Chapter 1

An Introduction to the Construction Industry

The construction industry, like so many basic American industries, is being transformed to meet the new demands of the twenty-first century. Project delivery concepts are changing—design-bid-build, in both the private and public sectors is now recognized as less than efficient when it comes to both time and money, often promoting litigation and restricting innovation. Relationships between owners, design consultants, and contractors are changing as well, given how the emphasis on design-build has reinforced the positive effects of team collaboration. Technological advances have produced 3-D and 4-D building information modeling, resulting in the potential to construct a building, step-by-step, virtually within a computer before a shovel is ever placed in the ground.

These new building delivery systems and technologies place more responsibility on the project managers who, as before, are charged with “getting it built.” The construction industry in the United States exceeded $1.1 trillion in 2005 and remains a vital part of the economy, providing jobs for more than 12 million people, along with untold millions in revenue to those industries dependent upon construction activities. We are a unique business, incorporating everything from small residential remodeling contractors to giant multinational constructors.

The construction industry can also be characterized as being highly fragmented, and although there are approximately 700,000 contractors in the United States, slightly more than 400,000 of them have less than four employees, while only one percent have more than 100. A highly competitive business, it is one in which profit margins are slim. Statistics compiled by the Construction Finance Management Association in
Princeton, New Jersey, reveal that over the past several years, net profit, after taxes, for industrial and nonresidential contractors ranged from 1.2 percent to 1.5 percent, a figure considerably less than the interest accrued in a passbook savings account.

Like with so many other businesses and institutions, the new century holds untold opportunities and challenges, as well as plenty of detours for the unwary. The paperless workplace predicted by computer gurus decades ago is now gradually unfolding. In mid-2005, General Motors announced they would build two automotive plants utilizing 3-D building information modeling techniques to define the project’s geometry and produce fully integrated and coordinated structural, mechanical, and electrical details—without generating one piece of paper.

Critical Issues Facing Contractors in this New Millennium

As the first decade of the new century unfolds, some demanding issues in the construction industry have become apparent, while others remain more subtle. Both institutional perception and resource changes are taking place, affecting all facets of the industry, such as the following, which will act as the headings of upcoming sections in this chapter:

- How our industry is perceived
- Information technology
- Human resources—the changing workforce
- Productivity
- Quality control
- Project delivery systems
- The organization
- Construction technology
- Safety

How our industry is perceived

In 2004, the Construction Management Association of America (CMAA), in collaboration with FMI (the management consulting firm headquartered in Denver), conducted a survey to determine how the industry viewed the ethical practices of its peers. The survey was directed toward owners, architects, construction managers, general contractors, and subcontractors. Their responses were not heartening.
Eighty-four percent of respondents said they encountered situations that they considered unethical in their business dealings, while 61 percent said the industry was “tainted” by unethical acts. Thirty-four percent, meanwhile, claimed they had experienced unethical acts on several occasions. Of course, the construction industry alone can’t be singled out for ethical lapses. Recently, the media has feasted on ethical and criminal acts committed by executives at Enron, WorldCom, and Tyco. Nevertheless, we in the construction business should revisit the way we do business in order to display for all to see just how the overwhelming majority of our firms operate: ethically, conscientiously, and with a strict work discipline. No portion of the industry was spared criticism by the CMAA—not owners, designers, or contractors.

Owners were blamed for authorizing work and then trying not to pay for it. They were accused of passing off some of their responsibilities to others and playing games with payments, as well as still shopping for prices once all the bids were received. And what about those reverse auctions on the Internet where some disreputable owners trolled fictitious low bids in the hope of hooking some desperate contractor?

Contractors, on the other hand, were accused of overbilling, front-end loading, bid shopping, and playing change-order games. Architects and engineers were chided for doing whatever was necessary to make their clients (owners) happy, often at the expense of the contractor, and for knowingly issuing drawings and other bid documents that were defective and deficient. Changing the perception of our industry is a difficult task, but the responsibility to do so rests with each of us—owner, design consultant, general contractor, and specialty contractor. We must launch conversations about ethical practices, and not ignore those that are unethical, just as we must make it policy to say “No” and walk away from situations that could compromise our integrity. Thus, in the end it is our responsibility to remove those few rotten apples from the barrel.

