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JAMES W. THOMAS (818)544-4722  
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OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 11/16/95

Project No. D-48-A76

Center No. 10/24-6-R7985-0A0

Project Director CIRCEO L JR

School/Lab DEAN ARCH

Sponsor DISNEY STUDIOS/GLENDALE, CA

Contract/Grant No. WA0000990

Contract Entity GTRC

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Title ROLE OF THE U.S. CONSTRUCTION INDUSTRY IN THE 21ST CENTURY

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Proceedings of the June 3, 1994 Symposium on:

THE GLOBAL FUTURE OF THE
CONSTRUCTION INDUSTRY

Final Report: Contract D48-A76
WALT DISNEY IMAGINEERING

CONSTRUCTION RESEARCH CENTER
COLLEGE OF ARCHITECTURE
GEORGIA INSTITUTE OF TECHNOLOGY

February 28, 1995
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INTRODUCTION

Thomas D. Galloway, Ph.D
Dean, College of Architecture
Georgia Institute of Technology

This Mini-Symposium is the first for the Construction Research Center at Georgia Tech and it springs from the Center's advisory board which has been asking probing questions and seeking answers to the critical issues facing the American construction industry. A central question, and one to which this seminar is directed, is where the construction industry is going nationally, as well as internationally. Obviously, this question therefore necessitates the definition of what is the "construction industry" to begin with. But it also raises the issue of what are the most needed and productive elements of this industry's future, but just not only for the purpose of the industry, but more strategically for the reassessment of the mission of the Construction Research Center here at Georgia Tech, a mission that attempts to assist this industry in realizing its future.

I do not think there is anyone that can help us think about these questions better than our keynote speaker, Dr. David Hawk. Dr. Hawk received his Bachelor degree in Architecture from Iowa State University in 1971. He received a Masters Degree in Architecture as well as a Masters in City Planning from the University of Pennsylvania and he received his Ph.D degree in Systems Sciences from the Wharton School at Pennsylvania in 1979. Presently Dr. Hawk is a Professor of Industrial Management as well as Professor of Architecture at the New Jersey Institute of Technology where he has been since 1981. He has taught at the Stockholm School of Economics, the Chalmers University of Technology, the Tokyo Metropolitan University, the College of Design and the College of Engineering at Iowa State University, and has consulted widely throughout Europe and Asia. He is a prolific writer and a well known researcher throughout the world in the areas of Construction Sciences and Industrial Management. He has published over 50 articles, and his latest book "Forming a New Industry: International Building Production" has received special recognition in the April, 1994 issue of Progressive Architecture.
THE GLOBAL FUTURE OF THE CONSTRUCTION INDUSTRY

David L. Hawk, Ph.D.
Professor, Schools of Architecture and Industrial Management
New Jersey Institute of Technology

Introduction

I begin with a slide (Figure 1) that portrays a dysfunctional attitude that has been creeping into business-as-usual over the past years, including those of construction. The cartoon may be hard to read. Let me quickly take you through its dialogue. It is from the Calvin and Hobbes cartoon series. The scene is of a lemon-aid stand where he plays the role of the entrepreneur businessman and she of the prospective client.

She says: “15 bucks a glass?”
He says: “That’s right, want some?”
She says: “How do you justify charging 15 dollars?”
He says: “Supply and Demand.”
She says: “Where the demand? I don’t see any demand.”
He says: “There’s Lots of demand!”
She says: “Yeah?”
He says: “Sure! As the sole stockholder in this enterprise, I demand monstrous profit on my investment!” And as president and CEO of the company, I demand an exorbitant annual salary! And as my own employee, I demand a high hourly wage and all sorts of company benefits! And then there’s overhead and actual production costs!”
She says: But it looks like you just threw a lemon in some sludge water!”
He says: Well, I have to cut expenses somewhere if I want to stay competitive.”
She says: What if I got sick from that?
He says: ”’Caveat Emptor” is the motto we stand behind! I’d have to charge more if we followed health and environmental regulations.”
She says: “You’re out of you mind. I’m going home to drink something else.”
(He then sits and grumbles to himself while staring at the ground before getting up and going home to confer with his mother.)
He says, to mother: “I need to be subsidized.”
"Caveat emptor" is the motto we stand behind! I'd have to charge more if we followed health and environmental regulations.

