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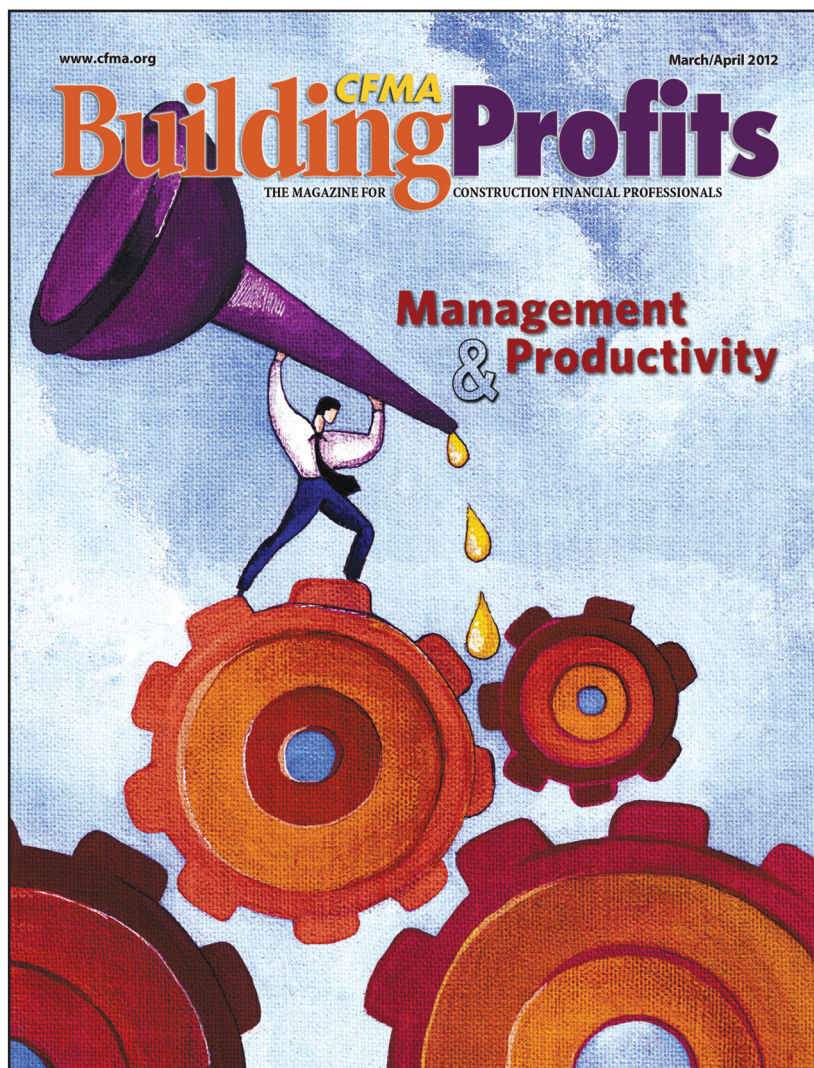
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CONSTRUCTION FINANCIAL MANAGEMENT ASSOCIATION

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WAVES OF CHANGE

Since the earliest days of business computing, there have been countless changes to the technology solutions available to those in construction. However, three major waves have significantly changed how contractors do business.

HOW WILL THE NEXT WAVE OF TECHNOLOGY CHANGE THE WAY WE WORK?

BY JOHN CHANEY

A Look Back

It's hard to deny that advances in information management and communication have played a part in most productivity improvements in the construction industry over the past several decades.

As we stand on the edge of the next wave of technological change, let's take a look back at the waves that have already dramatically impacted the industry.

WAVE 1: THE PERSONAL COMPUTER

Those in the business long enough may recall the first mini or personal computer (PC) that appeared in the office setting between the mid-1970s and early 1980s. It came bundled with the hardware, was not dynamically updated, and did not even carry a dollar value on a company's books; software was not considered an asset at this point.

These systems performed very specific tasks in very rigid ways. However, the ability to replace pen and paper and simplify number crunching still resulted in significant productivity gains.

WAVE 2: GRAPHIC USER INTERFACE

A rapid cascade of events occurred in the early to mid-1980s that led to dramatic improvements in the quantity and quality of available software applications.

