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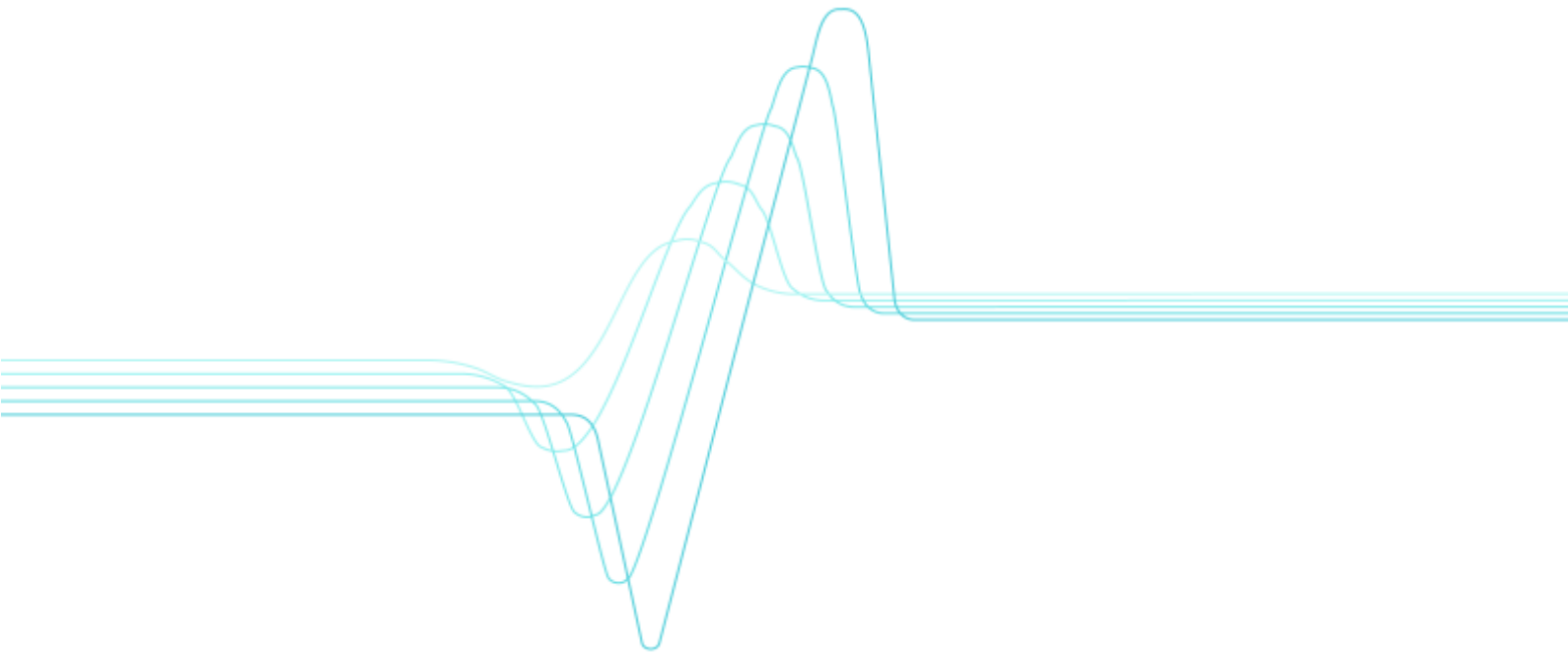
Jaana Koota

Market review and study of success characteristics in construction companies

Case: United States



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VTT Building and Transport

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Abstract

As a market area, the United States is a mature, highly developed, industrial nation with one of the highest real per capita levels of any country in the world. With a relatively decentralized, market-oriented economy, businesses have considerable flexibility to expand capital plant, lay off surplus workers, and develop new products. In 2000 the Gross Domestic Product in the United States was about $9,963 billion, which was about 1.3-times higher than in Western Europe (OECD Europe) and about 85-times GDP in Finland. Total value of construction was about $815 billion in 2000. Western Europe is on a par with the United States for the value of the construction. Compared to Finland, the value of construction in the United States is about 50-times the value in Finland. The residential construction portion in the U.S was 46 %, or $379 billion, while non-residential totalled near $292 billion, or 36 % of the total figure. Civil engineering was $144 billion or approximately 18 % of total value. Residential construction can be divided into new construction and renovation and improvements of housing buildings. The value of the new residential construction was $269 billion, while the estimated value of the renovation and improvements was $110 billion in 2000.

With globalization, understanding different business concepts becomes more and more relevant. If European companies want success in their cooperation and customer relations with U.S. companies, they have to be flexible in their ways of working and understand cultural differences in business. Therefore it is essential to realize which factors are important for success: Importance of diversified business mix, client focus (diversifying the practice/market sectors), business orientation, and willingness to change.

In this study, information of success characteristics in the construction industry is mainly based on interviews in selected U.S. companies and experts at Texas A&M University, Department of Construction Science. Information was collected from seven companies, whose fields of activities covered industrial construction, residential construction, HVAC services and design and planning. The success characteristics that are presented in this report are common for most of these case companies. These include, among others: differentiation, alliances and partnerships, safety performance and labour relations.

Preface

This report is part of the "TopUSA–Case Studies on Developing New Advanced Operations and Business Concepts in Construction Companies in the USA" -project. The goal of the project was to provide case stories on successfully implemented new operations and business concepts in construction companies in the United States for encouraging Finnish construction companies in their development and moving towards new innovative business opportunities. The project results are based on confidential interviews in selected U.S. companies, and information and research results published in the American literature.

The main project was carried out between January 2001– February 2002 at the Texas A&M University, Department of Construction Science. The interviews and their documentation were carried out by a research scientist of VTT and colleagues from A&M University. Local research organizations, such as Construction Industry Institute (CII), provided a good starting point for the project.

The project was carried out in collaboration with its financiers Tekes (National Technology Agency of Finland), Finnish construction companies Lifa-Air Ltd, Rautaruukki Corporation, and VTT Building and Transport.

The aim of this report is to present some basic success characteristics in the construction companies. A further aim is to describe the construction market situation in the United States.

Tampere, Finland
December 2002

Jaana Koota

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1. Introduction

1.1 Background

In the construction industry globally, the business arena is changing constantly and new business models and technologies are introduced frequently. In this business environment it is difficult for companies to develop their strategies fast enough. Companies want an organization flexible enough to adjust quickly to changing market conditions, lean enough to beat competitor's price, innovative enough to keep its products and services technologically fresh, and dedicated enough to deliver maximum quality and customer service. The comprehension of the new ascending technologies, the foresight of the changes in the business environment and, when needed, a capability to differentiate are necessary in order to attain a continuous competitive advantage in the business. Technology roadmapping is one possible tool for long-term strategic planning at both corporate and industry level.

In Finland, the Science and Technology Council, Ministry of Trade and Industry, Ministry of Education, National Technology Agency of Finland (TEKES), and Technical Research Centre of Finland (VTT) have pointed out the importance of cooperation with the United States and Japan. A remarkable share of scientific and technological development in the world is done in these countries. The Finnish construction industry also has recently shown a great interest in the United States as a market area.

1.2 Objectives

The aim of this study was to get acquainted with the basic knowledge of success characteristics of case companies in construction industry. The aim was to answer the question “Why are these companies successful in a changing business environment?”. A further aim was to describe the construction market situation in the United States. The purpose of the project was to give Finnish construction industry possible new ideas for their business concepts and also give general information about the construction business environment and market situation in the United States. The study is based on interviews of experts in selected U.S. companies, universities, and organizations, and information and research results published in the American literature.

1.3 Conducting the study

The project started in August 2000. At the same time VTT Building Technology had an ongoing project "Case studies on developing new advanced operations and business concepts in construction companies in Europe". This study is based on that project idea. The purpose was to find information on construction companies in the United States that may be compared with the European information.

The questionnaire for US companies was prepared and approved by the steering group of this project in January 2001. A group of twelve companies to be interviewed were identified with the help of experts at Texas A&M University, Department of Construction Science. The questionnaire was sent to these companies. At the end seven companies were interested in participating in this study and were willing to give an interview. Five of these case companies pointed out at the beginning of the interview that the information given in the interview is confidential. At that point it was decided that names of participating case companies would not be published in the report.

All interviews with case companies were carried out between April 2001 and February 2002. During that period of time also experts at the university and Construction Industry Institute were interviewed, and research results and literature were searched.

During the project, the researcher attended two conferences: Construction Project Improvement conference by Construction Industry Institute in 2000 and 2001; and the seminar: "Three Firms, Three Strategies – Successes and Failures" by CRS Center in February 2002.

The market information in this report is mostly based on statistical data and literature but also on interviews. A market review is presented in Chapter 2. After collecting all available material and information about case companies and the construction industry in general, the most common success characteristics were defined. These characteristics are presented in Chapter 3 in this report.

Collecting relevant information about companies faced some difficulties. Cultural differences between Finland and the United States made it somewhat hard to find essential information. For example, most US companies do not publish their annual reports like companies do in Finland. That was the reason why financial information could not be compared in the study.

