

Report on  
**‘CYBER-TOOTHED TIGERS’: A NEW BREED OF  
E-COMMERCE-ORIENTED A/E/C FIRM  
CHANGING THE RULES**

**A White Paper from the Building Futures Council  
Submitted to the Design, Construction,  
and Real Estate Industry**

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In fulfilling its mission, the BFC makes use of the varied talents of its multidisciplined and diverse membership to improve the process by which the physical assets of our nation's built environment are created, managed, and cared for.

Members serve as individuals and act collectively as a think tank to identify critical issues encountered in the building and construction process, analyzing, discussing, and advocating guidelines and criteria for improving efficiency in the process and furthering the well-being of our nation.

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## Abstract

In the first wave of electronic commerce, from 1994 to 1998, the architecture, engineering, and construction (A/E/C) industry appeared to watch from the sidelines as most of the industrialized world committed resources to developing and leveraging the technological wonder of the Internet. Most participants in the A/E/C industry were nearly oblivious to this reshaping of how business is done. During this time the industry focused its attention on recovering from the sluggish construction and real estate development economy of the late 1980s and early 1990s. The focus was primarily on how to get and do work *better*, not *differently*. Traditionally slow to adapt to new ways of doing business, this industry soon found itself lagging behind other industries in its use of the Internet as a business-to-business tool.

In 1995 and 1996 all that began to change, and by 1998 a new breed of A/E/C firm had emerged: the “Cyber-Toothed Tiger.” Armed with an entirely different business strategy and project delivery tools than traditional A/E/C firms, these “new” A/E/C firms were really not all new. Most were existing A/E/C firms that reinvented themselves, just as successful A/E/C organizations have done for years. No longer just in the design, engineering, or construction business, these organizations now also define themselves as being in the *information* business. Today, these firms play an instrumental role in reshaping the A/E/C industry and are actively—though perhaps unwittingly—improving the image of the industry as a whole.

In the future, successful A/E/C organizations will be comfortable with e-commerce, leverage new technologies, and offer an entirely different value proposition than traditional A/E/C firms. Traditional A/E/C firms and information technology (IT) “wannabes” will condemn themselves to further commoditization. Competitive advantage will be won and lost in the IT jungle.

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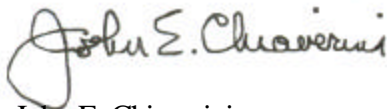
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## Foreword

At the beginning of a new century and millennium, businesses in the architecture, engineering, and construction (A/E/C) industry can take a lesson from the past to ensure their competitiveness and survival in the present day. Natural history teaches us that organisms that thrive and perpetuate themselves have certain traits that are especially suited to their environment. For example, polar bears can survive in harsh arctic conditions because of their thick white fur, which insulates them and acts as camouflage; also, their large clawed feet allow them to run quickly on snow and ice, and their streamlined shape makes them excellent swimmers. Similarly, in prehistoric times a fearsome kind of cat—the saber-toothed tiger—was at or near the top of the food chain. These cats’ short, powerful legs, strong jaw and neck muscles, and trademark dagger-like teeth allowed them to prey on much larger mammoths, rhinoceroses, and other thick-skinned animals of the day.

These modern and prehistoric examples have implications for the A/E/C industry of today. Modern businesses—design and construction included—operate in an environment of rapid technological advancement and proliferation that do not appear as though they will slow down. Firms in our industry therefore would be well advised to reinvent themselves into more fully integrated, knowledge-based enterprises to take full advantage of the benefits technology has to offer and thrive in the “New Economy” environment. Some firms—the “Cyber-Toothed Tigers” discussed in this white paper—have already done so in recent years and are leading the industry into a markedly different future full of promise for our industry, clients, and the built environment of our nation and world. By enthusiastically embracing the tools and techniques of information technology as part of a larger strategic plan; Cyber-Toothed Tigers possess key traits for surviving and thriving in today’s environment.

The Building Futures Council Board of Directors wishes to thank the author of this white paper, Thomas W. Emison, and the individuals and organizations who contributed to its completion. We hope the paper makes a positive contribution to the body of knowledge about a still relatively new but undeniably important aspect of the design and construction industry.



