PART

1

Technology

CAFM/IWMS—Balancing Technology, Processes, and Objectives

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EXECUTIVE SUMMARY

Facility management automation (computer-aided facility management or **CAFM** and integrated workplace management system or **IWMS**) primarily is viewed as a facility management departmental tool that supports facility management **(FM)** operations. Proper selection and implementation of technology tools are critical in determining the current and future value of the FM department to the organization. Optimization of the organizational value of the FM department occurs when the tools facilitate processes that deliver facility departmental objectives in support of an organization's mission.

Facility managers need to adjust the technology tools and processes well in advance of a problem's visibility in order to successfully address the new requirements for their customers. Proactively preparing the facility for inhabitants' future needs requires analyzing trends in facility management, business, and technology. New and future technology will facilitate the considerable task of achieving organizational objectives and more easily convey to leadership the value of FM to the organization.

INTRODUCTION

Most papers about CAFM/IWMS are written from either a market perspective or a system perspective. This book is written from an FM perspective with the primary focus on CAFM/IWMS as a facility management automation tool that facilitates the processes that deliver FM departmental objectives in support of an organization's mission.

Facility managers have three masters: the organization, the FM department, and the facility itself (see Figure 1.1). The success of any FM project is contingent upon appropriately balancing the project objectives with the requirements of these three masters.

Facility management automation projects also have three masters: the objectives, the technology, and the project.

There have been many studies over the past 25 years regarding the success of information technology **(IT)** projects. The general consensus is that 7 of 10 IT projects fail in some way. This "success" rate has remained consistent over the past 25 years. The cited causes of those projects that fail range from technology issues and poor project management to collaboration issues and inadequate interoperability. The bottom line is that most standard identified issues are symptoms rather than causes. The majority of IT projects fail primarily because the project objectives and the project solution are not aligned. A NASA study of hundreds of IT projects in the late 1990s supports this conclusion.

Many facility management stakeholders focus only on technology when they think about **FM automation**. This is evident in the myriad of cryptic industry acronyms such as IWMS, CAFM, **CMMS** (computerized maintenance and management systems) and BIM (building information modeling). While selecting the most appropriate technology is critical for optimizing value, it is not sufficient for success. Balancing technology and the organizational objectives is the key to optimizing the value and ensuring a successful FM automation implementation.

This chapter explores the interrelationship between the objectives and the technology for a successful FM automation project. In addition, the chapter addresses the history of CAFM/IWMS, the current technology, and a look into

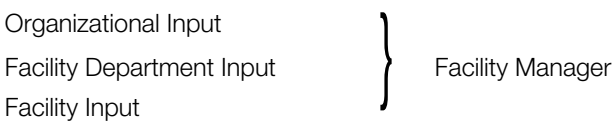

FIGURE 1.1 Input sources for the facility manager.

the near-term future. It focuses on the business objectives of selecting and implementing technology for FM rather than on an analysis of the technical tools. Since both the tools and an organization's objectives change continually, the need for aligning the two remains constant and therefore is the focus of this chapter.

OVERVIEW AND OBJECTIVES

Facility management automation has made significant progress over the past 20 years as technology has progressed at a rapid pace as defined by Moore's Law. Although Moore's Law was originally an observation regarding the number of transistors in an integrated circuit, it seems to apply to many forms of technology. The basic law states that the number of transistors on a circuit board will double every two years—an exponential rate of growth. Loosely translated to the technology used in the workplace, this means technology increases by an order of magnitude every 24 months. Measuring exponential increases in FM automation technology may not be as visible as it is in the commercial world. Compare the changes in consumer electronics from decade to decade, starting with the 1970s. For example, audio technology has progressed from reel-to-reel to 8-track to cassette to CD to DVD to MP3 in the past 40 years. The time between these first few advancements was much greater than the last few. Facility management automation tools have made similar advances and will be discussed in the technology section of this chapter.

Advances in technology can be evaluated best by the value provided, not by evaluating the technology itself. It often is difficult to separate the sales hyperbole from the true advances and equally difficult to distinguish the value added by the technology from the value added by process change. In order to fully understand the value added, we need to analyze the value of facility management to an organization and the value that process improvement adds to the use and implementation of technology.

Consider the aforementioned audio technology example. The initial improvements were to the quality of the product, the durability of the media, the price, the capacity, and finally the size. Combining the price, capacity, and mobility allowed the technology to enable a lifestyle change for the consumer. This is an example of the value provided by the advances in the technology following an exponential trajectory. In the author's opinion, FM technology is at the lower end of the exponential value curve, and technology advances will cease impressing us and the business landscape suddenly will be different. Reference the music recording and distribution industry to see this type of transformation in real time. For the

FM industry collaboration, social media and nano technologies[1] are starting to affect industry shifts.

Technology, without the context of process and objectives, cannot be evaluated. Before reviewing FM automation, FM objectives and the value of FM automation need to be defined.