Changes in hardware capabilities were able to support such new applications as Lotus 1-2-3. Changes in business models – especially IBM's release of rights to its disk operating system (DOS) for a growing number of "PC clones" – opened up the marketplace to healthy competition. Even legislative changes enabled the growth of the nascent software industry, including the 1985 Supreme Court decision in *Data General Corp. v. Digidyne Corp.*, which spoke against the tying arrangements between hardware and software operating systems.
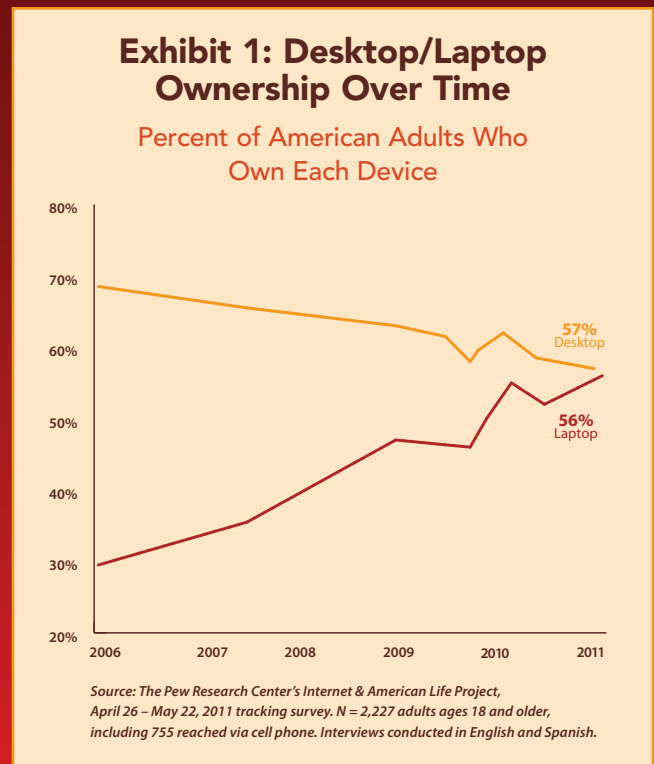
This separation and valuation of software created the incentive needed to develop a more user-friendly environment. So, the graphical user interface came to replace the green screen and "C prompt" of DOS, which fostered a growth in general computer usage and a flood of new applications for those who would not have otherwise had a use for computers in their work or personal lives.

WAVE 3: WEB-BASED COMPUTING

The impetus for the third wave, which is approaching full strength, is clearly presented below in Exhibit 1. Computers are now extremely user friendly and deliver applications considered integral to work and personal life.

Before this wave, users were mostly tied to particular operating systems and applications. Now, they can bring it all with them to the coffee shop, as Wi-Fi, wireless local area network (WLAN), and other technologies have enabled a shift away from the desktop.

More than just lattes and laptops, the beginning of this wave was about enabling users to work in a virtual environment. Using remote access technologies and software, one could effectively "log in" to the office work environment from a different location and use the software present at the office if it did not exist on the remote computer. But again, this was just the beginning of the next big change in information exchange and management.

Exhibit 1: Desktop/Laptop Ownership Over Time

Percent of American Adults Who Own Each Device

Source: The Pew Research Center's Internet & American Life Project, April 26 – May 22, 2011 tracking survey. N = 2,227 adults ages 18 and older, including 755 reached via cell phone. Interviews conducted in English and Spanish.
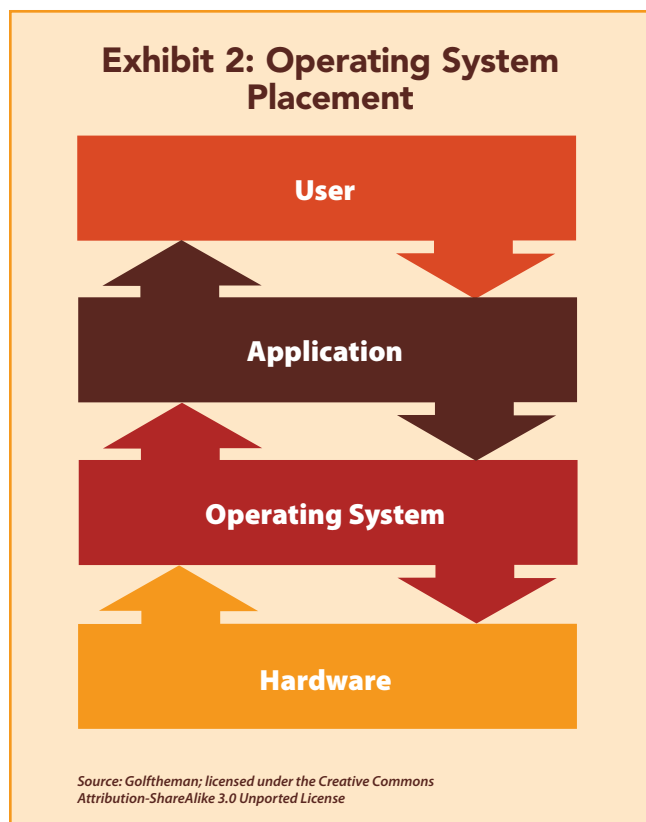
Patterns Emerge