John E. Chiaverini  
Chairman of the Board  
Building Futures Council

## Acknowledgments

The author wishes to thank the following organizations whose support or leadership (or both) contributed to the development of this white paper:

Associated General Contractors of America  
Civil Engineering Research Foundation  
Construction History Society  
Design/Build Institute of America  
International Alliance For Interoperability

In addition, the author wishes to thank Mr. Richard Allen of the law firm Gadsby & Hannah, for his leadership on legal issues related to this white paper. The following people also participated in this white paper's development:

Ms. Nadia Akel, University of California, Berkeley  
Mr. Gifford Albright, Pennsylvania State University  
Mr. Jon Antevy, E-Builder Inc.  
Mr. Richard Coughlin, Coughlin Consultant Services  
Ms. Nicola Cullen, Louis Berger International Inc.  
Mr. Dale Edwards, S.M.W. Seiko  
Dr. Thomas Galloway, School of Architecture, Georgia Institute of Technology  
Mr. John Geffel, Timberline Software Inc.  
Mr. B.H. McDonald, Parsons Brinckerhoff Construction Services Inc.  
Mr. Henry Michel, Parsons Brinckerhoff Construction Services Inc.  
Mr. Mike Miller, RSM McGladrey Inc.  
Mr. Chris Monek, Associated General Contractors of America  
Mr. Jeff Neyland, Centex Construction Group  
Mr. Chris Nobel, Hill & Barlow  
Mr. Robert Runkle, STV Incorporated  
Mr. David Schreiber, Construction Consultants Inc.  
Ms. Judy Schriener, McGraw-Hill Construction Information Group  
Mr. John Strothman, Strothman Associates Inc.  
Mr. John Voeller, Black & Veatch  
Mr. Ken Young, Hellmuth, Obata & Kassabaum

## **Introduction: Death, Taxes, and Change**

It's simple: Things change. At no other time in modern history has this maxim held more truth than now, at the dawn of a new millennium. Things have changed in the past, they are changing today, and will no doubt change in the future. Death, taxes, and change may be the only things about which we can be absolutely certain.

Throughout human history, there have been different driving forces, or engines, of change: economic, political, geographic, demographic, and technological. A simple glance back in time reveals how these driving forces and others have changed the course of human existence. They have been well documented. Today, these driving forces continue to influence us and shape our world. They redefine how we do our work, live our lives, and interact with one another.

The focus of this paper is on one of these driving forces, e-commerce, and its impact on the way we design, construct, and care for real property assets in a global economy. That e-commerce has fundamentally changed the A/E/C industry is not in question. How it has changed and will change the A/E/C industry, and how the many constituents in the A/E/C industry have reacted to and will react to this change, are the strategic issues that need to be addressed.

We are in the midst of a global technology revolution that is redefining how we do virtually everything we do and driving the fast pace of change in our business and personal lives. The global marketplace is being transformed into an increasingly knowledge-based economy. The first wave of e-commerce has engulfed us, forever changing things. But have we been here before? And what can we learn from history in dealing with the inevitable changes that will continue to wash over us?

## Historical Industry Perspective: Change Is Nothing New to the A/E/C Industry

The Building Futures Council does not focus on history and ultimately has few opinions on which A/E/C technological breakthroughs over time were most significant. History is a great teacher, yes, but the Building Futures Council is primarily interested in the way today's leaps will change the way we design, engineer, construct, and care for our homes, business centers, schools, hospitals, streets, bridges, highways, industrial parks, manufacturing plants, museums, waterways, stadiums, and airports, the stuff of our world.

It is important, however, to look back in time briefly to learn that change (especially technological breakthrough) is not a new phenomenon in this industry. Actually, the A/E/C industry has a rich tradition of change, technological innovation, and strategic reengineering. At any given point in time, though, it feels to those in the industry as if the pace of change in the A/E/C industry has reached new levels, and that change is somehow accelerating. Certainly, it feels this way to most of us today.

Pick any civilization on the globe and any time period in the past 5,000 years, and it is not difficult to identify the technological breakthroughs that revolutionized the way people design, build, and maintain their property. For example, in the 16th century the architecture and engineering professions, which until that time were essentially one discipline, began to split. Engineers (with perhaps a more "mathematical" perspective on the world) and architects (with perhaps a more "visual" perspective), divided into separate professions. It was a breakthrough inasmuch as it gave rise to a level of technical specialization and advancement not seen before. It was a big change. Ironically, this same "advancement" in the 16th century helped create the fragmented A/E/C industry we know today; an industry now being re-integrated with the advent of the e-commerce technologies discussed in this white paper.