Figure 1. Part of the Calvin and Hobbes cartoon series.
Many aspects of traditional business have become ineffective and inefficient. This can be seen across industrial and national borders. New models of business are needed. While it has not fully emerged I will show you aspects of a new model of international construction business that is becoming a major force for change. Some audiences, especially some filled with younger students, accuse me of using international comparisons to “bash America” instead of teach them. I am critical of some of what we do in the US, especially in construction, but I’m just as critical of what other countries do when lecturing there. It is far too easy to find examples of inefficient, low quality operations in all countries in the construction industry.

I have been hard on audiences in Japan, France, Finland and Sweden, but they have never accused me of “bashing” them. Perhaps its because I’m an American, but I think its more than that. When I spoke in Tokyo two years ago, about the study described here, I was quite critical of the attitudes behind their highly successful construction operations. The audience was made up of about 300 construction company and government officials, and others involved in the financing and using of their products of construction. My presentation was about an hour in length. During it I accused them of being too ethnocentric in their operations and egocentric in their attitudes. I mention the Tokyo meeting because the responses, questions and discussion that followed my formal lecture turned the event into an exciting forum. I felt the questions raised by the audience were more probing than my lecture. I believe that they were less interested in being offended than in discussing improvement.

Several dilemmas face those interested in bringing change into the construction industry. A twin dilemma is that much of the industry doesn’t know that it needs to change and in those instances where it accepts the need it doesn’t know how to change. It seems to only know that it doesn’t want to invest resources in the research that could illustrate why and how change should occur. One consequences of these unresolved dilemmas is that construction does not attract the kind of new people it needs for adapting, innovating and constructively changing. Warranted or not, the industry’s reputation fuels a self-fulfilling philosophy.
1. Two Dilemmas Concerning Construction.

A. "Why would someone be interested in joining the construction industry or the disciplines that form it, or in doing research for those who do not value new knowledge?"

- We should realize that many outside our industry see construction as a low-tech operation, and thus scientifically disinterested and technologically uninteresting. Corners of the industry even appear anti-tech. The implications that arise from this perception tend to lower the esteem of an industry that can only survive in a technologically-based society by being seen as valuable to that society.
- Construction says it is pragmatic but this comes across as being anti-idealistic. It is proud of having its feet planted firmly on the ground, which is seen as being firmly impeded in concrete. It should not appear to be so proud of this in the face of a society that is beginning to value visions and ideas.
- Construction activities are often perceived as controlled by local politicians, zoning and code officials, and union leaders. In some places construction is even seen as a hand-maiden of Mafia operations. (e.g., New York, Rome, Tokyo, Moscow, etc.) This supports a perception that it cannot be expected to be innovative, in any good sense, and must be closely regulated.

Even if wildly unfounded, there is a composite perception of construction that it: lacks vision, is steeped in ignorance, is overfilled with arrogance and is not an interesting place for young people to work out new ideas on product improvement, industrial advancement and societal development. Consumers see construction as a non-industry collection of fragments. Construction is seen as very different from computer and electronic industries where consumers gain the benefits from continual raises in product quality and reductions in product costs. Those industries are seen as constant innovators. Meanwhile the results of construction, as seen in roofs that cost more and leak, and air conditions that harms the environment while not working, are disappointing.

Construction is even seen as cynical of its clients. Building designers are fond of quoting Frank L. Wright's dictum: "I have clients in order to build buildings, I don't build buildings in order to have clients." (This was a Gary Cooper quotation in the movie version of Ann Ryan’s book *The Fountainhead*.) From this it is easy for industry leaders too refer to clients as bad, and
arguing that industry improvement requires better clients. Some industry representative have suggested a need to educate clients about construction.