2. Construction market and business environment

2.1 Economical overview

The United States is a mature, highly developed, industrial nation with one of the highest real per capita levels of any country in the world. With a relatively decentralized, market-oriented economy, businesses have considerable flexibility to expand capital plant, lay off surplus workers, and develop new products. The United States is at the forefront of technological capability, especially in computers and medical, aerospace, and military equipment. The economy has enjoyed a long, uninterrupted expansion since 1991, which has resulted in steady income growth and a drop in the unemployment rate to nearly 4 %. The increase of the Gross Domestic Product has been between 3 % to 7 % during the last decade, and a modest increase is expected also in coming years. At the moment there is some uncertainty about the development of the economy, because it is difficult to assess the impact of September 11th incidents and the war climate on the economy. Despite that, it is estimated that low interest rates will characterise the economy and spur on construction in near future also. [1, 2, 3, 18]

Similar to the rest of the industrialized world, the United States has an aging population profile. At the moment, the 65 and older segment stands at about 35 million people (about 12 % of the total population). In 1990, the number was about 31 million people. It is estimated that by 2010, that share will rise to over 13 %. In contrast, Americans below the age of 15 will account for 20 % of the population by 2010 compared with almost 22 % in 1999 and about 23 % in 1980. [2]

In 2000 the Gross Domestic Product in the United States was about $9,963 billion, which was about 1.3-times higher than in the Western Europe (OECD Europe) and about 85-times GDP in Finland. GDP per capita was about 33,040 dollars per capita. In Finland GDP per capita was about $22,520 which is approximately 10% higher than in the Western Europe on average. Gross Domestic Product and the GDP growth are shown in following figures of a GDP comparison between the USA and the Western Europe, and the GDP growth in the United States (Figures 1–2). [1, 2, 3, 4]

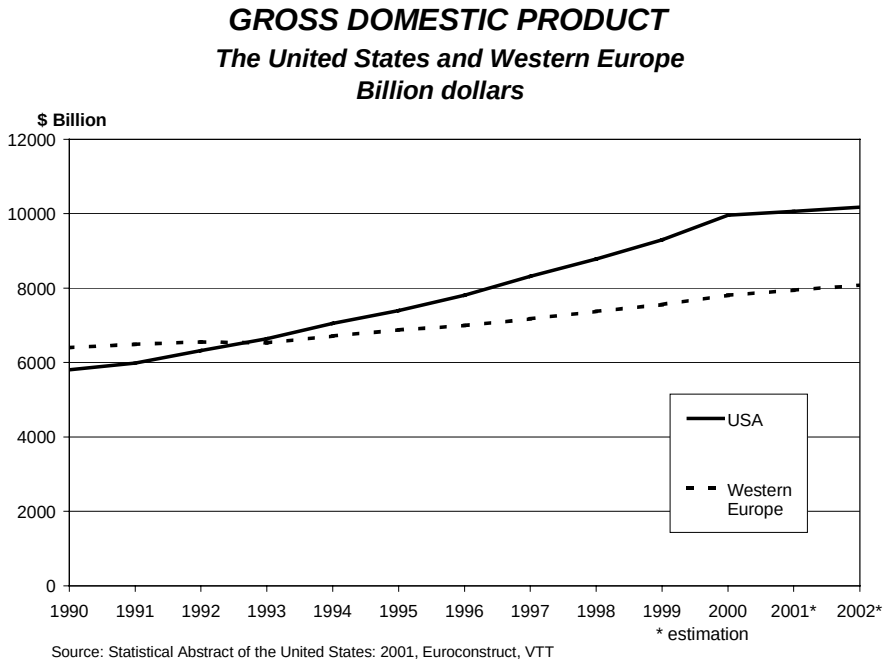


Figure 1. GDP in the United States and Western Europe.

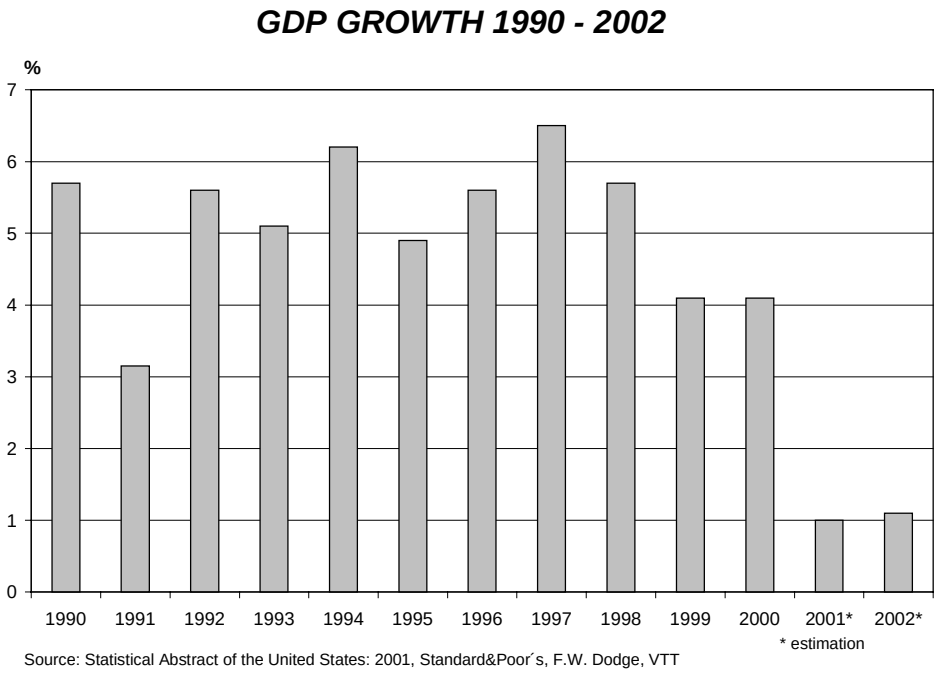


Figure 2. GDP growth in the United States.

The economy has kept up its growth through a combination of low unemployment and low inflation, both of which have been empowered by a faster productivity-growth rate. The rapid productivity advances have started to fade, and businesses have been forced to hire less-skilled workers even as wage demands accelerate. Nowadays new information technologies have been playing an important role in the productivity gains. The availability of real-time information has enchanced just-in-time inventory management and enabled manufacturers and distributors to reduce inventories and their associated costs. New technologies have made both capital equipment and labor more efficient and have allowed manufactures to fine-tune specifications to meet individual customer needs. [2, 3]

2.2 The construction business environment

2.2.1 General

The construction market can be divided into public and private sectors. In the United States the private sector makes up 79 % of the whole industry. Within the public sector, federal construction represents about 10% of the total construction industry. The construction market is recognizably fragmented. A large market area with different climatic conditions and other unexpected potential sources of danger require a diverse range action in the construction industry. For example, building codes vary from state to state, and region to region, depending upon the climatic requirements and possible hazards. These can include for example earthquakes, tornadoes, hurricanes, flooding, winter storm damage, and other natural occurring events. In addition, the local authorities can demand more strict codes and standards. It depends in what part of the country the construction activity is located and if the area is considered rural, city, or in a country type environment. [1, 2, 3]

The construction industry represents a significant portion of the nation's gross domestic product. Construction accounted for approximately 8 % (2000) of the GDP. Today more than 6 million people are employed in the construction industry, and about 60 % of the nation's reproducible wealth is invested in construction facilities. [1, 6]

In the construction industry globally, the business arena is changing constantly and new business models and technologies are introduced frequently. There are examples of differentiation in the construction market in the United States. Generally, in the construction business it is typical of companies to specialize in a few sub-sectors of construction - horizontally or vertically. This can be seen distinctly in industrial construction. The high volume of the construction market and its submarkets, and risks

and liabilities in the business attest to this fact, that companies attribute the differentiation to be essential to their business and competitive advantage. In addition to the market size, construction in the United States is fast and yet, on the other hand, the life cycle of buildings is shorter than in Europe. Differentiation and potential for new cost-effective business models and technologies are requirements to manage the changes of the business environment. Both demand for differentiation of companies and the rapid evolution of technologies, require continuous learning by the workforce (labor, professions and management) across the whole construction process (design, construction, operation, maintenance, renovation and demolition). Differentiation requires that a company is capable to develop its business models. Partnering, leadership, and teamwork are essential in the construction business. [4, 6]

2.2.2 National construction strategies

According to studies and interviews, the U.S. construction industry under-invests in research and development (R&D) compared with other U.S. industries and foreign competitors. Less than 0.5 % of annual construction industry revenue is spent on construction related R&D. The average R&D investment for general industry is 3.7 %. Some sectors of construction materials invest 1 % and housing materials and components invest 1.8 % of their revenue. However, companies do see that the continuous education of the workforce is part of the R&D. In total, research and development is done by government, industry, universities and colleges, and other non-profit institutions. In following figure is shown R&D expenditures in all fields of activities (Figure 3). [1, 6]

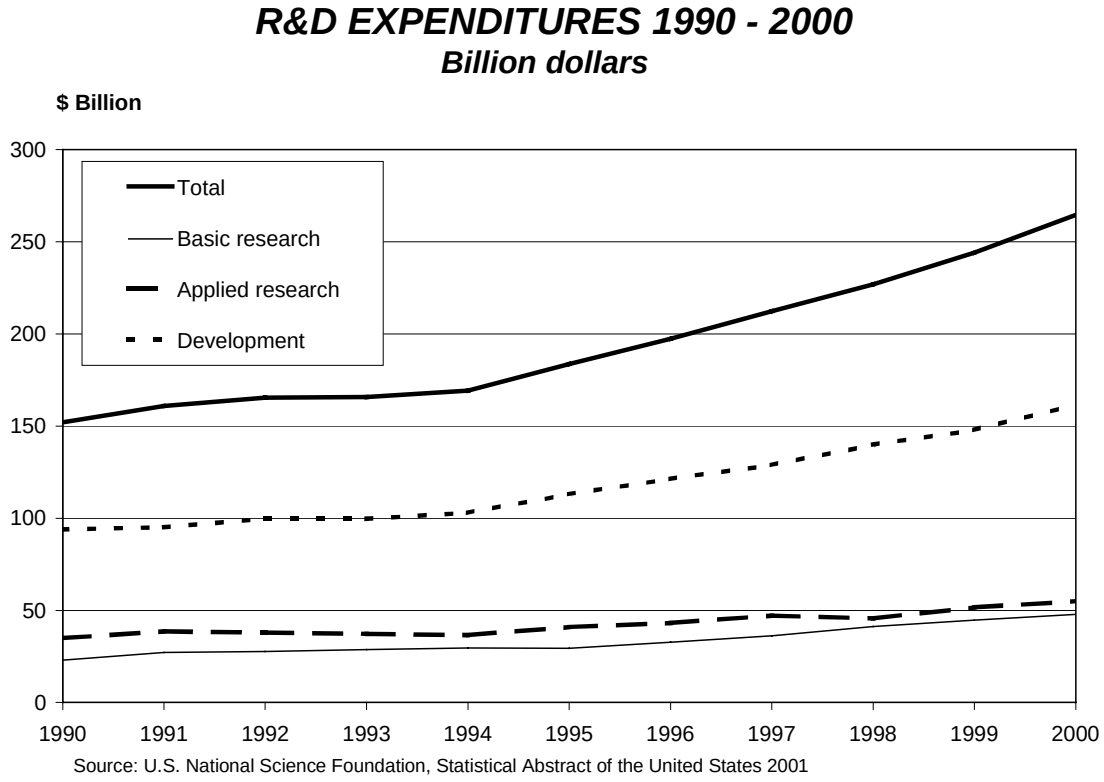


Figure 3. R&D expenditures, all fields of activity.