There was a downside to this new paradigm. These professions developed into somewhat separate camps. Over time, these camps developed unique ways of communicating within their professions. The language of each discipline became well entrenched, and not easily translated into the language of the other profession. More recently, the relatively new professions of general contractor and developer emerged. *New disciplines. New camps. New ways of communicating. New translation problems.* Then came construction managers and program management firms. Add to these additional sub-consulting professions, specialty contractors, suppliers of products and services, and others. *More disciplines. More ways of communicating. More translation problems.* Compounding this, technology has advanced at a pace most A/E/C organizations are simply unable to keep up with (is *any* organization able to keep pace?). Some keep up better than others ("bleeding edge" organizations), creating clusters of technology leaders, followers, wannabes, and laggards. This means *even more* ways of communicating and translation problems.

Another example of industry change can be found in the topic of changing project delivery systems. Today, players within the A/E/C industry are engaged in a debate on "design-build" and alternative delivery systems. While this appears to be news, it is in reality an age-old issue: How

to get the most value (i.e., quality) in the total project delivery process. This is not a “hot” discussion within the industry, but the latest twist on a very ancient discussion. The topic of changing project delivery systems is positioned as paradigm-busting news by today’s A/E/C industry media in a commercial attempt to interest readers. In reality, the only paradigms that have been broken may be those of the editors and publishers themselves and their readers who may not have studied the history of innovation in the architecture, engineering, and construction business.

So change is not a new phenomena in the A/E/C industry. Change has, in fact, been constant and ever present. What is new is the impact these new information technologies are having on the shape and makeup of the A/E/C industry itself. This particular technological innovation known as what we casually refer to as e-commerce offers extraordinary potential for change. The reasons are these:

- E-commerce is happening very quickly and is affecting every industry, not just the A/E/C industry.
- It will probably integrate the organizations and people involved in the facility design, construction, and maintenance process in fundamentally new ways that will redefine the A/E/C supply chain.
- It will give rise to a new kind of service provider: an organization that offers architect, engineer, contractor, and consultant—an organization with an entirely different value proposition than many of today’s A/E/C firms.
- True total project collaboration and complete, multiple-site interdisciplinary integration will increase.
- Communication systems will prosper and link parties to a project to a common language and total project delivery system.

All of this will be shaped in part by the Internet. The highly fragmented A/E/C industry is in fact beginning to integrate as a result of this breakthrough. Why is this industry behind, compared to other industry sectors, in its implementation of these emerging technologies? It is precisely because of the fragmentation of a large number of geographically dispersed players working with incompatible information systems.

## The New Economy and Its Implications for A/E/C: Can an Industry Reinvent Itself?

Conventional wisdom holds that industries, on the whole, cannot and do not *reinvent* themselves. The engine for reinvention, it appears, is at the enterprise level: companies, business units, organizations, entrepreneurs, universities and colleges, unions, trade groups, etc. People initiate change, not entire industries. So the natural questions arise:

How does breakthrough change occur in such a fundamentally fragmented industry such as the A/E/C industry that invests little on research and development? If we speak such different languages among our many disciplines, and have different motivations (business and other), how are we to make the changes needed to improve return on real property assets for the public and private owners of real estate in our society?

The answer to these questions is unfolding before us in a great experiment made possible by the unprecedented continuous nine-year U.S. economic expansion of the 1990s and early '00s. From this expansion, economists contend, a new economy has emerged, often referred to as just that: the "New Economy." In this new economy, success or failure is less dependent on seizing and expanding market share than on how quickly and effectively organizations are able to adapt to new paradigms, new ways of doing business, and new methods of meeting customers' needs that are all brought on by constantly changing technologies, etc.

According to economists, four powerful forces that have joined simultaneously drive the new economy: globalization, deregulation, demographics, and technological revolution.