As mentioned earlier, facility managers have three masters: the organization, the facility, and the FM department. The organization can be divided further into two customer categories: leadership and departments. Leadership is focused on an organization's market position, branding, strategic direction, and organizational culture, while, at least in traditional hierarchical organizations, departments are tasked with achieving the objectives defined by senior management.

Facility managers have to understand and reconcile the often conflicting objectives generated by the organization, the facility, and the FM department. These juxtaposed objectives require a myriad of tasks to achieve them. The facility manager needs to design and implement a strategic plan that balances budget, facility functionality, and occupant productivity in order to optimize the reconciled objectives.

VALUE OF FACILITY MANAGEMENT AUTOMATION TO THE ORGANIZATION

The value of FM to the organization normally can be evaluated by a variety of metrics such as employee attraction and retention, improved productivity, risk mitigation, sustainable initiatives, and strategic business planning support. All of these can be supported and enhanced by processes facilitated by FM automation tools. These tools provide value to the organization in three ways: interoperability, reorganization, and culture.

Interoperability

CAFM/IWMS systems generate far greater value than FM efficacy by providing information to other departments (see Figure 1.2). Improving efficiency for production departments could add more value than saving costs in managing a facility. Information interoperability generated by integrating strategic space planning with strategic organization planning can shorten the time to bring products and services to market and reduce the disruption time for space churn (see Figure 1.3).

[1] Nanoscience has to do with studying and manipulating processes and materials at their molecular or atomic level (see http://free.ed.gov/resource.cfm?resource_id=1945).

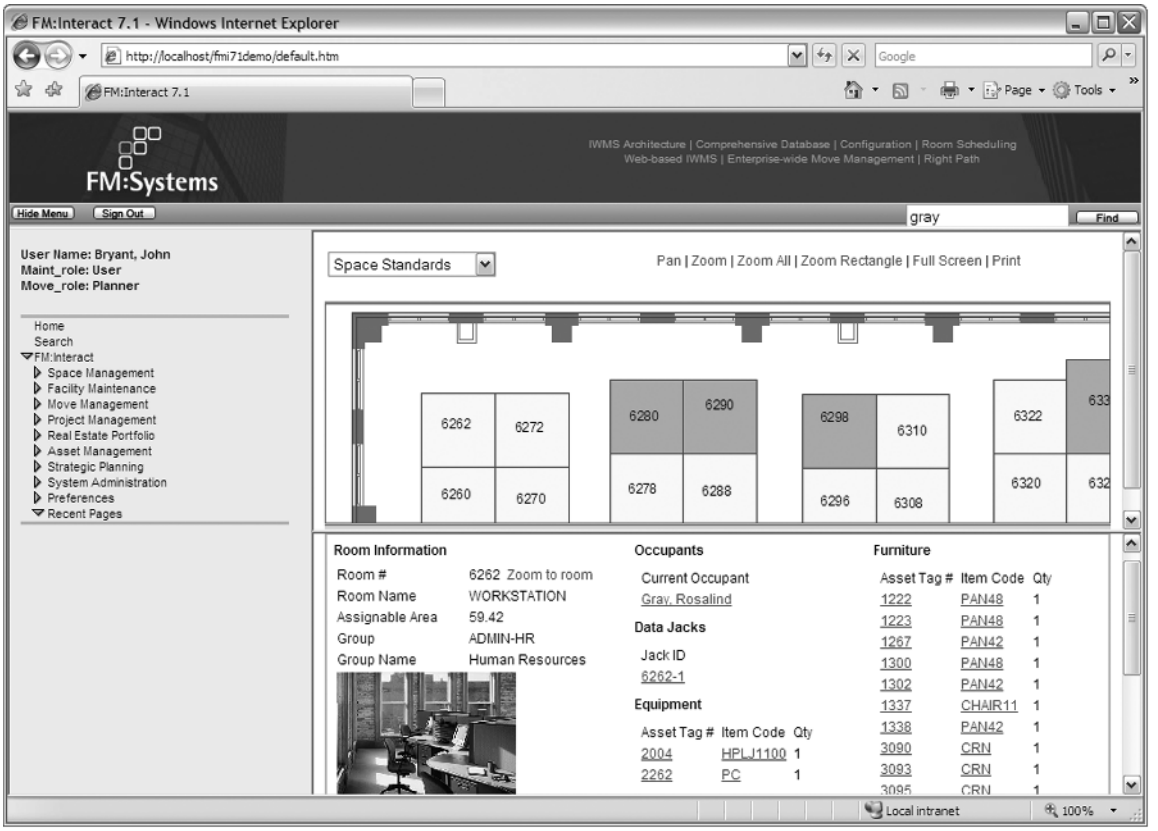

FIGURE 1.2 Integrated information about floor plans, occupants, and assets is available to everyone in the organization in a Web browser.

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Since CAFM/IWMS systems are a primary organizational information source that relates assets, people, and space, this information can be invaluable to departments for planning and executing processes to achieve their objectives.

Opportunity for Reorganization

A significant value of technology advances to an organization is its ability to flatten the organizational structure and eliminate silos. The computer greatly enhances communication, accountability, and delegation. This allows the elimination of data, process, and organizational silos that exist based on the past need for the organization to be the communication system between the field staff and senior management. The author believes there is a strong argument that real estate **(RE)**, FM, and most parts of IT should be merged into one organizational department.

