부 록

A: Current Trends and Issues and Facing the Capital Facilities Industry
- Louis Prudhomme, 미국 건설산업연구소(CII) 부소장

B: Construction Industry Trends and Issues in Japan
- Hajime Suzuki, 일본 건설경제연구소(RICE) 상무이사

C: 미국 건설산업의 생산성 향상을 위한 연구 방향 분석
(Fully Integrated & Automated Technology: FIATECH)

<부록 A>

Current Trends and Issues Facing the Capital Facilities Industry

2000.11.16

CONSTRUCTION INDUSTRY INSTITUTE

Louis Prudhomme,
Associated Director, CII

The construction Industry Institute (CII) is a consortium of leading users and suppliers of Engineering and Construction Services, working in partnership with Academia, dedicated to improving the constructed project and the capital investment process. Its mission is to improve the safety, quality, schedule, and cost effectiveness of its members and the industry through research, education, and implementation support. CIIs core processes are:Research, Implementation, Education, Benchmarking, and Globalization.

Our members are currently ninety-two of the largest owner, contractor, and industry supplier organizations in North America. The combined revenue of the member companies is more than one trillion dollars annually. The membership is split about evenly between owners and contractors/suppliers. Our academic partners are thirty-six North American Universities with outstanding Civil Engineering and Construction Management Departments that are staffed with highly qualified researchers and graduate students. At any one time we have approximately twenty of these universities actively engaged on project teams or standing committees.

CII has executed alliances and cooperative agreements with a number of other organizations whose missions are similar or that enhance the work of CII. CERIK, the Construction and Economic Research Institute of Korea has a cooperative agreement with CII as does the Project Management Institute through its Design-Procure-Construct Specific Interest Group.

The cooperative agreement between CII and CERIK was renewed June 5, 2000 for another three years in a signing ceremony in Austin, Texas by Kenneth Eickmann, Director of CII and Dr. Sung-Woong Hong, President of CERIK. The agreement has a provision for extension and addition of terms by mutual consent of the two institutions. The general areas of cooperation spelled out in the agreement are:

1. Exchange of information and research personnel and faculty during their respective sabbatical orother leaves
2. Cooperate in the professional/academic training of mutually acceptable research staffs

3. Preparing and submitting joint proposals to outside international funding agencies or carrying out, with internal or external financial resources, joint projects in Korea, the United States, and/or other countries for the conduct of research, education & implementation, and Benchmarking & Metrics, in the area of construction and capital project management
4. Organize joint seminars or conferences on topics of mutual interest There may be other cooperative forms, not here named, to suit specific needs as situations might develop.

It is envisioned that costs associated with any cooperative initiatives would be carried on a shared basis with the exact details worked out on a case-by-case basis to the satisfaction and mutual agreement of both parties in advance.

Recently, Bok Nam Lee of CERIK and I have identified several possible joint initiatives that we may pursue as part of our cooperative agreement:

- Risk Analysis for International Projects
- How to Leverage Offshore Engineering Centers
- Process and Productivity Comparisons between United States and Korea in Construction.

CII is addressing the major trends and issues facing the Capital Facilities industry today through its selection and funding of research topics and cooperative ventures. This paper and presentation looks at currently active research, research planned for next year, the trends and issues that will determine future research. It will address how we will organize to most effectively conduct future research, take on higher impact and more costly research, and utilize leveraged funding.

Some of the trends and issues that the companies and countries involved in the capital investment process face today are:

- Alternative project delivery and contracting strategies
- E-Commerce

- Supply Chain Integration
- Globalization
- Virtual Teams
- Smarter, healthier, longer lasting buildings
- New construction materials
- Workforce Diversity
- Engineering & Construction Productivity
- Improved Worker and Site Safety
- Design to Enable Construction Automation
- Fully Integrated & Automated Project Processes

CII is currently conducting research on fifteen topics relative to these trends and issues:

Projects finishing in Year 2000

1. Craft Productivity Improvements
2. Radio Frequency Tagging
3. 3D CADD in FIAPP
4. Effects of Field Rework
5. Electronic Simulation in Construction
6. Cumulative Impact of Change Orders

Projects finishing in Year 2001

7. Engineering Productivity Measures
8. Making Zero Accidents a Reality
9. Executing Small Projects
10. Evaluating On-Site Design
11. Project Delivery and Contract Strategy

Project finishing in Year 2001 or 2002

12. Making Virtual Teams Work

13. Improve Construction Supply Chain Performance
14. Pre-Fabrication,Pre-Assembly,Modularization, and Off-Site Fabrication
15. Update Construction Technology Needs

The CII Research Committee has developed a list of topics to be recommended for potential funding next year:

Potential Projects to finish in Year 2002 or 2003

1. E-Commerce Applications for Construction
2. Risk Analysis for International Capital Projects
3. Addressing the Shortage of Skilled Construction Craft Workers in the United States
4. Design Practices to Facilitate Construction Automation
5. Cost Effectiveness of Innovative Crew Scheduling
6. Improve the Project Change Management and Control Process
7. How to Leverage Off-Shore Engineering Centers

This presentation will further explore these issues and trends and CIIs approach to addressing them will be discussed. A panel discussion following the presentation will provide an opportunity to compare views of the industrys trends and issues by the participating countries.

Need for alternative Project Delivery and Contract Strategies:

For years, many owners and nearly all public works have utilized the low bid process to award work to contractors. The belief has been that firm price bidding, with the award going to the lowest bidder, would foster competition and result in the best price for a capital initiative. In recent years owners, public institutions, and local and state governments have become more interested in best value concepts. This has brought about the recognition that, more often than not, low bid does not yield best value. The low bid contracting strategy sets up an automatic adversarial relationship between the owner and the contractor. The owner has the objective of achieving the

lowest price;the contractor has the objective of maximizing profit. Conflict in inevitable, change orders become time consuming and contentious, and legal recourse is often utilized to settle disputes. Owners have become interested in developing more collaborative relationships with their contractors and suppliers. One approach that is being adopted more and more is that of Design-Build. The United States government and individual states are beginning to pass legislation that allows public institutions to utilize the Design-Build contracting strategy. This approach brings the owner and the contractor together much earlier in the planning process in a collaborative relationship. Design-Build and other alliance type relationships that result in collaboration, shared goals, and common objectives are becoming more commonplace.

(CII Research Team 165 Project Delivery and Contract Strategy)

E-Commerce:

The explosive growth of Business-to-Business (B2B) electronic commerce has now been directed at the construction industry, identified as the second largest industry sector in the United States. New companies providing E-Commerce services are being created at a rapid pace and many existing companies are developing tools and services that are being promoted as beneficial to all participants in the capital facility process. Many firms in the capital facilities industry are actively employing the new tools and services, through ownership investment in the new companies, by forming consortiums to create either supply leverage or purchasing demand, or by utilizing the new tools and services on their projects. Few firms in the capital facilities industry understand the current state of this fast-paced change in the industry, or have the ability to predict how it will evolve. We need to better understand the state and direction of the rapid-paced trend toward E-Commerce applications within the capital facilities process.

(CII Potential Research Team E-Commerce Applications for Construction)

Supply Chain Integration:

The manufacturing industry set out several years ago to more effectively integrate

their supply chains, resulting in the widely utilized just in time delivery approach for parts and supplies. This has greatly reduced on site inventory, the infrastructure required to house the inventory, and the associated capitalcosts. However, the construction industry has been slow to change their supply chain approach. It is common for construction projects to stockpile inventory in an attempt to provide schedule and labor productivity buffers. This results in huge lay-down yards and warehouses to collect the stockpiles, and large staffs to manage the inventory. Since construction projects are normally one-time events, these inventory facilities are always temporary, always different, and almost never develop good operating procedures over time. The end result is often chaos, lost inventory, re-orders, and productivity losses.

Modularization, pre-assembly, and off site construction techniques are well known and when used have proven to be cost effective from both a schedule and labor productivity standpoint. However, the decision to implement these techniques must be made very early in a projects life cycle to be truly cost effective. The initial plan, the engineering, the suppliers, the fabrication shops, and the construction contractor must all be involved early enough to make this approach reality. Once the engineering is complete, its too late to decide to modularize.

Elimination of stockpiles and integration of engineering and fabrication shops are only two of the major opportunities available to the capital facilities industry to improved supply chain management. The time has come for the capital facilities industry to streamline its supply chain.

(CII Research Team 172 Improving Construction Supply Chain Management)

Globalization:

As our virtual world continues to shrink, the physical horizons of nations and corporations are expanding. Manufacturing companies and service providers are expanding globally. Companies that build capital facilities for these organizations are following their clients around the globe. They are running head on into cultural differences, government regulations and restrictions, currency fluctuations, labor force issues, different standards such as job safety requirements. Many have naively rushed

headlong into these uncharted waters without adequate preparation and have paid dearly. Those companies who have learned lessons the hard way are reluctant to share their learnings lest they throw away a hard earned competitive advantage. Few decision tools exist to assist owners and contractors with decisions regarding capital facility planning. Its time for the capital facilities industry to step back and analyze the risks, understand the risks and learn how to mitigate the risk of doing business in foreign nations.

(CII Proposed Research Team Risk Analysis for International Projects)

Virtual Teams:

The Internet and World Wide Web technology have enabled huge quantities of data to be transferred around the world almost instantaneously. This has allowed project work to progress on a twenty-four hour, seven day a week basis, with data transferring to different team members as it follows the sun around the globe. New audio and visual communication technology allows team members who have never met each other face to face to communicate with each other in virtual meetings. While the technology to accomplish this virtual reality is here, the ability of the people to effectively interact in virtual spaces lags behind. People work much better in a face-to-face environment. Interfacing with hardware and meeting over distance and time zones is stressful to humans. We need to develop the procedural and behavioral modifications necessary to overcome this barrier to successful execution of virtual projects.

(CII Research Team 170 Making Virtual Teams Work)

Need for better buildings:

Owners are starting to recognize the need for better, healthier, longer lasting, more cost effective buildings, and more adaptable buildings over their intended life cycle. In the United States, the Federal Facilities Council has established a goal to design smart buildings. The belief is that if we can instrument aircraft and ships to detect problems, to predict needed maintenance, and to schedule required preventive

maintenance, we should be able to do the same thing with buildings. An exception to the longer life concept exists in the business of high technology. Owners involved in high technology need buildings to be designed quickly, built in nine months or less, achieve vertical start up, and provide positive return on investment in a very short period of time. The life cycle of high tech products often dont last any longer than two to three years, therefore facility life cycles can be very short. They need buildings that can be converted quickly to a different purpose.

Workforce Diversity:

The United States is experiencing a decline in the traditional supply of trained and qualified craft workers. The young, white, majority, male population that for so long fed the ranks of the construction craft pool is no longer coming to the industry in the same numbers. The number of women, racial minorities, and non-English speaking workers is growing. We need to find ways to effectively develop this more diverse population of workers into our trained craft workers of tomorrow and to provide meaningful, well paying jobs in this important sector of our economy.

(Potential CII Research Team Addressing the Shortage of Skilled Craft Workers in the U.S.)

Engineering and Craft Productivity:

While most engineering and construction contractors measure productivity using one of many different measures, there are currently no accepted standards for measuring either engineering or construction craft productivity. Therefore, it is difficult to benchmark and compare performance from one contractor to another or from one project to another. We need to develop standard measures that owners, engineering, and construction contractors can accept and universally adopt.

(CII Research Team 156 Engineering Productivity Measures)

(CII Ad Hoc Team Productivity Benchmarks and Measures)

Improved Worker Safety:

Over the past ten years in the United States, on-the-job injuries to construction workers have declined dramatically. Safety performance is measured using U.S. government standards, the OSHA Recordable Incident Rate and the Lost Workday Incident Rate. Nationally, for all construction companies, the Recordable Incident Rate has fallen from 14.3 in 1989 to 8.21 in 1999. The Lost Workday Incident Rate has fallen from 6.80 to 3.67. CII member company safety performance has been even better with their Recordable Rate declining from 7.19 to 1.67. Their Lost Workday Incident Rate has declined from 1.90 to 0.27. While these improvements are dramatic, the rate is still not zero and we still have workers being hurt on the job. We need to be able to build our capital projects without injury to our workers. The U. S. Construction Industry is committed to zero injuries on the job.

(CII Research Team 160 Making Zero Accidents a Reality)

(CII Proposed Team Extending the Zero Accident Reality to Shutdown Projects)

Construction Materials:

The construction industry still uses many of the same materials developed a hundred years ago. The manufacturing industry has modernized their processes and implemented technology advances to achieve productivity improvements. The high tech industry has developed exotic and highly innovative materials to streamline their processes. While that industry has made significant advances in use of new materials, the capital facilities industry still uses many of the same materials used by our fathers and grandfathers to build projects. We need new construction materials. We need products that are stronger, that last longer, that are less costly to put into place, that are easier and more cost effective to maintain over a projects life cycle.

Where will new construction materials and technologies originate? One sourcemay be the same high tech materials used in our military aircraft. Use of fiber reinforced composite materials has resulted in lighter, faster, stealthier, more fuel efficient aircraft. Because the material is very expensive to manufacture, the cost of each airplane built with this material is very high. We need to transfer use of this material to the

construction industry.

In the United States it is estimated that 230,000 bridges have deteriorated below acceptable condition. It is further estimated that $1.3 trillion will be required to bring our infrastructure up to acceptable condition over the next five years. Roads and highways have deteriorated to the point that motorists spend four times as much fixing damage to their automobiles caused by poor roads than states spend repairing them.

Fiber reinforced composite technology is being implemented in highway construction. Initially, concrete and steel beams of small bridges in need of repair were reinforced with panels of composite material. The result was an 80% increase in beam strength. The next step was to build a bridge completely from this new material, substituting it for concrete and steel. The first all composite bridge was installed in the state of Kansas in October 1966. The bridge, including the guardrails, was shipped to the site and installed in one day. Traffic crossed the bridge before the end of the day. The state of Ohio has passed legislation to foster economic development of composite bridge deck fabrication in Ohio, to establish a composite bridge factory, and has started a project to replace 100 below standard bridges with composite bridges. Not only will the cost of producing fiber reinforced composite material come down, so will the cost of military aircraft.

Designing for Construction Automation:

Construction remains a craft-oriented and labor-intensive industry, with very little automation of construction tasks. In order for the construction industry to achieve the productivity gains and cost reductions experienced by the manufacturing industry, we must find ways to reduce the labor intensity and apply technology and robotics in the construction process. Automation of on-site construction could lead to substantial increases in productivity and reductions in craft hour requirements. One of the barriers to using automation in construction is the traditional design process, which seldom allows or enhances the use of construction automation. We must find collaborative ways to bring the engineering and construction process together earlier in the planning

and engineering phases of capital projects. We must include this issue in our initiative of FIAPP.