Information technology

The ability to communicate more rapidly and more accurately has transformed both the design and construction segments of the industry. Wireless mobility has freed the project manager and their field supervisors from their copper umbilical cord so they can now instantaneously transmit and receive verbal and written directives at the touch of a button from their office, from the field, or traveling in between. Architects and engineers have already advanced computer-assisted design in 3-D and 4-D modeling to the point where it promises to produce a seamless flow of design that will reduce systems interference
issues to zero. Even further advances integrating design and construction are on the way.

By tapping into the global market, architects and engineers in this country can outsource work at the end of each workday to the other side of the world where the sun is just beginning to rise, thereby transforming each task into a round-the-clock effort.

**Human resources—the changing workforce**

The growing shortage of skilled workers and experienced managers that began to appear in the 1980s has reached dramatically high levels in today’s marketplace, and remains one of the major challenges facing the industry. Signing bonuses for managers, once relegated to professional athletes, are now prevalent in many areas of the country, and reveal the desperation of some contractors to attract productive employees.

Company benefits over and above those included in collective bargaining agreements are now offered to select employees to keep them from jumping ship to their competitors. A major challenge of this twenty-first century will be to recruit and train new trade and manager entrants to the construction industry, a task that is vital to the interests of the country.

Union membership rolls have been decreased from a high of about 30 percent of U.S. workers in 1948 to slightly more than 8 percent in 2005, and with the coming retirement of many experienced tradesmen, the pool of skilled workers will be reduced even more. To attract people to this industry, we must work hard to change the public’s perception of construction as the industry of the four Ds: dull, dirty, demanding, and dangerous. An aging workforce, the absence of apparent technological advances, and the lure of more attractive vocations have all contributed to this image.

The demographics of our population sounded the warning bell several decades ago, but we failed to recognize them. By the year 2010, it’s estimated that the number of 55- to 64-year-old males will outnumber the 18- to 24-year-old group by at least 1.5 million. A survey of the age of field managers in 2004 revealed that 80 percent were over the age of 36, and nearly half were older than 45. Thus, we must fill these ranks as today’s older managers approach retirement age.

**The undocumented immigrant problem**

The influx of immigrant workers that began in the late 1980s has accelerated, and today more and more jobsites require supervisors who are bilingual. The Pew Center in Washington, D.C., estimated that from 2000 to 2004, the undocumented migrant population increased by 10.3 million. About 20 to 25 percent of the entire construction workforce
in this country falls within that category. This presents a twofold problem for construction managers: a logistical one—the need to fill the labor pool with unskilled workers, and a legal one—attempting not to run afoul of the law in doing so.

The Bureau of Labor Statistics says that the construction industry will have to add 100,000 workers each year through 2012 to keep up with demand. Thus, these pools of construction day laborers are responding to a demand, particularly in the residential construction field where low-skill jobs such as painting, roofing, and landscaping have sharply increased due to the housing boom, and a situation in which these types of jobs are rejected by the local workforce.

At the other end of the labor force, high-paid union workers are declining in number as union membership continues its downward spiral from a peak in the 1950s when it represented 35 percent of all workers in this country. Since then, the number of private-sector union workers has continued to fall. This is not too surprising in the construction industry when analyzing the cost of union labor, where many “burdened” hourly rates in 2005 were in the $75.00 to $95.00 range, compared to some open-shop contractors who had labor rates of $30.00 to $75.00 per hour.

**Productivity**

Opinions vary as to whether productivity in the construction industry has remained flat over the past decade or increased marginally. A 2003 *Construction Industry Productivity Survey Report*, prepared by FMI, revealed that 47 percent of respondents, primarily general contractors, and secondarily, specialty contractors, indicated that productivity had remained the same or actually decreased in some areas. Of note to project managers, 81 percent of those answering the survey believed they could save 5 percent or more on field labor costs through better management practices.

Companies were found to invest less in productivity improvement than in safety programs; however, this could be misleading since increased safety at the jobsite should, as a by-product, increase productivity by retaining core work groups.

Those reporting in the FMI survey produced a list of five items that impact productivity, as well as the four greatest external challenges to improving productivity:

**Five items impacting productivity**

- Lack of planning skills at the management level
- Lack of communication skills at the management level
- Poor communication between project manager and their field management team
Lack of technical training at the craft level
Cultural resistance to change (This can be interpreted as “I’ve always done it this way and it worked—so why change?”)

