

2015

APPA THOUGHT LEADERS SERIES

FACILITIES & TECHNOLOGY: THE TRANSFORMATION OF “CAMPUS”

PART 2

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Section II:

Using technology to enhance critical campus functions

Although we think of the campus as a single unit, in fact, it is a composite of many people, spaces, and functions. Part of the challenge of understanding the campus as a whole is that each of these component parts is changing at its own pace. Some campus functions are leaping into the future and embracing technological innovation; others lag behind, held back by technical challenges, daunting costs, or simple discomfort with change.

For the new campus to achieve its potential, disparate campus functions must pull together, confront the challenge of change, and use technology to its fullest potential. For many campus functions, that approach will mean diving into big data. The theme of big data runs through discussions of technological advances across colleges and universities; in almost every campus function discussed subsequently, progress will require the integration and analysis of data stores.

The exciting news is that success in one function can build on the success of another function. Progress stops being linear and starts making exponential leaps. The collective impact of progress in these areas will be greater than the sum of its parts.

The following campus functions each include a description of the Role of Technology Today; a section on the Potential for Technology in the Future; and a set of Questions for Institutional Dialogue.

- Student success
- Instruction and pedagogy
- Research and grant development and support
- Learning environments and course scheduling
- Human resources
- Financial and other administrative systems
- Auxiliary services

- Campus security and mass notification systems
- Energy management
- Building automation
- Space management and master planning
- Environmental, health, and safety management

Student success

Role of technology today. Technology currently plays too limited a role in helping students achieve success. Colleges and universities collect vast quantities of data about their students, but most institutions do not do much with the data that they have gathered.

Some colleges and universities are beginning to harness the potential of this data to support students. For example, Austin Peay State University created its Degree Compass program in 2011 to help students select courses to stay on track for their degree programs. The system takes into account both the course requirements and the talents and needs of individual students and makes individualized recommendations. As well as guiding students, Degree Compass also provides recommendations to academic advisers and also an array of reports to help the institution develop class schedules. (Degree Compass was purchased by education technology company D2L in 2013 and is now a component of the CMS package Brightspace.)

Potential for technology in the future. Participants at the Thought Leaders symposium suggest that the challenges of integration and analysis will be solved. New systems will provide useful information culled from the mountains of student data—information that will be used to create comprehensive strategies for promoting student success. They will also focus on predicting future learning gains rather than simply reporting what has already happened, and smart systems will identify at-risk students early enough to turn around their performance.

Technology will also strengthen long-term relationships between graduates and institutions. The result will be lifelong learning relationships between alumni and their colleges and universities. This approach not only will help graduates fulfill their potential as productive, engaged global citizens but also will allow institutions to draw on the experience and wisdom of their alumni and create bonds of mutual support.

Questions for institutional dialogue

- What data does your college or university collect about students that can provide insights into their success? How accessible is this data?
- What progress has your institution made in integrating student data from different systems? What is getting in the way?
- Are efforts under way to analyze student data? Can you start with systems already in place? For example, does your CMS offer an analytics function?
- Can you make the case for learning analytics and other student success technologies to faculty, staff, and senior institutional leaders?

Data Point: Student success

Taking responsibility for student achievement

"We all know that the responsibility for educating students is not the student's alone. It is a responsibility that belongs to all of us. And we must adapt to meet students' needs in order to graduate more students."

— Dr. Jill Biden, Remarks at SXSWedu 2015,
March 10, 2015

Instruction and pedagogy

Role of technology today. The role of technology in teaching and learning is growing every year. Innovative technology has been a driving force in the shifts in pedagogy that have swept across college campuses. Online courses, not to mention online degree programs, could

not exist without video streaming, high-speed data access, and CMSs.

Some of these technologies are beginning to mature, while others are still early in their life spans. The campus CMS, for example, has reached near ubiquity just as first-generation systems are showing their age; institutions are turning to new platforms that will enable them to build what EDUCAUSE calls a "learning ecosystem with tools from many sources." EDUCAUSE notes that the old CMS is being replaced with learning management systems that center on the student rather than the course; they will support students throughout their education while providing students, faculty, and administrators with critical information.

Potential for technology in the future. The gap between potential and results will narrow as technology gets easier to use and institutions invest in training and skills development. The learning environment of the next few decades will incorporate technology as a matter of course. The most significant strides in technology for teaching and learning are expected to make interactions more personalized and targeted. Learning management systems will track student engagement and progress and will alert both students and faculty of danger signals. Learning will be measured more frequently—low-stakes assessments will guide instruction and gauge mastery. At the same time, new forms of testing will focus on higher-level cognitive skills such as solving problems and communicating complex ideas.

Questions for institutional dialogue

- How well does your CMS function for today's demands of faculty and students? Can it operate as a learning management system as well as a course management system?
- How deeply is technology integrated into classrooms? Where could integration be deeper and more meaningful?
- What support do faculty members need to gain the skills and understanding required to make full use of technology?

Data Point: Teaching, learning, and technology

Arizona State University's ambitious adaptive learning program

Arizona State University (ASU) is known for embracing innovation, and it has gone all-in on adaptive learning. Partnering with personalized learning company Knewton, in 2011, ASU moved all of its remedial mathematics courses to a new model that incorporates flipped classrooms, self-paced learning, and in-depth analytics.

