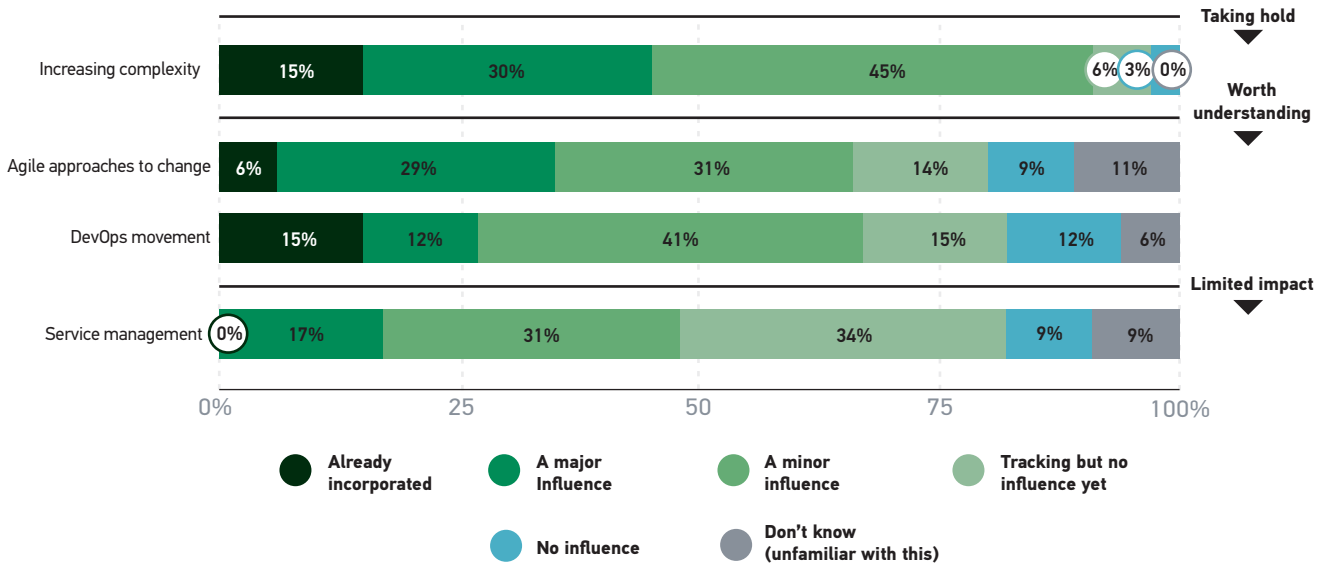

Figure 3. Trends and their influence on IT strategy: <2,000 FTEs

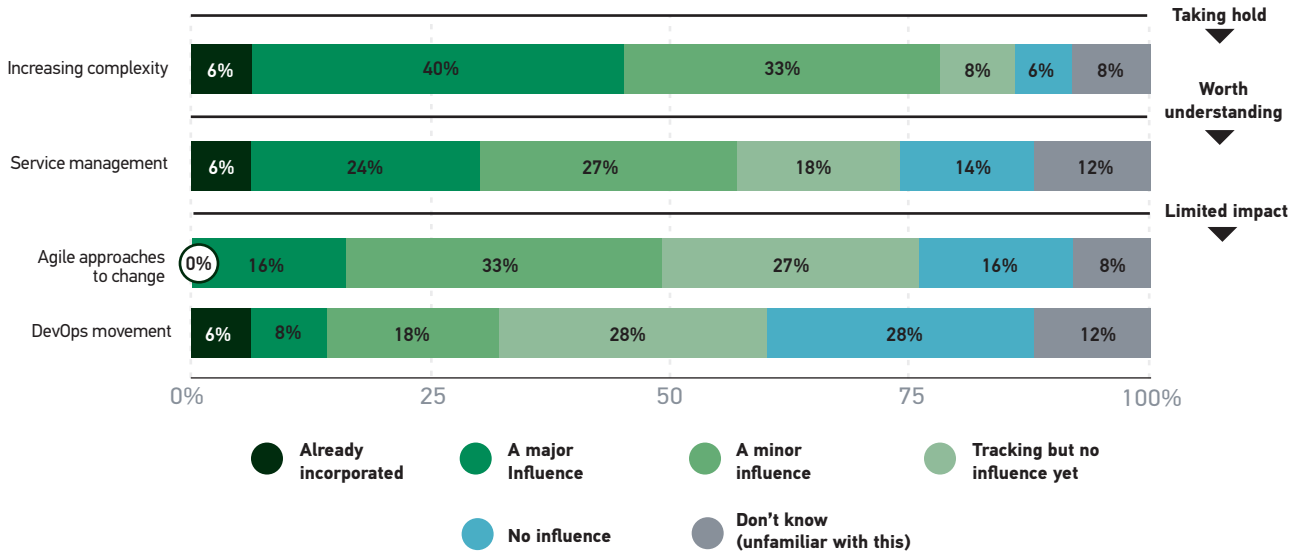

Figure 4. Trends and their influence on IT strategy: 2,000–3,999 FTEs

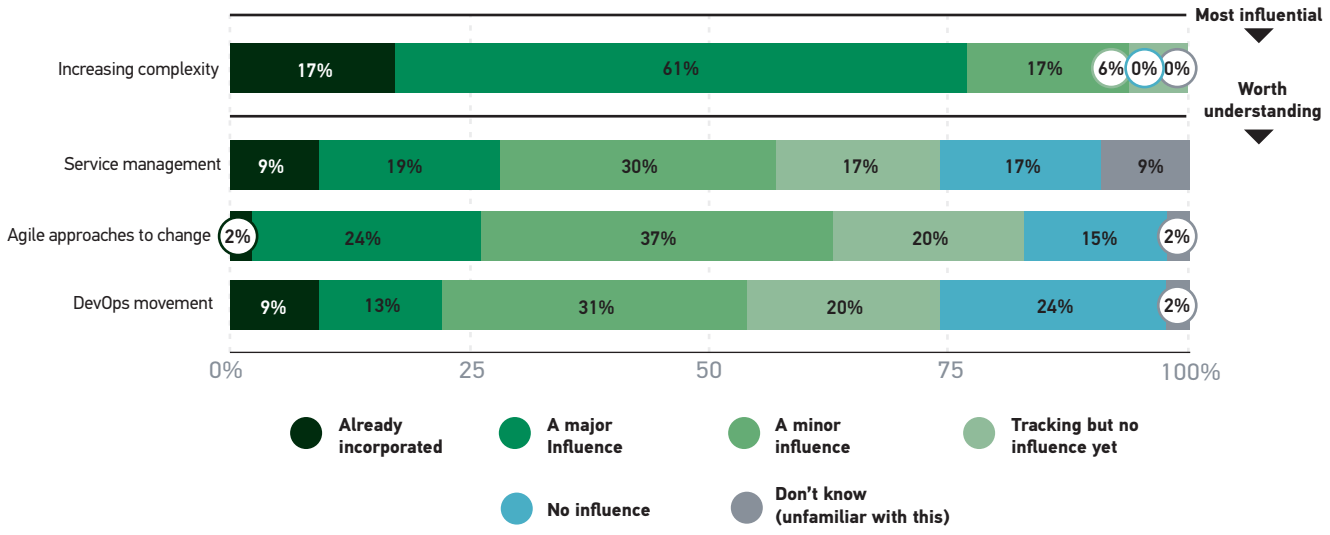

Figure 5. Trends and their influence on IT strategy: 4,000–7,999 FTEs

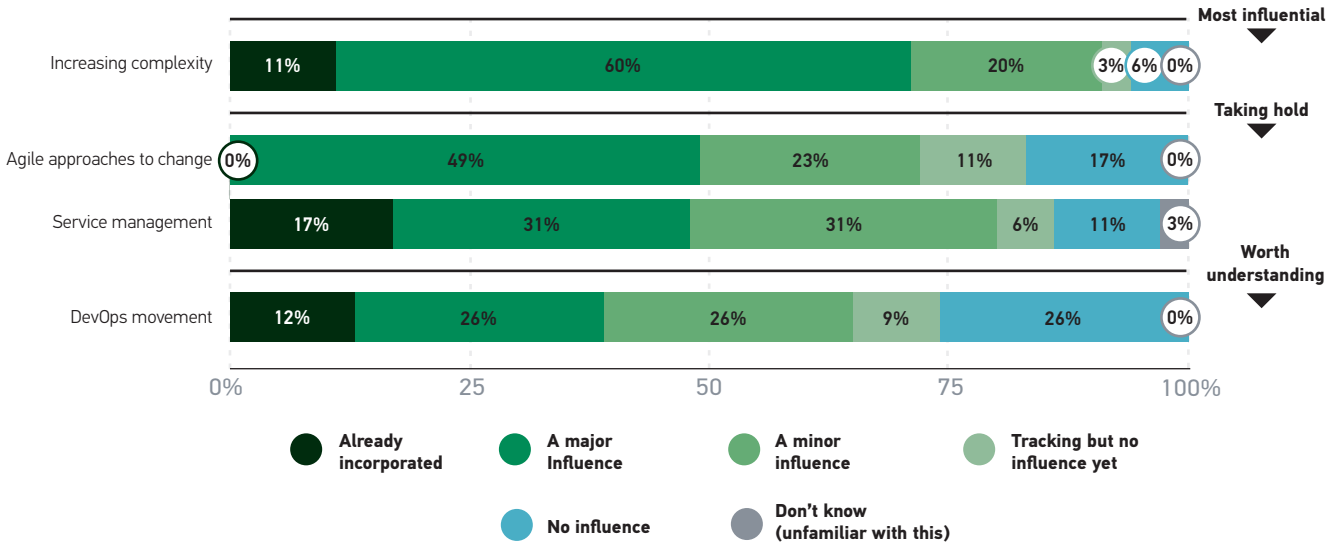

Figure 6. Trends and their influence on IT strategy: 8,000–14,999 FTEs