National Institute of Standards and Technology (U.S. Department of Commerce) has published a report "National Planning for Construction and Building R&D" in 1995, which includes a National Construction Goals Program. The baseline for each goal was the construction industry performance in 1994, and the objective was to have practices capable of meeting the goals available in 2003. See Appendix 1. [5]

The National Construction Goals program has a vision, which defines following objectives:

- High quality constructed facilities support the competitiveness of U.S. industry and everyone's quality of life

- U.S. industry leads in quality and economy in the global market for construction products and services

- The construction industry and constructed facilities are energy efficient, environmentally benign, safe and healthful, properly responsive to human needs, and sustainable in use of resources

- Natural and manmade hazards do not cause disasters [5]

The program contains two priority thrusts; better-constructed facilities, and health and safety of the construction workforce; these have been defined as a focus for research, development and deployment in the construction industry. Within these thrusts seven goals were identified. The plan to achieve the National Construction Goals deals with these seven goals, covering five sectors of industry (residential, commercial, industrial, institutional, and public works), seven areas of technology, and six barriers. [5]

Major non-technical barriers, which have been identified in the program, include for example, lack of leadership, regulatory barriers, liability, and scarcity of skilled labor, which is today the main problem in the construction industry. The program has involved close collaborations between the private sector and Federal agencies. Such collaboration has been vital to the purpose and success of the program. [5]

NATIONAL CONSTRUCTION GOALS, [5]

A) Better constructed facilities

Goal 1. 50% reduction in delivery time
Goal 2. 50 % reduction in operation, maintenance and energy costs

Goal 3. 30 % increase in productivity and comfort
Goal 4. 50 % fewer occupant related illnesses and injuries
Goal 5. 50 % less waste and pollution
Goal 6. 50 % more durability and flexibility

B) Health and safety of construction workforce

Goal 7. 50 % reduction in construction work illnesses and injuries

2.2.3 Main problem areas in construction industry

According to the National Construction Goals Program and interviews, some non-technical barriers or problems in the construction industry have been identified. This list includes lack of leadership, regulatory barriers, liability, adversial relations, financial disincentives and scarity of skilled labour. Also, some slowdown in delivery of products and material has been seen, especially after September 2001. [5, 6]

The single largest problem today is the shortage of skilled workers. To get qualified, skilled labour, not only in specialized subcontracting but also in general contracting is a really big problem. The construction workforce is inadequately trained in many instances. Most construction companies in the United States use temporary employees. Usually workers are on the payroll of the company for a particular project and then may or may not be hired. The reason for this is that most North American construction companies do not have permanent positions for all of their non-supervisory personnel. Employers in construction cannot always hire enough skilled labor to meet their current job needs. Traditionally, in the construction industry management has not wanted to invest much company time in training and in long-range development of these temporary craft people. Lack of training has a strong affect among others on safety. According to studies, 57 % of the workers had worked for their current employers for at least one year out of previous five. Additionally, 20 % of the workers had worked for their current employers for the entire five years. Studies also show that 25 % of all construction accidents happen to workers who have been on the job for one month or less. [5, 6, 8, 11]

The shortage of skilled labor within the construction industry has been exacerbated by the combination of high construction demand and low national unemployment. Builders are increasingly forced to employ inexperienced workers, which lengthens the construction schedule and may lead to improper installation of component. Even though the number of skilled workers has grown about 5 % annually since 1990, an additional 240,000 skilled workers per year are needed. [15]

According to the program to solve this problem, the objective is to assure that construction workers are skilled in the latest methods and equipment used in their trade or profession: for productivity, recognition and control of risks to health and safety, and environmental protection. The problem is that both the demands for the birth of enterprises and the rapid evolution of technologies, require continuous education of the workforce (labour, professions and management) across the whole building life cycle process (design, construction, operation, maintenance, renovation and demolition). The challenges upon management for productivity, teamwork, health, safety and environmental quality, demand both formal and continuing education. [3, 5]

Construction quality and occupational safety and health are fundamental issues in the construction sector. They are increasing in importance not only in economic terms, but also from the social and environmental perspective. Attention to occupational health and safety in construction companies has increased in the United States over the past decades. The 1990s is called the "decade for construction safety". The high number of fatal accidents and injuries has led to the greater emphasis on safety. Although construction work has become safer during the years, there is still need for further

improvements to reduce the numbers of fatalities and serious injuries in the industry. [7, 8]

Safety still remains a large concern for any type of construction. Public as well as private safety, are essential and much effort is put into safety issues during and after construction. While cost, time, and quality remain important, safety has moved to the forefront of contractor selection criteria. In private projects, contractors' workers' compensation rates (based on experience modification rates EMRs) and OSHA records are among the first items checked prior to their being considered for a project. Contractors with poor safety records are often excluded from the selection process. [3, 12]

The construction industry in the United States employs about 5 % of the entire industrial workforce. However, the construction sector has generally accounted for nearly 20% of all industrial worker deaths. There are about 636.000 construction companies in the United States and over 6 million workers are employed in the construction sector. According to statistics, 18 % of work-related deaths and 15 % of all workers' compensation cases occur in the construction industry. Approximately 1000 construction workers are killed each year. [10, 12, 13]

Falls are the most common source of construction worker fatalities. After falls, the most common cause of fatalities was being struck. Incidents in which a worker was caught in or between objects was the third most common cause of construction worker fatalities. Electrical shock was the fourth most common cause of fatalities. Of all fatalities, 11% are the result of contacts with overhead power lines. [7, 8, 11]

The Construction Industry Institute (CII) has an on-going research group, "Making Zero Accident a Reality", whose purpose is to develop a communication and education component to assist in understanding and implementation of best practices that support a Zero Accident culture. CII studies indicate that use of Safety Best Practices may also contribute to improved cost and schedule performance. Drug and alcohol testing is one part of Safety Best Practices, but it is a controversial topic in which the rights of workers to privacy and freedom of choice in their private behavior are pitted against the rights of the company and its workers rights to have a safe and productive workplace. Drug testing is shown to be effective in reducing the incidents of injuries. It is a common means of addressing safety, especially on large projects or large construction companies.[10]

Regulations and building codes vary from state to state, and region to region, depending upon the specific natural requirements. For example, in Florida a different design concept is needed because of hurricanes, in California earthquakes and in New York and Chicago strict fire codes need to be taken into consideration in design and construction. The local authorities can demand more strict codes and standards, which

depend in what part of the country the construction activity is located. Regulations affecting construction are promulgated and enforced by a bewildering variety of local, state and federal regulatory authorities. Regulations affect land use, siting, design, materials, construction, operations, and maintenance - every facet of the whole life cycle of the constructed facility. Generally, regulations have grown incrementally and often reflect prescriptive, arbitrary provisions for precluding recurrence of past problems. The result of multiple, prescriptive regulations is that provisional and regulatory authorities often are in conflict making it difficult to do anything, let alone to introduce a beneficial, innovative product or service. Also, some private sector organizations have supported prescriptive regulations as a means to deny potential competitors entry to the marketplace. [3, 5]

2.3 Construction market in the United States

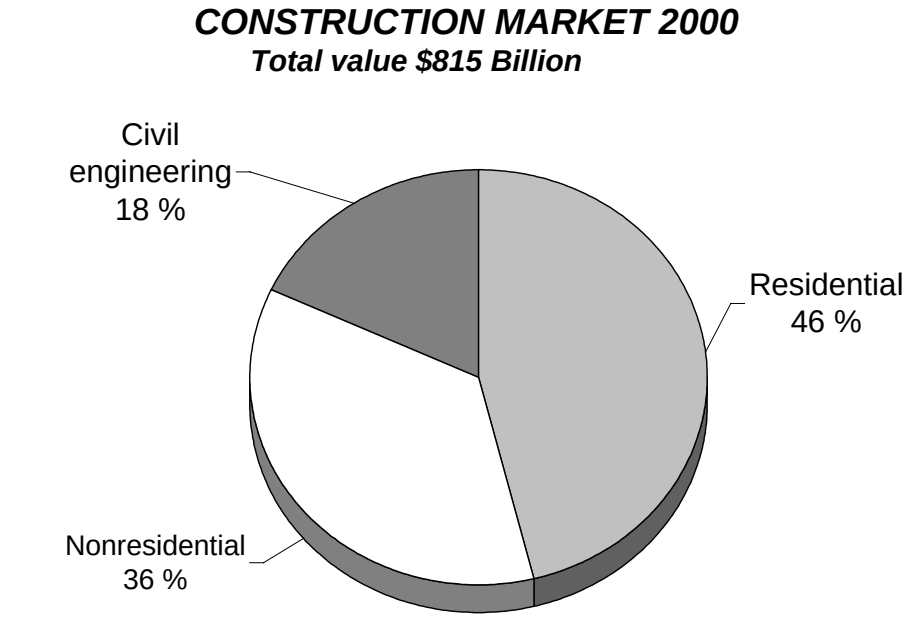
2.3.1 Value of construction

The construction statistics, which are used in this report, divide construction into three sectors: residential, non-residential, and civil engineering. Residential refers to one-family and multifamily housing; non-residential includes commercial office buildings, manufacturing, institutional, healthcare, retail and shopping, and other building structures; and civil engineering (non-building) refers to the Public Works (roads and bridges, water and sewer, airports, and waterways) and utilities. Residential construction can also be divided into new construction, and renovation and improvements. New construction covers over 70 % of the residential sector. [1, 3]

The total value of construction was about $815 billion in 2000. Western Europe is on a par with the United States for the value of the construction. Compared to Finland, the value of construction in the United States is about 50-times the value in Finland. The residential construction portion was $379 billion, or 46 % of the total value, while nonresidential totaled nearly $292 billion, or 36 % of the total figure. Civil engineering was $144 billion or approximately 18 % of total value. The value of the new residential construction was $269 billion, while the estimated value of the renovation and improvements was $110 billion in 2000. [1, 3, 4]