Students review mini-lectures and tutorials outside of class, then work through practice problems and challenge tests in class. Students cannot move to a new subject until they have mastered the last. All of their interactions with the system are monitored and reported to the instructor, who can easily see who is falling behind and what concepts they are missing. Students who breeze through the material can take the final examination and complete the course before the semester ends.

Implementing the system was not without problems, but early results seem promising. Knewton claims that pass rates have increased by 18 percent and withdrawal rates have dropped by 56 percent. Nearly half of students finish the course four weeks early. ASU plans to expand adaptive learning to other academic programs, eventually creating an entire adaptive degree program. "We're going to push the envelope," says Philip Regier, dean of ASU Online.

— Information from: Steve Kolowich, "The New Intelligence," *Inside Higher Ed*, January 25, 2013

Research and grant development and support

Role of technology today. Research would not exist in its current form without technology. As noted by David Lassner, president of the University of Hawaii, research is increasingly interdisciplinary, international, and data driven. Technology enables these shifts, allowing

collaboration across departments as easily as across continents and facilitating enormous databases and advanced computation.

Meanwhile, software systems to manage research grants are growing in popularity. These systems promise to reduce the burden of applying for and administering grants by automating budgeting, reporting, and resource allocation. Grant management systems can help researchers demonstrate their effectiveness and productivity and can help institutions support successful researchers.

Potential for technology in the future. Advances in data management technologies and practices will improve data collection and analysis and allow what participants at the Thought Leaders symposium called "one single version of the truth." The vast quantities of data generated by researchers must be managed systematically, with clear institutional policies for storage, ownership, and handling.

Researchers will also take advantage of multiple new technologies on the horizon:

- **Electronic lab notebooks (ELNs)**, software-based recording tools, will replace paper lab notebooks. ELN systems will allow for improved backup and data sharing across teams as well as consistent data collection.
- **Science DMZ networks** will enable high-performance data movement and collaboration. A science DMZ network is a subsection of a larger computer network designed specifically for the exchange of large quantities of research data; it sits between the institution's firewall and the World Wide Web. (The term plays on the notion of a demilitarized zone, a place of limited access that lies outside of a secured border.)
- **Advanced networks** will shuttle data between institutions and enable collaboration. These next-generation networks are restricted to researchers and offer blazing connection speeds. They will allow institutions to collaborate in new ways as enormous databases zip around the world.

Questions for institutional dialogue

- How is your college or university supporting collaboration among researchers within the institution, among institutions, and globally? Should investment in collaboration systems be a priority for the institution?
- How are research grants managed in your institution? Has the campus invested in a grant management system or developed one internally? If not, would such a system help support researchers in applying for and administering research funds?
- Does your institution have policies in place for research data management? Who is responsible for research data? What are the costs and benefits of a formal research data management process?

Data Point: Advanced technology for research New era of collaboration

"We are truly moving into the age of 'global instruments.' One institution might have a facility with a visualization capability, while another has an imaging facility, and a third has medical devices integrated with the environment. Rather than imagining all the research 'core' resources as existing on one campus, we are increasingly sharing research infrastructure with peer institutions in a formal, strategic way."

— Peter M. Siegel, CIO and vice provost for IT services, University of Southern California, in: "Researchers Go Global: Preparing the Next Generation of Innovators," EDUCAUSE Review, October 27, 2014

Learning environments and course scheduling

Role of technology today. The challenge of technology in the classroom is that the speed of change outpaces the ability of institutions to keep up with such change. Flipped classrooms, experiential learning, and other new approaches are only a few years old—it is not surprising that colleges and universities are struggling to adapt.

Course scheduling, on the other hand, has been little touched by technology—there is nothing "smart" about the process. Space in higher education is still often controlled at the level of the school or department, which owns offices, classrooms, and labs. Institutions that recognize the value—and the cost—of space are moving toward centralized systems that allocate resources based on the needs and priorities of the institution as a whole.

Potential for technology in the future. Classrooms will continue to become more collaborative and student centered. Participants at the Thought Leaders symposium also predict an evolution of technology that faculty and students use to interact with these learning spaces. Participants envision systems that adapt to different instructors so that the room and the systems within it automatically adjust to each faculty member's preferences.

Advanced systems could play a major role in increasing the utilization of space on campus. Centralized scheduling systems could make the most of the institution's investment in its space while matching classrooms to class sizes and teaching requirements. Thought Leaders participants anticipate a more flexible approach to room allocation that allows faculty members to schedule different classrooms depending on what they are teaching that day.

Questions for institutional dialogue

- How well do your classrooms support new teaching methods? How has your institution prioritized updating learning spaces?
- How are classrooms allocated in your college or university? What efforts are under way to improve the efficiency of space utilization? Where is progress occurring, and what is getting in the way of success?