(CII Potential Research Team Design Practices to Facilitate Construction Automation)

(CII FIAPP Steering Team)

(FIATECH)

FIAPP - Fully Integrated and Automated Project Processes

CIIs vision of FIAPP is having work and information processes for the capital facilities industry that are fully integrated, that communicate seamlessly with each other, that allow data to be entered only once and used in many places during multiple phases of the project. Data would flow back and forth from the engineer, to suppliers, to the fabrication shop, to the general contractor, to the subcontractors, to the startup and commissioning teams, to the facility operators, and back to the engineers for the next phase in the facilities life cycle. At each phase, additional data would be added and available to all users. The facility would be engineered, constructed, commissioned, operated, maintained, remodeled, and decommissioned with the continuous bi-directional flow and addition of project information over the entire life cycle of a capital project in a single integrated package. Different owners, contractors, and suppliers would be able to use the information without having to purchase and learn to use different information management tools.

Achievement of this vision would result in greatly improved accuracy, productivity, speed of execution, and cost effectiveness. The cost and time required to retrofit a facility for a new purpose and a new life cycle would be greatly reduced.

CII is pursuing this vision through its FIAPP Steering Team. As this team identifies potential research topics, it will recommend the topic be pursued either through the normal CII research process or through a new organization, founded by CII, called FIATECH.

(CII FIAPP Steering Team)

FIATECH

FIATECH is a new entity created by CII to provide leadership, direction, and the forum to undertake collaborative research, development, and deployment leading to fully integrated and automated capital project processes, FIAPP, for the purpose of reducing cycle time and costs, and improving the effectiveness of capital facilities in the context of the owners corporate enterprise.

The vision of FIATECH is that of owners, contractors, and suppliers dramatically improving the effectiveness of large capital facilities engineering, construction, and operation through the integrated application and deployment of the latest computer, automation, advanced communications, and other technologies.

FIATECH has industry members, much like CII, many being members of CII as well, with a different membership criteria and a different dues structure. The membership criteria is:

- Committed to FIAPP principles
- Engaged in North American manufacturing
  - Consideration is underway to change this requirement and open up membership to others outside North America
- Approved by the FIATECH Board of Directors

FIATECH dues are based on company revenue volume:

- Small Sales of $0 to $50 Million $5,000/year
- Medium Sales of $50 Million to $100 Million $5,000/ year+.00210% of salesof over $50 Million
- Large Sales of $1 Billion or more $25,000/year

Once a member has paid dues, they become eligible to participate in Strategic Focus Areas. SFAs function as specific interest or focus groups within FIATECH. Members pick and choose groups in which they want to participate. Further participation

requires contribution of additional funding and/or in-kind personnel. FIATECH dues fund the operation of the organization; leveraged funds by the members fund the Strategic Focus Areas.

FIATECH will make FIAPP a reality for the capital facilities industry. It will develop the integration activities and projects necessary to apply existing technologies to FIAPP. It will launch leveraged funded research and development to bring existing and new technologies to bear on capital facilities projects. This will be a giant step beyond the best practice research and implementation traditional to CII. It allows for higher impact, higher risk, higher cost research projects than CII has traditionally been able to undertake with its limited funding source. FIATECH will highly leverage available resources. It will bring together committed parties both within and beyond the capital projects industry. Its focus will be on results for the members and the SFA participants. FIATECH will collaborate to develop and deploy standards and protocols for current information technology.

FIATECH is expected to bring about improvements in the industry such as reduced design changes and rework, enable better control of project cost and schedule, improve supply chain management, rectify differences between intended design and actual construction, and capture as-built status of a project for use throughout the projects life cycle.

FIATECH will make FIAPP happen!

In conclusion, our industry is faced with many issues and evolving trends today. The virtual shrinking of our planet, the expansion of our marketplaces, the explosion of technology, the speed of communication, and the competitive pressures faced by businesses and nations today are driving change at an ever accelerating pace. We must stay ahead of the crest of change or be buried as it crashes over us. Organizations like CII and CERIK are working hard to identify the trends and issues, analyze them, and develop new directions to lead our industry into the future.

<부록 B>

Construction Industry Trends and Issues in Japan

2000.11.16

RESEARCH INSTITUTE OF CONSTRUCTION AND ECONOMY

Hajime Suzuki Executive Director, RICE

Construction Industry Trends and Issues In Japan

1. Macroeconomic Review and Outlook

1.1 Summary

(1) After two consecutive years of negative growth in the Japanese economy, the GDP growth rate for fiscal 1999 finally climbed to a positive 0.5%. After the overall economic slowdown following the collapse of the bubble in the early 1990s and the further stagnation resulting from the 1997 financial crisis, the Japanese economy has finally begun to see the light at the end of the tunnel.

The real GDP growth rate for first quarter 2000 rose by 2.4% from the previous quarter(or 10% on an annual basis), and was the first increase in three quarters. Private capital investment in particular showed fresh signs of recovery, with a 4.2% increase and there have been remarkable signs of private-demand-led recovery. The second quarter growth was also 1.0% real positive growth.

However, individual consumption and residential construction levels have remained relatively unchanged. The forces stimulating autonomous economic recovery had not yet reached strong levels in the first half of 2000, but the real growth rate for fiscal 2000 is sure to exceed the real growth rate(0.5%) for fiscal 1999.

(2) On the other hand, due to the consecutive Issuance of public bonds for financing the deficit of their revenue and the series of economic policies implemented after the collapse of the bubble, the total outstanding debt of national and local government organizations is in excess of 600 trillion, significantly exceeding GDP(nominal 494 trillion yen in fiscal 1999). For this reason, the task of fiscal policy reform is, along with economic recovery, a major issue facing the Japanese economy today.

1-2 Overview of the Macro Economy

1.2.1 Economic situation up to 1999

The Economic Planning Agency announced in June that the economy had hit the bottom of its recessionary valley in April 1999, after which it began to show signs of recovery. After the recession that followed the collapse of the bubble economy in the early 1990s and the further slowdown caused by the 1997 financial crisis, the Japanese economy, though still weak, is beginning to see the light at the end of the tunnel.

Economic growth in fiscal 1999 recovered to a positive 0.5%, thus ending the succession of negative growth rates in 1997 and 1998. Originally the Economic Strategy Council, an advisory body to the prime minister, indicated that the Japanese economy had the potential to achieve 2% growth. Today, however, the tremendous volume of non-performing loans left over from the collapse of the bubble economy has hindered the ability of the Japanese economy to get back on track toward the growth rate of 2%.

On the other hand, due to active fiscal investment and large tax reductions implemented as part of the governments economic policy and reduced tax collections due to the recession, the national governments outstanding debt amounted to a whopping 493 trillion as of the end of March 2000. This is almost equal to Japans GDP(nominal 494 trillion in FY 1999). Add to this the outstanding debts of local government institutions, and the figure rises to more than 600 trillion. Over the mid- to long-term, this enormous amount of outstanding debt is expected to cause economic distortions, thus making the task of fiscal policy reform, along with economic recovery, a major issue facing the Japanese economy today. A major point of contention in the general election held in June was whether to place higher priority on the economy or to simultaneously promote fiscal reform and economic countermeasures. Though the current administration(a three-party coalition of the LDP, New Komeito, and the New Conservative Party), which favors economic policies, ended up losing some of its seats, it clung to a comfortable majority and therefore retains political control. For now, therefore, policies favoring economic countermeasures will continue.

1.2.2 Economy in the First Half of 2000

The real GDP growth rate for the first quarter 2000 rose by 2.4% from the previous quarter after seasonal adjustments(an annual rate of 10.0%), yielding the first increase in three quarters.

Private investment in plant and equipment has clearly expanded, with a 4.2% increase, and there have been remarkable signs of private-demand-led recovery. Exports to Asia, where economic conditions are improving, have been on the rise, and have helped improve the economic situation in the first half of 2000.

However, individual consumption has remained fairly flat, and the forces stimulating autonomous economic recovery have not yet reached strong levels. Residential construction has also remained unchanged, while public works investments have fallen compared to 1999 when active fiscal injections were made in this area.

The employment situation has shown some minor signs of recovery, but continues to pose problems. The overall unemployment rate remains high at 4.7%(as of June, seasonally adjusted), and the job availability rate remains low at 0.59 jobs available per job seeker(as of June, seasonally adjusted).

Thus, the Japanese economy in the first half of 2000 has shown signs of recovery spurred by private demand, particularly private investment in plant and equipment. However, the negative effects of reduced public works investment are hampering the economys ability to recover, and thus foiling attempts to predict what will happen next.

1-3 Economic Outlook in the next decade

Since the bubble collapsed in the late 1980s, the Japanese economy has shifted from growth and expansion into a phase of stability and maturity, and, as mentioned earlier, was originally estimated to have a potential growth rate of 2%. Over the span of the next decade, the economy is likely to get back on that 2% growth track as a result of the current trend toward moderate recovery.

The aging of society and the population decrease are expected to put some constraints on the Japanese economy in the near future. The population of Japan is

going to hit a peak in the year 2007, after which it will begin to decrease. At the same time, the aging of society will progress at an accelerated pace, such that the percentage of senior citizens(aged 65 and older) to the entire population is expected to rise from its 1999 level of 17% to a massive 22% by 2010. The population decrease will trigger reductions in the scale of economic activity, and the aging of society will inevitably increase the burden on working people in terms of taxes and social security. The savings rate is also expected to decline, thereby reducing the societys overall resources available for investment. In 2010, the pace of population decrease will still be moderate, but if extraordinary technological innovations or means of increasing productivity are not unearthed, the Japanese economy will have a difficult time getting back on a track of positive growth over the mid-to long-term.

The aging of society will result in an increased reliance on fiscal measures, especially social security expenses, and will make fiscal reform even more difficult. Once the economy gets back on the track of autonomous recovery, fiscal reform must urgently be promoted by rationalizing and streamlining government administration.

On the other hand, the globalization of the world economy is also going to have an impact on Japans future economy. In a post-Cold War environment where most countries have adopted a market economy and the information revolution has intricately affected the global market, Japan has been able to retain its high international competitiveness. This has made it essential to create a framework for implementing deregulation, promoting the IT revolution, and building infrastructures for transportation and telecommunications networks. In terms of its role within Asia, Japan needs to promote technology transfers to other countries and the liberalization of the Japanese market, while also playing a more active role in pursuing economic ties with its Asian neighbors.

Another imminent issue is the increased impact that global environmental problems are going to have on the economy. Cross-national efforts in areas such as global warming have already begun, but Japan is pouring its efforts into creating an international framework for dealing with environmental problems and providing government development assistance in the environmental sector. Domestically, the

Table 1

	1996	1997	1998	1999	2000
GDP & Components mometary unit : billion yen					
GDP at real prices	490,018.4	489,664.4	480,165.2	482,350.8	489,575.3
GDP growth(%)	4.4	0.1	1.9	0.5	1.5
GDP at current market prices	504,391.4	507,632.0	497,255.8	493,818.4	511,904.3
Agriculture, Forestry, Mining & Quarrying	10,469	9,715	9,614		
% growth	0.4	7.2	1.0		
Manufacturing sector	122,526	124,494	117,216		
% growth	2.7	1.6	5.8		
Services sector	320,034	323,500	324,304		
% growth	3.6	1.1	0.2		
Construction sector	51,362	49,923	46,122		
% growth	2.1	2.8	7.6		
Demographic Indicators					
Population(1000s)	125,869	126,156	126,420	126,665	126,892
Population growth rate(%)	0.24	0.23	0.21	0.19	0.18
Total labour force(1000s)	67,380	68,000	67,920	67,930	67,400
Labour force growth rate(%)	0.94	0.92	0.12	0.01	0.78
Unemployment rate(%)	3.4	3.5	4.4	4.7	4.6
Financial Indicators					
Short term interest rate(%)	0.52	0.61	0.66	0.17	0.08
Long term interest rate(%)	2.751	1.991	0.972	1.836	1.762
Changes in consumer price index(%)	100.0	101.9	102.5	102.2	101.7
Base lending rate(Commercial banks)	1.625	1.625	1.5	1.375	1.375
Base lending rate(Finance banks)	2.5	2.3	2.2	2.2	2.2
Change against US $	108.78	120.99	130.90	113.91	106.71

Notes: 1) Construction Economy Forecast(RICE, May 2000); Annual Report on National Accounts(Economic Planning Agency, March 2000); Institute of Population Problems home page, Economic Data from Overseas(compiled by the Economic Planning Agency, Research Bureau, Overseas Research Division, June 2000), Management and Coordination Agency home page,and the Bank of Japan Monthly Bulletin(compiled by the Research and Statistics Department, April 2000).

2) GDP and gross production figures are for the fiscal year. GDP figures for 2000 are estimates. Realfigures based on FY 1990 prices.

3) All gross productivity figures are in nominal terms.

4) Populations figures are estimates.

5) Figures for labor force population and unemployment rates are seasonally adjusted. Figures for 2000 are current as of May.

6) The consumer price index assumes a baseline figure of 100 for 1995.

7) Interest rate figures are from year-end statistics(except for 2000 figures which reflect interest rates as of March 31).

8) Short-term interest rates reflect the average interest rates published in the domestic commercial papers.

9) Long-term interest rates reflect interest rates on long-term(10-year) government bonds.

10) The consumer price index for 2000 is as of April 30.

11) The base lending rates(Commercial Banks) reflect the short-term prime rates.

12) The base lending rates(Finance Companies) reflect the long-term prime rates.

13) Exchange rate figures are annual averages(except for 2000 figures, which reflect the average for March).

government is promoting a shift to a recycling-oriented social economy that addresses waste management and recycling issues.

As can be seen from the above, the outlook for the Japanese economy over the next decade is not one of unbridled optimism, but instead one that recognizes the various problems that remain to be addressed. Increased wisdom and effort will be required if the Japanese economy is to continue to thrive now that it has shifted from a growth orientation to maturity.

1-4 Construction Market

(1) In fiscal 1999, public construction investment remained fairly stable and private residential investment rose into positive numbers for the first time in three years. However, the reduction in private non-residential construction investment hindered overall construction investment, which decreased by 1.3% from the previous year, and resulted in a third consecutive year of negative growth.

(2) Due to reduced public construction investment and a dip in private residential investment in fiscal 2000, overall construction investment fell by a nominal 2.8% from last year. Private non-residential construction investment showed an increase for the first time in four years due to a round of corporate inventory adjustments, but will not be able to offset the decline in government construction investment and private residential investment.

(3) Overall construction investment for fiscal 2001 will fall by a nominal 6.0% from the previous year. Government construction investment will fall drastically if economic policies do not generate any additional investment. Though private residential investment is also expected to drop, private non-residential construction investment is expected to increase further. This is not, however, expected to help pull overall construction investment back into the black.

(4) The above indicates that construction investment is now in a phase of short-term contraction. Private investment is expected to be stimulated as economic recovery progresses, but massive improvements cannot be anticipated even over the medium to

long term due to the negative effects of fiscal belt-tightening, the aging of the population, and population decreases.