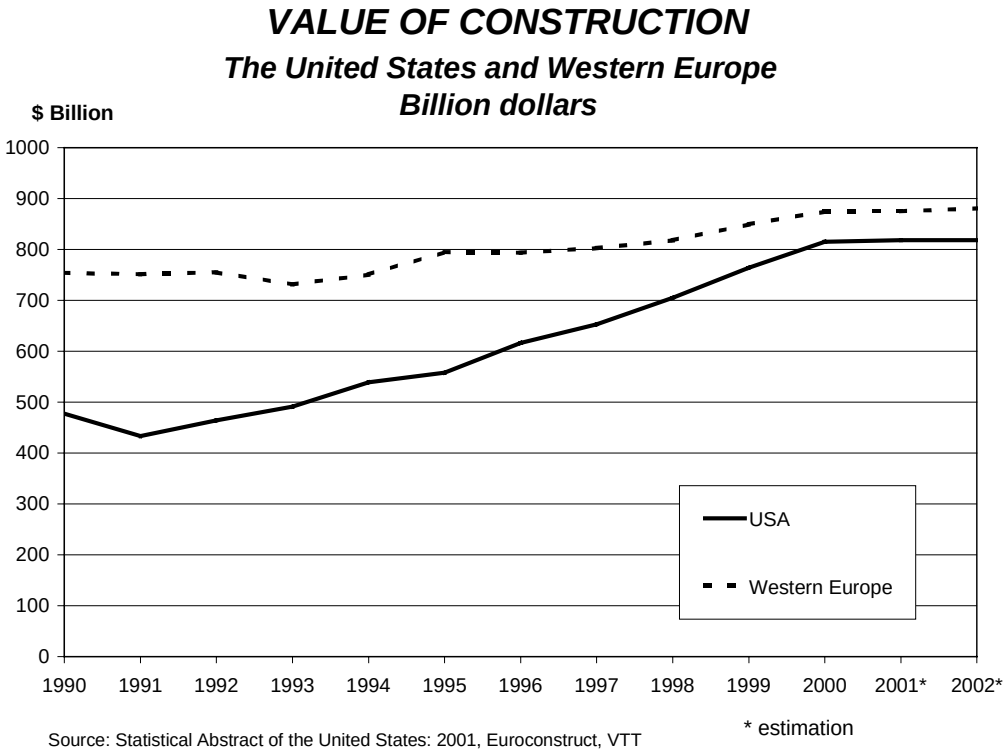
The U.S. construction industry has seen a steady growth since 1992. Growth has been 3 - 10 % annually through year 2000. In 2001 the estimated total construction put-in-place was about $820 billion. According to the latest estimation the value of construction will be almost $845 billion in 2002. Civil engineering and homebuilding were the prime drivers that pulled the industry. Also, the first months of the year 2002 have showed

a pretty good start. Federally funded construction is continuing at a strong pace because fiscal 2001 appropriations included increases in several categories. On the private market, the two strongest sectors have been school and apartment building construction. In the following figures are shown the value and division of the construction market in 2000 (Figures 4–6). [1, 3, 18]



Source: Statistical Abstract of the United States: 2001, VTT

Figure 4. Construction market 2000 in the United States.



Source: Statistical Abstract of the United States: 2001, Euroconstruct, VTT

Figure 5. Value of construction in the United States and Western Europe.

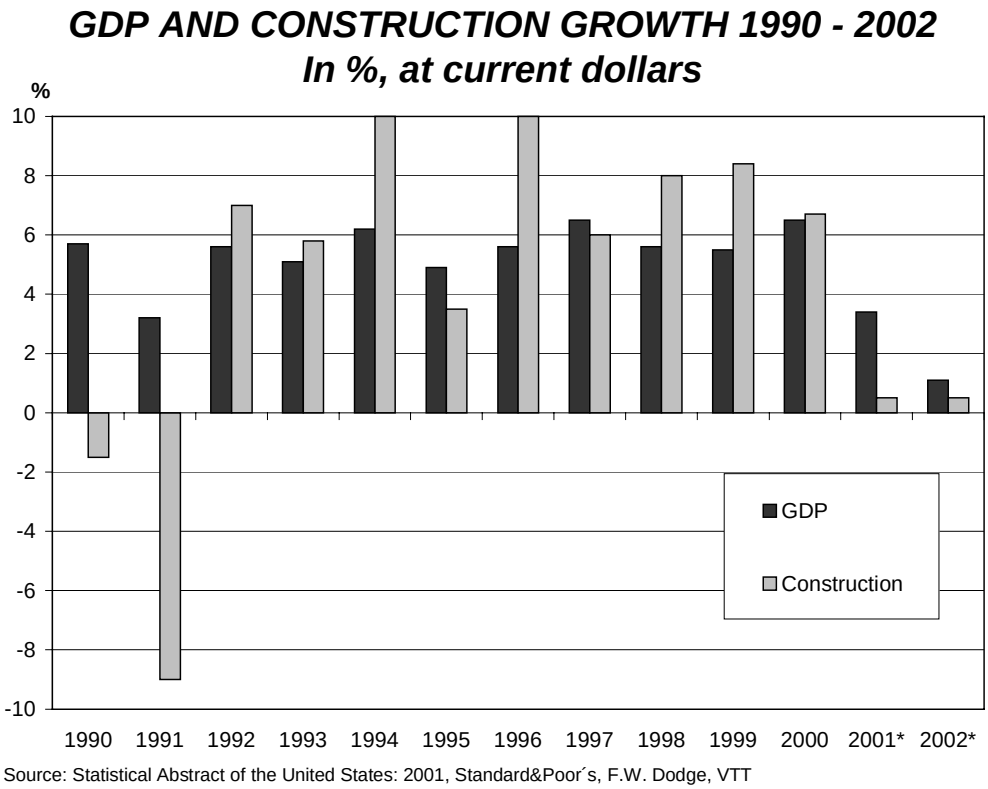


Figure 6. GDP and Construction growth in the United States.

2.3.2 Residential construction market

The country has enjoyed an unprecedented period of economic prosperity in recent years. While growth will not be as strong in the future as it has been throughout most of the 1990s, continued rising incomes will induce demand for more opulent residential units. Residential construction in the United States has typically been single-family housing (80%), but the multifamily housing is also increasing, due to the "Urban Sprawl" and traffic congestion in most of the major cities. Multi-family units accounted for only 20 % of the new starts in 2000. Demographics are a significant aspect of the residential market situation. Most of the new residential homes are being built in the southern portion (46 %) of the United States, and western portion accounts for about 24 %. [1, 2, 3]

The total number of households was 104.7 million in 2000. It is expected that the number of households should increase by some 13 million between 1999 and 2010 as the average household size decreases. As such, there will be increasing demand for residential construction, including apartment units to accommodate the increasing incidence of one- and two-person households. Demographic trends have become more

favorable to the construction of multifamily housing since 1995. Future prospects for multifamily dwelling construction are affected by the acceleration of growth of the population cohort of the younger (18-24) individuals who are an important market for apartment living. One reason is that an increased demand for apartments is coming from so called "empty-nesters": individuals moving into their fifties with children no longer living at home. This group of people is a particularly fast growing group. In addition, multifamily housing is one of the better targets for investors. However, multifamily housing will also be affected by weaker economic prospects. According to estimates, in 2002 multifamily starts will slow to just 312,000 units. [1, 2, 3]

According to statistics there were about 1.6 million new housing starts in 2000, which was a 6 % decrease from 1999. In 1999 growth was about 3 % compared to the previous year; in 1998 there was a strong 10 % expansion. Starts will slowly move downward through 2002, when they will bottom out at less than 1.4 million units. Single-family housing starts climbed 5 % in 1999, which was not as impressive as 1998's about 12 % jump, but still noteworthy since it is a further increase on top of an already exceptional level of activity (Figure 7). [1, 2, 3, 14, 18]

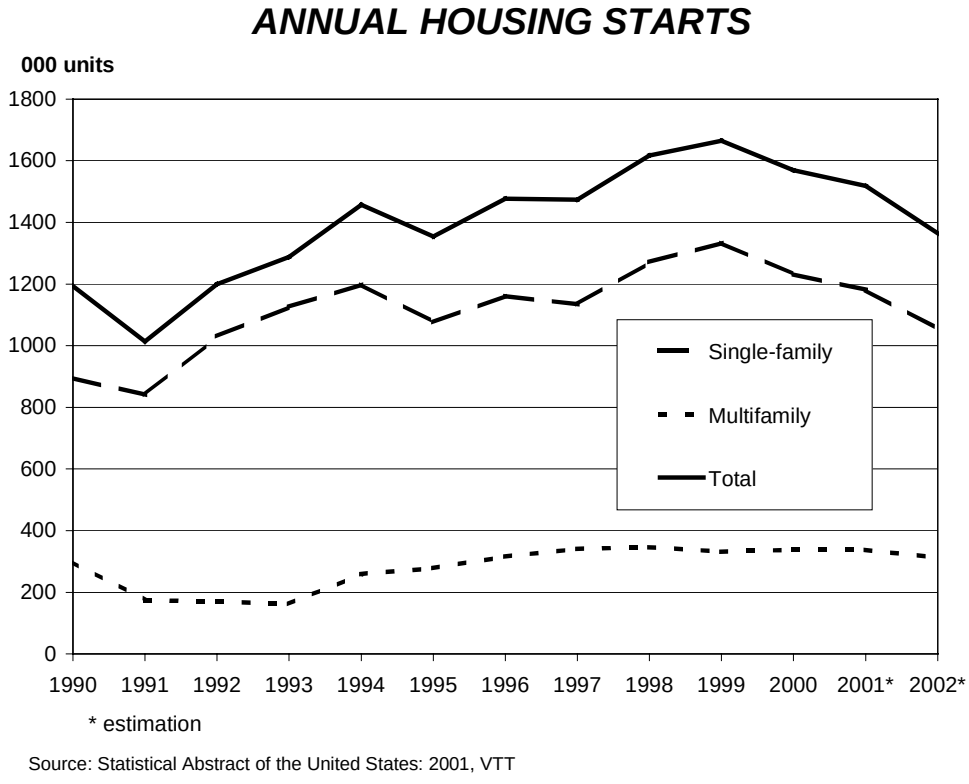


Figure 7. Annual housing starts in the United States.