Human resources

Role of technology today. Technology is essential to the operations of higher education HR departments, but Thought Leaders symposium participants believe that it is not used to its full potential. Many HR systems in place today fit an old model, what John Bersin, an HR expert writing for Forbes, calls "systems of record." These

Data Point: Learning spaces

Educational value of student-centered classrooms

New research is starting to make the case for the effectiveness of student-centered learning spaces. The University of Minnesota recently undertook a study to compare learning outcomes in two classrooms, one a traditional lecture hall and the other a new space that the university calls an active learning classroom (ALC). These rooms feature large circular tables with lots of space for laptops and other materials. The walls are lined with dry-erase boards. Instructors are provided with a podium in the middle of the room, where they control presentations displayed on numerous video monitors hung on the walls and ceiling.

In the study, the same professor taught the same first-year biology course to two different classes, one in a traditional classroom and one in the ALC. Researchers found that students in the ALC received higher grades than those that their ACT scores predicted, while students in a traditional room received grades nearly identical to those predicted by their ACT scores.

Observations showed that the classroom influenced the instructor to adopt a more engaged teaching style. Despite the professor's attempts to create identical instructional environments in both classes, she behaved quite differently in a traditional lecture hall than she did in the new classroom, where she interacted more with students. Researchers concluded, "When instructors adapted their pedagogical approach to the new space by intentionally incorporating more active, student-centered teaching techniques, student learning improved."

— *Information from: J.D. Walaker, D. Christopher Brooks, and Paul Baepler, "Pedagogy and space: empirical results on new learning environments," EDUCAUSE Review, December 15, 2011*

back-office systems, operated by HR staff, were built to store and manage employee data. New systems are what Bersin calls "systems of engagement." They are used by employees and managers themselves and are designed to help people work better.

The challenges facing HR technology are familiar ones. Data is trapped in silos and not integrated across systems. While the majority of universities (83 percent) have a data warehouse that stores workforce data across their organizations, fewer than half of institutions (44 percent) consistently integrate this data with other systems such as recruiting and performance management systems, according to surveys by Aon Hewitt, reported in its "2012 Higher Education Survey: The State of HR Effectiveness."

Potential for technology in the future. New HR systems and practices will manage the entire talent lifecycle, from workforce planning through recruitment, onboarding (bringing a new employee into the institution), performance management, and retirement and transition. As many routine administrative tasks as possible will be automated or will become the responsibility of employees working through well-designed employee portals. HR experts will deliver value to the institution by improving talent management and providing insights into ways to improve performance.

Questions for institutional dialogue

- Is your HR system a system of record or a system of engagement?
- How well is HR data integrated across systems? What sort of analysis is possible with HR data?
- Does the institution understand the value of integrated advanced HR systems? Can a business case be made for streamlining transactions and improving analysis?

Financial and other administrative systems

Role of technology today. Nearly all colleges and universities have a financial management system in place, although these systems are aging—according to research by ECAR, on average, they are 13 years old. On the

whole, these systems work. They may not be glamorous, but they are operational.

Two factors are challenging these established financial and administrative systems. First, 13 years is old for enterprise software. Many systems are nearing the end of their lifecycles. Second, colleges and universities have recognized the value of the data within these systems. Administrative and financial IT has the potential to be a strategic asset for improving the operation of the institution.

Potential for technology in the future. Next-generation financial systems will provide real value to colleges and universities—increasing efficiency, lowering costs, and improving operational performance. Colleges and universities should take advantage of the opportunity to upgrade new systems as existing systems age.

The greatest potential benefit of new systems lies in analytics. Colleges and universities cannot move to data-driven decision making without access to data and sophisticated tools for analysis. New tools should provide dynamic reporting capabilities that show data in real time. Business intelligence dashboards should display information by using easy-to-grasp visualizations, and users should be able to drill down beyond top-level summaries to explore data in depth.

Questions for institutional dialogue

- How old is your institution's financial system? How well is it operating? How is it integrated with other IT systems? Is replacing the system on the agenda of the college or university?
- What is the business case for investing in a new financial solution with greater analytical capabilities?
- What sort of advanced analytics and business intelligence tools are available to decision-makers in the institutions? Can these capabilities be added to existing systems?

Data Point: Consolidation of administrative processes

Creation of a single enterprise resource planning system for all Colorado community colleges

In 2004, the Colorado legislature mandated that the 13 community college systems in the state move to a single integrated enterprise resource planning (ERP) system. Previously, each college operated its own customized ERP system, making campus-to-campus comparisons difficult. Institutional policies varied across colleges, and maintaining different software versions required significant IT support.

Technical deployment of the ERP system was complex, requiring a system that could handle transactions from 13 different colleges in a single shared database. However, aligning business processes was harder. Everyone had to agree on points such as the criteria for issuing an incomplete for a course.

The result is a system that provides consistent data for comparison and analysis. The new system has reduced IT support costs and enabled small colleges to have the same functionalities as larger colleges. Most critical, according to Julie Ouska, CIO and vice president of information technologies for the Colorado Community College System, "The standardization of data elements and processes delivers ongoing operational savings in our business functions and enables effective data analysis across the system."