Perhaps the clients of construction already know too much. If so, we need to change the basis of what they believe and know. The research described here today documents that while many of the clichés above are partially true that they are relatively easy to change. In fact, on the more innovative fringes of the industry, change is already underway. Much of this change seems to be in response to the emergence and growth of international markets. In international transactions the demands for learning are great and the role of R&D is essential. A new kind of construction industry has already begun to form and started to emerge to meet international challenges. Some of the major players in defining that edge come from outside traditional construction.

Before looking at international construction lets look at why traditional construction has been so resistant to change. The resistance can easily be seen in the lore of the university training. The environment of architecture, engineering and construction disciplines is clearly in motion, yet the disciplines appear to work hard to keep their traditional packages sacred and secure. These departments are known on campus for their resilience. More energy seems to go into resisting change than would be needed to carry out changes. The academic disciplines that serve construction need to find a way out from such self-imposed restrictions. The classic distinctions between design, buildings, civil works and construction have long been accepted in schools, even if they have always been somewhat fuzzy in practice. Now they are becoming clearly counter-productive to the preparation of students and the needs of industry clients. Even the classic distinction between buildings and infrastructures has begun to stand in the way of designing and producing facilities that serve the integrated needs of dynamic organizations. Traditional differences no longer serve the needs of construction, nor its clients.

Suggestion: Perhaps we can locate a new conceptual framework around the idea of "facilities." Buildings, structures, civil works and other kinds of construction projects are all, in their best sense, facilities. They are to "facilitate" the operations of users. Where they can't help a client they at least shouldn't get in the way.
economies. Construction is frequently used in most countries by politicians and bureaucrats to gear-up or slow-down economic activity, and/or to distribute public monies to interests they find special.

Regardless of the historic rational for nationalism, a new rational for reduction of nationalism is emerging and gaining strength in business circles. Many resources required in construction have already moved beyond the control of single nations; including: ideas, designs, finances, technologies, materials and clients. Even if construction wanted to remain firmly cushioned in the comforts of nationalism it no longer has this option. The debts of many nations are too great to support such behavior and collusion.

Another reason why the international arena of business is intriguing is that it allows (requires) a greater emphasis on the local coupled to a greater awareness of the global. While this may seem like a contradiction, it in practice is not contradictory since the local is essentially the individual consumer. We see more and more companies recognizing and placing comments to this effect in their mission statements. The most global is where environmental issues, efficiencies in economic exchange and a rich variety of resources and ideas about business find each other; topics of prime interest to consumers. Nationalism has become an impediment to efficiency in the industries infected with it. It is interesting to see how the local and state levels of government find ways around national impediments and set up trade offices in Tokyo, Paris and St. Petersburg. Consumers also largely ignore nationalism, when given a clear opportunity to do so.

Conflict between the local and national has been growing in most industrialized nations, including Japan and Germany, with the local consistently winning. The local level is increasing its responsibility for public welfare and becoming a growing source of the tax revenues and funds management. It is also a becoming a sponsor of privatization schemes. The new-found authority that comes with this is being used to bypass the inefficiencies of national markets and seek the possibilities in the international. Signs of the possible impact of this shift in public authority on construction are becoming clear. International business people now see some sense in the hundred-year senseless definition of Ambrose Bierce regarding the true meaning of: "National
Boundaries: An invisible line separating the invisible rights of one side from the invisible rights of the other side.” (*Devil’s Dictionary*, 1888.)

Another definition, important to today’s discussion and closer to the management of construction operations, is seen in Bierce’s insightful definition of “logic.” This is portrayed in Figure 2. It illustrates why traditional logic, as well as traditional business beliefs, are caught up in such difficult times. This implies that even the framework behind the logic within which we operate will need to be changed.

Traditional industrial engineering logic, as shown in Bierce’s definition, has permeated the construction industry. It continues to be used to organize and manage construction operations. We clearly need to do better. One place to discuss “better” is via three core issues of what construction is, is becoming, and should be. These are outlined in Figure 3.

2. Shifting the Core of Construction.

A: Should Construction be Conceived of as an Industry?

Yes. There is a distinct trend towards industrialization of construction. This was clearly seen in the companies involved in the research project “Conditions of Success.” This is the study from which I speak today.