Table 2 Construction investment(or market) volume (at 1990 prices)

Fiscal year	1999(billion yen)	1996(%)	1997(%)	1998(%)	1999(%)	2000(%)	2001(%)
Residential Construction(A)	20,382.0	12.9	-19.9	-1.9	3.6	-0.9	-5.5
public	1,786.4	6.7	-12.4	0.7	5.0	0.6	-13.8
private	18,595.6	13.4	-20.4	-11.9	3.5	-1.0	-4.7
Non-Residential Construction(B)	12,015.7	6.4	-3.2	-12.5	-8.6	2.6	1.2
public	3,202.8	-1.3	-4.7	-9.2	-7.1	-3.9	-7.4
private	8,812.9	9.3	-2.7	-13.6	-9.1	5.0	4.0
Civil Engineering Construction(C)	34,741.8	-3.1	-2.4	-13.6	-9.1	5.0	4.0
public	28,113.1	-2.8	-1.3	2.9	1.5	-7.3	-12.7
private	6,628.7	-4.0	-6.2	-3.8	-6.6	2.4	3.0
Total construction investment(A+B+C)	67,139.5	3.9	-8.7	-5.3	-0.7	-2.6	-6.2
public	33,102.3	-2.1	-2.3	1.4	0.7	-6.5	-12.2
private	34,037.2	8.9	-13.4	-10.9	-2.1	1.2	-0.8
Repair and Maintenance(D)	-	-	-	-	-	-	-
Total construction market(A+B+C+D)	-	-	-	-	-	-	-

(at current prices)

Fiscal year	1999(billion yen)	1996(%)	1997(%)	1998(%)	1999(%)	2000(%)	2001(%)
Residential Construction(A)	21,650.0	14.2	-19.0	-12.0	3.1	-0.3	-4.8
public	1,882.9	7.9	-11.3	-0.3	4.4	0.5	-14.0
private	19,767.1	14.8	-19.5	-13.0	3.0	-0.4	-3.9
Non-Residential Construction(B)	12,628.5	7.3	-1.9	-13.2	-9.3	2.3	1.3
public	3,366.1	-0.5	-3.3	-10.0	-7.7	-3.7	-7.5
private	9,262.4	10.3	-1.4	-14.2	-9.8	4.5	4.3
Civil Engineering Construction(C)	36,580.9	-2.6	-1.1	0.7	-0.8	-0.6	-9.5
public	29,733.5	-2.3	0.0	2.2	0.8	-7.7	-12.7
private	6,847.4	-3.9	-5.0	-4.7	-7.5	1.8	3.2
Total construction investment(A+B+C)	70,859.4	4.8	-7.6	-6.1	-1.3	-2.8	-6.0
public	34,982.5	-1.5	-1.1	0.6	0.1	-6.9	-12.3
private	35,876.9	10.0	-12.4	-11.8	-2.7	1.3	-0.4
Repair and Maintenance(D)	-	26.5	-7.3	-8.7	-	-	-
Total construction market(A+B+C+D)	-	4.6	-4.0	-7.5	-	-	-

Source: Construction Economy Forecast, Research Institute of Construction and Economy. Statistics on Construction Undertaken, The Ministry of Construction.
Note : 2000 and 2001 are forecast.

Table 3

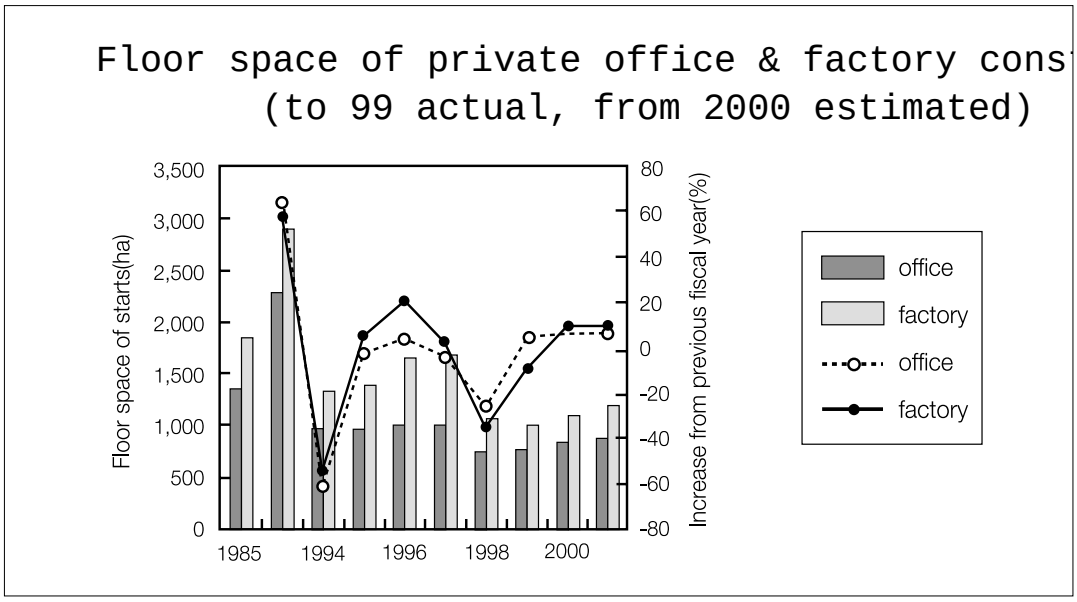
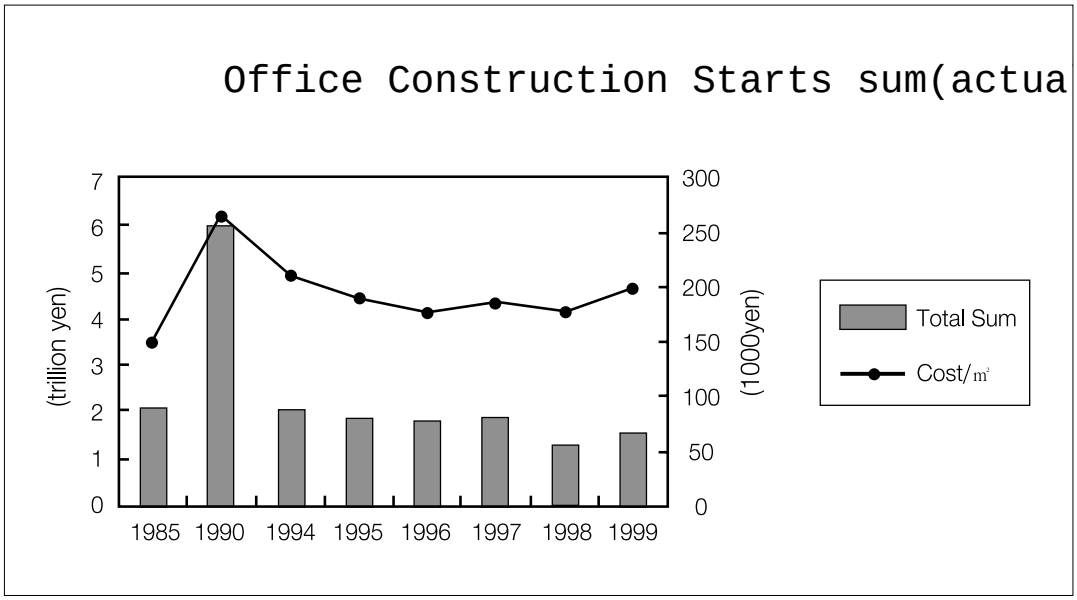


Table 4



3 Several issues of Construction Industry

3-1 Quality

3.1.1 Enhancement of Quality Assurance

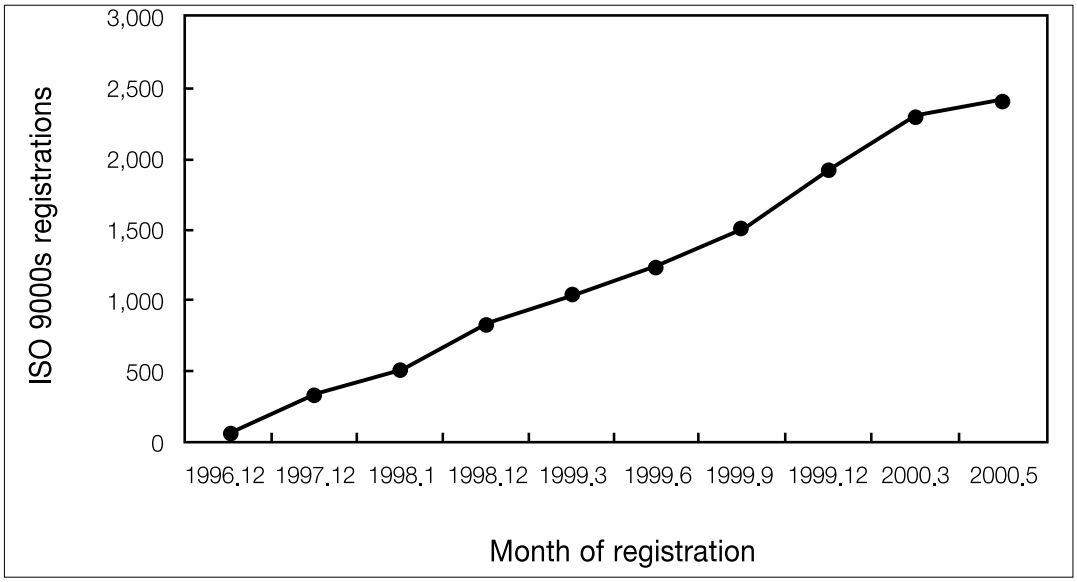
(1) Enhancement of quality assurance through ISO9000 series compliance

The Ministry of Construction has been working since 1996 on about 50 pilot projects to promote a better understanding of the ISO9000 series, and to engage a wide range of interested parties in a discussion concerning the benefits and problems associated with the application of ISO9000 standards to public works projects. As a result, the Ministry of Construction has determined that there is a high potential for the application of ISO9000 series standards to effectively serve as a means of improving quality assurance standards on public works and other construction projects. In fiscal 2000, in light of its findings, the Ministry of Construction announced 36 ISO9000 series compliance projects, primarily projects with an especially high degree of difficulty, that require project bidders to obtain ISO9000 series certification.

(2) ISO9000 series certification

Japanese construction companies first began working in 1995 to achieve ISO9000 series certification. Since then, the number of certified companies has risen rapidly. As of May 31, 2000, 2396 construction companies have registered with the Japan Accreditation Board for Conformity Assessment(JAB) for certification in the construction sector. More small and medium-sized construction companies have been obtaining certification in recent years.

Table 5 Registrations since Dec. 96



3.1.2 Enhancement of Skills of Workforce

The Ministry of Labour has implemented a skill assessment system for the purpose of improving workers skills and their interest in skill acquisition. This system comprises a four-level skill assessment for 38 types of construction-related jobs such as rebar work, and workers are assigned to a skill level based on their ability to pass both written and hands-on exams.

The Ministry of Construction is also working to develop training programs for multi-skilled workers who can work in several different sector of construction, as well as for core workers who can devise efficient construction methods for contracting engineers(supervisors) and who can coordinate work with the managers of other sector of work. In April 1997 the MOC opened the Cross-technique Training School to further these goals. To promote the training of core engineers, the Ministry of Construction is supporting the establishment of a system for evaluating them, and plans to investigate evaluation systems for companies that utilize core engineers, such as the public evaluation system, specialized construction companies strength index.

Also, the MOC is conducting a preliminary training program for new hires in the construction industry for small and medium-sized companies and specialized

construction companies who hire few new people and thus cannot efficiently implement their own independent training programs. It is also planning to join construction-companies to enhance construction skill training by providing industrial high schools with tools and materials, teachers, and volunteer lecturers.

3.1.3 Enhancement of Supervisory Level

Enhancement of skills of supervisors is largely being pursued through private instruction. Each company holds its own regular technology exchange meetings, provides quality control and safety and sanitation education, and has safety and sanitation coordinators conduct construction site safety patrols. In recent years, an increasing number of companies have been striving to elevate their technological capabilities by actively supporting to take qualification of execution management engineer and professional engineers and by sharing construction techniques that use information technology.

Table 6 Skill level of Workforce and Supervision Level

	Total Construction Workforce (a) millions)	No. of workers (b)(millions)	Skill level (b/a)[%]	Ratio of Supervisor to Workers [1:X]
1996	6.70	4.42	-	10.28
1997	6.85	4.55	-	11.10
1998	6.62	4.34	-	10.09
2000	6.57	4.32	-	10.29
Long-term target	-	-	-	-

Source : Labor Force Survey (Ministry of Labor)
Note : Skilled Workers section is noting

3-2 Information Technology

The initiative of the major general construction companies in using information technology in the construction industry include electronic procurement of materials over

the Internet, electronic collection of project companies, sharing of data(CAD, project information), using extranets with cooperating companies, and increasing distribution efficiency.

The Ministry of Construction established the Construction CALS/EC Action Program in June 1997, and aims to achieve construction CALS/EC in the projects under its direct jurisdiction by 2004. The major goals of the construction CALS/EC are as follows:

- Use of electronic procurement for all projects.
- Contracting through EDI(Electronic Data Interchange)
- Online submission of applications and bid notification for all public projects
- Creation of a comprehensive database of project information.
- Information linking and integrating using a GIS(Geographic Information System)

The MOC is promoting the early implementation of construction CALS/EC by providing active assistance to preparations for its introduction which are being conducted by various construction industry organizations.

3-3 Construction Technology

3.3.1 Research and development Investment

Table 7 Research and development

	Total investment in research and development(billion yen)	Construction sector investment(billion yen)	Percentage of total construction investment [%]
1995	9,395.8	204.4	0.26
1996	10,058.4	224.5	0.27
1997	10,658.4	225.2	0.30
1998	10,800.1	176.7	0.25
1999	N.A.	N.A.	
Long-term target	-	-	-

Source: Survey of Research and Development(Management and Coordination Agency) and the Forecast of Construction Investment(RICE, Economic Research Association).