— *Information from: Julie Ouska, "Consensus, compromise, and persistence: Implementing a single ERP for 13 colleges," EDUCAUSE Review, July 14, 2014*

Auxiliary services

Role of technology today. Auxiliary and ancillary services, from housing to dining to bookstores, have faced intense pressure to increase efficiency while adapting to new demands. Many auxiliary services operations have risen to the challenge. Dining, housing, and other services are frequently self-supporting, and may contribute to the campus bottom line. The smart use of technology

has supported these improvements. Systems to manage housing, materials and purchasing, and events have increased productivity and profitability. Driven by retail experiences in the private sector, students will demand similar systems on campus such as shopping carts, real-time account status, learned buying habits, and interfaces with smartphones.

Digital identification (ID) systems have played a big part in these improvements. Many campuses now issue a single smart card or “one card” to each student to access buildings, check out books from the library, take buses, and buy meals. This approach has posed a significant technical challenge that requires interactions among multiple systems with a high degree of security.

Potential for technology in the future. Auxiliary services will continue to focus on improving services while controlling costs. Savvy institutions will make increased use of analytics to assess how customers use campus services and then will target their efforts. The potential for sophisticated data analysis is enormous. For example, residence hall roommates could be matched based on similar traits in the same way that dating services match potential partners.

The most visible technical advances will likely come from innovations in identity cards. Today, most institutions (76 percent, according to Ingersoll Rand) use cards with traditional magnetic stripe technology, but magnetic stripes are notoriously vulnerable to hacking. New systems will use a computer chip embedded in the card. As well as being significantly more secure, chipped cards can be “contactless” so that they can simply be in close proximity to a sensor to work.

Technology is rapidly advancing to the point when students will not need cards at all, only their smartphones. Thought Leaders participants anticipate that smartphone-based systems will only be the beginning. The growth of wearable devices such as the Apple iWatch could usher in an era when sensors recognize individual users the moment they walk by a sensor.

Questions for institutional dialogue

- How have auxiliary services at your institution responded to demand for high services at low cost? What challenges have yet to be solved?

- What is the potential benefit of business intelligence and advanced analytics for auxiliary and ancillary services? Can you make the business case for investing in new systems?
- How does your institution handle access and identity management? Does the campus have plans to move to more secure contactless cards?
- Is smartphone-based identity management on the agenda at your institution? What are the technical challenges that must be solved to implement this approach?
- How can technology enhance the sustainability of auxiliary operations?

Data Point: Improving campus auxiliary services Smart social media and campus dining

Boston University (BU) Dining Services has earned a reputation as one of the best users of social media in higher education. The organization’s Twitter feed is particularly well managed, engaging students with humor and tact.

When a student posted a plea that one dining hall was out of ketchup, @BUDiningService responded, “We’re on it!” Within minutes, the ketchup was refilled. Questions about meal plans are answered carefully and promptly. Fun touches keep students engaged. When one student tweeted that she was craving shrimp cocktail, the staff whipped one up for her.

@BUDiningService is a major commitment for BU and Aramark, its food service provider; social media management is the full-time job of one employee, Aramark’s Robert Flynn, and he is committed to keeping up with posts seven days a week, morning and night. “It’s a constant thing,” Flynn told Boston Magazine. “We’re always available for the students, and that’s what it’s about. If the students are awake, we’ll try to be awake with them.”

— Information from: Eric Stoller, “#NomNomNom: Social media and campus dining,” Inside Higher Ed, September 4, 2012

Campus security and mass notification systems

Role of technology today. Technology has proven to be an essential component of security on modern campuses. When a gunman opened fire at the Florida State University Stroz Library in November 2014, police credited the campus security measures with quickly controlling the situation and limiting the number of casualties.

Technology underlies many security best practices. Building access is controlled through ID cards; the best systems know who is in which buildings at all times. Video surveillance systems both provide live feeds and store footage of campus locations. Communications systems allow individuals to report incidents, while mass notification systems alert the campus community of risks.

Potential for technology in the future. Advances in all aspects of security technology promise to improve safety for students, faculty, and staff. For example, institutions are now investing in new video surveillance systems that are connected to the campus network (as opposed to traditional closed-circuit television), allowing security staff members to view video feeds online and quickly share footage with local police forces. Institutions are seeking to strengthen communications systems, recognizing that in an emergency, cellular networks are likely to be jammed with calls.

Mass notification systems are growing more powerful as they become better integrated. Messages can be delivered via multiple systems—text messages as well as automated phone calls, desktop alerts, and even projection screens in classrooms.

Questions for institutional dialogue

- What systems are in place to control access to buildings? If your institution relies on traditional keyed doors, is moving toward carded access a priority? What other systems are available to monitor and control building access?
- Is video surveillance on campus widespread? What sort of remote access is available for both campus and local police?

- How well does the cellular system operate on your campus? In the case of an emergency, would the system quickly overload? What steps can the campus take to ensure that communications will not go down in a crisis?
- How many options are available for mass notification?

Energy management

Role of technology today. Advanced energy management systems have helped colleges and universities get a handle on their energy use. They have helped institutions track their energy consumption with sub-metering systems that enable a fine-grained look at electrical use down to the room level. Innovations in renewable energy have also allowed colleges and universities to start powering their campuses themselves. Higher education serves as a living laboratory for explorations of green energy approaches.