- **Globalization.** With the collapse of global communism, and the increase in free trade agreements (such as the European Union and NAFTA), businesses are being forced to operate and compete across broader areas. U.S. firms from all sectors of our economy are faced with more competition and look abroad for markets where our technological sophistication is valued.
- **Deregulation.** Since the 1970s, Americans have witnessed the deregulation of several industries: the transportation and energy sectors in the 1970s, financial services in the 1980s, and telecommunications, health care, and utilities in the 1990s. This is opening up competition, changing the paradigms, and contributing to containment of inflation. Domestic business productivity has improved as a result.
- **Demographics.** There is perhaps no more talked about economic force of change than the Baby Boom generation. The first American Baby Boomers turned 50 years old in 1996, bringing in their wake 78 million others whose very existence has forever changed the world and brought billions of dollars of capital to the economy.
- **Technology.** Computing power continues to grow exponentially. According to the well-known Moore's Law, chip computing capacity doubles every 18 months. Soon, this law will be made obsolete, as advances in new technology will enable chip capacity to grow even faster. The Internet has opened a vast, new opportunity for collaboration. New software is allowing more and more functions to be handled electronically. In 1998, U.S. businesses spent an estimated \$300 billion on IT (and prices for this technology have continued to

plummet). That's about 4-5 percent of our total economy, about as much as is spent on all nonresidential domestic construction that same year.

Together, these driving forces of economic change are now having an impact on the huge but fragmented A/E/C industry. IT price tags in our industry have dropped too. A/E/C customers are demanding more innovative use of IT by A/E/C firms. Software development firms and consulting firms that had traditionally focused on helping individual A/E/C companies improve project design, estimating, management, and accounting have developed products that improved overall collaboration and project delivery for several parties to a project. Some of our nation's most respected engineering, design, and construction colleges, universities, and technical schools are researching ways to bring the power of the Internet and new ITs to the design, engineering, and construction process. New associations and consortiums have been formed to improve interoperability within the industry. A/E/C company IT departments have grown in size and importance. Promises of better IT return on investment in this industry are coming true, especially for those firms that recognize the need for continuous training on new and emerging technologies.

Initially, in 1995 and 1996, this A/E/C e-commerce was limited to simple marketing and communications. Most Web sites were essentially electronic brochures. Then, the Internet became something more than a digitized marketing tool. A handful of innovative A/E/C-related organizations and individuals from around the world identified the real promise of the Internet:

- Industry integration as a result of more and better project collaboration
- Total project productivity and communications improvements
- Reduced rework
- Greater opportunity for design excellence
- Value-oriented design using world-wide collaboration on a twenty-four-hour, seven day basis
- Better value for end customers
- Increased investor interest in this sector of our economy

These innovators began researching ways in which the overall design and building process could be enhanced with the use of these new tools. This research paved the way for entrepreneurs who envision an A/E/C industry very different from the one to which we have become accustomed. This entrepreneurial spirit helped generate modest investor interest in the A/E/C industry; that investor interest has now developed into pockets of investor excitement. Engineering and architectural design processes, which with the earlier advent of CAD had become more technological, have become even more highly automated. Many A/E/C firms incorporate into their final designs—and into the process of design itself—high-tech attributes that were the stuff of science fiction just a few years ago. It now appears most A/E/C organizations either now have an e-commerce capability, or plan to have one soon. The once slow-to-adapt and fragmented industry has become an active participant in the global technology revolution.

## Succeeding in the New Paradigm: Becoming a Cyber-Toothed Tiger in the E-Commerce Jungle

The A/E/C industry, which according to conservative estimates makes up about eleven percent of the total U.S. economy, has awakened from its technology slumber. The Building Futures Council believes that in the market of the early '00s, this awakening will accelerate. E-commerce will be not just a new marketing tool but an entirely new way of designing, engineering, building, and caring for the real property assets of the nation. This fragmented industry will begin to integrate in ways never before imagined.

In the new paradigm, A/E/C firms will not be defined just by what they do, but *how they do it*. Our most successful and effective construction estimators, project managers, and field superintendents will morph into a combination of project manager, relationship manager, and technologist. Prime contractors, subcontractors, and suppliers of products and services to the industry will reinvent themselves, helping to create tightly linked virtual communities which promise to dramatically improve the efficiency of project material procurement. What are some of the other features of this new state?

- Electronic bid tools
- Interoperability (uniformity of information and languages)
- Electronic collaboration
- Non-proprietary IT systems
- Integrated virtual design
- Direct purchasing by owners and general contractors
- Handheld and wireless devices
- More targeted marketing (data mining)
- Continued leaps in communications bandwidth
- Materials marketplaces
- dot com company consolidations

Without a doubt, there will be other changes we cannot predict today.