Four greatest external challenges to improve productivity
- Poor quality of plans and specifications
- Poor coordination by owners, general contractors, and/or construction managers
- Slow responses from other members of the team: architects, engineers, customers, general contractors, and/or construction managers
- Lack of available and qualified craft personnel

Quality control
“Do it right, and do it right the first time” is a concept that will take on more importance in this and future decades. The shortage of skilled workers and experienced managers should increase the pressure placed on project managers from owners demanding, among other things, less call backs and less rework—in effect, higher quality.

In this competitive age, if your firm can’t produce a quality product and produce it both quickly and at a competitive price, owners will look elsewhere. Organizations such as The International Organization for Standardization in Switzerland has developed two generic standards for the worldwide construction industry in order to drive the construction industry quality control engine. ISO Standard 9000 applies to quality management systems, while ISO deals with environmental management systems—but we don’t have to look that far to see what else is being done to embrace quality.

In Providence, Rhode Island, Gilbane Construction, an industry leader in many areas, established a new department in 2005—Client Satisfaction—to raise client service to a new high by focusing on their needs and developing in-house programs that address them. Internal audits as a project begins, coupled with questionnaires to the owner and their design consultants, results in a regional and corporate level review to insure that the client’s needs are being fully met. Gilbane’s Director of Client Satisfaction says that the company strives to exceed the client’s expectations and not accept that the job is “just OK.”

Project delivery systems
Although guaranteed maximum price (GMP) type contracts and construction manager (CM) contracts continue to dominate project delivery systems, the search goes on for a better approach. As always, the cost of design and construction is a key concern of all parties; meeting schedules,
often tightly compressed, keeps the pressure on. Avoidance of disputes between owners, design consultants, and contractors continues to be a prime objective of all parties, and a method to promote more accurate and error-free design documents is another goal pursued by the industry.

For the moment, design-build seems to address speed of delivery when including both design and construction time, lessening disputes due to the collaborative process it creates, and even results in lower overall costs in many cases because it generates fewer change orders. Design-build has been growing rapidly and some experts project that 45 percent of all projects will be design-build by the end of 2010. When coupled with the latest electronic advances in building information modeling, it would appear that design-build is the project delivery system to beat.

The organization

Of the reported 656,448 general contractors operating in the United States, the overwhelming majority remain small businesses with modest annual volumes, operating in a limited geographic area.

McGraw-Hill’s Engineering News Record Magazine in their 2004 edition of the Top 400 Contractors in the United States reveals the wide gap between #1 Fluor Corporation with $13 billion in sales and the #400 firm with $112 million in sales. That leaves about 656,000 other contractors with a significantly smaller annual sales volume. The demographics of the general contracting business validates this small business concept, as shown next (Table 1.1):

<table>
<thead>
<tr>
<th>TABLE 1.1  Number of General Contractors by Revenue and Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of business by annual revenue</td>
</tr>
<tr>
<td>Less than $25,000</td>
</tr>
<tr>
<td>$100,000 to $249,999</td>
</tr>
<tr>
<td>$250,000 to $499,999</td>
</tr>
<tr>
<td>$500,000 to $4.9 million</td>
</tr>
<tr>
<td>$5 million to $9.9 million</td>
</tr>
<tr>
<td>Over $10 million</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size of establishment by number of employees*</th>
<th>Number of establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 4 employees</td>
<td>409,256</td>
</tr>
<tr>
<td>5 to 9 employees</td>
<td>123,389</td>
</tr>
<tr>
<td>10 to 19 employees</td>
<td>67,093</td>
</tr>
<tr>
<td>50 to 99 employees</td>
<td>10,958</td>
</tr>
</tbody>
</table>

*Does not include companies with employees in excess of 99; therefore, total does not equal 656,448.

SOURCE: Department of Commerce—U.S. Census
Construction technology

In the 1970s, spurred on by their concerns over an aging population and the potential lack of skilled workers in their construction industry, the Japanese began to develop a whole series of construction robots including excavation and real-time compaction robots, as well as rebar bending, concrete placement, and floor-finishing robots. Second- and third-generation models emerged in the mid-1990s and it appeared that the robots’ commercial production was just around the corner when the Japanese economy spiraled downward at the end of that decade putting most of these expensive programs on hold. Nevertheless, they showed what could be done.

Global Positioning System (GPS) satellites were used back then with increased frequency by survey parties, and now GPS is being investigated not only as a way to verify line and grade, but to guide unmanned excavating machines to produce those lines and grade. Combined with 3-D modeling, it is now possible to create a three-dimensional site plan on a remote console and, similar to a video game, grip two joysticks and actually direct an unmanned bulldozer to work the site. The equipment manufacturer, John Deere, is currently equipping 5 percent of its dozers with GPS units and by 2015 predicts that 20 percent of their new bulldozers will be equipped with automatic grade controls. This may be the first of a wave of automated construction machinery to be produced by U.S. manufacturers. After all, the Japanese have shown us it can be done!