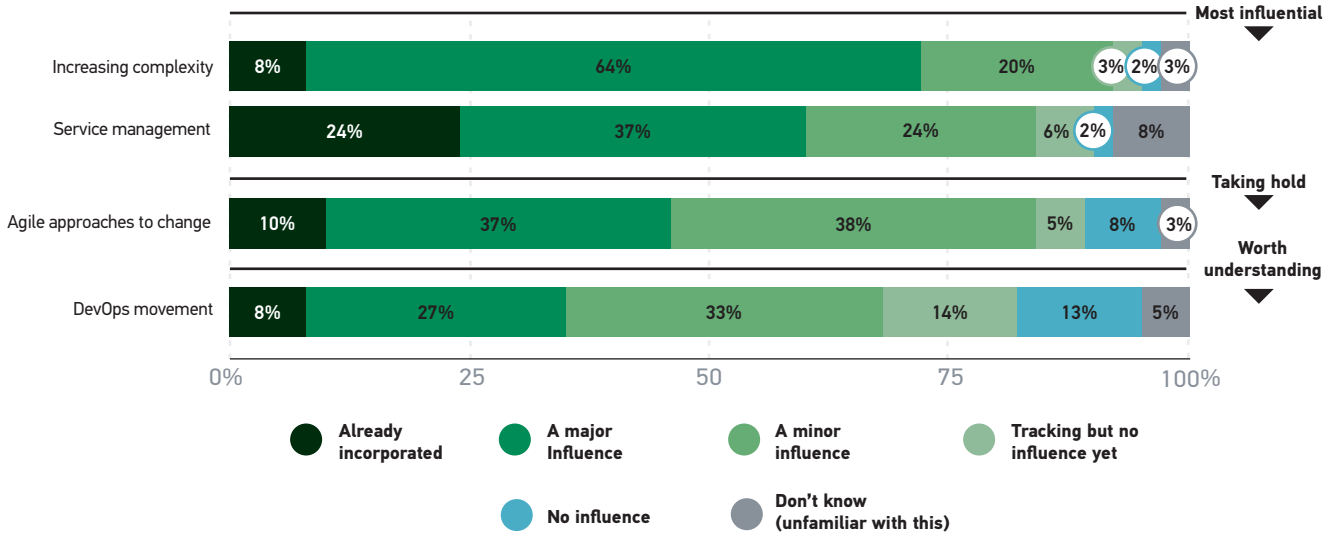

Figure 7. Trends and their influence on IT strategy: 15,000+ FTEs

Trends by Carnegie Class

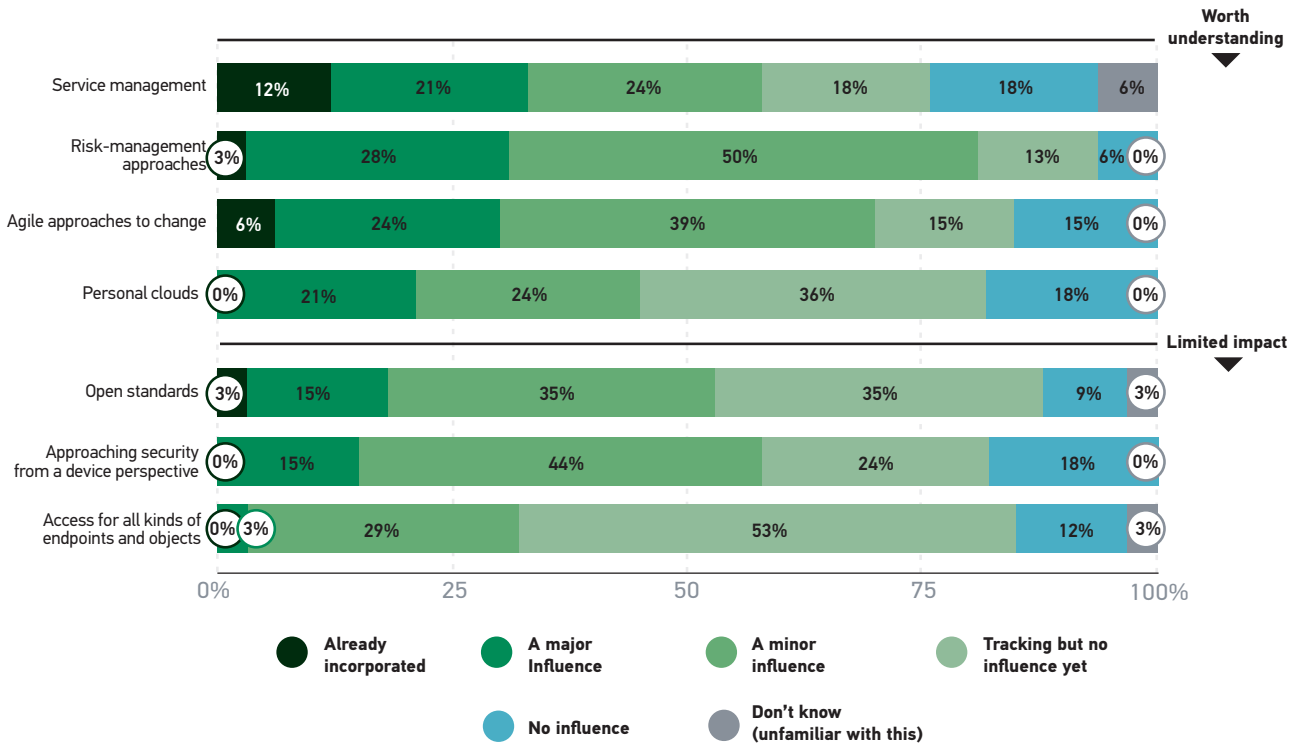

Figure 8. Trends and their influence on IT strategy: AA

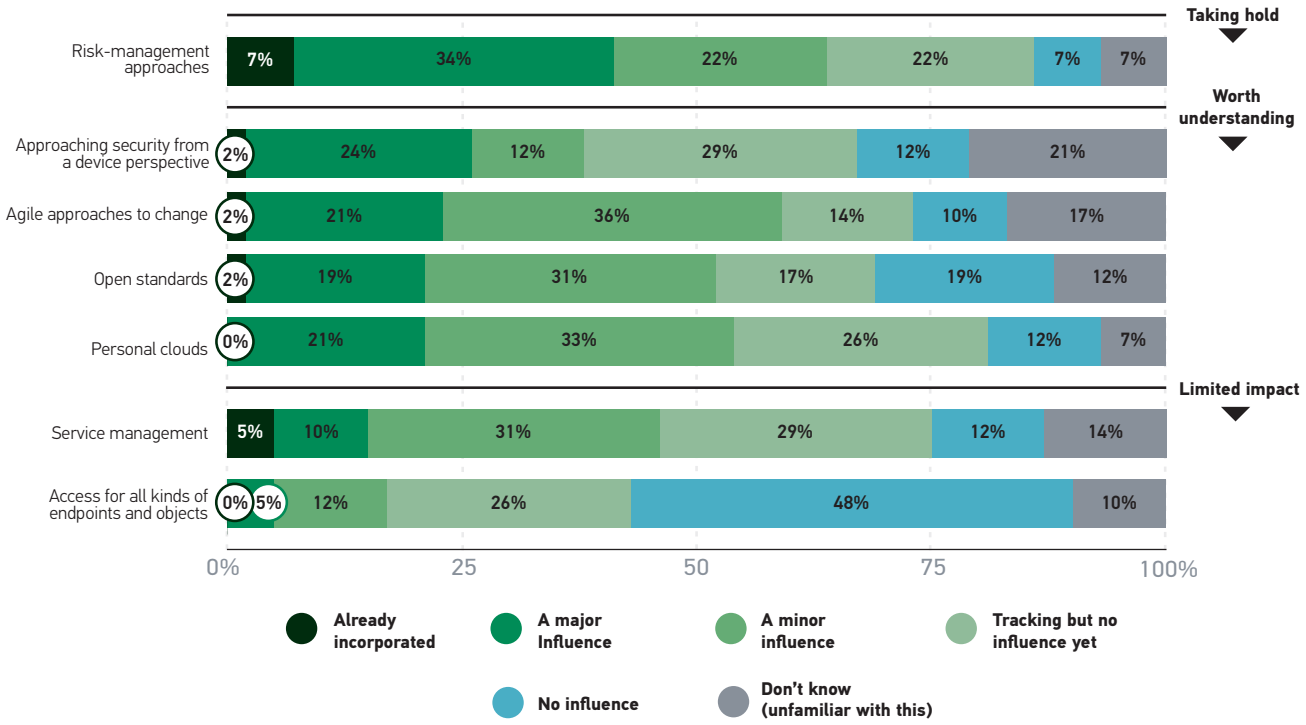

Figure 9. Trends and their influence on IT strategy: BA

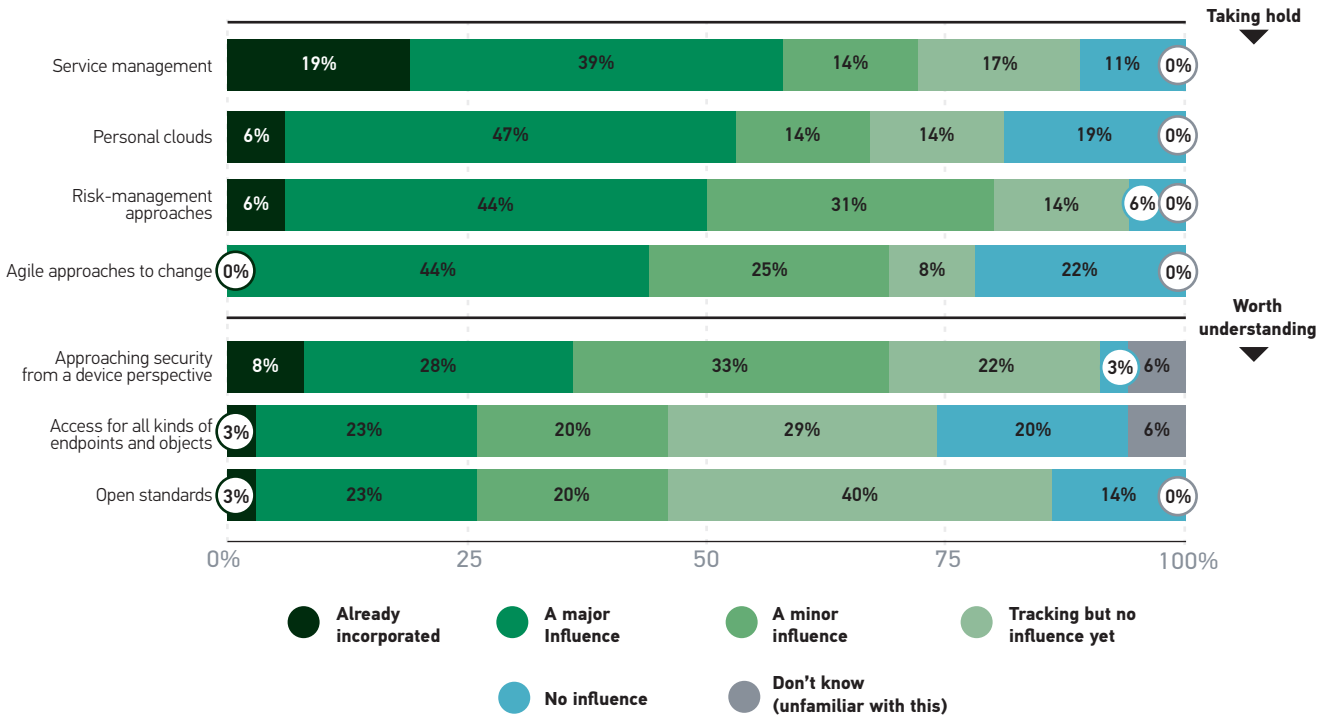

Figure 10. Trends and their influence on IT strategy: Public MA