Several industry-wide conditions need to exist in order to produce this kind of progress. They can be grouped into the following main categories:

- **Education.** First, A/E/C firms must educate their top management teams on this new paradigm. Without top management leadership, insight, and competence on this challenge, meaningful change will not happen at the firm, business unit, or individual level; and, without this leadership, new competitive enterprises will emerge that will be better positioned for success in the new paradigm.
- **Leadership.** Second, owners of real estate must understand that real property assets make up an enormous and untapped asset base in American business. Executives in leadership roles within American businesses must accept that real property assets can and should be managed strategically.

- **Industry Investment.** Third, research and development on new information technologies and the use of the Internet should continue to receive industry investment. Increased investment will help reduce much of the redundancy inherent in today's attempts at IT innovation among A/E/C firms, dot com organizations, software providers, consulting firms, and others.
- **Legal Environment Improvements.** Fourth, a legal environment must exist that allows the organizations involved in this new paradigm to innovate without the constant risk of liability and possible litigation. The American legal profession itself, which is a common law jurisdiction, must make some attempt to keep pace with the realities of A/E/C firms doing business in new ways (see the section "Legal Challenges Related to the Cyber-Toothed Tiger A/E/C Organization" below).

### ***How Cyber-Toothed Tigers Look and Act***

So what does the A/E/C Cyber-Toothed Tiger look like? They are not all young organizations! On the contrary, many of today's most forward IT thinkers in the A/E/C industry are seasoned veterans. And, some of the firms engaging in this leading edge work are large A/E/C organizations with extensive corporate histories. The myth that this kind of IT innovation is the unique province of the young is indeed a myth.

- The strategic position of a Cyber-Toothed Tiger is most often, but not always, that of value-added, proactive A/E/C resource. Typically, these organizations avoid hard-bid, reactive business opportunities because it is not in their nature (i.e., their corporate culture) to "be low" in order to win. (There do appear to be *some* bid-oriented A/E/C firms—organizations that compete almost entirely on basis of low price—with sophisticated IT and Internet strategies, however.)
- Cyber-Toothed Tigers select new business opportunities based on the technology profile of the customer sets or target markets. They seek relationships with customers and other decision influencers who are also technology-oriented, creating a sort of "technology club" or "fraternity" effect.
- Their mix of services often includes strategic facility planning and pre-project programming that is sold on a consulting basis.
- They do not confine themselves to a strategy based on their discipline of origin. For example, a Cyber-Toothed general contractor (GC), even one offering a high degree of self-performed work (masonry, carpentry, etc.), may develop an IT and Internet strategy that transcends traditional general contracting and is in effect a different value proposition than that offered by the ordinary general contractor. This GC doesn't just start competing *better* than other GCs, it starts competing *differently*.
- They are not all from within this industry. Many of the successful A/E/C dot com companies are owned and managed by people from outside the A/E/C professions.
- Top management is involved in research about technological change and optimistic about the new opportunities these changes represent, as opposed to feeling threatened by changing technologies.
- They promote a level of total team collaboration throughout the project that has been very rare in the past.

- Their project executives (principals and project architects, project engineers, field engineers, senior project managers, assistant project managers, superintendents, and others) invest time and other resources mastering the skills needed to leverage emerging information technology.
- They have a corporate culture which embraces change and they match this type of culture with an operational ability to effect change profitably. In short, they are opportunistic within the constantly changing world of IT.
- They recruit and develop people in their organizations who are technology-oriented.
- Finally, they have a strategic vision, a comprehensive and detailed plan, for how they will survive, or thrive, in the new paradigm. These plans or visions are often well researched, documented, and implemented within their organizations. As it turns out, the challenge in making this transition to a more technology-oriented firm is surprisingly non-technical. The technology itself is readily available, reasonably priced, and becoming more user-friendly all the time. No, the challenge is not technical, but *strategic*. In other words, owners, principals, and other senior management team members in these firms need to address the strategic challenges of the new paradigm: What kind of firm do you want to be? What role do you want to play in the A/E/C food chain? Could you inadvertently alienate some key customer groups by making the transition? What is the new competitive landscape? These are the strategic questions the Cyber-Toothed Tiger addresses.