3.3.2 Development of New Technological in the Major Construction Companies

Table 8 New construction

technologies & brief Description	Developer
Chemical-Free Semiconductor Plant To minimize the pollutants produced in semiconducto manufacturing environments, this project selected clean-environment machines and finishing materials based on the appropriate selection, installation, and performance of filters that eliminate pollutants. A rational use of space was employed at the various facilities, especially clean rooms. Takenaka Corporation has reduced its building and equipment construction by 10% over other projects, and will be able to complete the entire process from basic design to manufacturing equipment installation in a short 8.5 months.	Takenaka Corporation
Hybrid TASS(Taisei Shake Suppression System) Method This is a new earthquake-resistant construction method that uses elastic sliding bearings and laminated rubber bearings. The strength and width of the buildings vibrations are greatly reduced by the effect of the compound bearings, and costs are lowered by slimming down the upper part of the frame. Using sliding bearings also reduces the cost of the earthquake-resistant structure itself.	Taisei Corporation
Cyber Building This is a building that can comprehensively respond to problems involving electromagnetic waves using electromagnetic wave shield technology. Shimizu Corporation is devising preliminary estimates of possible problems using environmental measurement and simulation technologies, and is performing appropriate electromagnetic environmental engineering on the entire process from planning to maintenance.	Shimizu Corporation
Hybrid Slip form Method This is an extremely fast method of constructing tall bridge piers that uses steel pipes for the reaction abutments and raises a slip form(PC from). Steel pipes are used as the main reinforcement, and a complex structure using a line from the PC strand is used in the tie. As a result, Obayashi Corporation has improved construction safety, reduced the energy needed for the process of rebar fixer, and increased the speed of construction.	Obayashi Corporation
Comprehensive Tunnel Construction Management System This system makes it possible to build high-quality, reliable structures when constructing tunnels that pass through mountains. This system is comprised of a (1) information construction system which uses methods of prospecting vibration, electromagnetism, and drilling, a (2) design support system which provides design assistance using data obtained from the (1), and a (3) quality control system which uses sophisticated tunnel cross-section measurement devices.	Nishimatsu Construction
TBM Automatic Spraying Robot By loading an automatic concrete spraying robot into a TBM(tunnel boring machine), this system is the first in the world to allow the simultaneous performance of both excavation and lining work. It automatically performs tasks involved in the TBM method, such as washing the walls of the excavated area, taking cross-sectional measurements, and calculating the concrete spraying thickness. This system can help improve the work environment, raise quality, shorten construction times, and reduce costs.	Sato Kogyo

Description of new technology	Developer
Earthquake-Resistant Bridge Pier Rapid Construction Method(REED Method) This is a method of structurally forming and constructing structural steel concrete compound structure bridge piers using studded H beam(which can bear tensile force) and a highly durability cast in from(which can bear compressive force). As a result, this method enables fast-paced construction through the repetition of simple tasks, improved earthquake resistance through the use of highly rigid H beam, and enhanced aesthetic beauty and durability through the use of pre-cast from.	Maeda Corporation
Fiber-Reinforced Cement Mortar with Metal-Like Malleability Properties(High Ductility FRC) High ductility FRC achieves high malleability that can resist deformations 200 times the degree of conventional mortar by incorporating inexpensive high-strength fiber in its structure. Taking advantage of the characteristics of fiber to make a highly earthquake-resistant member with outstanding safety properties makes it possible to reduce the volume of other earthquake-resistant materials, thereby greatly reducing costs. Also, since this technology can also be expected to help control the size of cracks, it may have applications for highly durability structures.	Kajima Corporation
Ashcrete This is a new type of concrete. Instead of the standard components of normal concrete, Ashcrete uses fly ash, a high-volume by-product of coal fired power plants. Because of its added strength under water, durability, and water-retarding properties, it has all the properties necessary to make an ideal material for undersea applications. Ashcrete also has a wide range of applications because its added volumes of metal slag enable adjustable specific gravity.	Hazama Corporation
Positioning Management System Using GPS This is a construction management system for ocean civil engineering construction that uses GPS positioning technologies and underwater ultrasonic waves. It allows structure installation positions to be managed accurately and easily without interference from weather and other conditions above the ocean surface even at extremely deep levels of about 200m, levels at	Penta-Ocean Construction

3-4 Environment

3.4.1 Environmental Impact Assessment Law

Japans environmental impact assessment system used to be left to the discretion of government officials based on the Cabinets Guidelines Concerning the Performance of Environmental Impact Assessments, but since the process of establishing the Basic Environment Law and the Basic Environment Plan revealed the need for revisions to this system, the Environmental Impact Assessment Law(Environmental Assessment Law) was enacted in 1997.

All businesses over a certain size are automatically required to conduct studies, provide estimates, and perform, at their own expense, assessments of the impact of their business activities on the environment before engaging in those activities. Companies must then use the results of those studies to take the relevant environmental issues into consideration in carrying out their business.

The new law marks a watershed in the history of environmental conservation because it requires that the assessment procedures include mechanisms for ensuring that the views of local residents are reflected in the assessment.

3.4.2 Building Construction Materials Recycling Law

The Japanese government has designated the year 2000 as the first year of the recycling-oriented society and has decided to enact legislation regarding a basic framework toward that end. The government has thus compiled the Basic Law Promoting the Formation of a Recycling-Oriented Society which sets out the basic principles of recycling policies, such as regulations regarding waste disposal and the collective responsibility of producers.

It has also enacted the Revised Waste Disposal Law which requires waste disposal companies to ensure final waste processing and the Building Construction Materials Recycling Law(Construction Recycling Law) which systematizes the registration of demolition companies and requires the recycling of concrete, asphalt, and lumber.

Construction waste accounts for about 20% of total industrial waste, about 40% of the volume of final processed waste, and about 90% of illegal dumping, thus making the promotion of construction waste recycling an extremely important issue.

While new laws have been introduced to promote the proper disposal and recycling of waste, such as the Basic Law Promoting the Formation of a Recycling-Oriented Society, Revised Waste Disposal Law, and the Building Construction Materials Recycling Law(Construction Recycling Law), the construction industry is being urged to undertake active environment-oriented efforts and to achieve stringent goals.

It is essential that recycling plans be implemented if the construction industry is to

be viewed favorably by society as an industry that makes an important social contribution.

3.4.3 ISO14000 Efforts

The number of companies in Japan obtaining certification under the ISO14000 series of international standards for environmental management systems is rapidly increasing.

Many companies in the construction industry are moving forward with preparations for obtaining certification for such purposes as fulfilling their corporate mission(social demand), preserving the global environment, improving their corporate image, bolstering their companys stature, or establishing an environmental management system.

The statistics on ISO14000 certified companies compiled by the Japan Standards Association as of April 2000 indicate that a total of 3,693 companies have obtained certification. Of those, 207 are general construction companies(5.6%) and 44 are facility and equipment construction companies(1.2%).

4. Globalization of the Construction Market

4.1 Government Policy on Liberalization

The construction industry in Japan has not traditionally discriminated against foreign entrants to the market regarding requirements for obtaining construction business licenses and other measures. In 1994, however, in response to the growing movement toward international construction market liberalization evidenced by ongoing negotiations to revise the WTO Agreement on Government Procurement, reforms to Japanese bidding and contracting procedures were enacted with the Cabinet Resolution approving the Action Plan on Reforms of Bidding and Contracting Procedures of Public Works(hereafter the Action Plan). This plan aimed to ensure the high quality

of public works projects while increasing the transparency, objectivity, and competitiveness of bidding and contracting procedures, ensuring the thorough application of the principle of non-discrimination against foreign companies, and making it easier for foreign participants to become familiar with Japanese bidding and contracting practices. In addition to having the same forward-looking character as the WTO Agreement on Government Procurement, which went into effect in 1996, this Action Plan incorporated other independent government measures aimed at market liberalization. The major components of the plan are as follows:

Projects valued over a standard amount set out in the agreement are subject to open bidding, and design/consulting work is handled through either public invitation bidding or competitive public invitation bidding.Broadens the items by which foreign companies were evaluated. Establishes procedures for handling complaints.

The WTO Agreement on Government Procurement(GPA) went into effect later in 1996. A comparison of the Action Plan and the GPA reveals that while the Action Plan applies to national government-related construction and design/consulting work, the GPA is broader in scope and is applied at the level of prefectural and designated city governments. Also, while the Action Plan is applicable to construction as well as design/consulting work, the GPA applies again more broadly to the procurement of goods and other services.

4.2 Legal Regulations Applying to Foreign Construction Firms and Technical Specialists Entering the Japanese Market

4.2.1 Legal Systems and Procedures for Establishing a Business Office

When a foreign corporation establishes a business office in Japan for its representatives, it need not obtain any licenses or permits, nor must it register with the Regional Legal Affairs Bureau. When a foreign corporation establishes a branch(or sales office) or a corporation in Japan, it is required to: a) register the branch(corporation) in accordance with commercial laws, b) submit reports or

documents in accordance with the foreign exchange and international trade laws, and c) submit various documents to the tax authorities.

4.2.2 Obtaining a Construction Business License

A company engaging in the construction business in Japan must obtain a construction business license in accordance with the Construction Business Law. A permit is not required if the company is only a subcontractor for light construction work as defined by law, but if the company engages in any other kind of construction work, it must obtain a construction business license regardless of whether it is a domestic or foreign firm. Also, a major requirement for obtaining that business license is that the company employ a person with a certain number of years of management experience in Japan, but special approval may be obtained by the Ministry of Construction for persons with the same degree of experience in foreign countries if the Ministry recognizes that person as having the same or greater level of capabilities as is needed to fulfill this requirement. Likewise, the requirement of employing specialized engineers with certain qualifications or with actual work experience in Japan may be able to be met by getting the Ministry of Construction to approve personnel with qualifications or actual work experience overseas.

(For details regarding construction business licenses, see 5, Construction Business Licensing System.)

4.3 Penetration of Foreign Construction Firms in the Japanese Domestic Market

Table 9 Number of foreign corporations and foreign-capitalized Japanese corporations that have obtained construction business licenses

Country	Foreign companies	Foreign-capitalized Japanese companies	Total	By permit	
				Minister of Construction	Prefectural governor
U.S.A.	8	22	30	9	21
South Korea	8	1	9	9	0
Germany	0	6	6	1	5
Holland	1	5	6	1	5
Switzerland	0	5	5	3	2
Sweden	0	4	4	0	4
France	1	1	2	1	1
England	0	2	2	1	1
China	0	1	1	0	1
Finland	0	1	1	0	1
Singapore	1	0	1	0	1
Total	19	48	67	25	42

Source : Ministry of Construction
Notes : 1. As of September 30, 1999.
2. Foreign corporations: Companies whose entire(100%) capital comes from a foreign firm.
3. Foreign - capitalized Japanese corporations: Companies whose majority(50% or more) capital comes from a foreign firm.

4.4 Effects of Liberalization on WTO Participation

Table 10 Public works orders received by foreign firms(million yen)

	Fiscal year	1996	1997	1998	1999(Apr.-Nov.)
Orders received by foreign firms	Construction	9,798	13,736	15,631	10,803
	Design and consulting	491	256	261	327
	Total	10,289	13,991	15,891	11,130
Orders received by South Korean firms	Construction	16	1,008	4,084	7,039
	Design and consulting	0	0	0	0
	Total	16	1,008	4,084	7,039

Source : Ministry of Construction
Note : Includes orders planned by third sector public institutions as well as national government institutions and local public organizations.

Since the Action Plan on Reforms of Bidding and Contracting Procedures of Public Works was enacted in 1994, the number of public works projects undertaken by foreign firms has steadily increased. The increase in the number of orders received by South Korea has been especially remarkable since it became a party to the WTO Agreement on Government Procurement in 1997.

4.5 Policies and Plans Aimed at Cooperation in the Asian Construction Market

4.5.1 ODA Technological Cooperation Projects

Japan is the worlds second largest economy and the worlds top contributor of ODA. In addition to helping to raise the level of trust and respect that other countries have for Japan, the Japanese government grants ODA with the basic understanding that it helps promote the national interests of Japan, a country that is dependent on world peace and stability and that relies on the international community for resources, energy and food. In light of this knowledge, technological assistance projects that utilize Japanese firms and take advantage of the experience of specialists at universities, think tanks, local governments, and private companies, and which aim at transferring useful technologies and managerial skills are one of the most important means through which Japan provides overseas aid. Various technological cooperation programs are already underway in the construction sector in areas such as construction materials development(Indonesia), new housing technology research(China), and increasing construction productivity(Philippines).

4.5.2 Cooperation with Local Firms through ODA Projects

Overseas contract amounts for Japanese construction companies were valued at 729.7 billion for fiscal 1999. A breakdown of orders reveals that 492.3 billion were placed with Japanese companies(branches or sales offices), and 237.4 billion were

placed with local companies. There is a large gap between the value of orders received from Asia, Japans leading overseas source, whose overseas contract value of 483.5 billion accounts for 66.3% of its overseas contracts, and those from the second runner-up, North America, with 138.1 billion. Mid-Term Policies Concerning Government Development Assistance, August 10, 1999.

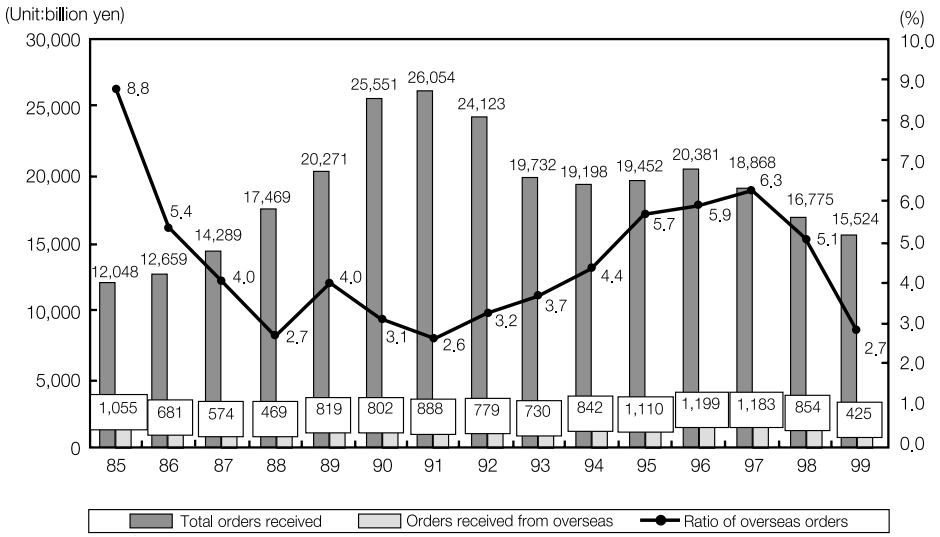
Overseas Contract Association of Japan. Totals for the 54 member companies By undertaking projects in Asia, Japanese construction companies which operate as main contractors or joint venture participants are able to form close cooperative relationships with local subcontracting firms and other joint venture participants. They are also able to engage in technology transfers in areas of construction such as process management, quality control, and construction methods. As a result, they not only help to improve the technological capabilities of the local companies with whom they share a cooperative relationship, but also raise the overall level of the construction industry in the countries in which they operate.

4.6 Overseas Construction Orders Received by Domestic Construction Firms and Orders for Construction in Japan Received by Foreign Construction Firms

4.6.1 Overseas Construction Orders Received by Domestic Construction Firms

Overseas construction orders received by major constructio firms and order ratios by region are shown below.

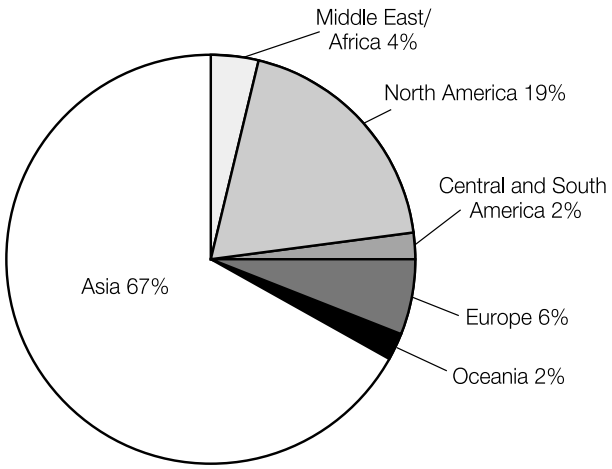
Table 11 Trends in overseas construction orders received by the big 50 general



contractors (1985 ~ 1999)

Source: Survey A of Orders Received, Research and Information Division, Economic Affairs Bureau, Ministry of Construction. Survey conducted among the big 50 general contractors.
Note : The number of overseas construction orders does not include those received by local corporations

Table 12 Overseas construction contracts in fiscal 1999 (ratio of order values by region)



Source : Overseas Contract Association of Japan. Totals for the 56 member companies.