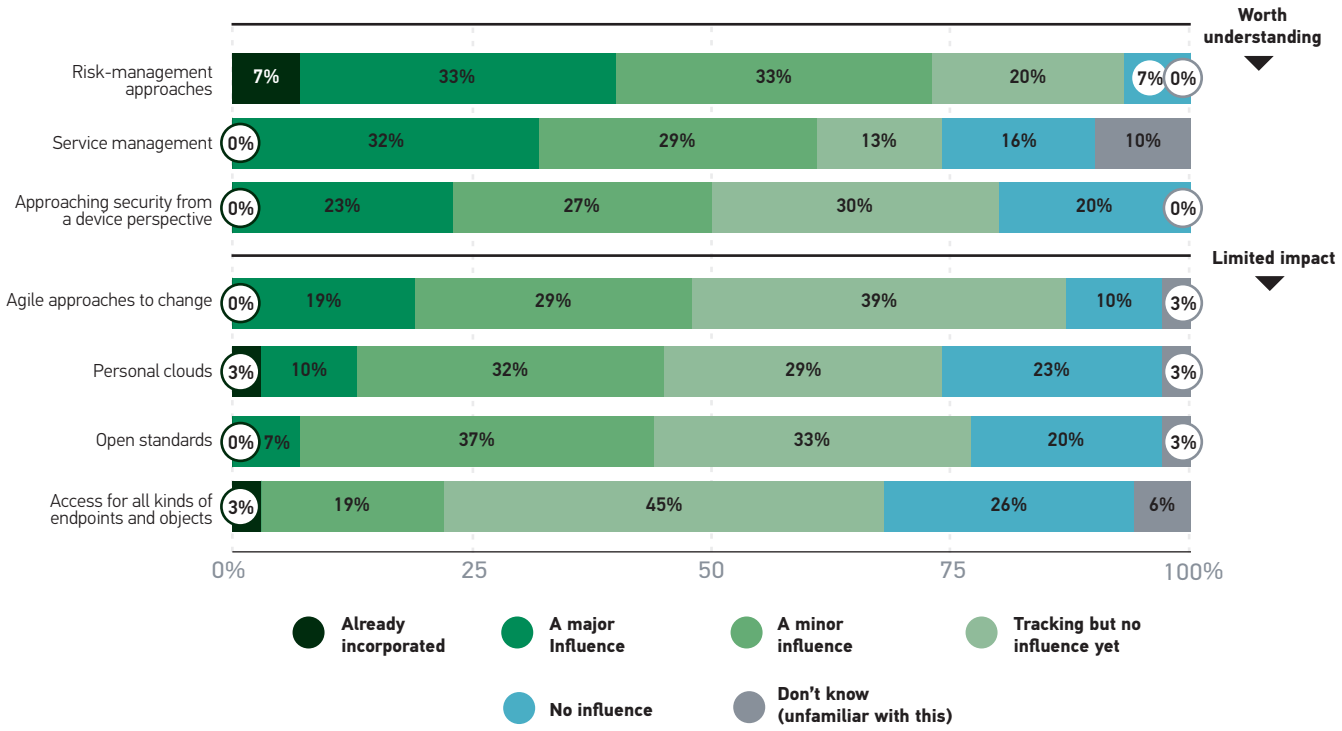

Figure 11. Trends and their influence on IT strategy: Private MA

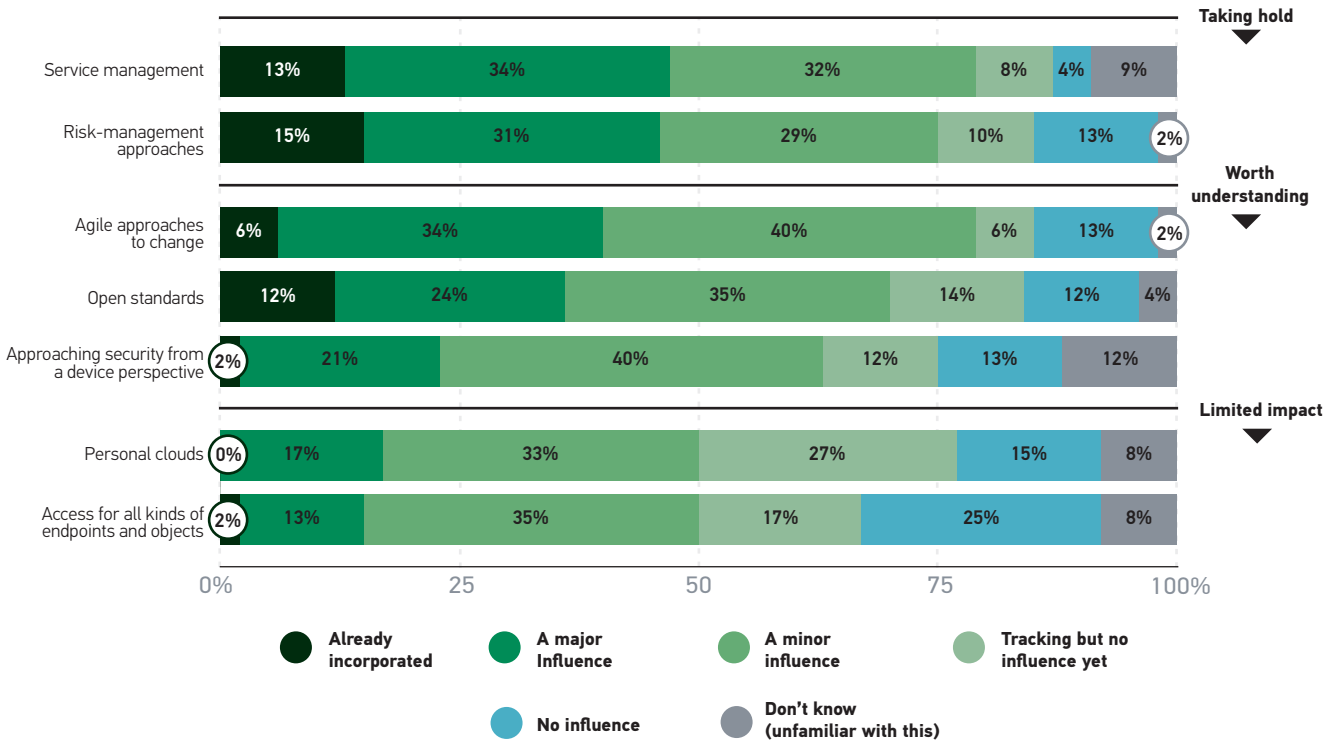

Figure 12. Trends and their influence on IT strategy: Public DR

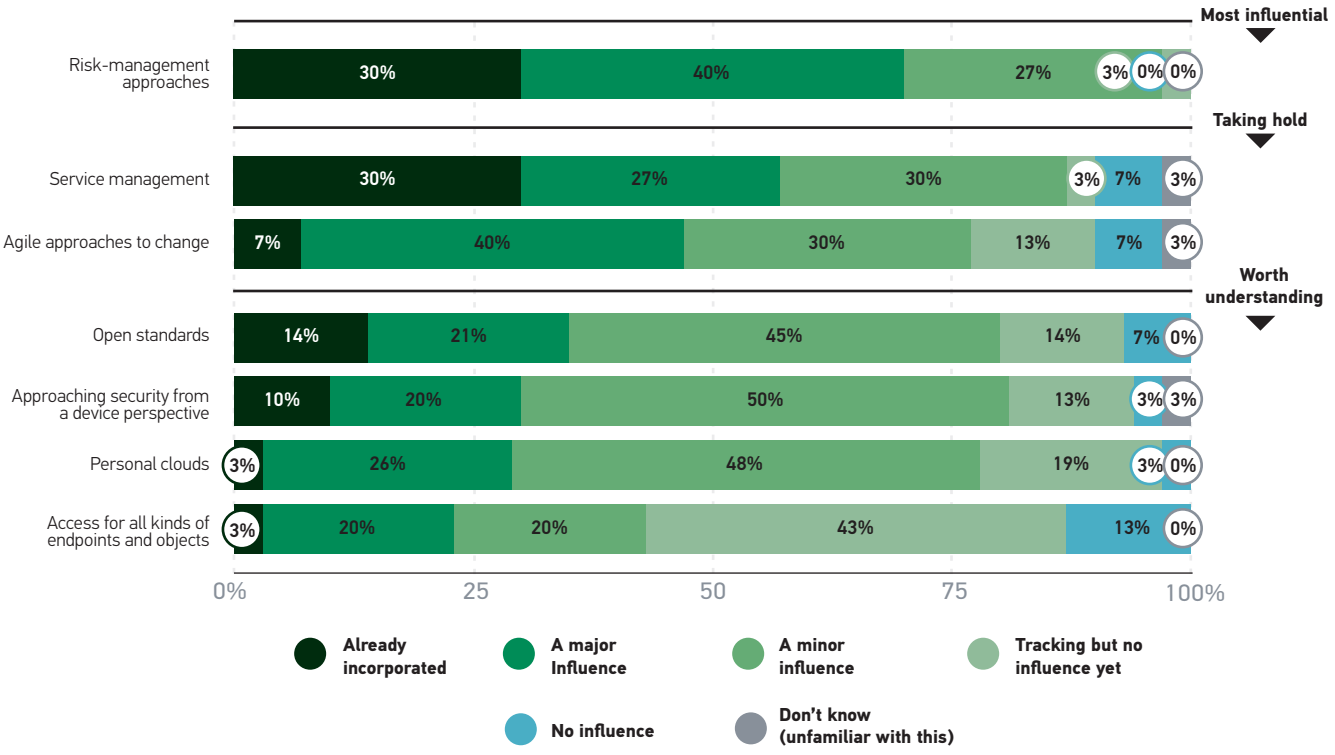

Figure 13. Trends and their influence on IT strategy: Private DR

Pace of Technology Adoption as a Differentiator