## **Legal Challenges for the Cyber-Toothed Tiger A/E/C Organization**

There are several legal issues or challenges presented to the A/E/C industry as a result of emerging and constantly changing information technologies. Five are of particular note are:

### ***Case in Controversy Prerequisite for Developing Common Law***

The United States is a common law jurisdiction. Common law is judge-made law in which appellate courts review the findings of trial courts and write opinions on specific cases in controversy. These opinions then become the common law. Because of this system, lawyers look to precedent on cases already decided that are similar to the fact pattern at hand. This then provides guidance as to how the court may react and apply traditional legal principals to a new set of circumstances. Hence case law is retrospective and not prospective in nature.

It is only when an appellate court reverse prior precedent, an action far more an exception than rule, that the common law develops. This common law model promotes stability and predictability so long as society does not change too quickly thereby giving case law the opportunity to advance in a slow but systematic fashion.

In a real sense, courts wait for someone to take an action that it later views as improper rather than set guidelines that may have prevented that behavior in the first instance.

The law also develops by legislation. In the business context, statutes are passed to address commercial problems that affect a significant number of constituents. Hence with enough “noise” legislatures are moved to address a given problem. With respect to the Internet the recently passed Electronic Signatures in Global and National Commerce Act (June 8, 2000) and the now-pending revisions to the Uniform Commercial Code are examples. Again, for the most part, statutory law, like case law, is retrospective.

The speed at which advancing technology is changing the way society functions makes the systematic and retrospective development of law problematic. This is particularly true in the design and construction industry in which technology based collaboration, communication, and procurement has changed and continue to change the way business is done. Although many tried and true legal principals and precedents remain alive in this changing paradigm, there will be an entire new breed of disputes and issues arising from technology’s impact.

We have clearly entered a period of “legal instability” where traditional legal principles of the physical world become strained when applied to business transactions of the virtual world. A couple of construction practice examples demonstrate this point.

There is substantial case law allocating risk of design and construction defects through the traditional supply chain of contractor to subcontractor to supplier to manufacturer. Electronic procurement allows direct procurement from the manufacturer, thereby saving substantial intermediary transaction costs. Such direct procurement also changes the distribution of the risks of defective performance that has developed over the years by case law and common contracting

practices. Risks normally assumed by “middlemen” are no longer relevant. A new and, in large part, legally untested paradigm is presented.

Another example of legal instability caused by technology relates to the idea of notice. Typical contracts and much case law address the importance of giving notice of a change in order to, among other things, give an owner the opportunity to avoid the costs associated with a change before the work is performed. In an “open” environment of project collaboration, all project parties have “electronic” notice of all the work being done as part of the collaboration. Theoretically, in a pure and open collaborative environment, one is always on notice.

### ***The Protection of Intellectual Property***

One example in which technology is out-pacing legal principals is in the area of intellectual property protection. Traditional intellectual property is protected by patents granting the inventors certain exclusive licenses to develop and market inventions. In this day, by the time new software or Internet based applications are made available for general use, they become outdated.

Many application service providers, or ASPs, for instance, spend more attention on developing the next generation of an application version rather than protecting a past version. ASP competition is so fierce and sophisticated that it takes little effort to reverse engineer any product shortly after it is made available. There is little point in spending the time and effort to protect a technology when that technology may become obsolete overnight. Intellectual property protection, in the traditional sense, becomes less relevant. Staking out market share as fast as the market will allow is almost all that matters.

How the law will address and offer lightning-speed protection to this ever-changing technology will be one trend to watch closely.

### ***Design and Construction: Service or Product?***

Traditional legal principals make a distinction between a product and service. A service is viewed as one requiring the exercise of professional judgment, which is not ordinarily associated with perfect performance. In contrast, a product is a fungible commodity, subject to a variety of warranties relating to perfect delivery.

Under the traditional paradigm, design and construction are considered services. Moreover, design is considered a professional service that cannot be delivered perfectly as it calls for the exercise of judgment. Technology, however, is moving design and construction function to one of streamlined procurement, coordination, and “installation” of services or products. Standardization of products and services promotes more efficient collaboration and procurement.

There is, however, a troubling aspect of standardization driven by technology. As professional judgment becomes less critical in a standardized environment, design and construction practices become more homogeneous. If the design and construction process is to become “modularized,” the law is more likely to impose a standard of perfection all at a cost to creativity. In the eyes of the law, will technology turn the lead designer and general contractor into a product vendor?

What then happens to the project if the information becomes corrupt, confused, or is not available when needed? Can the service provider hold that information hostage?