The greatest challenge for most institutions remains the cost required to take advantage of new technology. Most campuses operate with a mix of old and new buildings, building systems, and energy infrastructure. Investments in high-efficiency upgrades must compete with other campus priorities.

Potential of technology in the future. Thought Leaders participants expect that energy management solutions will become less expensive, easier to use, and more automated over the next decade. New systems will provide facilities managers with more data about energy use while integrating with building management and business systems. Future systems will also supply users with data about their energy use along with information on how to cut consumption. Colleges and universities will educate smart consumers, who will make responsible decisions about energy throughout their entire lives.

Thought Leaders participants anticipate that campuses will increasingly become “microgrids”—that is, self-contained energy networks that generate, store, and consume electricity. Microgrids normally connect to the regional electrical grid but can disconnect and operate in “island mode” in the case of power outages. As well as increasing reliability, microgrids will be equipped with the most advanced smart grid technology to provide continuous monitoring of energy consumption and generation.

Questions for institutional dialogue

- How much data about energy use is available to your institution? Can you monitor consumption on the level of academic units? Buildings? Offices? Dorm rooms?
- What strides has your campus made in energy-efficient systems? Where would additional investments pay off for the institution?
- Is your campus generating any of its own energy? Could facilities management develop partnerships with academic units to develop renewable energy projects?
- How can you engage the campus community as an energy conservation champion?

Building automation

Role of technology today. Building automation systems (BASs) are a product of advanced technology. Next-generation building automation is driven both by technological innovations and business factors. Colleges and universities see enormous potential to improve the efficiency of their facilities with smart responsive systems.

However, increased functionality has created increasingly complicated systems that are a challenge to operate. Staff members need new skills to understand and maintain advanced automated buildings. Senior facilities officers welcome the new data available but struggle to translate it into actionable intelligence. Analytics tools need to catch up with automation.

Potential for technology in the future. Ease of use, interoperability, and integration will increase as technology improves and vendors respond to facilities managers' needs. New systems will be designed with analytics in mind. The quantity of data will grow, thanks to the Internet of Things, along with solutions for mining that data.

The BAS will be based on open standards rather than proprietary software. Cloud-based platforms will allow plug-and-play integration of the components best suited for individual institutions. Self-diagnosing and self-healing systems will assess their own status, correct problems when possible, and notify the staff when service is required. The role of the facilities manager will be as much to supervise systems as to supervise staff.

Data Point: Energy management

Development of a microgrid at University of California San Diego

The University of California San Diego (UCSD) is pointing the way for colleges and universities seeking to optimize energy use. The campus operates a sophisticated microgrid that generates 92 percent of the electricity used by the campus of 45,000 people, 450 buildings, and nearly 2,000 acres. Power is produced in a cogeneration plant, via a fuel cell (at 2.8 megawatts, the largest such cell on any campus), and through solar panels. Excess energy is stored in a variety of systems, including batteries and a thermal energy storage system. Energy use is constantly analyzed via a system known as the UCSD Master Controller, which integrates power system analytics and optimization software that plans and schedules generation, storage, building management systems, and demand load.

While focusing on reliability for the campus, UCSD also operates its microgrid as a lab to test energy innovations. For example, it recently installed a shipping container housing worn-out electric vehicle batteries; no longer able to operate cars, they can still hold enough charge to store energy for the microgrid. If it works, the system could provide a second life for the batteries and reduce waste.

— *Information from: Power Analytics, "ESDA, UC San Diego, and Viridity Energy unveil new generation smart grid at California Higher Education Sustainability Conference," press release, June 21, 2010*

Questions for institutional dialogue

- What data does your BAS provide to your facilities operation? How can you make use of this data to improve efficiency and advance the strategic goals of the institution?
- How closely integrated are the buildings, building information systems, and building automation systems on your campus? Can you get a comprehensive view of the campus and how it is functioning? What components of a fully integrated system are missing, and can you move toward adding them?
- What skill sets and training are needed to support the gathering of the best information possible from the BAS?

Space management and master planning

Role of technology today. Higher education campuses are planned, designed, constructed, and managed, with technology playing a role every step of the way. Colleges and universities have assembled toolkits that incorporate geographic information, building information modeling, and facilities information management systems. While powerful, these systems have their limitations. Greater integration would greatly increase their impact. Systems are often highly technical, and translating the data they contain into information that makes sense to a general audience is challenging.

As a result, master planning is often perceived as an exercise that contributes little to the real world. That perception is a missed opportunity. Master plans should be living, breathing documents that inform both long-term visions for the campus and day-to-day use of buildings and grounds. Technology does not yet empower campus planners and facilities managers to fulfill the potential of the master plan.

Potential for technology in the future. Thought Leaders participants believe that master plans can become more powerful and dynamic through technological innovations. They imagine being able to show administrators how different options would shape the campus. All sorts of scenarios could be played out in real time—for example, changing traffic patterns, adding new classroom buildings, and increasing enrollment.

Such a system is still in the future, but it would build on the technology now under development. New space management systems will consolidate data into a single integrated system. Straightforward metrics will draw clear lines between the institutional priorities and the facilities operations and plans. Predictive analytics will assess the impact of proposed changes to the built environment. Most powerfully, improvements in space management and information systems will take the master plan off the shelf and into the real world. Plans can become dynamic documents that are adapted as needs shift.