Although we did find quite a few differences related to Carnegie Classification or institutional size, an institution's approach to technology adoption is even more strongly related to differences in the trends' influence on institutional strategy. Some institutions adopt technology early, some late, and some are mainstream adopters. This range of approaches to technology adoption is found in all kinds of institutions, large and small, public and private, community colleges and doctoral universities (see figures 14 and 15).

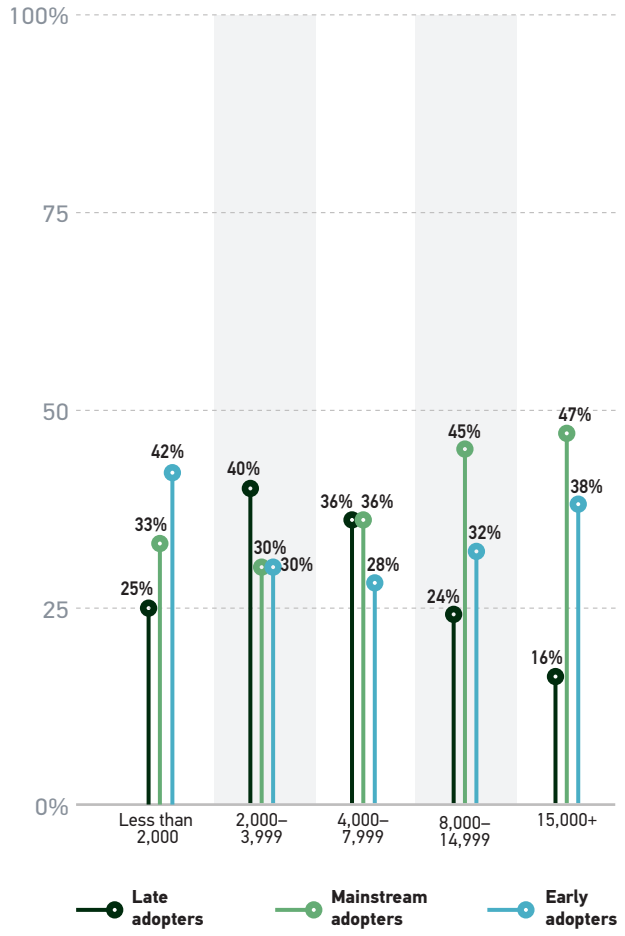

Figure 14. Approach to technology, by institutional size

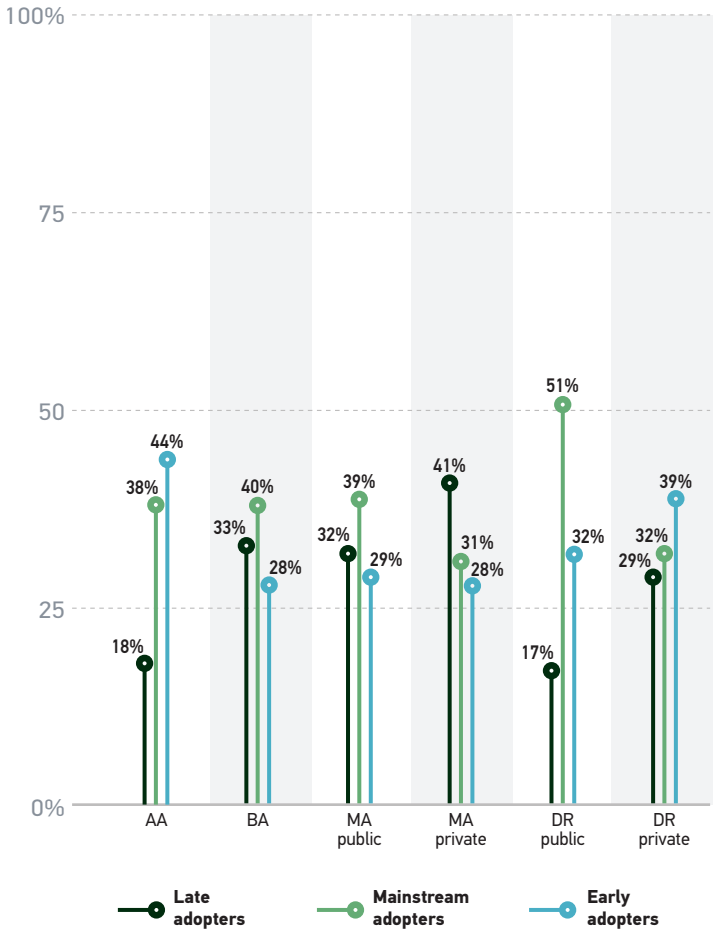

Figure 15. Approach to technology, by institutional type

The influence of more than half of the trends (18 of 29) differs depending on whether an institution is an early adopter (34% of institutions), a mainstream adopter (39%), or a late adopter (27%) (see figure 16).