Several patterns emerge when looking at these waves of change. People and companies want to be more productive. More than ever, information and communication are the keys to productivity. So, people and companies move toward ways in which information management and communication become easier and more accessible. This simple yet powerful paradigm has caused major changes in business management systems.

When considering how these changes were effected, another pattern emerges. Exhibit 2 below shows a simplified model of how business management systems are built. The first wave that delivered the PC brought this model to the market, and each subsequent wave has worked to break or flatten it.

Separating the operating system from the hardware made operating systems easier to use and turned hardware into more of a utility than a proprietary part of the model. Then, unchaining the user from a workstation and providing remote access was the first step in making the operating system a utility and granted greater access to applications. Web-based computing completes this work.

Exhibit 2: Operating System Placement

User

Application

Operating System

Hardware

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Greater access is not the only benefit of business applications delivered over the Web. Because these applications must adhere to Web design standards, moving them to the Internet means redesigning their user interfaces. (This is not the case in virtual environments, which provide the existing interface in a remote session.)

In addition, users have become accustomed to intuitive navigation and one-click access to information for Web applications. So, for technical reasons and to fulfill client expectations, vendors will be challenged to deliver software that is not only more accessible, but also more user-friendly.

Web-Based Computing Defined

Remote access and working in a virtualized environment is often confused with Web-based computing, but equating the two ignores some fundamental differences.

To cut through all the buzz and confusion about "cloud" or Web-based computing, one simple litmus test can be applied: Is the Internet the platform for accessing and using applications and data from any device with a browser? If so, then the solution is Web-based. In other words, if the Internet and Web services are used as a communication path to a company's software, then the solution is a remotely accessed virtual environment – even if that software is hosted by a vendor or some other third party.

Why does this matter? If you consider the differences in usability and access (as shown in Exhibit 3 on next page), then answering this question becomes less about the technology debate and more about business needs. How important true Web-based computing is to a company depends on its type of business, its information infrastructure, and how its em-ployees work independently and together.

Is Web-Based Computing Right for Your Company?

The most efficient companies know when and how to make changes to the way they do business, such as moving to Web-based software. There is no single formula that trumps intuition and common sense, but there are considerations that can help in making these decisions.

HOW WELL DO YOU KNOW YOUR BUSINESS?

It can be insulting to suggest that someone does not know his or her business. The truth is most business owners and managers know their trade extremely well. But, knowing your business also means knowing your position in the

market and what makes your company unique and valuable to its clients.

Any decision that involves significant change should be predicated on keeping the company on course and maintaining the unique value it brings. It is important to ask, "Why are we doing this?" and then ensure the answer aligns with your company's client focus and position in the industry.

The suitability of a new process or technology depends on the type of work it is meant to support. Decisions to implement change are not based solely on what is the latest, "coolest" technology or what everyone else seems to be doing or talking about doing. Nevertheless, these things influence even the best-intentioned decision makers.

IDENTIFY YOUR COMPANY'S NEEDS

Only after you identify specific business needs should you investigate solutions that specifically relate to those needs. Nearly every company has at least one example of going about this process backwards, when a new or popular way of doing things presents itself and the company looks for ways to make its business fit the technology. This results in the "technology tail wagging the business dog."

Figure out what to change by questioning your company's business processes, including:

- Does everyone have access to all the information they need whenever they need it?
- Are multiple systems being used to manage and manipulate the same sets of information?
- Does it seem that more time is spent trying to work with a technology solution than having it work for the company?

"Yes" responses to these and similar questions should be the genesis of your company's decision-making process.

With business requirements in hand, your company can then decide if Web-based software can (or should) play a role in its solution from the standpoint of functionality. Here are a few of the specific functional benefits:

Connecting the Field to the Office

The transfer and translation of information from where work is performed and where business is managed is key to smooth business operations. If this is identified as an area in need of improvement within your company, then both Web-based software and remote access solutions can help by making business software easier to access.