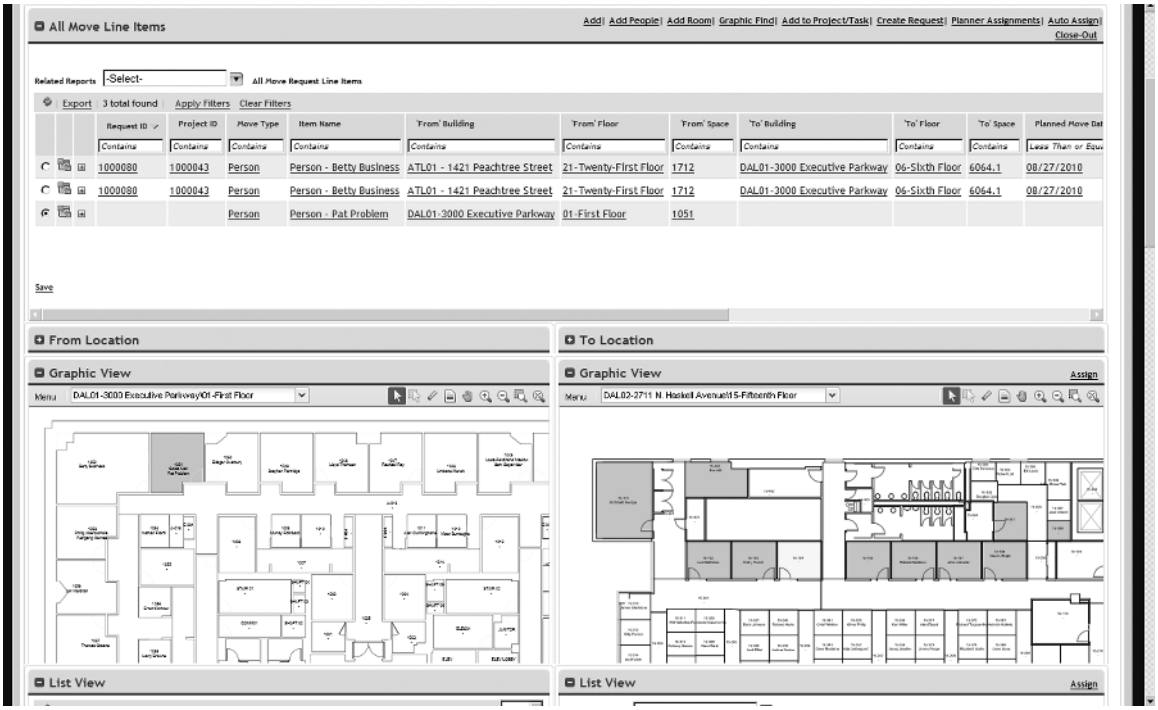

FIGURE 1.3 Move management.
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Conveying Culture

While it is obvious that everyone in an organization has more direct daily contact with the facility and technology than anything else, most organizations do not leverage the facility and FM as tools to convey and promote culture. Facility management automation tools can be used to convey the culture, promote employee retention, and facilitate productivity. Facility management departments can use a web site for conveying information, enforcing processes, and marketing the organizational value of facility management to the organization.

FACILITY MANAGEMENT TECHNOLOGY

In the 1980s, FM automation needs and desires far exceeded available technology. FM business processes were far more advanced than the technology could address. In 1980, the platform for FM automation was based on the mainframe computer. For most organizations, technology was limited to financial information only. During the 1980s, personal computers **(PCs)** had less power than

the calculators used by college students 10 years ago. The applications were a combination of general office tools such as word processors, spreadsheets, and a few single application tools like computer-aided design **(CAD)** or CMMS. CAFM systems were created that combined a few single applications into one system and, most importantly, integrated CAD and data. During the late 1980s and early 1990s, PCs were networked with local area networks **(LANs)**. The PCs became powerful enough to make CAFM systems viable for larger organizations. In the late 1990s and early 2000s, the conditions were reversed and technology advances outpaced an organization's ability to assimilate it. The 1990s saw the proliferation of the Internet, Web-based applications, and personal digital assistants **(PDAs)** (see Figure 1.4 to see the evolution of FM automation tools). Since 2000, significant advances have occurred with wireless communication, **radio**