Questions for institutional dialogue

- What tools are available to your institution today to plan and manage space on campus? How closely integrated are these systems? What advances in technology could benefit these functions?
- How clear is the connection between the campus planning and facilities management function and the institutional mission and vision? How can you make these links clearer to stakeholders and institutional leaders?
- How old is your campus master plan? How often is it consulted when making decisions about the campus? What steps would be necessary to make the master plan a dynamic resource?

Data Point: Master planning

Importance of data-driven decision making

“Institutions who know their value to society can show it through measurable outcomes. ... Using sophisticated data analysis and tools for decision-making steps up the level of sophistication that university partners are able to add to the process, whether it be programming, construction, allocation of space, etc.; it is used to assess current environmental impact, set institutional goals, and measure performance.”

— Society for College and University Planning (SCUP)
Academy Council, “Report on Trends in Higher Education Planning 2014,” 2014

Environmental health and safety management

Role of technology today. The potential of technology in environmental health and safety (EHS) management in higher education has yet to be fulfilled. Certainly technology is essential to EHS management today. Colleges and universities rely on reports, databases, and spreadsheets for record keeping and compliance. However, few institutions have invested in specialized software to improve the management of EHS functions, according to Matthew Littlefield, the president of consulting firm LNS Research, in a recent article on environmental health and safety. Littlefield says that in addition to failing to use specialized systems, institutions rarely integrate EHS data with other campus information systems. The result is an island of data that fails to bring added value to the institution.

Potential for technology in the future. Smart use of technology has the potential to elevate EHS activities

from simply a compliance function to a more integrated and integral role on campus. By automating routine tasks and integrating data from across the institution, EHS systems could promote a safety culture, improve the efficiency of campus operations, and better manage risk. New technical solutions will streamline the record keeping that is the backbone of compliance, while new systems will integrate EHS data with other campus operations and management systems for real-time use and making evidence-based decisions.

Questions for institutional dialogue

- What sort of technology does your institution use in EHS systems today? Can you make the business case for investing in new EHS systems?
- How well is EHS data integrated with other campus systems? What opportunities exist to automate the data integration for improved record keeping and compliance?

Section III:

Integrating facilities management and information technology

Executing the transformation of the college or university campus will be the responsibility of the facilities professionals within higher education—and it will not be an easy task. New technology will require new skills and new approaches to day-to-day tasks. The result, however, will be a new campus for a new era, one where technology supports smart operational decisions, enhances teaching and learning, and fulfills the mission of higher education to educate responsible global citizens.

Restructuring the facilities management organization to effectively integrate new technology

Facilities management departments were not designed with technological integration in mind. **Internal reorganization** will be necessary to prioritize systems integration, automation, and business process intelligence. The changes required will depend heavily on the size and type of institution. Large research universities will likely need to expand dedicated technical groups within facilities management to address work management, hardware maintenance and renewal, software and data management, building automation, energy accounting, campus enterprise automation, materials management, SCADA (Supervisory Control and Data Acquisition), space data, GIS, and more. Smaller campuses will need to reconfigure staffing to establish a dedicated technology group to address building and business automation systems, as well as strengthen partnerships with their colleagues in IT. Facilities organizations with limited technical capabilities at the institutional level should consider partnerships across state systems or among private institutions.

Integration with Information Technology. No matter how large or small the campus, the facilities department needs to **strengthen relationships with the IT department**. Ties can be formalized with designated

liaisons but should also rely on more informal personal connections across all levels. Improved relations can start with something as simple as lunch between the senior facilities officer and the CIO once a month. The important consideration is that both Facilities Management and IT recognize the mutual benefit of a better understanding of roles and common interests.

Identification of Common Tools. There are many opportunities for collaboration to build or make available common tools that can benefit both Facilities and IT, such as 1) a space database of all IT-related server rooms, data centers, and data hubs; 2) GIS mapping of IT infrastructure; 3) data center information systems; 4) GIS inventories of audiovisual equipment by classroom/lab; and 5) preventive maintenance scheduling coordination.

Coordinated Support Systems. Collaboration to coordinate services and support of classroom technology, such as a classroom hotline, after-hours service response, component renewal, parts inventories, maintenance stocks, and work management.

Crafting policies that enhance facilities/IT integration

In the long term, the **lines between IT and facilities will blur** as technology becomes tightly integrated within the fabric of the campus. If this prediction sounds outlandish, keep in mind that this year Google filed a patent for technology that turns any wall into a touchscreen. If the walls of the campus are themselves interactive technology, where does IT end and facilities begin?

As they adjust their structure and amp up their professional goals, facilities organizations also need to assess their **internal policies** to ensure that they are up to the challenges of current technology.

Security. Security is a primary concern. Powerful systems create unprecedented risks. Hacking a building automation system, for example, could wreak havoc on a campus; an inadequate password could put an entire campus at risk. Facilities organizations need to partner with IT experts to create stringent cybersecurity protocols in line with the enterprise as a whole.