4.6.2 Contracts for Overseas Construction Orders by Country

The Ministry of Construction conducted a survey of business activity at the end of

the most recent accounting period or between accounting periods among Japans big 56 domestic construction companies(36 general contractors, 20 facility and equipment construction companies) that operate internationally. The countries from which the companies have received the most overseas construction orders as well as those with whom they want to expand their business(respondents could give up to 5 answers) are shown below.

Table 13 Countries with large numbers of construction orders last year

(Unit: companies)

Countries with large numbers of construction orders	1999 Survey Primary service seekers			
	Japanese firms	Other private organizations	Public organizations	Total
1. Singapore	9	10	5	24
2. Thailand	9	3	5	17
3. Philippines	10	2	5	17
4. China	6	4	5	15
5. U.S.A.	9	4	2	15
6. Malaysia	6	6	2	14
Others	28	14	41	83
Total	77	43	65	185

Table 14 Countries with whom expanded business is desired

(Unit: companies)

Countries with large numbers of construction orders	1999 Survey Primary service seekers			
	Japanese firms	Other private organizations	Public organizations	Total
1. China	11	3	4	18
2. Philippines	9	3	6	18
3. Singapore	5	6	3	14
4. Thailand	6	2	5	13
5. Vietnam	6	0	6	12
6. U.S.A.	7	2	2	11
Others	26	16	51	93
Total	70	32	77	179

5 Construction Business Licensing System

License Categories

There are two types of construction licenses, national licenses granted by the Ministry of Construction and prefectural licenses granted by prefectural governors, and two types of construction firms, special and ordinary construction firms.

A single construction firm cannot simultaneously hold both a national and prefectural construction business license, nor can a single firm be categorized simultaneously as both a special and ordinary construction firm.

Difference between a National License and a Prefectural License

When a company intends to establish offices and do business in two or more prefectures, it must obtain a national construction license. If a company intends to establish an office and do business in only one prefecture, it must obtain a prefectural license from the prefecture that has jurisdiction over that location.

Difference between Ordinary Construction Licenses and Special Construction Licenses

All construction firmsboth general contractors and subcontractorsmust obtain an ordinary construction license unless they only intend to perform extremely small jobs. A special construction license, however, must be obtained to engage in general contracting where contracts worth 45 million or more are received directly from the end client, or to engage in subcontracting involving contracts worth 30 million or more.

The special construction license is part of a system designed to protect the interests of subcontractors and to ensure that projects are carried out properly. The required qualifications for a special construction license are more stringent than those for an ordinary license.

Table 15 Trends in number of construction business license holders(1975 ~ 1999)

	Total	Growth rate	Permit from Minister	Growth rate	Permit from governor	Growth rate
1975	350,817		6,331		344,486	
1980	488,520	39.3%	7,465	17.9%	481,055	39.6%
1985	518,964	6.2%	8,337	11.7%	510,627	6.1%
1990	508,874	-1.9%	8,944	7.3%	499,930	-2.1%
1991	515,440	1.3%	9,022	0.9%	506,418	1.3%
1992	522,450	1.4%	9,124	1.1%	513,326	1.4%
1993	530,665	1.6%	9,332	2.3%	521,333	1.6%
1994	543,033	2.3%	9,619	3.1%	533,414	2.3%
1995	551,661	1.6%	9,871	2.6%	541,790	1.6%
1996	557,175	1.0%	10,062	1.9%	547,113	1.0%
1997	564,849	1.4%	10,485	4.2%	554,364	1.3%
1998	568,548	0.7%	10,742	2.5%	557,824	0.6%
1999	586,045	3.1%	10,815	0.7%	575,230	3.1%

Source : Ministry of Construction.
Note : Numbers of companies are as of the end of March in each year.

6 Contract Award Procedures(Methods of Seeding Pulit and Pivate Sector Contractors) and Contracts Types

6-1 How Public-Sector Clients Select a Contractor

The main features of the bidding and contracting system for public works projects in Japan are as follows:

(The qualification of bidders is largely based on Corporate Capability Assessment System which is explained below.).

6.1.1 Selective bidding system

1) Seledve bidding

Selection committees invite selected firms to submit bids. The selection is made on the basis of track record and each clients own ranking system This system is widely

used by local governments of medium size or smaller and for small-scale construction projects.

- Used for small-scale projects(usually under 100 million).
- Used by clients who do not have staff that are qualified to review the bids submitted in an open bidding procedure, and by clients who require a construction firm with some special construction technology.

2) Selective bidding by public invitation

Under this system, both the project and the construction firms are ranked. Firms that have registered their interest in the relevant type of construction project, and whose rank qualifies them to bid on that project, are publicly invited to provide technical documents. On the basis of these documents, roughly ten firms are selected to submit bids.

- This system is used for basically the same type of projects for which the selective bidding by project interest registration system is used. The difference is that selective bidding by public invitation is used when an unusual type of construction technology is required.
- Used primarily for projects with a contract value of 200-720 million.
- An explanation of why a particular firms bid was not selected will be provided upon request.

3) Selective bidding by project interest registration

At the beginning of each fiscal year, construction firms register with prospective clients to indicate what types of construction projects they wish to bid on. When it comes time for a contract to be awarded for a particular project, the client requests 10 or 20 registered firms to provide technical documents(provisional selection). On the basis of these documents, about ten companies are selected to submit bids.

- Used primarily for projects with a contract value of 100~200 million.
- An explanation of why a particular firms bid was not selected will be provided upon request.

6.1.2 General competitive bidding system

This system is used primarily by the national government, institutions affiliated with the national government, prefectural governments, and designated cities. It is used for:

- contracts worth more than 750 million(4.5 million SDR) that are issued by the national government;
- orcontracts worth more than 2.50 billion(15 million SDR) that are issued by: (1) institutions affiliated with the national government; (2) prefectural governments; or (3) designated cities.

Bidding eligibility

- The point score assigned to the company on the basis of the business assessment criteria must be above a certain threshold.
- The company must have experience with the same type of construction project.
- The company must have qualified technical personnel available for the project.

6.1.3 Negotiated contract system

This system is used primarily:(1) for projects that must be done by a particular firm due to the fact that it requires special technologies, equipment, or machinery; or (2) when severe time constraints make it impractical to carry out the competitive bidding process.

6.1.4 Other bidding systems

1) Design-build system

In principle, the design and construction phases of public works projects in Japan are carried out separately, but a small number of clients(such as the Housing and Urban Development Corporation and local government-affiliated housing corporations) are beginning to use the design-build system.

2) Value engineering (VE) system

This system is beginning to be used occasionally (by the Ministry of Construction, and local government-affiliated housing corporations) in conjunction with open bidding, selective bidding, and negotiated contracts. It is reported that many prefectural and local governments are examining the possibility of using this system in the future.

The VE system is carried out during bidding, performance of the contract, and after contract completion, and is intended to serve as a means of improving both functionality and cost.

3) Contract award based on price and technology

In addition to price, the client using this system also calls upon bidders to submit technical proposals, which the client then evaluates from various perspectives, including quality, speed, design, and safety.

4) Private Finance Initiative (PFI)

The Private Finance Initiative (PFI) Law was enacted in July 1999, and the Basic Guidelines based on that law were released this March. Under this system, contractors are chosen by open competition and through public invitation, and those selected use their own funds, managerial capabilities, and technological capabilities to construct, maintain, manage, and operate public facilities.

Cf Corporate Capability Assessment System

The principal system used in Japan for assessing a construction firms capabilities is the business assessment system.

For construction firms that receive direct contracts for public works projects, business assessments are carried out by the Minister of Construction or a prefectural governor. These assessments entail an examination of a specifically formulated list of Objective Criteria for Assessing the Business of a Construction Firm. The assessment results are used to assign the company a point score, which is publicly announced (see the table below).

Organizations that place orders for public works projects assign each prospective

contractor a ranking, taking into consideration the results of the contractors business assessment as well as the result of the organizations own qualification assessment based on the contractors construction performance.

Total points (P) = 0.35X1 + 0.10X2 + 0.20Y + 0.20Z + 0.15W

		Assessment criteria
Scale of operation	X1	Average annual construction revenue, classed by type of project
	X2	Shareholder 's equity, number of employees
Business condition	Y	Ratio of revenues to operating profit;Ratio of capital to ordinary profit;Ratio of cash flow to revenue;Ratio of require working capital to monthly turnover;Ratio of account receipt and work in process to annual sales;Ratio of accounts receivable to monthly turnover;Equity ratio;Ratio of interest-bearing debt to monsthly turnover;Net interest payments ratio Ratio of shareholder 's equity to fixed assets;Ratio of fixed assets long-term capital;Ratio of value-added output to fixed assets
Level technical expertise	Z	Number of technical employee, classed by type of business
Other assessment criteria	W	Non-wage benefits;working days per year;On-site safety record;Number of construction industry accountants on staff

6-2 How Private-Sector Clients Select a Contractor

Private-sector clients most often select contractors by means of the mission method (a decision is made after price negotiations with a single company) or by getting estimates from several companies. There are two main types of contracting systems, the blanket construction-only contract system and the design-build system, and gross price contracting(lump-sum contracting) is the predominant method of contract payment. Examples of Construction Management(CM) and Project Management(PM) contracting have also arisen, but their use remains quite limited.

In addition, electrical power companies have begun to use the VE system, and real estate developers have begun to use direct contracting(in which major real estate developers dispense with general contractors and award contracts directly to specialized contractors).

7. Constuction Work Force

7.1 Classification of Construction Industry Workers by Job Type

Two-thirds of construction industry workers are on-site workers. There has been no change in the actual numbers of workers since 1995, but recently the number of sales personnel has been rising.

Table 16 Breakdown of construction industry employees (Unit: 1,000 people, avg.per year)

Type of work	1990	1995	1998	1999
Specialists and technicians	290	430	430	420
Management staff	340	350	350	340
Clerical staff	840	930	960	940
Sales staff	220	290	310	320
Workers	3,950	4,380	4,340	4,320
General laborers	80	90	90	80
Others	160	150	150	150
Total	5,880	6,630	6,620	6,570

Source : Annual Report on the Labor Force Survey, Management and Coordination Agency.

7.2 Employment Situation at Major General Contractors

Table 17 Trends in number of employees by job type

	Clerical staff	Technical work	Skilled work	Other	Total
1994	62,731	118,145	4,48	4,677	190,037
1995	59,735	117,979	4,751	3,871	186,336
1996	57,909	116,500	4,403	4,360	183,172
1997	55,831	114,768	4,371	3,408	178,378
1998	50,093	112,907	3,751	2,803	169,554
1999	49,053	104,732	3,732	2,068	159,585
(change from prior year)	(-2.1%)	(-7.2%)	(-0.5%)	(-26.2%)	(-5.9%)

According to a survey conducted by the Ministry of Construction among the big 36

general contractors, the number of workers in all job types has decreased in recent years. In 1999, the fifth consecutive year of decrease, the number of employees dropped by about 5.9% from the previous year.

<부록 C>

미국 건설산업의 생산성 향상을 위한 연구 방향 분석

2000.11.16

(Fully Integrated & Automated Technology, FIATECH)

1 연구의 개요

(1) 분석의 배경과 목적

○ 세계건설시장에서 경쟁력이 가장 뛰어난 국가인 미국 건설업계의 경쟁력 확보와 유지가 왜 가능한지를 분석

○ 현재에도 경쟁력을 가진 기업이 미래에도 더욱 높은 경쟁력을 가질 경우 국내기업들의 해외 시장 진출이 더 어려워질 수 있다는 점을 부각시켜 대응책이 서둘러져야 함을 강조하기 위함.

○ 세계건설시장에서 선두를 달리고 있는 미국계 기업들의 생산성 향상의 접근 방향을 분석하여 정보를 제공함으로써 공동 연구에 참여한 기업들에게 생산성 향상의 중요성을 전달하고자 함.

○ 건설산업에 정보화 및 자동화 기술을 접목시키는 방향을 분석하여 국내기업들의 연구 방향 수립에 시사점을 주고자 함.

(2) 분석 범위와 방법

가. 범위

○ 미국건설산업연구원(Construction Industry Institute, CII)에서 신규로 착수하고자 준비하고 있는 FIATECH의 연구 범위

○ FIATECH의 연구 범위와 방법

나. 방법

○ CII를 직접 방문하여 관계자 면담

○ 면담을 통한 입수자료 분석
○ 면담과정에서 얻은 정보
○ FIATECH에 대한 전문가의 시각

(3) 분석의 한계

○ 새로운 연구 방향은 수립되었으나, 효과 검증에는 상당한 시간이 필요

○ 새로운 연구방향에 대한 구체적인 진행방법이 없어 방향 분석만 가능한 상태임.

○ 연구분야는 정립되어 있으나, 분야별 과제는 아직 결정되지 않은 상태에서 특정 과제별 분석이 어려운 상태임.

○ 현재까지는 구체적인 자료 노출을 기피하는 경향이 강해 구체적인 분석에는 상당한 시간이 경과한 후에 연구에 직접 참여하는 방법이 최선일 것으로 판단됨.

2 미국건설산업의 새로운 연구방향의 배경

(1) 미국건설업계 연구 및 개발(R&D)의 당면과제

○ 제조업이나 정보통신산업 등 타 산업에 비해 R&D 투자액의 절대적 부족

○ 정보화 및 자동화 등 산업의 변화 추세와 속도에 비해 별도의 조처가 따르지 않을 경우 건설업의 생산성은 현재보다 훨씬 저하되어 사용자(일반국민) 및 발주자들로 부터 외면을 당하게 될 것이라는 위기감이 고조되고 있음.

○ 건설산업의 특성상 기획설계, 제작, 시공 및 시운전 등 단계별로 주체자가 분리되어 있고 지역적으로도 떨어져 있으며 또한 시간적으로도 차이를 가질 수밖에 없음. 그러나 이러한 특성에도 불구하고 현재 및 미래 산업은 전반적으로 통합화 추세로 가고

있음. 따라서 건설산업만 예외로 남을 수 없다는 위기감이 높아지고 있으나 개별 기업이 독립적으로 대처하는데는 한계가 있음.

○ 건설업의 R&D는 광범위한 성격으로 인해 시간이 많이 소요되고 비용도 상당 수 투입되며 더욱이 결과를 실용화시키는데 또 다른 시간 투입을 필요로 함으로써 경영자 혹은 소유주가 R&D 투자에 대한 판단을 하는데 어렵게 만들어버리는 요인이 되고 있음.

○ 위의 특성에도 불구하고 건설기업들은 개별적으로 연구를 함으로써 기업간의 연구 중복은 물론 이를 상용화시키는데 실패하고 있어 전형적인 고비용 저효율 상태가 지속되고 있음.

(2) 시장환경변화와 건설산업에 대한 압력

○ 정보산업과 타 산업의 급속한 발전은 속도(Speed)와 생산가격(Cost)에 상당한 변화를 주고 있으며 이로 인한 혜택은 소비자들이 실감하고 있는 상태임.