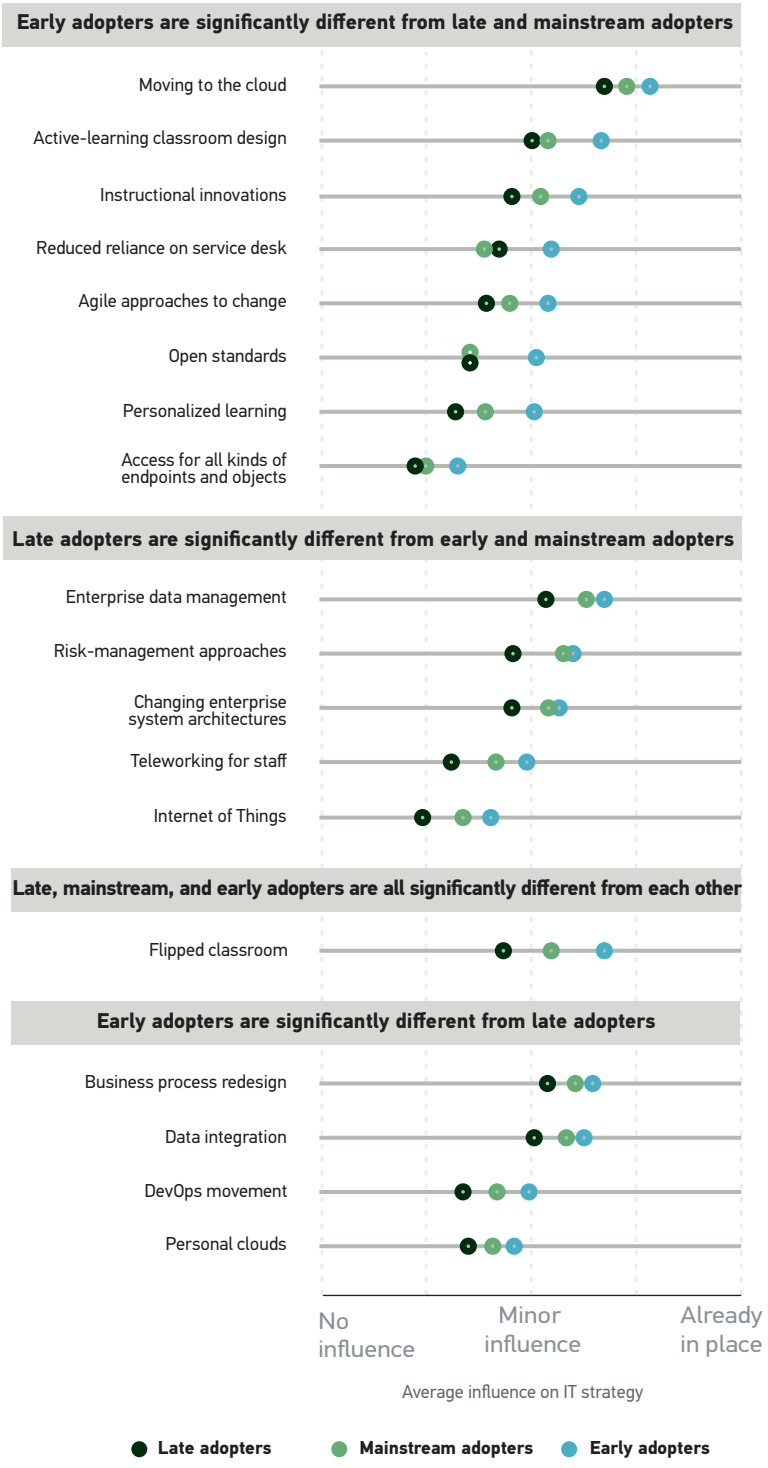

Figure 16. Influence of approach to technology adoption on IT trends

In some cases, early adopters are significantly *more* influenced by trends than mainstream or late adopters:

- Access for all kinds of endpoints and objects
- Active-learning classroom design
- Agile approaches to change
- Evaluation of technology-based instructional innovations
- Incorporating open standards into enterprise IT architecture
- Moving to the cloud
- Personalized learning
- Reduced reliance on service desk

In some cases, late adopters are significantly *less* influenced by trends than mainstream or early adopters:

- Changing enterprise system architectures
- Enterprise data management
- Internet of Things
- Risk-management approaches
- Teleworking for faculty, staff, and IT staff

Four trends are significantly more influential among early adopters than late adopters. Mainstream adopters are not clearly differentiated from either group, however.

- Business process redesign
- Data integration
- DevOps movement
- Increasing adoption of personal clouds

One educational trend—flipped classroom—differs significantly across all three groups: 62% of early adopters, 42% of mainstream adopters, and 31% of late adopters have already incorporated flipped classroom into their IT strategy or report that it is exerting a major influence.

Among early adopters, the following trends were all *most influential* (see figure 17):

- Active-learning classroom design
- Business process redesign
- Consolidation/evolution/retirement of historical services into emerging platforms
- Data-driven decision making
- Enterprise data management
- Increasing complexity of technology, architecture, data
- Mobile device diversity
- Moving to the cloud
- Shared services

Only two trends, unbundling and access for all kinds of endpoints and objects, had *limited impact*.

For late adopters, only moving to the cloud was *most influential*, and eight trends—approaching security from a device perspective; DevOps; incorporating open standards into enterprise IT architecture; personalized learning; teleworking for faculty, staff, and IT staff; Internet of Things; unbundling (of data and content from applications, of content from courses, of faculty roles, etc.); and access for all kinds of endpoints and objects—were of *limited impact* (see figure 19).