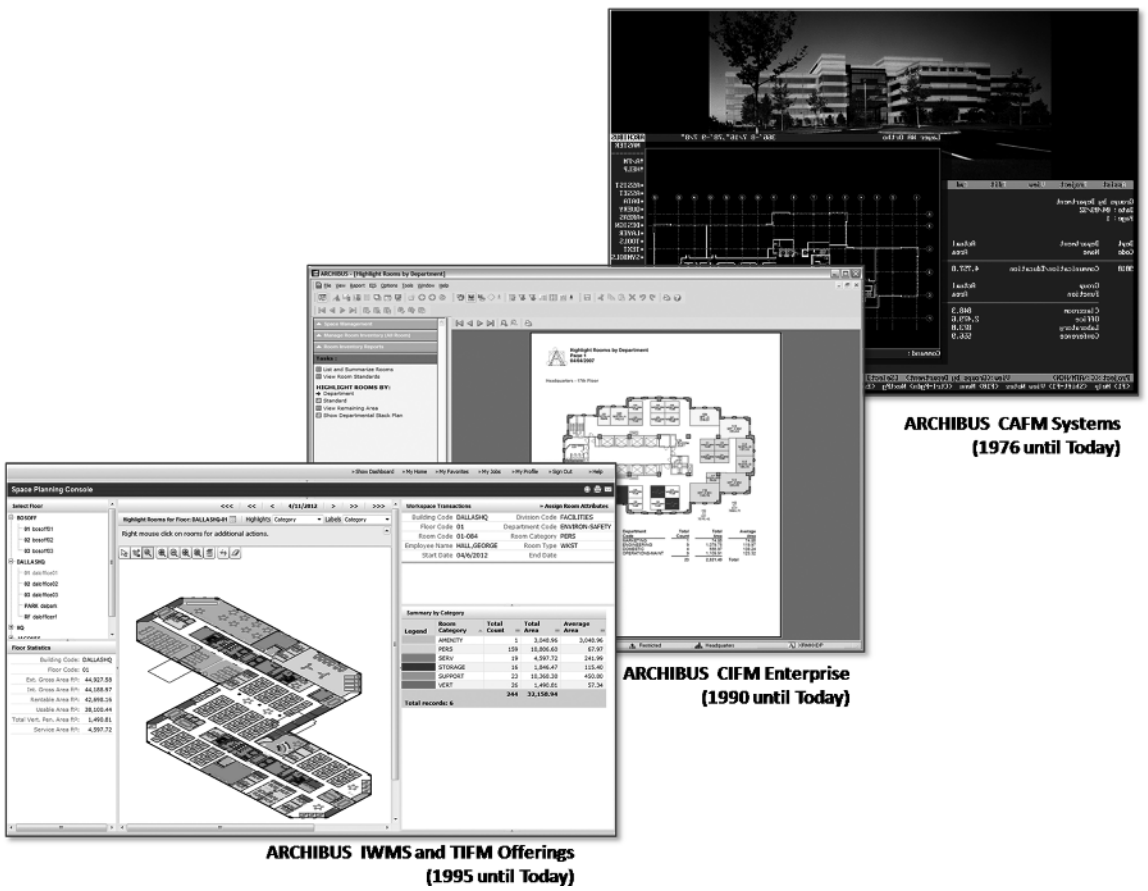

FIGURE 1.4 Thirty-five-plus-year history of CAFM/IWMS showing DOS, Windows, and Web formats.
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frequency identification (RFID), motes,[2] building information modeling **(BIM)**, Google Earth, and interoperability. CAFM/IWMS applications have become more sophisticated, integrating many FM, RE, and IT applications.

Today, technology is advancing far faster than an organization's ability to evolve its work processes and organizational structure to take advantage of the new tools. This trend will continue far into the future. For hardware, Moore's time frame of 24 months per hardware generation is shrinking and it is currently closer to 12 months. For software, the time frame also is shrinking (but at a slower rate) and is currently 24 to 36 months. Regardless of the pace of advances, the technology already has outpaced an organization's ability to assimilate it into its processes, management approach, culture, and objectives.

The convergence of FM, RE, and IT is an example of how technology is more advanced than the industry's ability to integrate its tools into best practice processes. In the late 1990s, there was technology to integrate all functions of these three typically separate departments. Only a handful of companies actually tried to merge these departments. Most convergence experiments focused on the move process in organizations that had high churn rates and high-technology requirements for staff, with most being in the financial industry. The current industry emphasis seems to be the integration of human resources (HR) with FM. All of these integration trends point to the need for interoperable FM information for enterprise analytics.

Given the rapid pace of technological advancement, many organizations seem to implement technology using a "leap frog" approach: that is, they implement a technology, integrate the processes and the technology over a few years, and then repeat the process. During the time between technology implementations, technology often advances significantly. The author believes that many organizations do not realize that the value life cycle of hardware, software, and processes is two to four years. Most change management initiatives take longer than the technology life cycle. By the time the new technology and processes are rolled out, the objectives and technology have shifted.

Balancing Act

The balancing act consists of selecting and implementing tools that support the processes that achieve clearly defined objectives. Misalignment typically begins by starting with the wrong part of the equation. Most FM automation projects start

[2] A mote is a node within a wireless network containing sensors. It is capable of reading the sensor data, performing data processing, and then communicating with other connected network nodes (see http://en.wikipedia.org/wiki/Sensor_node, May 2011).

with either a broken process as the focal point or by trying to find a tool to facilitate accomplishing a task more efficiently (better, faster, cheaper). The primary focus and starting point should be the organization's objectives.