○ 제조업이나 제작업 등에서 품질을 높이면서도 가격은 오히려 떨어지는 이중적 효과에 대한 혜택은 소비자들이 누리고 있는데 반해 건설시설물에 대한 변화는 피부로 느껴지지 않아 상대적인 불만이 가중되고 있음.

○ 이러한 상대적인 불만을 직접적으로 나타내는 그룹은 일차적으로 대규모 발주기관들임.

○ 발주기관들의 불만은 그동안 지속되어 오던 선린의 관계를 떠나 경쟁에 의해 계약자를 선정하는 구조로 가고 있음.

○ 발주기관들의 이러한 움직임은 기존 기업들의 수주난을 유발시켜 결과적으로 경영난으로 연결되어 버리는 형태로 나타나게 됨. 일반적으로 수주난은 시장의 물량 감소가 직접적인 원인이겠으나, 미국의 경우 1930년 경제 공황 직후 건설시장 규모는 가장

호황기에 있었다는 판단이며 이 호황기는 향후에도 수년간은 지속되리라는 전망이 지배적임(ENR 2000. 2.20자 Cover Story 참조).

○ 시장의 성장성에도 불구하고 많은 대형건설업체들이 수주난 및 경영난에 봉착하고 있는 이유는 시장 변화 흐름에 적절한 대응을 하지 못했기 때문으로 판단됨. 그러나, 보다 근본적인 이유는 주요 발주기관들이 갖고 있는 건설업의 생산성 저하에 대한 불만이 있는 것으로 해석됨.

○ 이러한 이유 때문에 최근 미국건설산업계의 기술개발 핵심은 생산성 향상, 즉 공기 단축, 비용 절감 및 품질 향상에 두고 있는 것 같음.

○ 또한 건설업이 갖고 있는 3D[어렵고, 위험하며, 지저분함(Difficult, Dangerous, Dirty)]는 건설현장의 숙련공과 기술인력의 부족 현상을 심화시키고 있음. 이러한 문제점은 계속해서 발생할 것으로 예측됨. 따라서 노동력 부족의 대체안으로서 기계화 및 자동화 연구의 필요성을 증가시키고 있음.

○ 건설산업의 자동화 및 기계화는 독자적인 연구보다는 비용의 효율화를 따져 기존의 제조업과 제작업에서 실용화되고 있는 자동화 및 기계화 기술을 응용하는 방향으로 나타나고 있음.

(3) 미국건설기업들의 미래 국제경쟁력 현안

○ 건설기업들의 R&D 투자 감소로 인해 현재보다 미래에 건설기술의 하락을 예고하고 있음. 이에 따라 현재보다 국제경쟁력이 훨씬 저하될 것으로 예상하고 있음.

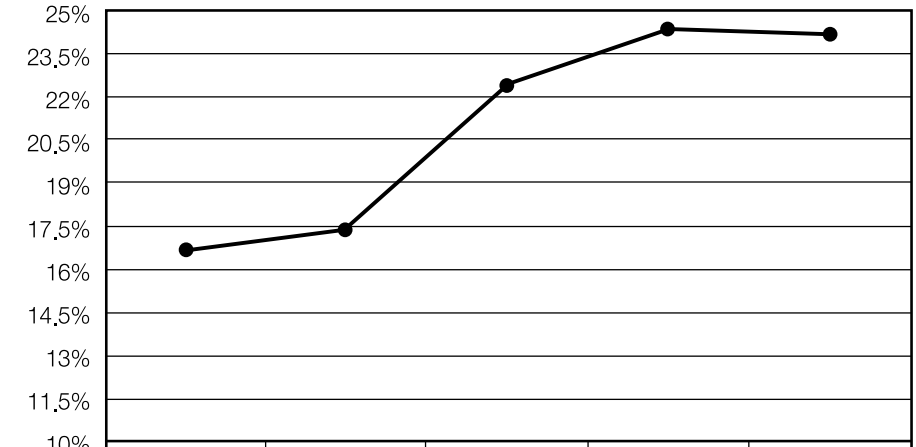
○ 정보산업과 금융서비스업의 발전과 미 경제의 지속적인 성장으로 야기된 실업률 하락은 유능한 인력들이 타 산업으로 빠져나가고 있으며 대학 등에도 미국내 인력이 건설부문에 지원하는 경향이 눈에 띄게 감소하고 있음. 특히 건설관리(CM 및 PM)부문에는 50% 이상이 외국인 학생들로 채워지고 있어 심각한 인력 부족이 예상되며 이로 인해 기술력은 크게 감소되리라는 우려가 높아지고 있음.

○ 인력이 타 산업으로 이동하는 경향은 현장근로자들에게도 동일한 현상으로 나타남에 따라 미국내 건설사업의 생산성도 동시에 하락하는 경향이 있어 그동안 상대적인 국제경쟁력을 유지했던 기조가 붕괴되리라는 우려가 높아지고 있는 상태임.

○ 미국의 상위 대기업들이 해외건설시장에서 차지하는 비중은 최근 2년간 하락하는 추세를 보이고 있어 미국내 건설산업계에 경쟁력 하락이라는 불안감을 야기시키고 있음(<그림 1>). 이는 과거 2년(1998년 및 1999년) 동안 세계건설시장의 크기가 평균적으로 5.8% 성장(ENR, 2000. 12. 4자)했음.

○ 그럼에도 불구하고 점유율이 하락하는 것은 미국건설산업계의 경쟁력 하락이 별도의 조처 없이는 지속적일 것으로 판단하는 분위기임.

<그림 1> 미국의 상위 건설기업들의 해외시장 점유율 변화 추이



	1995	1996	1997	1998	1999
점유율	16.6%	17.3%	22.3%	24.3%	24.1%

*ENR, August(마지막 주), 1996-1999(세계 상위 225개 기업중)

(4) 생산성 및 국제경쟁력 향상을 위한 새로운 시도

○ 현재까지 나타났거나 잠재되어 있는 문제점들을 방치할 경우 미국내 건설산업의 생산성 하락은 물론 해외시장에서도 국제경쟁력이 크게 떨어질 수밖에 없다는 위기감이 나타나기 시작함.

○ 이러한 위기감을 없애기 위해서는 새로운 생산체계와 생산구조를 개발해야 한다는 공감대가 형성되기 시작함.

○ 그러나 이러한 공감대 형성에도 불구하고 개별 기업차원에서 독자적인 연구를 하기에는 지나친 자금 부담과 실패시 기업 도산에 직면하게 되는 위험성이 있음.

○ 따라서 이러한 위험성과 자금 부담을 고려하여 기업간 공동연구의 필요성이 어느 때보다 증가하고 있음.

○ 공동연구의 핵심적인 연구방향은 생산성 향상에 두고 있으며 생산성 향상의 목표는
- 현재보다 공기 단축
- 현재보다 소요비용 절감
- 현재보다 품질과 성능 향상(동일한 투자비 내에서)에 두고 있음.

○ 생산성 향상의 수단은
- 기계화/자동화
- Pre-assembly 및 Module 공법
- 정보화로 인한 Process 비용 절감이 됨.

○ 생산성 향상을 위한 방법 개발의 방향은 건설부문에서 자체 개발하는 방향보다는
- 정보산업(Information Technology/System, IT/IS)에서 기개발 및 사용중인 기술.
- 제조 및 제작산업(Manufacturing Industry)에서 기개발 및 사용중인 기술 등을 건설산업에 응용하여 새로운 생산방식과 관리방식을 개발해 내는 것임.

○ 신기술 적용의 대상은 기존의 공종(콘크리트, 배관 등) 중심에서 완성시설물(교량, 터파기 등)과 완성시설물의 부품(교각, 교대 등) 중심으로 전환. 이는 통합체계를 염두에 두고 있음.

3. FIATECH 분석

(1) 목표

○ 신규 건설 설비의 생산성을 획기적으로 개선
- 기존 설비보다 투자비는 30~40% 절감
- 기존 설비보다 공기는 30~40% 단축

○ 유지 및 보수비용을 통상 수준보다 이론적 수치로 낮춤.

○ 발주기관의 투자비 회수 기간을 최대한 단축시킴으로써 경제성을 확보함.

(2) 사명

○ 사명
- 북미지역 건설관련 기업들의 국제경쟁력을 최대한 향상시킴.
- 타 산업에서 기개발된 기술을 건설산업에 적용함으로써 생산성 확보는 물론 건설산업에서 기술개발에 소요되는 비용을 절감시킴.
- FIATECH은 비영리기관으로서 자신의 이익보다 회원사에게 이익을 돌아가도록 함.

○ 역할
- 각종 연구 및 개발과제(FIATECH 지정과제)에 대한 연구비 지원 및 연구 지원
- 기술 및 실용기술(FIATECH에서 개발)을 실용화시키는데 지원
- 시설물의 공기나 총생애주기 비용에 중요한 영향을 미치는 기술에 대해 토론의 장을 마련하는데 주관
- 연구 및 개발에 필요한 자료 및 정보지원센타 기능
- FIATECH 연구과제에 대한 결과물 출판, 언론에 홍보 및 각종 잡지 등에 기고문 작성

(3) 기본접근수단

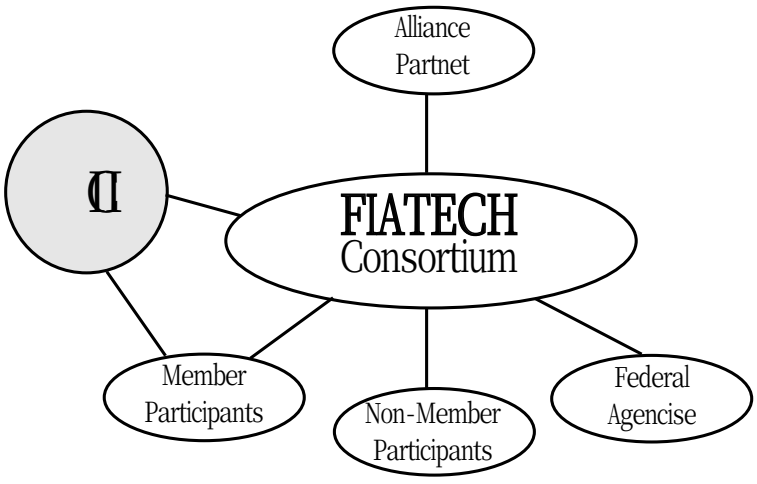
○ 기존에 개발되어 있는 정보기술(Information Tech.)을 건설Process와 Production에 접목시킴.

○ 제조 및 제작업에서 사용되고 있는 자동화(Automation), 공업화 공법(Modularization) 및 사전조립공법(Pro-Assembly)의 기술을 건설산업에 적용시킴.

○ 연구, 개발 및 적용(Research, Development & Deployment, R&DD) 등 기존의 연구 개발 중심에서 적용단계까지를 확대시킴.

○ 건설관련기관(발주기관, 건설회사, 건설연구소, 대학의 건설관련학과 등)들과 공동 연구(<그림.2> 참조)

<그림 2> FIATECH의 공동 연구추진 체계



(4) 조직

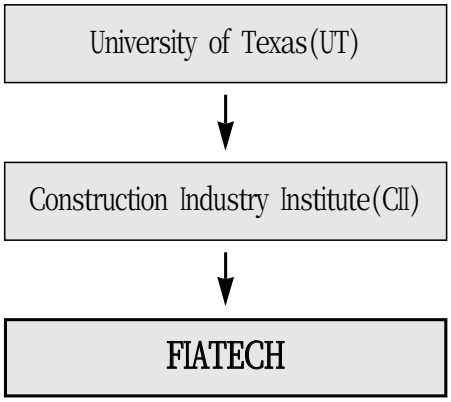
○ 현재의 조직(<그림 3>)

- CII 산하에 위치
- 1999. 7월에 창립

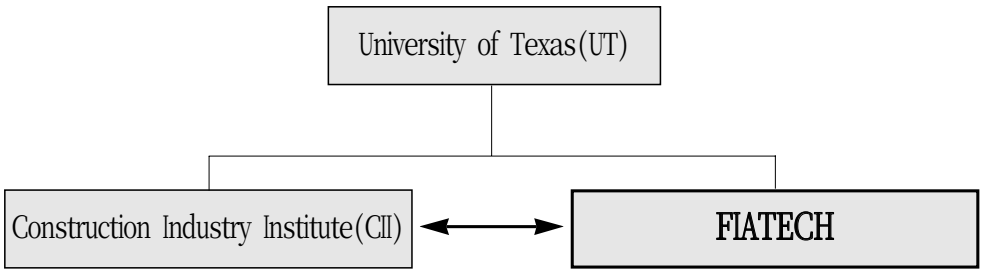
- CII 산하에 독립 부서로 위치

○ 미래 조직(2000. 11. 16 이후, <그림 4>)
- CII로 부터 독립하여 별도 법인 연구기관으로 발전
- 2000. 11. 15, 첫 이사회에서 결정
- 이사회 결정에 따라 <그림 4>와 같은 조직으로 발전 예정

<그림 3> FIATECH의 현 조직



<그림 4> FIATECH의 미래 조직



(5) 인력

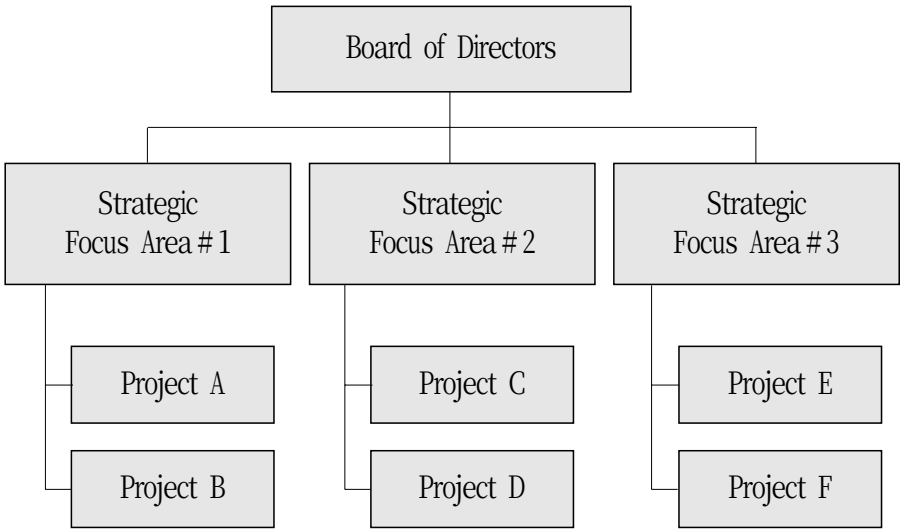
○ 현재의 인력(2000. 10. 20 현재)
- FIATECH에서 근무하는 전담요원은 3명임.
- 연구진은 CII 인력을 활용

- 상당 수의 인력을 보충하기 위해 인터뷰 중임

○ 미래의 인력(2001. 11. 15 까지)