The loss of momentum for homebuilding started at the latter half of 1999 and continued in the more deliberate economic environment of 2000-2001. Given the heightened

levels of homebuilding during the latter half of the 1990s, little pent-up demand will remain to lift construction activity above the underlying demographic demand. [2]

The home building industry is characterized by many relatively small companies operating over limited geographic areas and rely heavily on subcontractors to perform most on-site work. Most of all homes are constructed via a system classified as platform building construction. Platform systems have each level built on top of each other like a platform. Most homes are constructed of timber frames, but the external shell is typically vinyl, brick or wood. Panelized systems, modular units, manufactured housing, and engineered lumber are very common in new homes nowadays. There have also been advances in handyman tools, which makes the installation and fastening much easier and quicker. Major obstacles are the increasing land rates and demand for prime located sites. Environmental studies on land areas are required prior to obtaining any permits to build. [3, 16]

2.3.3 Nonresidential construction market

Nonresidential building accounted for about 36 % of the total value of construction in 2000. In area, activity covered 1.86 billion square feet (about 167 million m^2) of space. While the total nonresidential building market decreased 0.6 % in 2001, the public sector was posting a double-digit growth, with about 11 % growth rate, in virtually all markets. School construction keyed the public sector growth by increasing 13 %, to $49 billion in 2001. This followed a 12 % increase in 2000. Other public markets showed a marked acceleration in annual growth. According estimations, the annual growth rate for 2000 and 2001 went from 2 % to 21 % for public housing, from 3 % to 14 % for institutional buildings and from 2 % to 16 % for drinking water facilities. [1, 2, 3, 14]

The manufacturing sector's share of the GDP is expected to increase slightly through 2010. In absolute terms, the U.S. manufacturing sector's contribution to real GDP would rise from $1.6 trillion in 1999 to slightly less that $2.2 trillion in 2010, suggesting that there will be continued demand for both expanded and new manufacturing capacity. [1, 2, 14]

Retail construction has been helped by its close relationship to the pattern of single-family housing. Since 2000, the more deliberate economy has led to slower growth for retail sales as well as a moderate downturn for housing starts. Hotel construction is projected to fall over the coming years after reaching a record high in 1998 at 88.6 million square feet (8.2 million m^2). The investor wariness about overbuilding has hit the limited service segment of the lodging industry particularly hard. [1, 2, 3]

Office construction (in sq.ft.) rose 40 % in 1997 and another 43 % in 1998. The 290 million square feet (about 27 million m^2) of office space added in 1999, marked the highest level of office construction since 1986. Suburban markets continue to see brisk activity, but construction in downtown markets is catching up with the earlier progress in the suburbs. In period 2000–2001, a slower economy and the slight increase in suburban vacancies have had a constraining effect on rent increases, which have led to a drop in construction activity. [1, 2, 3]

Institutional building has been driven by robust increases in school construction. In recent years education building has been a primary driver for institutional investment. Despite the growth in primary schools, senior highs, colleges, libraries, and museums, there is still a shortage of classroom space. The U.S. Department of Education projections of K-12 enrollments (through the year 2009) show that the total number of students will increase through 2006, and then ease back slightly. College enrollments will increase through 2009, suggesting that a growing share of construction activity will come from college and university projects. The need for school renovation work is also pressing. According to the National Center for Education Statistics, 29 % of the schools built before 1970 have not been renovated in almost 20 years. In addition, the average age of the nation's school buildings is 42 years old. Other institutional categories that witnessed significant growth in 1999 were courthouses, detention facilities, dormitories, and airline terminals, while religious and amusement-related projects remained at a high level. It is estimated that the market will plateau through 2003 before rising once again. [1, 2, 3]

As mentioned, the 65 and older segment's share of the U.S. population will continue to rise. As such, there will likely be increasing demand for construction of facilities such as hospitals (new and expansions) and nursing care facilities. [1, 2, 14]

On the whole, the floor space of buildings (residential and nonresidential) in 2000 totaled 4967 million square feet (about 462 million m^2) of which residential buildings were major with 63 % share - the second biggest was commercial buildings with a 24 % slice (Figures 8 - 9). [1]

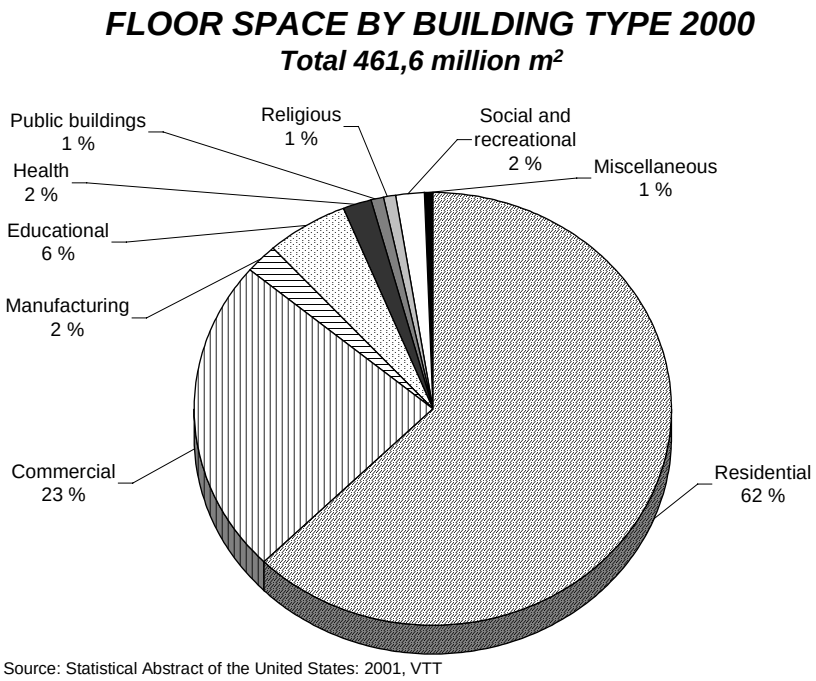


Figure 8. Floor space by building type 2000 (%).

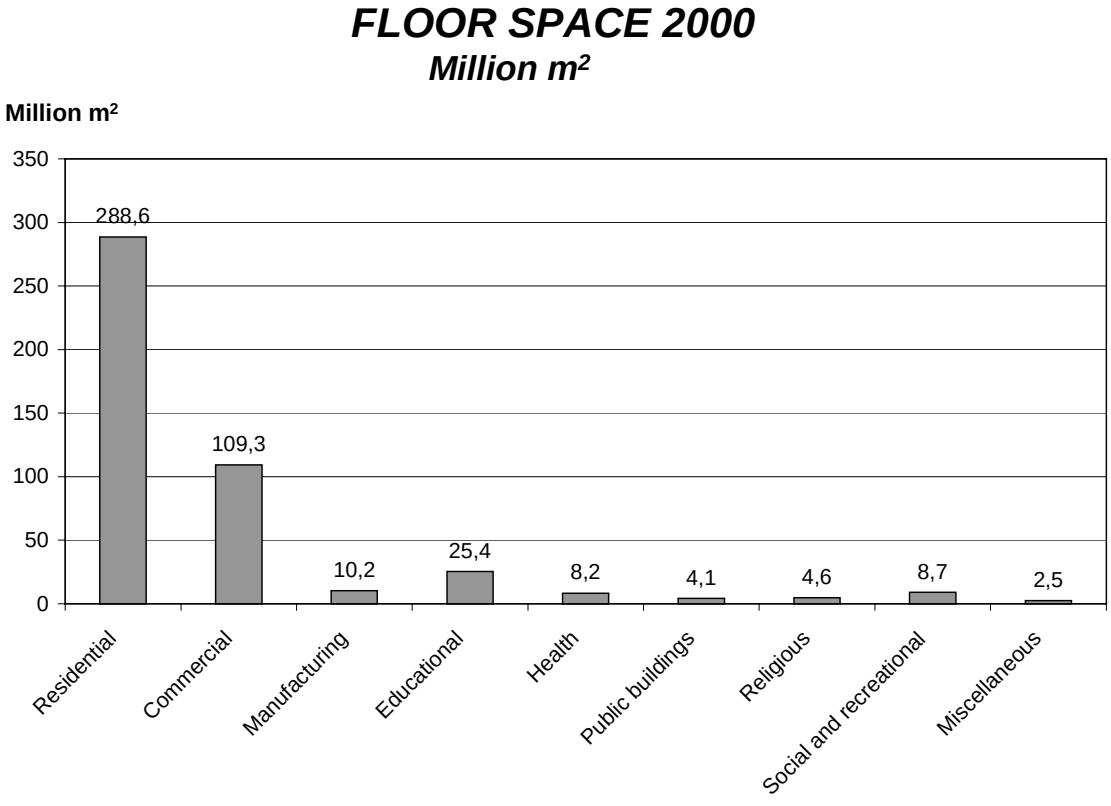


Figure 9. Floor space by building type 2000 (m^2).