Many argue that construction cannot and should not be conceived of as an industry. Some say that at most construction is a sector in each national economy. They argue that construction is not sufficiently integrated to be seen as an industry, and that this is its strength. The remainder, including clients, argue that construction is simply a mess. Those inside construction who hold the “mess belief” often use it as the basis to argue that, “Only by the grace of God, and through my innate and uneducated intelligence, do things get organized in construction.” These people, often in the positions of management in construction companies, seem gleefully miserable about the state of construction. They essentially argue that you cannot learn from others how to do well in construction. It is only through first hand experience, and many years of it, do you acquire the skill needed to understand construction activities. Henry Ford felt the same about early automobile production. Thomas Watson had similar beliefs about early adding machines. Both the auto and computer industries have come to depend on highly trained graduates.
"The art of thinking and reasoning in strict accordance with the limitations and incapacities of the human misunderstanding. The basis of logic is the syllogism, consisting of a major and minor premise and a conclusion: thus-

**Major Premise:**
60 men can do a piece of work sixty times as quickly as one man.

**Minor Premise:**
1 man can dig a post hole in 60 seconds: therefore

**Conclusion:**
60 men can dig a post hole in 1 second, by combining logic and mathematics, we obtain a double certainty and are twice blessed."

Ambrose Bierce, *The Devil’s Dictionary*

Figure 2. Reasons for the Construction Industry to move on from business as usual.
3 KINDS OF QUESTIONS:

- Should Construction be an Industry?
  YES____ NO____

- Will it have a global dimension?
  YES____ NO____

- Does it have a role in the future?
  YES____ NO____

Answers to these requires knowledge which we do not yet have, yet which we can approximate with research, meaning to search again.

Figure 3. Three kinds of questions about the Construction industry.
The clients of construction, who usually work in highly dynamic industries, are meanwhile getting increasingly upset with the products from the building industry. The clients need more performance and often end up with less. Architects rise up to tell them that “less is indeed more.” Construction urgently needs to better respond to the rational expectations of its clients. This will require some schema for the rational integration of the parts of the construction process prior to consultations with clients over their needs. In this way, construction and its clients can invest their scarce resources in managing the non-rational aspects of reality.

There are other advantages to organizing the parts of construction into an industry. One is that we can better learn from other industrial groups about what efficiency means and how they manage to achieve it. From this basis we can also begin to conceive of buildings as products which then allows us to truly evaluate their qualities and performances. Seeing buildings as projects allows us to discuss when the process should begin and when it will optimally end, but leaves the in-between as a black box. Perhaps we prefer it this way but we shouldn’t. Many clients already see our projects as products, albeit not very sophisticated ones. Looking at the complex network of parts and interconnections between them as an industry provides a beginning.

B. Should Construction have a Global Dimension?

Here too I will argue yes. In fact, as the study results point out, it is the transformation of companies out from their traditional nationalistic base camps towards a global orientation that is doing the most to bring the disparate parts of construction together as an industry. As was mentioned before, since many of the resources of construction, as well as its clients, are already international the industry needs to move to find ways to organize this reality. (Elsewhere I argue that international is a primitive form of global since international can be defined as interactions between only two nations, e.g., US and Canada. Global is a more fundamental transformation of outlook and actions, and tends to transcend nations.)

C. Does Construction have a Future Role?

I argue yes to this question as well. Some members of the construction industry are not aware that this is even a question. They believe that of course there will always be a need for
construction firms, even though economic cycles will cause construction operations to periodically expand and contract. A number of economists outside construction have instead argued that as a national economy develops the role for construction necessarily declines. Ranko Bon, Bovis Professor at Reading University, England knows most about this question. Those who believe this to be true often use US statistics, and the declining percentage of GDP seen in the US economic, as their best example. I think they are wrong but on the other hand just because there is a continuing need for facilities does not guarantee who will be able to design and build them. The research presented here found that some of the most exciting changes in why, what and how we build are coming from outside traditional construction firms: One of the these examples, a house built as a demonstration in Tokyo, was designed by a computer scientist.