- 2000. 11. 15, 이사회 승인 후부터 신규 인력을 30명 수준으로 확보할 계획
- 30명은 FIATECH 전담 및 상근 근무자로서 <그림 5>와 같은 3개 조직에 배치
- 추가 인원은 원칙적으로 연구개발사업 단위로 참여하고 있는 기관들로부터 한시적으로 투입 예정(이를 RTP, Release Time Professional로 불림)

<그림 5> FIATECH의 미래 조직과 인력 운영 계획



(6) 운영기금 모금방법

○ FIATECH의 정식 출범 시기까지는 CII의 기금 사용

○ FIATECH 독립 운영으로 운영비는 원칙적으로 회원사들의 연회비로 운영

○ 연구 및 개발에 소요되는 추가비용은 원칙적으로 연구과제별 참여 기업과 공익 연구기금에서 충당

(7) 회원가입과 회비분담 원칙

○ 회원 가입

- FIATECH 회원과 FIATECH의 과제별(Project # #) 참여기관으로 구분
- 회원가입자격은 NAFTA 가입국이나 북미(캐나다, 미국 및 멕시코)에 1개 이상의 사무소를 둔 기관

○ 회비분담 원칙(연회비)

- 기관의 규모에 따라 차별화
- 연간 수입이 5천만불 이하는 5천불
- 연간 수입이 10억불 이상인 경우는 2만 5천불
- 연간 수입이 5천만불 이상에서 10억불 미만인 경우는 5천만불 초과당 5천불 추가

(8) 연구대상과 범위

○ 연구대상

- 설계 및 엔지니어링기술(CAD/CAE Technology)
- 정보통신기술(Advanced Communication Technology)
- 현장감식 및 추적기술(Field Sensing & Tracking Technology)
- 모듈화기술(Modularization Technology)
- 현장자동화기술(Field Automation Technology)
- 건설자동화기술(Construction Automation Technology)
- 사전조립기술(Pre-Assembly Technology)

○ 연구범위

- 사업기획, 설계, 제작, 시공 및 유지 및 보수 단계
- 통합기술(Integration Technology)

(9) 가입회원에 대한 혜택

○ 기개발된 기술을 생산성과 연계시켜 경제성 보장

○ 비가입기관보다 시간적으로나 기술적으로 상위 레벨의 경쟁력 보유

○ 비가입기관들로 부터 비록 한시적이기는 하나, 지적소유권 보장으로 일정기간 동안은 비가입기관들에 비해 상대적으로 경쟁력에서 유리함.

(10) 현재까지의 실적 및 향후 계획(2000. 10. 21 현재)

○ 실적

- FIATECH 독립 준비
- FIATECH의 운영 준비 및 조직 정비
- 핵심 인력 확보
- FIATECH 홍보자료 개발 등

○ 회원사 모집 현황(<표. 1> 참조)

- 2000. 10. 20 까지 총 42개 기관 가입
- 정부기관은 미항공우주국(NASA), 미공병단(COE), 미상무성(DOC) 등 3개 기관

<표 1> 회원사 모집 현황

기관구분	종합건설 (EC)	기술용역 (E)	발주기관 (Owner)	정보통신 (IS/IT)	정부기관	합 계
회원 수	12	6	15	6	3	42

○ 향후 계획

- 제1차 이사회 개최(2000. 11. 15)
- 회원 모집 계획
- 연구과제 선정(이사회에서 결정)

- 연구과제별 착수
- FIATECH 전담요원 모집

(11) FIATECH 연구방법 예시

○ 이미 언급한 바와 같이 직접개발보다는 타 산업에서 이미 실용화된 기술을 도입 응용하는 체계임.

○ 타 산업에서의 기술도입 기준은 반드시 생산성 향상과 연계되어야 함.

○ FIATECH 연구의 이러한 방향을 이해하는데는 <그림 6>이 좋은 예시가 될 것임.

○ <그림 6>은 터파기공사에서 정보시스템을 도입함으로써 얻어지는 효과를 실증적으로 보여주는 예시임. 도입된 정보시스템의 구성은;
- 위치정보시스템(GPS)
- 3D 도면 작성 및 관리시스템
- 스캐닝 시스템(정보시스템)
- 무선통신시스템(통신시스템)
- 물량계산프로그램

○ 위에서 도입된 정보시스템에서 3D CAD와 물량계산프로그램을 제외한 3개의 시스템은 일반적으로 상용화된 정보통신기술임.

○ 위의 정보시스템은 건설공사 중 토공사에 적용시에 얻어지는 효과는 크게 다음과 같음.
- 정확한 터파기로 여굴에 의한 작업량 증가 방지
- 터파기 보조 혹은 감독자 불필요. 또한 준공 측량이나 기성고 산출을 위한 별도 계산 불필요
- 중장비의 움직임과 작업량을 실시간대로 측정하여 3D CAD에 입력이 이뤄져 별도의 준공도 작성이나 도면 변경에 의한 재작업이 불필요하게 됨.

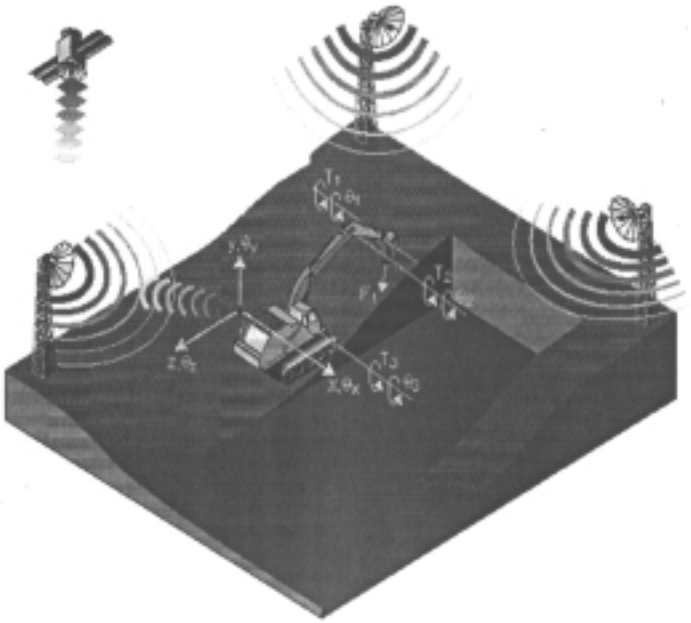
- 중장비의 움직임이나 위치를 3D CAD의 정보의 무선통신을 통해 중장비운전기사에 전달됨으로써 중장비운전의 숙련기능공의 필요성을 제거시키는 효과까지 얻게 됨.
- 위의 정보 및 통신시스템을 토공사에 적용함으로써 얻어지는 생산성 향상의 효과로는;

  소요공기 40% 이상 단축

  공사비 50% 이상 단축

  인력감축 60% 이상으로 예측하고 있음.

<그림 6> 터파기공사에 도입한 정보 및 통신시스템의 구성 예시



(12) CII 및 UT와의 관계

○ CII(미국 건설산업연구원)와 관계

- FIATECH 독립 법인 설립시까지 지원
- CII에서 진행 중인 FIAPP 과제를 FIATECH으로 이관

  * FIAPP - Fully Integrated & Automated Project Process로 건설과정 통합 시스템임.

- FIATECH 독립법인 설립시까지 인력 및 설비 지원 등

○ UT(University of Texas)와의 관계
- UT내 독립연구소로 등록
- FIATECH에서 개발된 연구 결과에 대해 자산권 보유
- FIATECH에서 개발된 기술에 대해 소유권을 외부로부터 한시적 기간동안 보호 역할.

4 미국건설산업의 기술개발 및 연구

건설산업과 관련되어 신규로 개발되거나 개선되어지는 결과는 거의 모두 건설산업의 기술개발 및 연구로부터 얻어지는 결론임. 미국건설산업의 경우 건설산업과 연관된 이해 당사자간에 묵시적 혹은 관행적 기술 개발 및 연구에 관한 업무 분담은 미국뿐만 아니라 기타 국가들에게도 좋은 시사점을 주고 있음. 이것은 현재 세계건설시장에서 단일국가로는 가장 높은 경쟁력(1999년도의 경우 24.1% 점유)을 유지하고 있는 원인 중의 하나로 지목받기 때문임. 따라서 미국내 건설산업과 연관된 각 기관들의 기술 개발 및 연구에 대한 역할 분담과 연구 방향을 분석해 보는 것은 국내건설산업에도 상당한 시사점을 주게 될 것으로 판단됨.

(1) 공공연구기관

○ 국가 차원의 출연연구기관(예를 들면 "한국건설기술연구원"이나 "교통개발연구원" 등)으로 건설분야 전문연구기관은 없음.

○ 다만, 건설분야의 민간연구기관이나 공공연구기관들이 건설 기술 개발을 위해 연구과제를 국가 차원에서 재정적으로 지원해 주는 방식을 택하고 있음. 국가 차원의 재정지원은 과학재단기금(NSF)과 국가기술 및 표준규격연구원(National Institute of Standards and Technology, NIST) 등을 통해 이루어짐.

○ 국가 차원이 아닌 연구기관으로서 건설분야의 대표적인 연구기관은 미공병단(LOE, Us Army Corps of Engineers) 산하의 건설공학연구소(CERL, Construction Engineering Research Laboratories)임.

○ CERL은 기술부문에서 가장 포괄적인 연구를 하고 있으며 연구부문은 군수 목적이외도 민간부문에서 충분히 활용이 가능한 부문을 담당하고 있음.

○ CERL에서 1997년에 수행한 연구실적을 보면(Annual Report for Fiscal Year 1997, CERL) 다음과 같다.
- 운영기술부문(Installation Operations)
- 환경보존과 환경품질부문(Conservation and Environmental Quality)
- 건설 및 성능개선부문(Facility Acquisition and Revitalization)
- 첨단중장기부문(State of Art Equipment and Facilities)
- 절차개선부문(Continuous Improvement Process)

○ CERL에서 자체 개발하였거나 CERL에서 기금 지원을 받아 수행한 연구결과는 군사목적의 비밀사항이 없는 한 상용 목적은 일반적으로 공개하고 산업계에서 공유하는 정책을 가지고 있음. 그러나 CERL에서 개발된 과제는 특수 목적이 많아 완성시설물 위주로 적용하기에는 상당한 한계를 지니고 있는 특성이 있음.

(2) 민간연구기관

○ 순수 건설산업만을 위한 독립적인 법인 형태의 연구기관은 없는 것으로 파악됨.

○ 다만, 특수 목적의 연구를 위해 한시적으로 공동연구팀(Research Consortium)을 구성하는 사례는 있으나, 이런 경우에도 공동연구팀은 대학이나 기존의 부설 연구소의 산하 조직으로 존재하게 됨.

(3) 학교 부설 연구기관

○ 대부분의 이공계열 대학들이 자체적으로 연구소를 개설하여 운영하고 있음.

○ 건설부문의 연구소는 대부분 건설엔지니어링 및 관리(Construction Engineering and Management, CEM) 학과와 연계되어 있음.

○ 부설연구소 운영은 주로 Hardware와 관련된 부문(예, 구조해석 및 재료시험 등)은 자체 실험실을 통해 이루어지며 프로세스 및 관리(Process and Engineering) 부문은 연구관리 중심으로 이루어짐.

○ 프로세스 및 관리부문의 대표적인 대학교 부설 연구기관으로는;
- 스탠포드대학의 CIFE(Center for Integrated Facility Engineering)
- 텍사스대학의 CII(Construction Industry Institute)
- 버클리대학의 LCI(Lean Construction Institute)

○ CIFE는 다음과 같은 특징을 갖고 있음.
- 건설정보 및 로보틱 부문에 전문성을 가지고 있음.
- 산업 차원보다는 주로 특정기업으로 부터 과제를 수탁받아 연구를 수행. 연구결과에 대해서도 범용성보다는 기금을 지원한 기업의 자산으로 남게 되어 공유 차원에서 보면 공개되지 않은 특성이 있음.
- 순수 연구보다는 특정 사업(Project)에 적용하는 응용 기술이 중심이 됨. 즉 연구, 개발 및 적용(Research, Development & Deployment)의 세 단계를 적용하고 있음.
- 이 연구소를 통해 공유되는 정보는 지적소유에 해당되지 않는 사례연구나 기초이론 연구가 핵심을 이루고 있음.

○ CII는 다음 장에서 세부 기술

○ LCI의 특징은 다음과 같음.

- 생산성 향상과 관련된 연구를 집중적으로 수행하고 있음.
- 발주방식과 역할분담 및 생산성과의 상관관계에 대한 연구가 대부분임.
- 비교적 소규모 인원으로 운영되며 발주방식의 주사용자가 발주처이므로 특정 그룹을 위한 연구가 핵심을 이룸.
- 위의 두 연구기관에 비해 산업의 인지도가 떨어지는 편임.

(4) 기업연구소

○ 극소수의 대기업을 제외하고는 기업내 부설연구소를 운영하는 기업은 없는 것으로 파악됨.

○ 다만, 별도의 연구소가 아니더라도 기업 자체 내에서 부서 형태로 존재하는 기업은 상당 수 있는 것으로 파악됨.

○ 그러나, 국내와 같이 부설연구소라도 독립적인 법인 형태나 또는 별도 실험실을 갖춘 형태로는 운영이 되지 않으며 실험과 관계된 연구는 거의 100% 외부 위탁방식으로 처리한다고 볼 수 있음.

○ 기업이 자체내 연구소나 또는 연구부서에서 수행하는 과제의 특성은 다음과 같음.
- 기업의 전문부문과 관련된 시설물의 프로세스나 전산프로그램으로 처리 가능한 기술의 개선에 관한 연구. 이 연구는 연구자에 의해 수행되기 보다 기술지원조직(일반적으로 Staff Function에 해당)에 의해 업무와 연구가 병행되는 형태로 진행됨.
- 자체내 기술개발보다는 상용화된 기술을 찾아내고 이를 기업의 전문성과 연계시킬 경우 부가적인 생산성 향상을 계량적으로 측정하는 부문에 집중함.
- 상용화된 기술을 응용하는 측면과 자체 개발하는 방안에 대한 경제성 비교 검토가 상당한 비중을 차지하고 있음.
- 기업의 생산성 향상에 관한 개선분야 연구가 대부분임.
- 타 연구소나 타 사업에서 사용되었거나 개발 중인 기술에 대한 분석도 중요한 연구과제임.

○ 그러나, 최근 들어 기업의 개별연구보다는 공동연구팀을 만들어 공동 출연하는 연구 방향으로 가고 있음.

(5) 공급자연구소

○ 국내와 달리 재료(콘크리트, 철근 등)에 관한 연구는 대부분 공급자연구소에 의해 수행됨.

○ 공급자는 자사 제품의 판촉을 위해 기존 재료에 대한 성능 및 내구성 향상은 물론 진행 중인 연구과제에 대해서도 적극적인 홍보 활동을 하고 있음.

○ 공급자연구소는 자사의 제품뿐만 아니라 자사 제품을 사용한 혼합재료에 대한 연구도 병행하는 특징이 있음. 예를 들어 시멘트공급자연구소(포틀랜드시멘트)가 연구하는 부문은;

- 콘크리트에 관한 연구
- 콘크리트 혼화제에 관한 연구
- 콘크리트 제품(예, 빔이나 교량 등)에 관한 연구
- 철근 및 철골에 관한 연구
- 거푸집 및 거푸집 공법에 관한 연구 등이 이에 해당됨.