IT Unburdening

Traditional business software deployments involve ongoing hardware maintenance and upgrading, regular updates and installations for client and server software, and the creation and maintenance of a private company network to support the business software. If IT infrastructure complexities and costs are issues, then a Web-based solution should be considered.

In a virtualized environment, there are still significant client-related requirements to ensure that remote connectivity software is installed and updated. Even if server applications are hosted in a private cloud, IT must still monitor usage and manage the vendor's performance. True Web-based software removes much of the capital investment and management inherent in traditional deployments that persist in virtualized solutions.

Device Independence

More people are using mobile devices for computing and data management than ever before (see Exhibit 4 on next page). While growth in personal use dominates, business data will continue to rapidly increase. If being restricted to desktop or even laptops to access business information starts to get in the way of teams working together, then accessing information via the Web is a natural solution. Web-based applications

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Exhibit 3: Remote Access vs. Web-Based Environment

Typical Remote Access/Virtual Environment User:

▶ Can access the business applications from a remote device that must be set up with specific remote access software – accessing company applications and data from any device not supported.

▶ Is restricted during virtual session to use of applications specific to the virtual environment.

▶ Can remotely access the work "desktop" environment.

Typical Web-Based Environment User:

▶ Can access the business applications from any remote device with Internet access and a browser – no special preparation or software is needed.

▶ Can move data from between the Web-based application and the local device.

▶ Only accesses Web-based applications. Not a remote virtual desktop environment.

typically require only a Web browser and Internet access, and many applications have mobile-specific user interfaces.

EVALUATE POTENTIAL EFFECTS

When choosing to adopt a new technology, "Be careful what you wish for; you just might get it." New solutions or processes that solve one business need can cause problems or place a burden on other areas.

When evaluating any significant change, take a broad look at how it will affect every group and all workflows. Even switching to a new office phone system can cause a drop in productivity. To help avoid introducing more problems than solutions and keep the inevitable disruptions to a minimum, carefully evaluate all the people and processes that may be affected by change. A framework for this evaluation can be built from the three I's: Impact, Infrastructure, and Integration.

Impact

As previously mentioned, a solution that solves one business need can cause unintended consequences, particularly if it

changes the way multiple departments get work done. There are two best practices that help reduce the potential downside of a new technology investment.

First, involve other departments in major technology decisions, even if it's not immediately clear that they would be affected. This not only allows other groups to raise objections or concerns, but it can also help others in ways not envisioned by the purchasing group and primary users (e.g., a new Web-based remote time-tracking application used by field staff could also be used to track inventory across multiple locations). Involving more people in the decision-making process can slow it down, but the advantages of company-wide buy-in more than make up for this inconvenience.
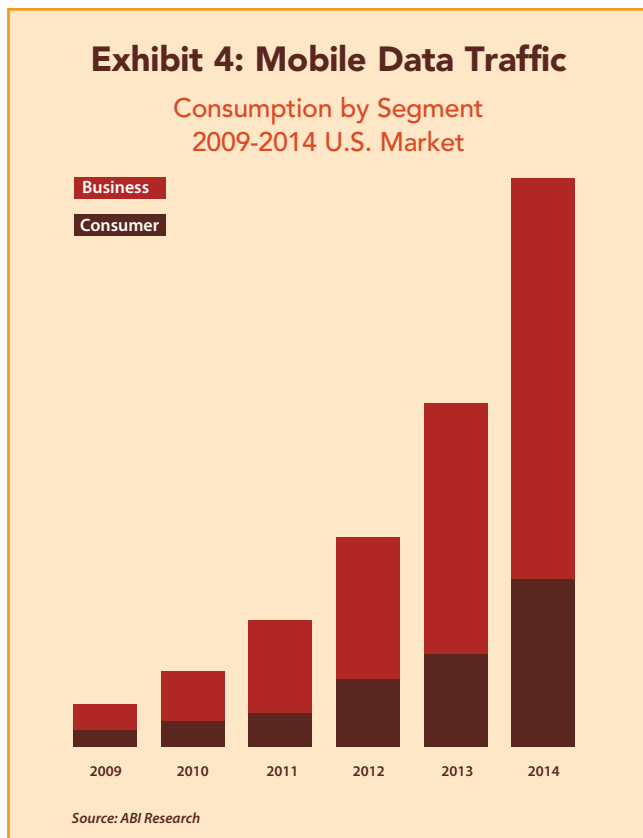
Second, keep a "disruption" list while evaluating new technologies or processes. Most companies focus on ensuring that new investments will solve problems. However, you should also consider how current workflows will be disrupted, and if these disruptions will affect others in the company. This shouldn't be viewed as a list of negatives – the solutions that bring the greatest increase in technology may also bring the greatest disruption. This list simply helps a company understand the true impact and cost of implementing change.