2.3.4 Civil engineering

The United States is a mature, highly urbanized country. Much of the country's basic infrastructure is already in place and, to that extent; future projects are mostly replacements for existing infrastructure. For many decades, population shifts in the United States saw emigrations from the large cities into the suburbs. In more recent years, housing and population shifts have encouraged movements from the suburbs to even more remote communities. Both trends required significant investments in such infrastructure as highways and rail. A recent trend suggests that emigration from the large cities is being offset by gentrification of large, old city neighborhoods. [2, 3]

In the United States, civil engineering is more commonly known as "Public Works" or "Public Owned Construction". This refers to roads, bridges, airports, utilities, rivers and waterways, and environmental public works, such as water supply, sewage and the EPA (Environmental Protection Agency) Superfund program. [1, 3]

The total volume of civil engineering was about $144 billion in 2000, which was about 18 % of the total value of construction. Highways and bridges accounted for 36 % of the total, which reflects the need to repair an aging infrastructure - as well as new projects - throughout the country. Sewer systems and water supply facilities accounted for about 12 %, and public utilities about 33 % of the total expenditure in 2000. [1, 3, 14]

Boosted by the enchanced funding levels of the Transportation Act for the 21st Century (TEA-21) passed in 1998, highways and bridges are projected to show growth over the next years. The share of highways and streets has been high in recent years. Highway work jumped 11 % in 2001, after growing just 1 % in 2000. The funding levels contained in TEA-21 (subject to annual appropriations), will largely determine the pattern for highways, bridges, and many other public works sectors. This bill authorized $217 billion over the 1998-2003 period, including $175 billion for highways and $41 billion for mass transit. This represents a total 40% increase over funding in the prior legislation and a 44% increase for highways alone. [1, 2, 3, 14]

Civil engineering has seen across-the-board improvement since 1999, involving both transportation and environmental segments. At the same time, power plant construction has been on the way to doubling in 2003. The environmental construction categories grew in 1999 and 2000, helped in a broad sense by the funding support provided by rich budget surpluses at the state and local government level. [2, 3]

Electric power plant construction holds the most promise of any construction sub-sector over the coming years. Twenty-four states have had electricity deregulation programs in

recent years, easing uncertainty about the deregulation process and setting the stage for independent power producers to accelerate plans for more cost-effective generating plants. The need for more generating capacity became especially visible in the summer of 1999, as several major markets experienced power shortages resulting from the high demand caused by hot weather conditions. [2, 3, 14, 18]

2.3.5 Building products and materials

U.S. construction manufacturers (excluding wood products) enjoyed a prosperous year in 1999 as the domestic construction market recorded an all-time best record. Product shipments in 1999 were $176 billion, which was a 5 % increase from 1998. However, despite the production increases and strong market, the U.S. exports were significantly less than imports, demonstrating a strong national demand for building products and materials. Since 1992, The United States have had a net trade deficit due to the strong domestic market, a strong US dollar, and innovative foreign suppliers of these products. It should be noted that a majority of the trade is with the NAFTA (North American Free Trade Agreement) countries. In spring 2002 the United States set up steel tolls for imported steel. Over previous years, cheap imports had pulled down domestic prices and this was one reason why several companies in U.S. steel industry have recently gone into bankruptcy. Steel tolls were set up to protect the U.S. steel industry. [3, 14]

The construction wood products industry in the United States is a world leader in production and trade. Most of the soft wood products are utilized for residential and light construction (about 81 %) and 65 % of structural panels. The value of shipments for 1999 was $111 billion, which is an increase of 3 % from 1998. However, despite the production increases and strong market, the USA exports were significantly less than imports, demonstrating a strong national demand for building wood products and resulting in a net trade deficit since 1992. Again most of the imports are from the NAFTA countries, with imports from Canada accounting for 71 %. [3]

2.4 Building process and real estate management

2.4.1 General

The United States has provided a source of ideas for improving the efficiency and speed of building for several decades. This reputation is based largely on an ability to deliver large high-rise buildings faster and at lower costs than elsewhere. The U.S. approach to building is dependent on very competent specialist contractors and widespread use of

procedures and standards. This approach is very much based on letting the market to do its work. Major developers see buildings as financial investments first and as architecture second. This priority flows through the whole design, manufacture and construction process. Designers, construction managers and specialist contractors are selected on the basis of the lowest price for specific project. [17]

The United States is a highly litigious culture and many aspects revolve around the construction industry. Therefore companies try to avoid any potential risks that may possibly lead to litigation or arbitration. Partnering and continuous open communication have proven successful in reducing disputes, formal claims and litigation. [1, 3, 9]

2.4.2 Project delivery systems

In the past 25 years, the construction industry has seen a remarkable evolution of project delivery systems in response to increasing owner requirements, urgency of schedules, heightened demands for safety and quality, and the critical necessity of reducing adversity in construction. In the private sector, more contracts are nowadays negotiated than are awarded by way of sealed competitive bids. Negotiation of contracts allows a wide range of delivery systems and hybrid forms. [9]

The evolutions of Design-Build, construction management, and program management have accompanied owners' desires for life cycle studies. It is particularly important that owners offer adequate design and construction fees to allow professionals to fully explore the solutions to design/construct/maintain problems. With a growing emphasis on preconstruction services, more projects are proceeding under design-build, construction management, or program management systems. Design-build has proven effective in projects where time and cost control are priorities. Effective integration of design and construction is the salient identifying characteristic of design-build.

Design-Build seems to be a clear choice in today's construction industry. A fully integrated project is desired, but the industry is still in the beginning stages for a complete integration of the building process. Design-build contracting has emerged in recent years, in both the private and public sectors, as an important and viable project delivery option. Design-build is an agreement to perform both design and construction under one contract between an owner and design-build contractor. There are four reasons for the interest in design-build: [3, 9]

- Owner demand for a single source of design and construction responsibility

- Demand for faster delivery of construction

- Re-evaluation by architects of the tasks traditionally performed by them

- Increasing owner acceptance of nontraditional project delivery methods

The most appealing aspect of design-build to an owner is "single point responsibility". Meaning that an owner deals with one service provider rather than a separate architect, contractor, and possibly other entities. The further appeal of single-point responsibility is that it reduces the time spent by the owner on design and construction, including the selection of a designer and a general contractor, and maintaining communications with both parties. Design-build is almost always a quicker delivery system than design-bid-build lump sum contracting, and it may be quicker than negotiated general contracts. [9]

Construction management surfaced in the 1960s and has become an important project delivery system in both private and public sectors. Construction management is quite flexible and can be adapted to any construction project. The key identifying characteristics is that the construction manager is less a direct controller of trade contractors and more an overall administrator of trade contractor performance.

Program management is the result of owners´ needs for more external management of their projects. Program management is particularly used in projects that are quite complicated or have multi-phase building programs. The owner retains a program manager early in the decision making stage, and the program manger guides the entire design/construct project. Program management is sometimes called "project management" or "professional project management". [9]

Because of the fragmentation of the construction market, the existing regulatory system can be confusing and chaotic. Designers may get different code interpretations at different stages of the design process by different code officials. To eliminate duplication, overlap, and conflict at all levels in regulation, the following actions are needed:

- Standardize building code models (zoning, fire code, and land use) and develop a prompt code approval process

- Improve code interpretation consistency through greater training of building officials, and work towards a system of one-step permitting

- Accelerate the plan review process, standardize design development and construction document review times, and develop certification programs for plan reviewers

- Use contract services for plan check and inspection services to prevent delays [6]

2.4.3 Real estate management

Typically there are two types of real estate services in the United States. Owner occupied real estate is referred to as Facility Management, and Owner outsourced is typically called Property Management (in house or outsourced). Property management can be either full service or selected services depending upon the owners´ goals and resources. The main difference between facility management and property management is that property management collects rents and can perform asset management, while facility managers do not. The trend in real estate ownership is to have a third party manage the entire real estate process and concentrate on their core business. [3]

3. Success characteristics in case companies

3.1 General

Information in this chapter is based on interviews at selected U.S. companies and with experts at Texas A&M University, Department of Construction Science. Information on success factors in construction business were provided during Construction Project Improvement Conferences by the Construction Industry Institute (CII) (Austin, Texas, September 24-26, 2000 and September 23-25, 2001), and in the seminar "Three Firms, Three Strategies - Successes and Failures" by the CRS Center (Texas A&M University, February 8, 2002). Some information was also collected from American literature.

In total, information on success characteristics were collected from seven companies, which represent industrial and heavy construction (highways, steel construction, etc), commercial and residential sectors, HVAC services, and design and planning. Most companies have been in business over 50 years, some even over 100 years. Most companies are privately owned, and one company is based on Employee Ownership, which is not yet common in the United States. Companies operate mainly in the United States, but some companies have worldwide business.

Only one company provided financial information on their business; therefore these companies could not be compared financially. Success characteristics that are listed in this chapter are common for most of the interviewed companies.

3.2 Differentiation on the market

Differentiation is essential in the construction market in the United States. Generally it is typical for companies to specialize in a few sectors of horizontal or vertical construction. Distinctively this can be seen in industrial construction. The high volume of the construction market and its submarkets, and risks and liabilities in the business are same reasons why companies consider differentiation to be necessary for their business and their competitive advantage.

In addition to the large market size, the tempo of construction in the United States is fast. On the other hand the life cycle of buildings is shorter than in Europe. Differentiation and potential for new cost-effective business models and technologies are some requirements for managing the changes in business environment. Both demands for differentiation of companies and the rapid evolution of technologies require continuous learning by the workforce (labour, professions and management)

through the whole construction process (design, construction, operations, maintenance, renovation and demolition). Differentiation requires that a company is flexible and capable of developing its business models when needed.

One company pointed out that few engineering and construction companies can deliver a project from conception to commissioning and include in that package conceptual design, detail engineering, procurement, fabrication, field erection, mechanical installation, start-up assistance and even operator training if needed. This kind of business concept and expertise is the strength of that company.

All interviewed companies have listed their values and key strengths, which included among others, construction expertise, innovation and daily improvement as performance values. Companies also emphasized the importance of a diversified business mix, client focus (diversifying the practice/market sectors), business orientation, and willingness to change.

3.3 Partnerships / alliances

The Construction Industry Institute defines alliance or strategic partnering as:

> "A long-term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant´s resources. This requires changing traditional relationships to a shared culture without regard to organizational boundaries. The relationship is based on trust, dedication to common goals, and an understanding of each other´s individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services." [12]

Alliances have gained popularity among large companies that do continuous construction. Some companies eschew the term "partnering" due to inferred legal implications and even have a problem with the word "alliance", and thus say, "preferred supplier". Elements of alliance partnering are: [12]

- Mutual trust
- Shared goals/objectives

- Open communications
- Evaluation/measurement/continuous improvement
- Equity
- Synergism
- Shared risk
- Rewards/incentives
- Competitive edge
- Shared vision

Partnering is a formal structure to establish a working relationship among all the stakeholders through a mutually developed strategy of commitment and communications. Basically, there are two variations of partnering in use: [12]

- Individual partnering, where the owner, key contractors, and designer agree to cooperate on quality standards, information exchanges, and dispute avoidance. The process does not follow a standard form but usually involves a preconstruction conference, set of agreements, and charter of cooperation signed by all parties.

- Long term relationship partnering, which is a partnership of the owner and the construction company or design firm wherein the owner agrees to award a series of contracts to the construction company in return for assurances of priority service. These are sometimes called alliance agreements or preferred supplier agreements.