Processes may break for a variety of reasons, with a common reason being that initial objectives have shifted. Trying to fix a broken process without validating the objectives will have limited success. Similarly, making a task that achieves the wrong objective more efficient only accomplishes getting to the wrong objective faster.

Once the objectives have been identified, the processes that will accomplish the objectives should be defined or refined. Only after the objectives and processes have been established can the requirements for the tools be defined.

The system selection process should be based on:

- Organizational objectives
- FM department objectives
- The value provided to the organization
- The value provided to the FM department

Each function or feature should be mapped directly to the objective supported and the value provided. Table 1.1 is an example of this mapping for a move management process. This matrix can be used as a reference to ensure that the technical solution and the project objectives stay in alignment throughout the life of the project.

TABLE 1.1 Mapping objectives to values and features.

Objective	**Organization**		**FM Department**	
	Value	**Feature**	**Value**	**Feature**
Shorten planning time	Reduce effort of the organization Faster to market	Share, move documents (including drawings)	Reduce risk, reduce cost, and improve services	Integrate with strategic space planning
Improve information sharing between all move project team members	Reduce effort of the organization, reduce redundant work, reduce risk of failure, reduce the rumors	Facilitate team communication via a Web portal	Increase service, reduce effort, lower cost, and reduce risk	Facilitate interdepartmental communication via a shared Web-based application
Improve quality of services by reducing failed move projects	Reduce effort of the organization	Mandatory move request form with key information required	Reduce risk, reduce cost, and improve services	Implement Six Sigma and use the system to provide metrics

TECHNOLOGY OF THE (NEAR) FUTURE

A well-respected facility manager made the analogy that managing real estate was like steering an ocean liner: you have to start turning miles (or years for facility managers) in advance of the actual turn. Anticipating changes in both technology and an organization's objectives is not much different, except that instead of navigating the ocean, FM navigates the rapids. Reacting to changes in either technology or the organization's objectives is not sufficient for success. Facility managers need to proactively anticipate their customer's requirements before the customer is even aware of the problems that generate the new requirements. Facility managers need to adjust the technology tools and processes well in advance of a problem's visibility in order to successfully address the new requirements.

Proactively preparing the facility to address its inhabitants' future needs requires analyzing trends in FM, business, and technology.

Trends in Facility Management

The International Facility Management Association **(IFMA)**, **APPA**,[3] and the U.S. General Services Administration **(GSA)** all have their own view of current trends in facility management for their primary focus. Not surprising to facility managers, the trends have a high degree of correlation. The common trends are:

- Energy, sustainability, and Leadership in Energy and Environmental Design **(LEED)** certification (see Figure 1.5).
- Aligning FM planning with institutional goals; linking facility management to strategy.
- IT, building automation systems, and emerging technologies impacting enterprise production.
- Performance measurement and accountability; instituting metrics for performance measurement and transparency.
- Implementing total cost of ownership **(TCO)** strategies, managing aging building, and facilitating change management.
- Globalization; hiring the best candidates for the future.
- Security and institutional safety.
- Dynamic and dramatic shifts in the way people need the facility and the FM services to support a global and increasingly virtual collaborative work methodology (e.g., alternative workplace, virtual classrooms, and telework).

[3] Originally established as the Association of Physical Plant Administrators of Universities and Colleges, the organization changed its name to the Association of Higher Education Facilities Officers (see www.appa.org).

FIGURE 1.5 Sustainability module showing costs and benefits of planned initiatives.
Reproduced by permission of FM:Systems

Trends in Business

Business drivers are typically focused on supporting the organizational mission and improving the bottom line. Technology advancements have added several new tools, and a few difficulties, to this objective by creating the ability to cost effectively collect accurate, timely, and relevant metrics, reducing the requirement of people to filter and process information, and increasing the speed of change.

- **Business by the numbers: Numerati**.[4] There are many groups using numeric analysis for managing businesses. While this always has been true for financial analysis (e.g., economic value added [**EVA**] and market value added [**MVA**]), it is becoming more commonplace to use numeric analysis for process improvement (e.g., Six Sigma).[5] The newest trends include analyzing how an organization

[4] *Numerati* relates to a nonfiction book written by Stephen L. Baker. Baker maintains that, because of the data explosion caused by the Internet, smartphones, social networking, and so on, the people who can manage this data explosion will change the world.

[5] A business strategy (see http://en.wikipedia.org/wiki/Six_Sigma, May 2011).

interacts much the way a web site monitor program analyzes how people navigate a web site. The analysis can be on communication patterns, information flow patterns, and talent usage and location patterns. There is also a growing trend to use value analytics to determine the value and optimization of technology implementation.

- **Permanent elimination of middle management**. Each of the last four recessions has resulted in the permanent loss of middle management positions. Technology has eliminated the need for most of middle management.
- **Continuous improvement and reorganizations**. Technology has removed most of the reasons that justified and guided the design of organizational structures. New business processes are created to respond to the changes in the business environment. Some of those changes include globalization, global recession, Internet commerce, demographic shift to Asia, analytics, security, and government change in the Middle East.