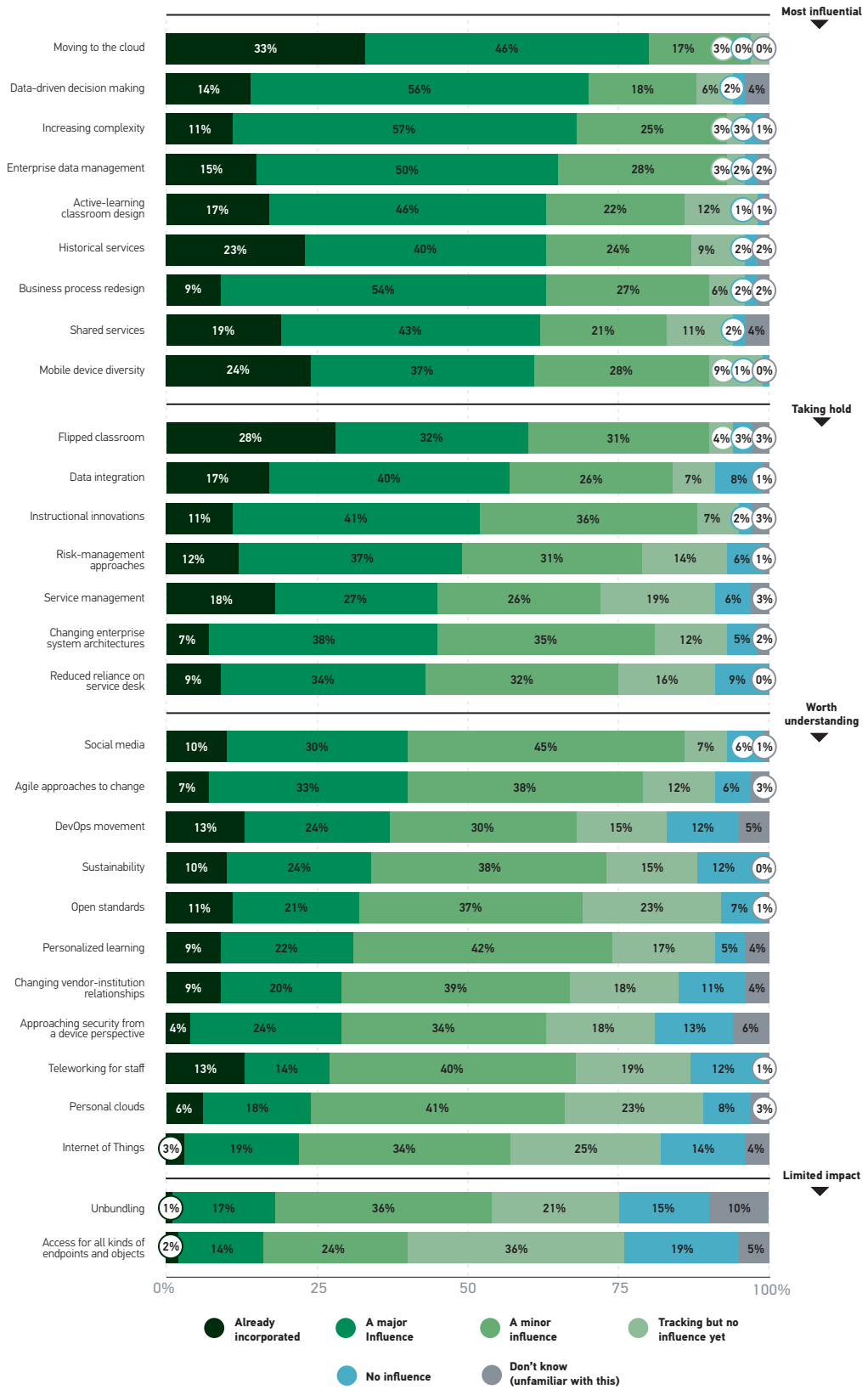

Figure 17. Trends and their influence on IT strategy: Early adopters

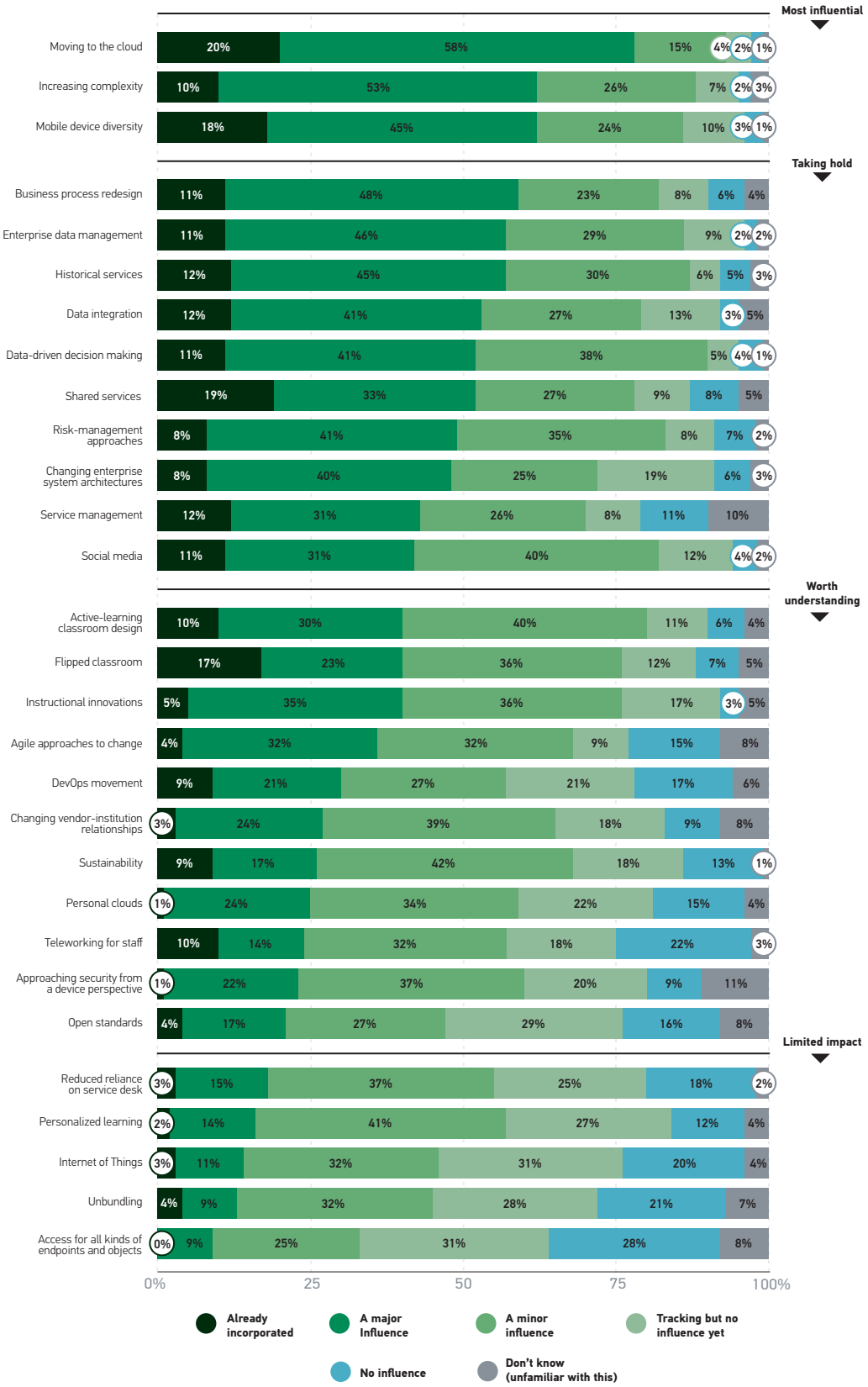

Figure 18. Trends and their influence on IT strategy: Mainstream adopters

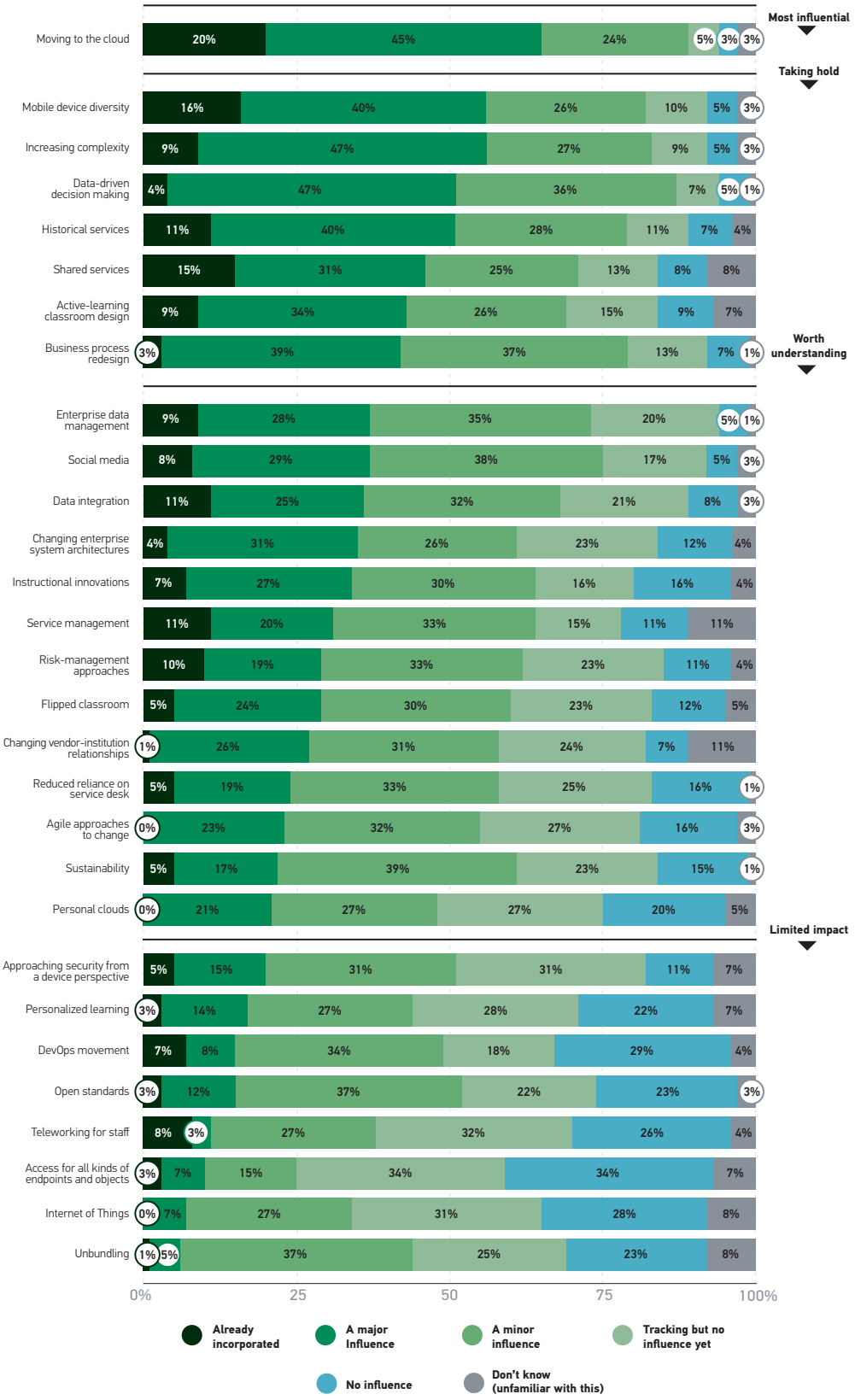

Figure 19. Trends and their influence on IT strategy: Late adopters

Conclusions and Advice

Change is hitting higher education from many directions. Many IT and institutional leaders are likely to feel overwhelmed, particularly those at small, resource-challenged institutions whose preferred approach to technology adoption is cautious and measured.

These trends are interrelated and interdependent. Strengthening an institution's technology and data foundations sooner can facilitate better, faster, and less expensive incorporation of the trends students and faculty are more likely to desire and notice. Analytics requires managed and integrated data, which are unlikely to be found within legacy architectures. Personalized learning and the ability to evaluate technology-based instructional innovations also require integrated systems and, often, analytics. Students, faculty, and staff want to work, study, and access institutional resources anytime, anywhere, from any device or platform. Meeting such expectations requires strong networks and excellent security.

In particular, the trends related to restructuring technologies, data, and IT services are foundational investments all institutions should consider addressing. At the very least, IT leaders should be highly literate in the potential value, challenges, resource requirements, and cultural disruption that will likely be associated with addressing legacy complexities with contemporary system and data architectures, processes, methodologies, and service delivery. These changes are still high risk as well as high reward. And yet the choice is increasingly looking like fire versus frying pan.

Find mentors and partners. An intrepid, lucky, and experienced few will be able to lead the changes under way; the rest of our institutions will be well advised to seek out mentors who are further along and partners who can collaborate.

Too often, however, foundational investments drag on, disheartening and distracting IT staff and the institutional community. Consider which visible trends are most highly valued by your constituents, and be sure to incorporate at least one or two into your IT strategy and investments. Progress in the most exciting areas can increase resolve to stay the course with infrastructure and process changes. But choose the high-value investments carefully to avoid moving too soon in an area the infrastructure and services are not yet prepared for.

Trends influence and motivate change, but people implement it. Even the best-resourced strategy and the most-committed leadership will be stymied by an unprepared and disaffected staff. Ensure that the IT workforce (and the people in affected business units) feels engaged in change, supported, and capable. Make workforce engagement the responsibility of supervisors and leaders and not the "problem" of the workforce itself.

Finally, IT worries these days begin and end with information security. Consider the security implications of each of these trends, and identify and manage associated risks. Information security ("Developing a holistic, agile approach to information security to create a secure network, develop security policies, and reduce institutional exposure to information security threats") is the number one IT issue EDUCAUSE has identified for 2016.[13] In particular, institutions should ensure that the institutional community is well trained and informed, that next-generation security technologies that can respond to evolving threats are in place or planned, and that the institution has an information security strategy to which institutional leadership is strongly committed.[14]