Infrastructure

The state of a company's IT infrastructure and the staff in place to support it are also important factors. For example, if a decision is made to solve the need for remote access by implementing a virtual office environment, then the company should be prepared to provide more phone support to remote users, maintain a higher inventory of portable computing hardware, and keep the connectivity software installed and updated on all remote hardware.

As work becomes decentralized and more software applications move out of the office and into the field, bandwidth becomes more important. Cloud applications of any type (public, private, or even virtualized environments) add to bandwidth requirements. Business Internet connectivity is typically asymmetrical, which means the company's service provider allows for greater data speeds in one direction – usually downstream from the Internet to the company.

However, many business applications are "upstream" intensive. For example, a GC may wish to upload huge construction plan documents to a shared online storage location or application and repeat the upload process whenever the plans change. IT management must be prepared to support

Exhibit 4: Mobile Data Traffic

Consumption by Segment
2009-2014 U.S. Market

Business

Consumer

2009 2010 2011 2012 2013 2014

Source: ABI Research

Contractors of all types and sizes use multiple applications to run their businesses; the better these applications work together and share information (i.e., the tighter they are integrated), the more streamlined business operations become.

a significantly increased upstream bandwidth demand in this scenario.

It is difficult for a company to predict how much bandwidth will be sufficient as the industry utilizes more Web-based applications. However, two things are certain: 1) Requirements will increase and 2) the best way to determine how much is enough is to regularly measure company usage and make adjustments to available bandwidth as usage consistently approaches the maximums.

Integration

Software applications, as well as people, must work well together in order to optimize productivity. Contractors of all types and sizes use multiple applications to run their businesses; the better these applications work together and share information (i.e., the tighter they are integrated), the more streamlined business operations become.

Smaller companies are more likely to use more generic "horizontal" software that can be used by many types of businesses to perform basic tasks such as accounting, project scheduling, and customer management. Larger companies with more complex operations tend to invest in industry-specific enterprise software.

When considering integrating your company's software, here are two questions to consider:

- How does it differ between generic and enterprise software?
- How will it be affected by a shift to Web-based applications?

Generic applications are inherently more amenable to integration. For example, Excel can typically be used as-is to export and import data to and from other applications.

However, the generic nature of such an application can actually interfere with the smooth interoperation of software solutions. Excel spreadsheets are often created in ways that only one person (the creator) can fix. If a spreadsheet needs to be reformatted to allow for integration with another application, then it may require significant effort, usually on the part of the person who created it.

Enterprise applications are more rigid in their structure and use, but they can provide standard interfaces for connecting with other complementary applications. The downsides are that making use of these interfaces is often complex, requires third-party involvement, and the software "hooks" included in the interfaces may not be sufficient to the level of integration required.

The move toward true Web-based applications will bring some change to this integration landscape. The playing field is somewhat leveled in that use of the Internet as a platform breaks dependencies on hardware and operating systems. Web services can be used to tie multiple Web-based applications together.

And, since third-party Web applications can be delivered quickly and easily over the Internet (i.e., no installation required), the number of new interoperable applications should grow significantly.

In short, Web-based delivery of enterprise software will make integration and customization easier and bring more choices to the market. How much this matters to a company depends on how many different applications are in use and how much customization is required.

Summary

It is easy to lose sight of what's important when talking about technology in business, as discussions tend to focus on the details – features, functionality, and "bells and whistles." What technology can do and how things work are important and should be part of any decision to change and help estimate the total cost of ownership and ROI of a new business information system.

However, a decision to implement a new technology should not be based solely on "what" or "how." It should start by asking "why." If a new technology holds the potential to help staff work better together and help the company work better with others, then there is a compelling reason to consider change.

It's clear that the construction industry is headed toward increased collaboration. How it will get there is still being defined, but there is little doubt that Web-based solutions will play a part.

So, while it may not make sense for all companies to move in this direction immediately, chances are it's a good idea for all contractors to take notice and watch for the right time to adopt the next wave. ■

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