Trends in Technology

While most manufacturers of facility management automation technology are wrestling with the maturation of Web technology as it progresses from childhood into adolescence, the advances in technology that will have the greatest impact on facility management will be in fields other than FM automation software.

FM automation software will be driving more and more toward interoperability by integrating existing technologies like geographic information systems **(GIS)** with CAFM/IWMS, RFID with CAFM/IWMS, building control systems with CAFM/IWMS, security with CAFM/IWMS, and so on (see Figure 1.6). There are two limiting factors holding back these integrations: (1) manufacturers strive to own their market via proprietary technology, and (2) an organization's departments striving to own the silo via organizational boundaries and information hoarding. Assuming these hurdles are overcome, the next great obstacle for advancement is the organization's ability to rapidly alter its structure and culture to take advantage of the new processes and tools.

The advances that will impact facility management will be in the following areas:

- Gestural interfaces like iPad, Wii, Kinect, and Google's Gmail Motion will transform the way people interact with the computer/telephone and workspaces.
- Web-based CAD **(cloud computing)**.
- Open source digital camera. Frankencamera is a "hackable" camera. This allows innovators to integrate state-of-the-art digital camera technology with any other open technology. Both the hardware and software are open source,

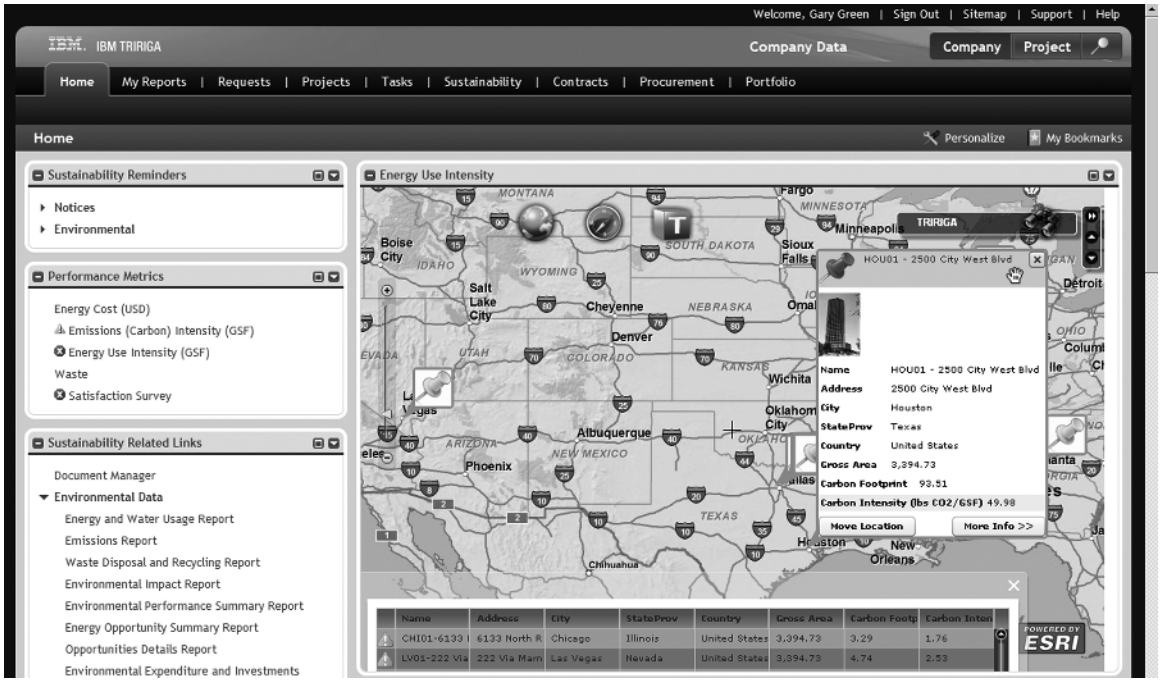

FIGURE 1.6 Sustainability portal with GIS interface.

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so an innovator can hook it up to other technology or extend its capability. Potential FM applications are security, automated visual maintenance inspections, interactive way finding, visual mobile communication, and virtual visual design sessions.

- RFID will provide the ability to effortlessly track any asset dynamically. This means facility management can manage more types of assets and a greater number of assets with far more accuracy in real time.
- The greatest impact BIM will bring to the FM industry will be changes to the design and construction processes and to the relationships between the owner, architect, engineer, contractor, and manufacturer. Another significant potential area of impact will be real-time energy management optimization.
- **Nanotechnology** probably will have the greatest impact on the facility management profession than any other. It will profoundly change everything from the materials buildings are made of, the products used for services, the generation and consumption of energy, communication, asset management, types of required facility management service, and risk management.