Various discussions about these three concerns will go a long way towards informing the future of construction. To make the discussions more knowledgeable will require more research than the industry is used to supporting. By research I here mean “Re-Search, i.e., to again search those things that are most closely believed.” Construction has traditionally supported some limited research into restricted areas of concrete. Topics like new mixes and methods of forming concrete are thought to be okay, as long as they aren't overdone. Current research needs in construction are well above concrete. Some researchers from other industries have suggested that construction R&D suffers tremendously from the scientific problem of “misplaced concreteness.” Some institutional R&D, similar to what was done in micro-electronics and information systems, is needed. Three possible topics for this kind of research are illustrated in Figure 4.

3. Three Possible Research and Development Topics for the International Construction Industry.

A. An Industry - Who and What is it?

It was previously pointed out that there is a client need to see construction activities organized into an industry. The major impediment to this seems to be internal. Research needs to be taken into the reasons for construction's reluctance to become an industry.

Many people within construction dislike the concept of industry. They see it as a means to force parts together around a highly rational process that eliminates the freedom and flexibility
3 TOPICS:

1. AN INDUSTRY - What is it?
   - Using technocratic process to reduce variety and eliminate the unpredictable, or...
   - Using reason to organize the rational and allow negotiation with the non-rational.
     (Experiences under the streetlight...)

2. THE FUTURE - Where is it?
   - Using consultants to prepare for the next major trend, or...
   - Using employees to create that which ought to be.
     (Is there life after strategic thinking...)

3. THE GLOBAL - What means it?
   - An enlarged playing field for more business-as-usual, or...
   - A setting without the insulation of the usual.
     (Definitions of political boundaries...)

Figure 4. Three topics of discussion about the Construction Industry.
they have. They feel that if they are part of such an organized entity that they will have less ability to control it. Thus, they do not like it. This belief comes from an outdated view of industry and industrialization. Industrialization has changed a great deal from the days of spinning machines and Henry Fords. It is now simply a reasonable way to organize rational things so there is more time and energy for managing the non-rational, a category of growing importance in today’s world. Where it is disregarded, or mis-managed, the non-rational becomes the irrational. This includes politics, poetics, religions and aesthetics. Industrialization is a way to simply organize those things that can be organized so we can better deal with those items that have traditionally been ignored and which now demand our attention.

Within the report on the research you will note that I make a distinction between crafts, trades and industries. Most architects feel warm and fuzzy about the term crafts. Much of the rest of the industry likes the term trades, but almost no one relates to being in an industry. We need to look at the three categories more closely. There are serious limitations in the activities of crafts and trades. These limits can be easily managed with sophisticated forms of industrialization while keeping the known advantages of both.

B. The Future - Where Does It Lie?

Companies in other industries have traditionally relied on consultants to answer this question. Most of what was learned was that they shouldn’t have hired consultants to do such important work. They could have gained more by investing in their employee infrastructure and preparing themselves to create a desirable future while trying to find out what the future would be. This would have been a better investment than paying someone else to predict a future out of control, and which no one particularly likes. Some construction companies are just not beginning to worry about their uncertain future and what role they will have in it, and are following the pattern of hiring some of the same consultants to tell them where their future lies.

Construction should leap over this pattern and move directly to doing its own internal research into what its future ought to be, instead of paying others to project where they are headed in spite of what they do.
C. The Global Arena - What Does It Mean?

In its most limited meaning global is a term for an enlarged economic playing field where a firm can get a greater share of the world's business-as-usual. This attitude has generally led to disaster in other industries. Those who moved traditional operations into the global arena by adding an international division missed most of the new opportunities and found many new problems. To have global operations you must be prepared to manage a very different kind of corporate phenomenon. You cannot simply export your home operations manual. A number of large US companies got away with doing this during the fifties because they were the only producers still producing; most other countries were involved in war reconstructions. Now there are more and varied providers goods and services client expectations are greatly enhanced. As long as one firm willing to change what it does to meet client expectations there is trouble for all those that won't, or can't, or who have a cynical attitude towards clients.