Hardware and Software Procurement. Facilities organizations should also consult with IT departments to develop **policies for testing and approving new software and equipment.** New facilities systems are too complicated and mission critical for their selection to be ad hoc. A process should be put in place for assessment, selection, rollout, and support. Standards need to be set to vet new solutions, especially when the goal is to increase integration and interoperability. New systems need to be able to talk to one another; it is likely that they will rely on the same open source platform.

Creating successful facilities/IT integration

Senior facilities officers will need to consider dozens of details to harness the potential of technology, and transparency and participation are key in the decision-making

process. Some critical points brought up in discussions at the Thought Leaders symposium include the following:

- Identifying synergies between Facilities and IT. Make the effort to identify mutually beneficial improvements and tools.
- Building maintenance and IT maintenance cycles should be coordinated. Communication will make maintenance easier for both organizations, especially for mission-critical data centers and communication hubs.
- Commissioning should include an IT component to ensure that the technology within new buildings, both building systems and user systems (such as audiovisual equipment in classrooms), is operating at peak capacity.
- Clear responsibility and clear line of authority need to be established for technology decision-making across the campus. All systems and software need an owner.
- While IT can support Facilities with advanced technology, Facilities can support IT with sustainability. The departments should find ways together to cut energy costs and improve the efficiency of IT operations.

Data Point:

Benchmarking to improve operations

Reliance on APPA operational guidelines to shape facilities management

"We [Philadelphia University] are small, tuition-driven, and private, with the desired ability to be nimble. We're not heavily endowed but are committed to sound financial management. It's vital to understand which standards must be reached and which are not practical. So, given our resources, it is not the University's priority to be a showplace facility, but everyone from the president on down to staff must agree on the established expectations.

"APPA's tables of standards are invaluable. They show everyone involved what the best practices and expectations should be for an institution operating at a desired level. For maintenance we commit to Level 3, managed care, and strive for Level 2, comprehensive stewardship.

"In grounds we adopted and customized the APPA tables creating a campus plan with mapped maintenance zones, detailing services, and we categorized every plant as native, invasive or non-native/non-invasive. Our costs are level, but we're getting more bang for the buck. We're practicing sustainability, keeping some spaces more meadow-like with native plants, but our greens are sharp, and our highest impact areas are showplaces."

— Thomas Becker, associate vice president of operations at Philadelphia University, quoted in: Anita Blumenthal, "Getting Better all the Time: New Thinking & Rethinking Generate Innovative Strategies, Best Practices," APPA's Facilities Manager magazine, July/August 2013

- Planning and design guidelines need to address technology. Technology requirements should be as clear and straightforward as lighting or furniture specifications.
- IT and facilities departments should establish procedures for working together that include clear assignment of roles and responsibilities and clear lines of communication.
- Master plans must be coordinated to include concepts and standards important to Facilities and to IT.
- Collaborate and reach consensus on designs for mission-critical services so that maintainability and system redundancy can be retained. Include energy efficiency goals at each step of the design.

Data Point:

Facilities systems integration

Increased energy efficiency with an integrated facilities management system

The San Mateo County Community College District recently announced the implementation of a new comprehensive system to maximize energy use while integrating facilities information. The system incorporates building control, energy management, and building analytics into a single platform that allows facilities managers to visualize, analyze, and implement energy performance strategies. With real-time analysis and actionable suggestions, the system is a glimpse into the future of the integrated building systems that experts predict will soon be found on campuses across North America.

— *Information from: Joshua Bolkan, "California community college district aims to improve energy efficiency with analytics," Campus Technology, July 9, 2015*

Facilities professional of the future

Facilities experts will need to change along with their departments. The **demands on facilities professionals** have grown over the decades, but technological innovation poses unprecedented challenges. Facilities managers must learn how to function in a multidisciplinary world and communicate with a wide variety of audiences while

mastering professional skills, technical innovations, and global competencies. Their time will be spent on ideas and insights rather than routine maintenance and management. A commitment to the continuous training of employees is critical.

The greatest value that facilities professionals will offer their institutions will be as **super strategists**. They will leverage the data available to the organization to spot trends and adapt proactively. Reactive maintenance—something fails, and someone goes to fix it—will be trumped by proactive, planned maintenance. Looking ahead, facilities management will become more proactive. Facilities managers will identify and implement integrated cooperative strategies.

Certainly technology will facilitate this process. The Internet of Things will create a campus buzzing with **smart equipment** that will monitor and communicate the slightest deterioration in performance. The idea of facilities without failures—no water leaks, no broken wires, no stalled elevators, no hot/cold calls—may seem far-fetched, but new technology will bend the curve toward failure rates unimaginable in previous eras.

However, technology will only achieve its full potential if it is managed by facilities professionals with an **ambitious strategic vision** of the future. The most successful leaders will be ones who use technology to resolve problems that no one ever imagined were solvable.

Imagining the IT/facilities integration of the future: where we are going

The potential of technology and facilities integration is difficult to grasp. Undoubtedly, facilities professionals of the future will invent systems impossible to predict today. However, some innovations are not only possible but probable within the next 5 years to 10 years. The technology for the solutions discussed in the rest of this section does not yet exist—but it will, and participants at the Thought Leaders symposium predict that the campus of tomorrow will see these developments soon.