- Motes will allow facility managers to easily and cost effectively collect a variety of information by remote sensors. This will allow real-time monitoring and adjustments for all building systems and will greatly reduce energy consumption while increasing the level of comfort and service.
- **Electronic paper** will be able to quickly change from a contract to a newspaper, to a blueprint, to an Internet search, to an interactive 3D model, to a series of images, to a presentation, to a teleconference, with a simple command, therefore greatly reducing paper consumption.
- 5D has many definitions in the FM industry. Essentially, 5D expands a 3D model by integrating the detail of information and time. The value of information is well established through CAFM/IWMS and BIM tools. Adding a time component enhances the value of the information considerably. The time component allows continuous real-time modeling, predictive analytics, preventative action, and real-time interaction and communication between the FM department, the occupants, and the facility. In short, 5D enables optimal facility management. Combining real-time information enables productivity optimization for the facility occupants by facilitating communication, providing just-in-time FM services, enhancing predictive FM services for long lead items, and real-time resource management for space, equipment, energy, utilities, and professional services. 5D can not only increase productivity but can also reduce risk by improving facility operations, faster emergency response, and real-time risk analysis and alerts. Scream!point is an example of 5D technology. Scream!point provides several time components on a cloud-based, technology mashup platform of gaming, GIS, and BIM (Figure 1.7). It integrates time, information, and the 3D model in several ways. It integrates 3D models with various time-based technologies, including project scheduling tools, mobile communication devices, the cloud, animation tools, and gaming tools. Moreover, 5D supports and promotes interoperability.
- Interoperability of data and communications. Most CAFM/IWMS systems are becoming interoperable. There are several new software applications that are facilitating interoperability, including:

  Google. Google is expanding its services to include data and application sharing on a worldwide basis. One pertinent example for the architecture, engineering, and construction **(AEC)**/FM industries is how BIMStorm[6] uses Google as a key component.

[6] BIMStorm, developed by Onuma Inc., an architectural firm and software development company, is a dynamic collaborative process whereby professions collaborate in real time on the Internet. It has implications for the convergence of GIS, FM, and BIM.

FIGURE 1.7 5D cloud-based, technology mashup platform of gaming, GIS, and BIM.
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BIMStorm™ (Figure 1.8). One critical lesson that BIMStorm teaches is that many team members utilizing a vast array of technologies can collaborate on very large projects without explicit communication, direction, delegation, or technology integration. The BIMStorm accelerates design and analysis by engaging architects, engineers, contractors, developers, building owners, urban planners, code officials, lawyers, insurers, and other building industry professionals. The strength of the BIMStorm is mobilizing a team to utilize a wide range of tools that directly address the specific needs of the project. BIMStorm allows all the experts to collaborate in real-time decision making. This collaboration allows the team to spot problems and identify patterns and trends as the project progresses and make real-time corrections. External experts can view the project data while the design evolves without knowing the technology tool sets used by the designers. BIMStorm extends both interoperable data and technology to include interoperable design and communication processes.

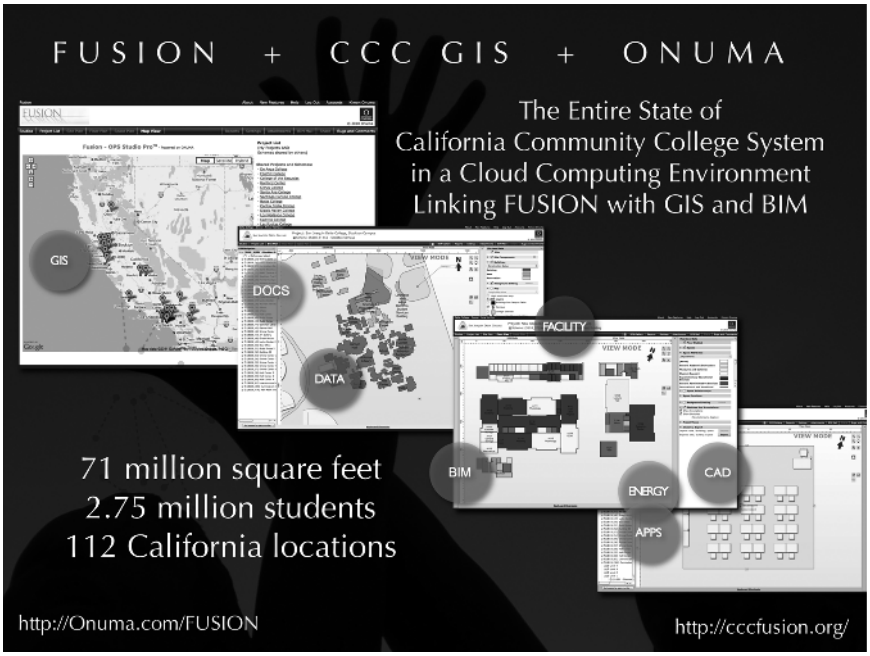

FIGURE 1.8 BIMStorm real-time interoperable collaboration throughout the design process.

Reproduced by permission of FUSION+CCC GIS+ONUMA. Linking facility data to BIM and GIS. Onuma, Inc. and the Foundation for California Community Colleges

MS SharePoint. This collaboration application is the PowerPoint equivalent to document management. While it is useful as a document-sharing device, its greatest value will be making collaborative document sharing as commonplace as PowerPoint presentations.