5 미국건설산업연구원(CII) 분석

(1) 건설산업연구원 개요

○ 설립 연도

- 1983년도

○ 설립 목적

- 연구를 통해 주요 시설물의 생산성을 향상시킴.
- 연구에 참여하는 기관들이 세계 시장에서 최고의 경쟁력을 확보할 수 있도록 지원

○ 사명

- 전문성을 심화시킴
- 연구를 주도(관리함)
- 정보를 공유(회원사간)
- 회원사간 협력관계 지원
- 건설산업의 핵심 역할 주도

(2) 조직

○ 원장(Director) 산하에 4개 기본조직

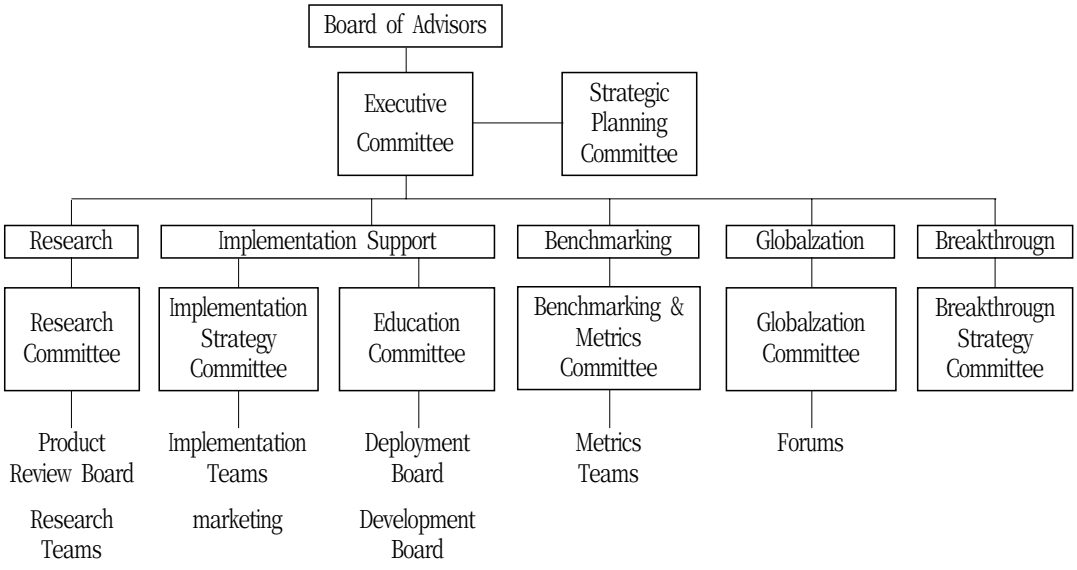
○ 기본 조직은 <그림 7> 참조

○ 자체내 연구보다는 외부수탁 및 관리가 핵심임.

○ 자체내 상근 인력은 20명 내외임.

<그림 7> CII 조직도

(3) 기본 전략과 성장 배경



○ 기본 전략

- 민간 발주자(Owner Contractor) 중심으로 발주자가 입을 수 있는 혜택을 부각시켜 운영 및 연구기금을 마련.
- 계약자(Contractor) 그룹은 발주기관과의 협력관계(Networking) 유지를 위해 참여.
- CII는 자체 연구보다 대학이나 협회 등에 연구를 위탁하고 관리하는 역할 중심임.
- CII가 주대상으로 하는 연구의 범위가 사업생애주기(Project Life Cycle)를 중심으로 하기 때문에 연구의 결과가 대부분 사업기획단계에서 최고의 활용도가 있으므로 이 경우 당연히 발주기관이 적극적으로 참여하며 이로 인해 기금 마련이 비교적 용이함.

○ 성장 배경

- CII가 대학부설 연구기관이면서도 독립적 운영이 가능했던 이유는 텍사스주에 위치한 석유화학 관련 기업들이 국제 원유가 상승으로 인해 자금 여력이 미국내 타 기관에 비해 비교적 풍부했기 때문으로 판단됨.
- 연구를 철저하게 Outsourcing으로 했기 때문에 비교적 단기간내 많은 결과들을 보유할 수 있게 됨.
- 회원사들의 직접적인 혜택을 위한 사례 비교 분석(Benchmarking Metrics)이 비교적 성공을 거뒀던 것으로 판단됨.

(4) 운영자금과 비용분담 원칙

○ 운영자금

- 회원사들의 연회비
- 정부기관의 출연
- 미국과학재단(NSF)

○ 비용분담원칙

- 회원가입에는 연간 $36,000 소요
- 다만, 연구과제(Research Project)별 기금 모집은 하지 않고 있음.
- 연구과제별 비회원은 일정액을 분담하는 방식임.

- 연구에 참여하는 기업은 인건비와 직접경비를 부담함.

(5) 연구대상과 범위

○ 연구대상
- 생산기술(Technology)
- 사업조직(Organization)
- 인력(People)
- 정보(Information)
- 사업관리(Controls)
- 품질(Sigma)

○ 연구범위
- 사업의 생애주기(Project Life Cycle)
- 단계별 특정기술

○ 사업별 비교대상(Benchmarking Metrics)
- 투자비 증감(Cost)
- 공기 증감(Schedule)
- 안전(Safety)
- 설계 변경(Change)
- 재수행 가격(Rework)

(6) 현재까지의 실적과 향후 계획

○ 연구실적
- 70 연구요약 보고서
- 138 연구보고서
- 46 실적용 사례 보고서

○ 향후 계획
- 특정 대학 중심의 연구에서 탈피
- 미정부기관의 출연금 비중을 확대
- 발주기관 중심에서 계약자의 참여를 확대
- 미국 중심의 연구에서 국제공동연구 중심으로 확대
- 사업경험 자료의 DB를 국제건설시장 자료 축적 DB로 확대

(7) 기본 전략의 수정

○ 기존의 미국내 연구 중심에서 세계 건설시장으로 확대

○ 미국내 발주자 중심에서 건설산업의 생산성 확대 전략으로 정부 기관의 출연을 확대 시킴.

○ 학교 중심의 연구에서 산업 중심의 연구로 옮겨감에 따라 미국내의 자원을 최대한 이용하려는 방향 설정.
○ 전략의 수정을 실제적으로 실천하기 위해 전략부문에서 탁월한 능력과 각계 각층과 인맥이 두터운 3성 장군 출신의 인사(Ken Eickmann)를 연구원장으로 영입.

○ 기존 특정분야(Civil Engineering)의 한계를 넓히기 위해 2000. 11월중으로 연구실을 옮길 계획까지 수립.

(8) 진행중인 과제와 국제공동 연구과제

○ 진행중인 과제(단기성)
- 전자 시뮬레이션
- 3차원 CADD
- 작업조의 생산성 향상
- 소규모 사업의 효과적 운영방법
- 종업원 인센티브제 도입

- 근로자 생산성 향상 방법
- 사고 제로(Zero)화 방법
- 설계 변경으로 인한 영향 분석
- 발주방식과 수주전략 개발
- 유지 및 보수 설계방법 등

○ 가시적인 국제공동연구 과제(첫 시도)
- 국가별 건설 핵심 상품과 위험도 분석

6 미국건설산업의 연구동향 분석에 의한 시사점

최근 미국건설산업의 생산성 향상을 위한 연구 방향 수정과 함께 동향 분석이 국내건설산업에 주는 시사점을 다음과 같이 요약할 수 있음.

○ 연구의 기본 목표는 건설업의 생산성 향상에 두고 있음. 또한 가시적인 목표를 계량화시킴으로써 연구 성과에 대한 계량적인 분석이 가능하도록 하고 있음. 구체적인 예시로서 FIATECH이 제시하고 있는 생산성 향상 목표는;
- 공기와 공사비를 현재방식보다 30 40% 절감

○ 신기술이나 첨단기술을 개발하기 보다 타 산업에서 이미 상용화된 기술을 건설산업에 도입 응용하는 방향을 채택하고 있으며 건설산업에 도입 여부는 경제적인 타당성 여부로 판정하고 있음.

○ 기업의 개별연구에서 탈피하여 이해당사자들이 공동으로 연구 및 개발하는 방향으로 급선회하고 있음.

○ 기술개발을 위한 공동연구팀(Research Consortium) 구성에는 기술의 사용자인 발주자, 기술제공자인 계약자, 기계화 및 표준화 기술제공자인 제작자, 설계와 시공의 통합을 위해 기술용역사 등 건설산업의 연관 관계사가 공동으로 참여하는 것이 일반적임.

○ 한꺼번에 모든 연구를 진행하기보다 연구 효과가 큰 부문부터 단계적으로 시행

○ 첨단기술보다는 생산성 향상에 기여하는 정도에 따라 연구의 우선 순위가 결정되어짐.

○ 개별기업 단위로 실험실을 갖춘 기업부설연구소는 찾을 수가 없으며 실험과 관계된 연구는 주로 제작업체의 연구소나 학교부설연구소에 의해 이뤄지는 구조임.

7 주요 권고사항

FIATECH과 미국의 기타 건설산업의 연구동향 분석에서 얻어진 시사점을 통해 CINTECH 1단계 연구에 참여하고 있는 기업들에게 권고하고 싶은 내용들은 다음과 같음.

(1) 연구의 방향 정립

○ 기존의 신기술 또는 첨단기술 개발 등 소과제 장기간이 소요되는 개발 중심의 연구에서 생산성 향상에 관한 연구로 모든 역량이 결집되어야 함.

(2) 공동연구 활성화

○ 현재와 같이 기업의 개별연구에서 이해당사자들이 공동으로 참여하여 개발된 기술이 적용될 수 있는 방향으로 가야 함. 이는 기술서비스와 제공자, 그리고 사용자가 동시에 참여하는 연구가 되어야 가능함.

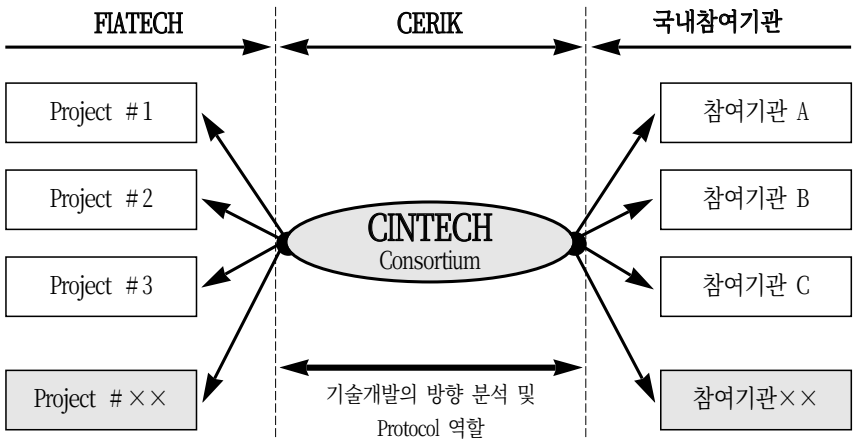
○ CINTECH의 1단계 연구와 같은 산연공동연구팀이 지속적으로 운영될 수 있는 환경을 갖추는 것이 바람직함. 그리고 선진국의 기술개발 동향과 개발된 기술을 활용하는 체계는 <그림 8>과 같은 체계를 권고함.

(3) 연구의 효율성 제고

○ 기존의 기업들이 보유하고 있는 실험실이나 별도 건물을 다음과 같은 방안으로 처리하는 것이 효율적인 것으로 판단됨.

- 주변의 대학과 공동으로 운영하는 방안
- 공급자와 공동으로 운영하는 방안
- 동종의 업체와 공동 운영하는 방안
- 발주기관의 연구소와 통합하여 운영하는 방안
- 매각하고 필요시에는 연구를 외부 위탁하는 방안

<그림 8> 공동연구팀 구성과 외국기술동향 분석 모델



(4) 시장 확대를 위한 연구

○ 기업들에게 닥친 당장의 현안을 해결하기 위해서는 기업이 보유한 전문성을 바탕으로 시장 확대를 위한 연구가 우선되어야 함.

○ 시장 확대를 위한 연구로는 ;

- 주요국의 시장 크기 분석과 위험도 분석에 관한 연구
- 국내건설시장의 잠재력에 관한 연구 등의 수행이 필요함.

○ 시장 분석(Opportunity and Risk Assessment)에 따른 기업들의 잠재력과 역량 강화를 위한 전략 수립 연구

(5) 기업의 경영 전략과 연계

○ 어떤 기술에 어떤 역량을 갖출 것인가에 대한 선택은 반드시 기업의 비전과 경영 전략이 일치되어야 가능함.

○ 기업의 비전과 경영 전략에 따라 기업의 기술개발 방향이 결정되며 결정된 방향에 따라 필요한 전문성 개발과 인적자원의 개발이 수반되어야 함.

○ 따라서 기술개발 전략을 반드시 기업의 경영 전략과 연계시키는 조처가 따라야 함.

(6) 연구결과 활용체계 구축

○ 연구과제 선정은 반드시 개발 후 적용하는데 목적을 두고 해야 함.

○ 연구와 활용 체계가 시스템적으로 연결되도록 해야 연구와 실업무 적용이 가능함.

Abstract

The Prospects for the Environments of the Construction Industry in Korea

The main purposes of this report are to analyze the changing circumstances in construction industry and to forecast future circumstances focused on the construction demand in Korea. The construction industry in Korea had benefited from fast growing demand and low competitiveness pressures until early 1990s. The proportion of construction investment to GDP had continuously increased from 12.3% in 1970 to 23% in 1991. But the increasing rate of construction investment slowed down below the GDP growth rate after early 1990s. Moreover the construction investment was decreased for 3 years after 1997 when the financial crisis occurred. Many construction companies went to bankruptcies due to the reduced demand and rising financial cost.

We analyze this current situation of construction industry as not only the result of temporarily economic fluctuation but also the result of fundamental changes. In Chapter 2, we analyze the relation between the macro-economic trend and construction investment comparing to the past performance of developed countries. Also the institutional environment of construction industry has been change over 1990s, particularly late 1990s. In order to enhance the market system, government reduced the entering barriers into construction industry and introduced the least price bidding system in government procurements. We suggest that the next steps of government policy on construction industry are focused on enhancing the evaluation system for construction firms and strengthening the assurance system for the execution of contract. We analyze the supply system, the competitive environment and technological changes in construction industry and forecast their future direction.

In Chapter 3, we forecast the demand for construction industry over 2003 by using time-series analysis. We see that construction investment(real value) and construction contract value(nominal price) will be increased 3% and 4% per year over

2003 respectively. we forecast the construction demand of 54 public institutions by analyzing the construction plans of public institutions. Also we analyze and forecast the emerging construction demands, remodelling demand for building and houses, rebuilding demand for houses and SOC demand of North Korea. Finally we derive the important factors that will affect construction demand in the future and analyze the effectiveness of them on categories of construction demand qualitatively.