Personalized learning and work spaces. Technology will recognize students, faculty members, and staff personnel the instant that they walk into a room. Buildings

Data Point: **Developing future facilities professionals**

Engaging high school and college students with a global (even intergalactic) initiative

The professionals of the future are gaining insights into facilities management challenges that Earth-bound experts can hardly imagine by participating in the Mars City Facility Ops Challenge developed by the National Institute of Building Sciences, Total Learning Research Institute, NASA, and International Facility Management Association.

The program allows students to perform as facilities managers responsible for maintaining a virtual base on Mars. High school and community college students will work as teams to keep the water, energy, HVAC, and other building systems operational—on another planet.

While a simulation, the project uses an actual building information model of the Mars City facility developed by professional designers. Teams will employ professional maintenance software in scenarios developed by teams of facilities management professionals. As well as furthering science, technology, engineering, and mathematics (STEM) skills and promoting interest in facilities management careers, the Mars City project will build skills needed by 21st century facilities professionals: teamwork, communication, and a global perspective.

— *Information from: National Institute of Building Sciences, “Buildings-focused STEM education program reaches important milestone,” press release, July 24, 2014*

will respond to users, customizing spaces to meet their needs. Responsive spaces will increase engagement with students and faculty, making even classrooms and labs adapt to users.

Powerful, real-time facilities information management systems that integrate data, increase efficiency, and improve the credibility of decision making. Powerful platforms will streamline the day-to-day activities of facilities management, from ordering parts to tracking maintenance histories and calling up building plans. The system will start at the ground level, managing the details of operations, but will extend all the way to top-level management, with tools for predictive analytics and business intelligence.

Building designs based on the use of existing spaces. In the past, the campus was the invention of administrators, donors, and architects who offered ideas about how the campus should operate. Tomorrow, buildings will be designed, in effect, by those who use them, through systems that track how students, faculty, and staff interact with their spaces.

Space management systems that track and allocate campus resources as needed. Space allocation will be examined in real time, then managed with an eye toward flexibility. Staff members who work on laptops will reserve desks when they need focused time but otherwise will share general space. Classes will rotate among rooms depending on what work they are doing that day. Space will be valued as a prized resource and will be conserved for its most productive and important purposes.

Conclusion:

Evolving facilities, evolving skill sets

This report has focused on the evolving idea of the college or university “campus” as higher education is transformed by technology. The campus of the technology age isn’t your grandparents’ campus. The entire framework for delivering and receiving an education is changing.

It is also clear at this point that as the campus evolves, so too must the skills of facilities professionals. This industry has already undergone a remarkable evolution, as facilities managers undertook new challenges and mastered new skills over the last 50 years. The evolution required in the next 50 years will be even greater. In the past, buildings were static things—they sat unmoving and unresponsive as events happened within them. Soon, buildings will be “alive,” sensing the world through sophisticated monitoring systems, deciding for themselves what they need based on powerful algorithms, and communicating their condition 24/7. Managing an entire “zoo” of “smart” buildings, all evolving at a pace faster than any seen before, will place unprecedented demands on facilities professionals, who must become experts in the care of a new breed of campus facilities.

What will it take to successfully manage the new campus? This report introduced the idea of the facilities professional as a “super strategist”; an idea worth emphasizing. A major culture shift is required. Making the new campus a reality will require more than technology. It will require a new way of thinking, one that is fast, adaptive, insightful, and visionary.

Super strategists will keep their eye on the big picture. They’ll understand the mission of their institution and harness all the resources at their disposal to reach their desired goals. They’ll anticipate what’s coming rather than simply reacting to events. Their skills will extend beyond disciplines and departments. They will be integrators, gathering information from multiple sources, looking at it from all angles, and discovering connections in unexpected places.

Sound like an intimidating job description? Absolutely! Super strategists won’t just appear out of nowhere. The higher education facilities industry must make a deliberate and sustained effort to develop these capabilities within its ranks. As a profession, we must break down the needed competencies into manageable components and determine how to teach new skills and encourage new ideas. We must scour our ranks for promising individuals with curious minds and wide-ranging vision. We must study both the successes and failures of other industries that have undergone major transformations and adapt what works to our industry.

The stakes are high. For decades, higher education was a stable industry, but this period of disruption could shake the foundations of colleges and universities. We could see losers as well as winners. No one can make change go away by ignoring it. As much as they already have on their plates—and we know you’re already confronting myriad day-to-day challenges from aging buildings to tight budgets—facilities professionals need to look to the future and understand how they as individuals can become more strategic in their thinking.

Ask yourself: What don’t I know? What am I missing? What connections can I make within my institution to broaden my perspective?

Senior facilities officers should ask questions about their departments as well: Who within the ranks has a multidisciplinary, strategic way of thinking? How can we encourage that approach within the organization? What skills are missing on our team? Does our organizational structure help or hinder integration with IT? How can we position ourselves to be more proactive?

The campus is changing. The professionals responsible for the campus must change as well. Are you ready?

Download the full *Thought Leaders* report at www.appa.org/bookstore