Newforma. The Newforma suite of products provides interoperability of information and processes across many FM activities throughout the life cycle of the facility. The Newforma Project Center application is the first step in integrating data and processes for AEC/FM projects. The current focus of the tool set is on project Information management for the AEC industry. The interoperability development track for most CAFM/IWMS systems is toward integrating data and processes via workflow tools. Newforma accomplishes both data and process interoperability through application and data integration. Some of the interoperability is achieved through effective project information management **(PIM)** (Figure 1.9). Newforma captures the information created throughout planning, design, procurement, construction, commissioning, and operation of a facility, as well as the relationships between the disparate pieces of information. Newforma provides tools for exchanging files and integrating project communication between all AEC/FM parties in real time. The introduction of real-time integration and mobility capability is another example of 5D (adding the time component to the facility information

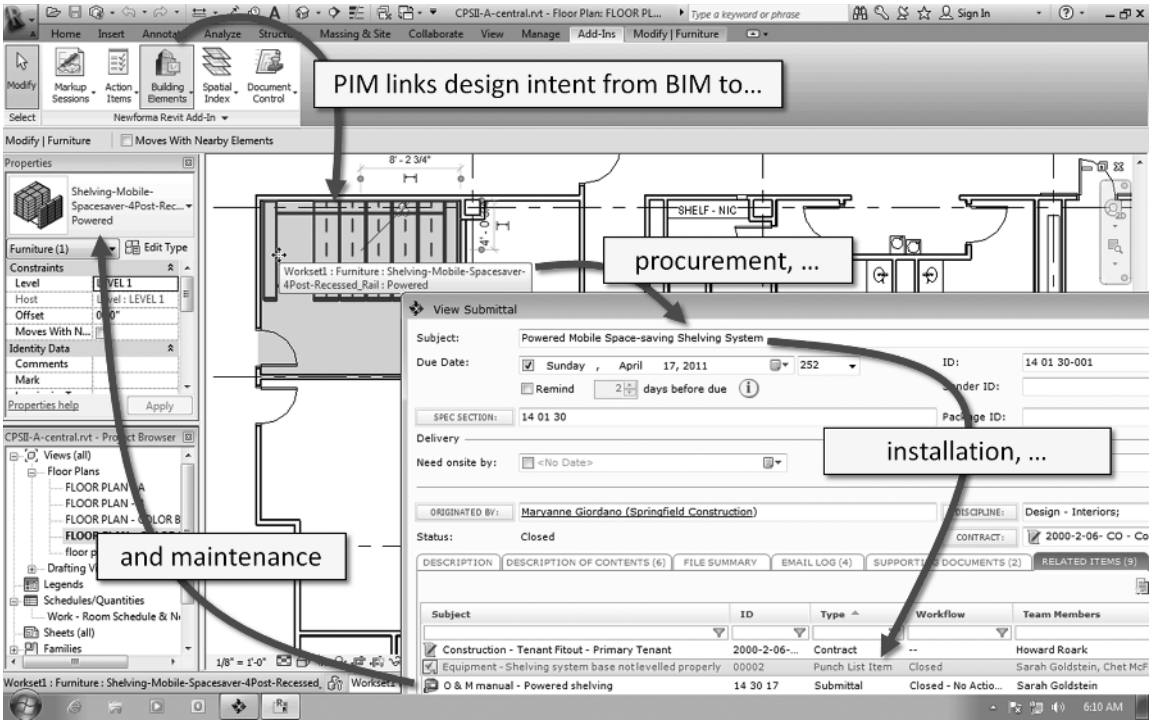

FIGURE 1.9 PIM technology showing information interoperability throughout the facility life cycle.
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model). This kind of interoperability enables better decision making throughout the facility life cycle.

- Seamless collaboration using many technology tools, some of which will be integrated directly with the building infrastructure and the assets within the building (see Figure 1.10). Some examples are:
  - Convergence of phones, e-mail, IM, blogs, **wikis**, and searches.
  - MIT's Oxygen project.
  - Convergence of technology and furniture to create collaborative workspaces.
  - Tablet PCs and smartphones.
  - Integration of GPS, RFID, motes, nanotechnology, and artificial intelligence (AI) to interactively link assets into the collaboration process.
  - Social networks.
  - Cloud computing and cloud streaming.
  - Real-time translation—both aural and visual (Nuance, Google Goggles, Word Lens).
  - Web for the Illiterate—Web navigation that does not require the ability to read.

FIGURE 1.10 Strategic Master Planning showing the integration of multiple data sources, types, and technologies.
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ADDITIONAL RESOURCES

APPA—Leadership in Educational Facilities, www.appa.org
GSA—General Services Administration, www.gsa.gov
IFMA—International Facility Management Association, www.ifma.org
BIMStorm—www.onuma.com/services/BimStorm.php
MIT Oxygen project—Bringing abundant computation and communication, as pervasive and free as air, naturally into people's lives, http://oxygen.lcs.mit.edu
MIT Technology Review, www.technologyreview.com
Stanford University CIFE—Center for Integrated Facility Engineering, http://cife.stanford.edu/