Typically in the construction business, many companies subcontract much of their work. Interviewed companies emphasized the synergies, which have been gained through alliances or long-term partnerships. For example, companies have been able to take best practices in lower-cost production and add these to abilities of other companies. These kinds of relationships have brought in a lot of work for the interviewed companies. One company has as a core value: "Partner well". This company has lot of partnerships that last years and years, compared to companies who create their partnership for one project at the time. Companies also see that growth through acquisitions is important.

The marketing aspect and culture of business negotiating is different from that in Finland. In the United States more personal relationship is needed and many aspects of communications are required. This is a notable cultural difference. There are also other differences; among others, Finnish “Quality” is realized or defined in more concrete terms, but in the United States “Quality” is more of a perceived or subjective issue. In addition, the litigious attitude/perception in the United States has caused the "Owners" and "Contractors" to be cautious when taking on a construction project and to avoid any costly mistakes that might lead to litigation or arbitration. [3]

3.4 Safety performance

In the United States considerable efforts have been made to increase safety at work in the construction industry in recent years. Many companies have made studies in accident prevention. Over the last twenty years the construction death rate has been reduced by about 40% by the industry in general. Certain groups of companies have reduced the death rate by up to 60%. There are many companies in the United States, especially in the petrochemical construction industry, that have made significant progress in reaching near zero accident rates.

Safety performance in the construction industry is getting better and better. Generally companies are now beginning to realize that if they spend more money on safety they are saving money, and there will more productivity, less loss time, and less injuries/deaths. Noticeably, budgets for safety are increasing. It is estimated that, on average, companies spend between 1-10% of project costs on safety. However, there are wide differences in the amounts and items included in the concept of safety. [7]

Interviewed companies pointed out that they focus “number one” on safety performance. Things have changed in the construction business, and such companies don't accept accident or lost workdays as before. Projects are designed to be executed in a safe way. Changing the culture and the way of thinking, companies have found that over the past ten years the best improvements have taken place in safety. Safety is not only evident in the field but also in shops and in the office. Better safety performance is seen as a cultural change, but also as a business benefit. Interviewed companies have some of the best safety records in the industry.

Cultural differences between Finland and the United States can clearly be seen in the safety aspect of construction business. In Finland, safety is a self-evident truth in business and it encompasses working ergonomics, mental health and safety throughout all construction project phases. In the United States, companies contribute significantly to safety through training and incentive programs to make their safety records better.

3.5 Environmental aspects

The life cycle of buildings, green construction and sustainability are hot topics in the construction industry today. Building and environmental codes have improved nationally, and in different areas of the country people have become more conscious of environmental issues and of reusable, recyclable building products and materials. In the United States the cultural heritage of buildings is different from that in Europe. This can be seen from the value of renovation and modernisation of buildings, which is minor in American construction business.

Interviewed companies saw environmental issues as element in the market. In the construction process, companies need to get through the permit phase concerning environmental codes and regulations, which vary from state to state. Facilities need to be designed to meet regional environmental regulations. At the moment pollution and emissions are a hot topic especially in industrial construction.

Environmental issues are becoming more and more common, which affects a large portion of the construction industry. Environmental codes have become more demanding in the last 5 years and can increase the costs of the budget and possibly delay the project schedule. Designers are beginning to use more environmentally sound products and materials, while organizations are promoting issues such as energy efficiency, Indoor Air Quality (IAQ), more daylighting, Green Building Standards, water conservation, Brownfields (soil or facilities that are contaminated with hazardous products) and recycling. Several organizations are under the United States Green Building Council (USGBC). [3]

In Finland, sustainability and energy efficient building have been part of the business for several years. In the United States, especially in California, the energy prices will have impact on future building materials and systems. During the height of the power crisis in early 2001, the average daily cost of wholesale power in California topped 300 dollars per megawatt hour, which was ten times what had been normal in previous years. Of all states, California has the most strict environmental and building regulations and codes.

3.6 Labour relations

Today the biggest problem is the shortage of skilled workers. To get qualified, skilled labour, not only in specialized subcontracting but also in general contracting is a really big problem. The construction workforce is inadequately trained in many instances. [5, 6, 8, 11]

The interviewed companies think that the construction market continues to be a strong market, because people need structures to be built. The limitation remains in the ability to find qualified craft people and labor to build those facilities. Companies pointed out that their ability to grow is based on the ability to recruit, train and maintain a qualified workforce.

Companies try to maintain employment even through hard times. One company pointed out that the best way to succeed is to select, hire, teach and train, and retain great people. Training and continuous education of the workforce is one way to retain better staff. Competitive wages is another thing to keep people in service. Interviewed companies told that they have higher salaries and better benefits compared to the construction industry in general. The company as a drug free workplace is also one way to attract workforce. The market of the workforce is changing. The challenge is to get new qualified people for tomorrow. One company has a good example of loyal workforce; they have a so-called 25-year club, which have 300-500 members. These people have worked for the company 25 or more years. For a construction company this is pretty unusual.

3.7 Other information of companies

Low R&D Investments:

According to studies and interviews, the U.S. construction industry under-invests in research and development (R&D) compared with other U.S. industries and foreign competitors. Less than 0.5 % of annual construction industry revenue is spent on construction related R&D. However, companies see that the continuous education of the workforce is part of R&D. On the whole, research and development is done by universities, institutions and organizations in the construction industry. Interviewed companies pointed out that the main reason for low own R&D investment is the fact that technology has became public. Therefore, companies lack the interest in spending very much in R&D. “Everything can be copied nowadays” and according to interviewed companies, “there is very little new development in the business”. Nevertheless, companies do see that continuous education and life-long learning of the workforce can be seen as part of the R&D investments.

Information Technology:

Most of the companies regard their business to be a basic industry, and they do not need to have so much information technology. However, there needs to be some strategic investment in IT. Companies pointed out that IT is important in standardizing their

in-house programs and documentation, and controlling all the information from past projects.

Now with developments in the Information technology (IT) sector, new tools and advancements are changing the building industry. e-Commerce is having a dynamic effect on the building industry and hopefully will enable the industry to become more efficient and effective. It will take many years to bring this fragmented industry into the new paradigm, but small advances are being noticed. Some examples of these changes are: quicker construction projects, faster and relatively error-free designs, more competition, 3D modelling, better efficiency, smarter and intelligent buildings, integration of design tools, industry wide partnerships, more demanding owners, and a global market. [3]

Bonding capacity:

Adequate bonding capacity is important for the companies. It is a strong benefit to the market, and an advantage to the up-coming market. On the market there are a lot of companies that do not have the assets, because they are not capable to bond, especially after September 11, 2001.

4. Summary

If Finnish construction companies want to establish their business in the international market, they need to be able to recognize possibilities for cooperation, and to be flexible to differentiate. It is also crucial to understand cultural differences and differences in business etiquette. Finnish companies have some special knowledge and know-how, and these could be applied in the American market in cooperation with local companies.

Interviewed U.S. companies had been in business for decades and had also survived through crisis and recessions during their history. Their business environment is regulated: Regulations and building codes vary from state to state, and region to region, depending upon the specific natural requirements. Regulations affect land use, siting, design, materials, construction, operations, and maintenance. The result of multiple, prescriptive regulations is that provisional and regulatory authorities often are in conflict making it difficult to do anything, let alone to introduce a beneficial, innovative product or service. Also, some private sector organizations have supported prescriptive regulations as a means to deny potential competitors entry to the marketplace.

The main success characteristics, which are addressed in this report, were common for the interviewed companies. These five characteristics are relatively general observations and can be found in every successful company in construction industry.

Differentiation on the market

Differentiation is essential in the construction business in the United States. Generally it is typical for companies to specialize in a few sectors of horizontal or vertical construction. Distinctively this can be seen in industrial construction. The high volume of the construction market and its submarkets, and risks and liabilities in the business contribute to the fact that companies attribute differentiation to be necessary for their business and their competitive advantage.

In addition to the large market size, the tempo of construction in the United States is fast. On the other hand the life cycle of buildings is shorter than in Europe. Differentiation and potential for new cost-effective business models and technologies are some requirements for managing the changes in the business environment. Both demands for differentiation of companies and the rapid evolution of technologies require continuous learning by the workforce (labour, professions and management) through the whole construction process (design, construction, operations, maintenance, renovation and demolition). Differentiation requires that a company is flexible and capable to develop its business models when needed.

Partnerships and alliances

Typically in the construction business, many companies subcontract much of their work. Interviewed companies emphasized the synergies, which have been gained through alliances or long-term partnerships. Alliances have gained popularity among large companies that do continuous construction. Some companies eschew the term "partnering" due to inferred legal implications and even have a problem with the word "alliance", and thus say, "preferred supplier".

The marketing aspect and culture of business negotiating is different from that in Finland. In the United States more personal relationship is needed and many aspects of communications are required. This is a notable cultural difference. There are also other differences; among others, Finnish “Quality” is realized or defined in more concrete terms, but in the United States “Quality” is more of a perceived or subjective issue.

Safety performance

Safety performance in the construction industry is getting better. Generally companies are now beginning to realize that if they spend more money on safety they are saving money, and there will more productivity, less loss time, and less injuries/deaths. Noticeably, budgets for safety are increasing. Cultural differences between Finland and the United States can clearly be seen in the safety aspect of construction business. In Finland, safety is a self-evident truth in business and it encompasses working ergonomics, mental health and safety throughout all construction project phases.

Environmental aspects

The life cycle of buildings, green construction and sustainability are hot topics in the construction industry today. Building and environmental codes have improved nationally, and in different areas of the country people have become more conscious of environmental issues and of reusable, recyclable building products and materials. In the United States the cultural heritage of buildings is different from that in Europe. This can be seen from the value of renovation and modernisation of buildings, which is minor in American construction business. In Finland, sustainability and energy efficient building have been part of the business for several years.

Labour relations

Today the biggest problem is the shortage of skilled workers. To get qualified, skilled labour, not only in specialized subcontracting but also in general contracting is a really big problem. The construction workforce is inadequately trained in many instances.