Safety

Once again, the scarcity of skilled workers places added importance on maintaining a safe working environment, not only to polish the industry’s image, but to retain the integrity of productive work teams.

More owners, aware of safety from both a moral and cost standpoint, are requiring that contractors provide them with a history of safe working conditions as part of the project bid criteria. Although construction accounted for approximately 6.6 percent of the total workforce in the United States in 2000, it had the dubious distinction of accounting for 19.5 percent of all workplace fatalities. As worker compensation insurance rates continue to remain a significant factor in the calculation of a company’s overhead—and therefore its competitiveness—builders need to be more aware of the cost implications of a poor safety record as well as a good one.

The changing marketplace

Tomorrow’s managers will have to become more astute and selective in defining their markets in the face of stiffer competition, and more general contractors are looking to specialization, or niche marketing, to do so.
Niche marketing will become more important as each company seeks to exploit its experience and expertise in the field of its choice and thus narrow the field of competition. Marketing or sales development, long ignored by many contractors who depended upon word-of-mouth in a defined geographic marketing area, has now become not only essential, but sophisticated, as witnessed by the proliferation of contractor Internet web sites. When the longest economic expansion in the nation’s history ended dramatically in mid-2001, contractors needed to reassess their market strategy to assure that they had the necessary tools available to survive and thrive in the coming years.

The changing role of the general contractor. The character and role of the general contractor has changed dramatically over the past 50 years or so. The time when the general contractor employed crews of laborers, carpenters, masons, and operating engineers, and owned substantial numbers of excavating equipment (“iron”), performing significant amounts of work with their own forces, is largely over. Construction projects became more sophisticated in design, and as competition intensified, the reliance on specialty contractors, subcontractors, soon became the order of the day. As early as 1991, subcontractors accounted for 75 percent of all construction company establishments, and that number has been growing ever since. Change is nothing new to contractors. When activity in new construction lessens, contractors pursue renovation, rehabilitation, and interior tenant fit-up work. When private sector work decreases, the contractor looks to the public sector for projects. But in the coming years, along with the usual concerns over costs and getting the job done on time, other factors will occupy the thoughts and actions of progressive contractors. The electronic age is here to stay and those contractors that fail to embrace the advantages it has to offer will find themselves at a disadvantage. Old ideas must give way to the new, presenting yet further challenges that must be surmounted, just as the problems of the past were.

The project manager’s role. With all of the changes taking place in the industry, the project manager’s role remains constant: control over both the work process and the costs associated with that work. Management of a construction project can be divided into four components:

- **Construction engineering** The proper technique of assembling materials, components, equipment and systems, and the selection and utilization of the best construction technology to do so.

- **Management of the construction process** Establishing the most effective way to implement the construction process, including proper
scheduling and the coordination and control of the flow of labor, materials, and equipment to the jobsite.

- **Human resources management** Since labor productivity and a harmonious working environment are essential elements of a successful project, control over human resources becomes important, more so than ever these days where shortages of both skilled workers and experienced managers exist.

- **Financial management** Construction is a high-risk business with historically low profit margins. Control over costs, cash flow, and adequate project funding is critical to the success of any business endeavor, and construction is certainly no exception.

All of these key management functions, to some degree or other, will fall upon that most visible member of the construction team, the project manager, who must not forget the seven criteria essential to the successful completion of a project.

- The project was completed on time.
- The complete project cost remained within budget.
- The quality levels expected were achieved.
- The project was completed with no unresolved disputes and no outstanding claims.
- The contractor maintained a professional relationship with the designers—the architect and engineers.
- The contractor maintained a mutually beneficial relationship with all subcontractors and vendors.
- The contractor-client relationship was a good one.

The project manager’s role in the construction process may vary from company to company depending, primarily, upon the annual revenue and sophistication of the individual firm and the availability of support staff. Some companies assign the project manager, estimating buy-out responsibility along with their management duties, while other companies assign these tasks to specific departments and staff. But the one project management responsibility that remains constant is the effective orchestration, guidance, and control of the construction process from beginning to end. Project management means managing the construction project—and that is what this book is all about.