### ***The Knowledge Contractor***

One of the more rapid changes to the design and the construction industry is the introduction of the “knowledge manager” to the project team. E-Builder, Cephren, BidCom, Bricsnet and a host of others coordinate archives and distribute project knowledge from a common data repository. The open availability of project information to the team is a cornerstone to effective collaboration. It is also major shift from tradition.

Project knowledge is ordinarily decentralized among the project team. Under the old paradigm, each member “owned” its respective intellectual property sharing only that which it deemed necessary. Decentralization causes inherent project inefficiencies that technology can now address with Internet-based lightning-speed collaboration and communication.

How then does the law view this new party to the project team? Does an Internet-based project knowledge manager provide a product or service? What are the implications of security breaches if the project knowledge base becomes unavailable or corrupted? Who owns the knowledge and does it make a practical difference if that knowledge is entrusted in a single team member? Is the knowledge manager subject to a perfect standard of performance as a supplier or non-negligent standard as a professional? All of these questions are yet to be addressed.

In addition to the above concerns the knowledge manager is in effect the archiver of project team history. As such, the knowledge manager is a natural target for discovery efforts. Why bother chasing individual team members for documents that are surely incomplete when there is a single comprehensive source of project records?

### ***Jurisdiction***

The law of jurisdiction has principally developed premised on physical presence and sufficient contacts in a given jurisdiction. When transactions are consummated and performed virtually, the courts struggle with deciding the jurisdiction of disputes arising from those virtual transactions. The appellate courts that have looked at this issue have reached inconsistent conclusions. Some have concluded that a virtual presence alone is enough (e.g., a Web page offering residents a product or service), while others look for some notion of physical presence to accompany the virtual presence.

Not only is there the question as to how a court will apply law in addressing technology, but also where and which courts have the authority to do so. It is little wonder that contractual-based methods of dispute resolution like arbitration will likely take hold before the courts deal with these questions. It is also a paradox that as private arbitration does take hold, the courts will be left with fewer “cases in controversy” to help advance the common law.

## **Conclusions and Recommendations to the Industry: Strategic Considerations for A/E/C Top Management Teams and the Industry at Large**

There is little doubt that technological change will continue to reshape the A/E/C industry. In this reshaping, there will be winners and losers; there already are. The Building Futures Council believes that all of the constituents involved in the industry (including public and private owners, planners, engineers, architects, constructors, manufacturers, attorneys, accountants, financiers, insurers, investors, academia, and others) must recognize this inevitability. In order to improve the way in which the physical assets of our nation's built environment are created and cared for, we need to think less about our interdisciplinary differences, and more about our end goal, which is to put in place facilities that further the overall well being of our nation. And we need to become more technology-oriented in doing so.

The opportunity to improve the image of the industry, which has been a major concern for A/E/C organizations for decades and is now one of our biggest obstacles to industry growth, is directly in front of us. Working together, our different constituents and many disciplines can use these new technologies to create an atmosphere in our industry that is more akin to that which characterized the turn of the 20th century or the post-World War II era. At those times, the A/E/C professions were highly regarded and admired. We were busy building the infrastructure of the most powerful nation in the history of the world. With the advent of electricity and the internal combustion engine, career opportunities were plentiful, entrepreneurial spirit ran high, project innovation was exciting, and architecture, engineering, and construction feats were performed almost daily. Today, if we can make some attempt at becoming Cyber-Toothed Tigers, we can recreate that spirit and make it a more attractive career avenue for our nation's youth.

However, in order to realize these benefits, and many others, it is essential for the A/E/C industry to get proactive with its use of technology and the Internet. To be among the Cyber-Toothed Tigers, one cannot be pulled reluctantly into the new paradigm, but must make a planned, brave leap into the future. The Building Futures Council encourages organizations in the A/E/C industry to think strategically about these changes, not just tactically. That is, don't make a mad dash to adopt the latest IT "toys"; rather, make a planned maneuver to make your organization a more technology-oriented organization, be it a business, an association, or whatever. Devote financial, marketing, and management resources to this new opportunity, or be prepared to compete against those who do.

For most of us in the A/E/C industry today, we have dreamed of a tool that would help make the overall design, construction, and maintenance processes more integrated and efficient, improve total team communication and collaboration, and enable us to be compensated appropriately for the value we add, instead of just having work awarded to the lowest bidder. That tool is the Internet and its related information technologies. They are here now and being leveraged by Cyber-Toothed Tigers every day. Are you among them?