The interviewed companies think that the construction market continues to be a strong market, because people need structures to be built. The limitation remains in the ability to find qualified craft people and labor to build those facilities. Companies pointed out that their ability to grow is based on the ability to recruit, train and maintain a qualified workforce.

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Appendix

National Construction Goals, 1995

Sources: NISTIR 5759, National Planning for Construction and Building R&D, December 1995 , National Institute of Standards and Technology, U.S. Department of Commerce; Workshop on National Construction Goals as related to the Commercial and Institutional Building Sector, July 16, 1996, conducted by National Institute of Building Sciences for the Construction and Building Subcommittee of the Technology Innovation Committee of the National Science and Technology Council.

GOAL 1. 50 % Reduction in delivery time

- Ranked the highest priority.

- Reduction in the time from the decision to produce a new constructed facility to its readiness for service is vital to industrial competitiveness and project cost reduction.

- Owners, users, designers and constructors are among the groups calling for technologies and practices reducing delivery time.

- The process is characterized by seemingly endless permitting, legal wrangling, reviews and inspections.

- The goal of reduced delivery time offers a challenge and large potential impact to the public works support infrastructure. Public works projects are increasingly subjected to regulatory, liability, budgetary, and procurement barriers, most of which have increased delivery times. Reversing this trend will require major breakthroughs in regulatory coordination, reductions in planning/design schedules, sharing in liability/risk, the use of performance standards, alternative procurement strategies, and incentives for innovation.

- The measure of performance is not just construction time, but the total time from project conception to occupancy, or other beneficial use.

- For residential construction the steps in a project are: land acquisition, site planning, design, zoning clearance, construction of first model house, construction of first house for sale, closing on first house, completion of project (depends on local market).

- An achievable construction cycle time goal for on-site builders is 63 work days (88 calendar days) for 185,8 m2.house, a realistic ideal goal for modular builders is 28 work days (42 calendar days) under the most favorable conditions.

- Research is needed:

- Information systems; appropriate databases available to and shared by all stakeholders, and electronic filing of building permit applications

- Engineering software; user-friendly CAE (Computer Assisted Engineering) programs and 3D CADD systems

- Construction methods; automated positioning and surveying, material management, and computer based construction simulating systems

- Construction equipment; computer/satellite controlled earth moving equipment, continuous monitoring of tool wear

- Project delivery systems; e.g. design/build

- Standardization of designs and codes; code bodies working on single model codes for various building occupancies. Performance codes to augment specification codes for acceptance of innovation.

GOAL 2. 50% Reduction in operation, maintenance, and energy costs

- In the U.S. in 1995, the largest part of OM&E (Operation, Maintenance, and Energy) in U.S. buildings was the energy bill, about $210 billion ($150 billion for electricity, $60 billion for "fuel" - e.g. gas, oil). For an office building this represents 27 % of the total operation, maintenance and energy costs.

- Maintenance and Repairs (M&R) costs can drop for several reasons:

- Automated monitoring and "alarms" can ensure that equipment gets needed routine maintenance and prompt attention when a sensor detects that some part or lubricant needs replacing. Improved monitoring can lead to better record keeping, and thus strengthen the market for more durable equipment.

- A significant part of M&R is devoted to "HVAC" (Heating, Ventilation, and Air Conditioning). But the earlier half of our Goal 2 is halve HVAC costs, and thus

halve the capacity and cost of the HVAC equipment. This will roughly halve the associated M&R costs.

GOAL 3. 30 % Increase in productivity and comfort

-Maintenance of a competitive economy and high standards of living requires improvements in productivity and comfort. Occupant comfort depends largely on the nature of buildings, building furnishing, and indoor environments. The quality of indoor environments, where people spend 90% of their time, also has a large impact on occupant health and productivity.

- There is evidence that better indoor air quality and lightning and better control of indoor temperatures can also directly improve the performance of physical and mental work. Even very small improvements in performance, a fraction of a percent, would be sufficient to justify investments to improve indoor environments.

- Many technologies and procedures for improving indoor environments already exist, but they are rarely used because associated health, productivity, and comfort benefits have not been adequately quantified and demonstrated. Examples of these technologies include ventilation systems that provide occupants individual control of their thermal environment, more efficient air filters, and building materials with lower pollutant emissions. Procedures that can improve indoor environments and, thus, improve productivity and comfort, include more effective cleaning of buildings and improved maintenance of heating, ventilating and air conditioning systems.

GOAL 4. 50% Fewer occupant related illnesses and injuries-Health effects associated with the indoor environmental quality (IEQ) of buildings can be categorized into building-related illness and sick building syndrome. Building-related illnesses are medical conditions of known etiology such as Legionnaire's disease, humidifier fever, respiratory allergies or asthma, carbon monoxide poisoning, and pesticide poisoning.

-Research needed:

- Develop performance fire standards and the technical basis for engineered fire safety

- Develop an understanding of the molecular factors affecting materials flammability

- Develop methods of predicting the effects of natural hazards such as wind and earthquakes on constructed facilities

- Develop improved understanding of the relationships between building design and accidents such as slips and falls

- Develop improved measurements for both environmental exposures and health outcomes in indoor environments

- Assess the baseline prevalence of health effects related to problems with indoor environmental quality, and monitor trends

- Design interagency demonstration projects to evaluate the effect of current good practice guidelines on occupant health

- Conduct methodologically strong studies of the impact of various interventions on building-related illnesses and symptoms of sick building syndrome

- Conduct special studies of crime environments (e.g., convenience stores, schools, restaurants/bars) to assess the potential for and efficacy of crime prevention through environmental design

GOAL 5. 50% less waste and pollution

- Because buildings shelter and support most human activities, improvement of the performance of constructed facilities provides major opportunities to reduce waste and pollution at every step of the delivery process, from raw material extraction to final demolition and recycling of the shelter and its contents. Examples are reduced energy use and greenhouse gas emissions and reduced water consumption and wastewater production. Waste and pollution also can be reduced in the construction process: construction wastes are estimated at 20-30% of the volume of landfills.

- While the demand for residential housing starts seems to have slowed, the actual demand for building materials has increased mainly due to the increasing size of the new units.

- It is estimated that half of the world's energy is spent in construction and operations of buildings.

- Current tax laws and other policies pose significant barriers to reduction of waste and pollution with respect to building and construction. They encourage consumption, buying larger houses, depreciation and disposal of buildings. Current policy of lowest bid/low upfront costs is incompatible with the concept of life cycle costing.

- Life cycle assessment techniques are needed in the process of selecting materials from sustainable sources, as well as to measure environmental impact of building and construction activities.

- Standards are developed to evaluate green building design and operations.

- Technologies are developed to recycle and reuse construction and demolition wastes, and renovation, rehabilitation of existing buildings.

- Research is needed:

- Life cycle assessment of resources, building materials, and environmental impacts
- Technologies to collect, reuse, or reuse construction materials
- Technologies to increase efficiency of construction in choosing materials, effective designs, and energy consumption and to reduce losses from fire, wind, earthquakes, etc.
- Scientific research needed to provide bases for environmental assessment standards
- Development of analytical models to assess energy efficiency and options for decisions on renovation, rehabilitation, or new buildings.

GOAL 6. 50% more durability and flexibility

- All sectors of the industry give importance to life cycle performance in durability and flexibility

- Durability will be affected by:

- Design including siting, configuration and materials selection to provide a facility that will endure in its natural and manmade environments
- Manufacture of materials and components to treat materials properly and meet plans and specifications
- Construction and placement of materials and components to treat them properly (avoid damage) and conform with plans and specifications
- Operation and maintenance to prevent damages

- Repair and renovation to avoid increasing problems (e.g. leaky roof)

- The most valuable technical advance for durability is ability to predict service life for a specified material, component or system in a specified configuration and environment. The most valuable technical advance for flexibility may be performance criteria for the variety of uses of constructed facilities. With these performance criteria, the effort and cost to adapt a facility can be determined as a measure of flexibility.

- Research is needed:

- Data on, or models for, expected service life is quite lacking. Data are needed on operating, maintenance and renovation or repair costs, too. An early milestone for pursuit of this goal is to collect and critique data on modeling durability and flexibility.

GOAL 7. 50% reduction in construction work illnesses and injuries

- The construction industry is one of the most hazardous industries in the nation. More fatalities occur in the construction industry than in any other industry. Construction workers also experience a higher incidence rate of nonfatal injuries and illnesses than workers in other industries.

- Research is needed:

- Hearing loss data

- Data on exposure to hazardous levels of respirable silica and asbestos fibers.

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Market Review and Study of Success Characteristics in Construction Companies
Case:United States

Abstract

As a market area, the United States is a mature, highly developed, industrial nation with one of the highest real per capita levels of any country in the world. With a relatively decentralized, market-oriented economy, businesses have considerable flexibility to expand capital plant, lay off surplus workers, and develop new products. In 2000 the Gross Domestic Product in the United States was about $9,963 billion, which was about 1.3-times higher than in Western Europe (OECD Europe) and about 85-times GDP in Finland. Total value of construction was about $815 billion in 2000. Western Europe is on a par with the United States for the value of the construction. Compared to Finland, the value of construction in the United States is about 50-times the value in Finland. The residential construction portion in the U.S was 46 %, or $379 billion, while non-residential totalled near $292 billion, or 36 % of the total figure. Civil engineering was $144 billion or approximately 18 % of total value. Residential construction can be divided into new construction and renovation and improvements of housing buildings. The value of the new residential construction was $269 billion, while the estimated value of the renovation and improvements was $110 billion in 2000.

With globalization, understanding different business concepts becomes more and more relevant. If European companies want success in their cooperation and customer relations with U.S. companies, they have to be flexible in their ways of working and understand cultural differences in business. Therefore it is essential to realize which factors are important for success: Importance of diversified business mix, client focus (diversifying the practice/market sectors), business orientation, and willingness to change.

In this study, information of success characteristics in the construction industry is mainly based on interviews in selected U.S. companies and experts at Texas A&M University, Department of Construction Science. Information was collected from seven companies, whose fields of activities covered industrial construction, residential construction, HVAC services and design and planning. The success characteristics that are presented in this report are common for most of these case companies. These include, among others: differentiation, alliances and partnerships, safety performance and labour relations.

Keywords
construction, companies, enterprices, market review, USA, United States, business environment, economics

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