Notes

1. A total of 338 individuals responded to the survey. Multiple responses from an institution were removed for analysis.

2. Charles C. Bonwell and James A. Eison, "Active Learning; Creating Excitement in the Classroom," *ASHE-ERIC Higher Education Report No. 1.* 1991 (Washington, DC: The George Washington University, School of Education and Human Development).

3. Malcolm Brown, "Seven Principles for Classroom Design: The Learning Space Rating System," *EDUCAUSE Review,* February 22, 2015.

4. Eden Dahlstrom and D. Christopher Brooks, with a foreword by Diana Oblinger, *ECAR Study of Faculty and Information Technology, 2014,* research report (Louisville, CO: ECAR, July 2014); and D. Christopher Brooks, with a foreword by John O'Brien, *ECAR Study of Faculty and Information Technology, 2015,* research report (Louisville, CO: ECAR, October 2015).

5. Charles Dziuban and Anthony G. Picciano, *The Evolution Continues: Considerations for the Future of Research in Online and Blended Learning,* research bulletin (Louisville, CO: ECAR, June 16, 2015).

6. Jacqueline Bichsel and Patrick Feehan, *Getting Your Ducks in a Row: IT Governance, Risk, and Compliance Programs in Higher Education,* research report (Louisville, CO: ECAR, June 2014).

7. The EDUCAUSE IT GRC Program has created an IT Risk Register for institutional IT departments to use to get their strategic IT risk-management programs off the ground. The IT Risk Register is a sortable checklist that lists common strategic IT risks and catalogs those risks according to common risk types and IT domains.

8. Eden Dahlstrom and Stephen diFilipo, with a foreword by Mark Askren, *The Consumerization of Technology and the Bring-Your-Own-Everything (BYOE) Era of Higher Education,* research report (Louisville, CO: ECAR, March 2013).

9. Eden Dahlstrom, with D. Christopher Brooks, Susan Grajek, and Jamie Reeves, *ECAR Study of Undergraduate Students and Information Technology, 2015,* research report (Louisville, CO: ECAR, December 2015).

10. "Gartner Says 6.4 Billion Connected 'Things' Will Be in Use in 2016, Up 30 Percent From 2015," press release, November 10, 2015.

11. See "trend" at Oxford Dictionaries.

12. The other trends exerted similar levels of influence at all institutional types: moving to the cloud; increasing complexity of technology, architecture, and data; mobile device diversity; consolidation/evolution/retirement of historical services into emerging platforms; business process redesign; shared services; data integration (APIs, etc.); changing enterprise system architectures, integrations, and workflows; growing ubiquity of social media; green technology/sustainability; changing vendor-institution relationships; approaching security from a device perspective instead of an enterprise system perspective; and unbundling.

13. See the EDUCAUSE Top 10 IT Issues page.

14. These are 2016's top three strategic information security issues, as identified by the Higher Education Information Security Council (HEISC); see Joanna Lyn Grama and Valerie Vogel, "The 2016 Top 3 Strategic Information Security Issues," *EDUCAUSE Review,* January 11, 2106.