It is with these things in mind that the project “Conditions of Success: Internationalization of the Building Industry” was formed and begun in 1989. Figure 5 outlines the three locations where the work was based. The scope of the project was to examine what the conditions would be that surround future construction activities, and what responses would best find success in these arising conditions. The key was with the phenomena of internationalization. Of major interest was who was being attracted to the international marketplace and who would do well in it. The project came to include sixty participating companies who came from seven different countries. See Figure 6.

Many of the participating companies specialized in certain areas of construction such as: materials process, component production, design, assembly, general construction, construction management, real estate development, finance and facility management. This was a very broad range but was essential to the research since we were trying to determine how much a single organization should include and some included the entire range. In this way we could evaluate whether, for international operations, it is better to specialize in limited functional areas or try to include many areas.
CONDITIONS OF SUCCESS
Internationalization of the Building Industry

Institute of International Business: Sweden
New Jersey of Technology: United States
Tokyo Metropolitan University: Japan

David Hawk

September 1989 - June 1992

Figure 5. Project: “Conditions of Success”.
STUDY SAMPLE PROFILE

60 COMPANIES IN 7 COUNTRIES

SIZE:
18 of the world’s largest construction companies
3 largest architecture and engineering service firms
3 of the largest materials producers
2 of the largest private developers

TURNOVER:
Ranged from $50+ million to $28 Billion. Mean - $3.9 Billion

AGE:
Ranged from 187 to 2 Years. Mean - 66 Years

STUDY RANGE INCLUDES:
- Materials
- Components
- Design
- Engineering
- Construction
- Construction Management
- Real Estate
- Finance
- Facility Management

Figure 6. Outline of the 60 companies studied.
Some of you might ask why some of the major US companies joined this study, since you must know that they generally shun spending any resources on these types of ventures. Since US companies are the biggest and best why would they take part? Many joined because some of their major clients were participants early on. Those who took part became aware that they were neither the biggest or best at much of construction. Some of the foreign firms were ten times the size of the US counterparts and were better at several aspects of construction.

4. Conditions of Success: Schematic Results from the Study

There were three stages in the research:

A. To visit and hold interviews with the key executives in the participating companies around five major question areas. The interviews were usually with the CEO or general managers, or executive vice presidents.
B. To formulate, distribute and analyze a questionnaire resulting from stage one interviews.
C. To organize and hold a symposium around the tentative research results for the participants so they might participate in the articulation of the results they found useful.

Figure 7 outlines the areas of inquiry used during the interview stage. Interviews required from between 2 to 3 hours up to 2 to 3 days depending on the breadth of the person/firm being interviewed.

Figure 8 illustrates the ranking of what the executives felt to be the most important issues for construction over the next decade.

Dominant Issues for Reorganizing Future Construction Activities

- Environmental Concerns.

The list is topped by environmental concerns as the most important. It came to be defined during the project in two respects. a) As short-term environmental clean-up being as area of major work, and b) The growth in long-term environmental values in the client base which would require rethinking of design and construction. An example of the second involves the growing importance of environmental concerns to the approval process. In one instance there was a plan, design and
CONDITIONS OF SUCCESS
Internationalization of the Construction Industry

- **Construction Product:** Consequences of Process Construction as an Industry, a Sector, Ambiguity, a Mess?
- **Company Size:** Breadth, Depth, and/or Vision.
  How big should you be? Does it matter? Why?
- **Locational Focus:** Local-National-International
  How should you perceive yourself? How should you be perceived?
- **Employees:** The critical resource
  How to attract good employees. How to keep them
- **Models of Operation:** European, Japanese, American
  What will be important in the 1990s? Who will be successful?

October 4, 1990

Figure 7. Conditions of Success: Internationalization of the Construction Industry
CONNECTIONS OF SUCCESS
Issues from Interviews

- ENVIRONMENTAL CONCERNS
  1. Environmental clean-up as a potential
  2. Environmentally conscious design & approvals

- TECHNOLOGY
  1. Where are they?
  2. How do you enter them?

- QUALITY
  1. How to raise it?
  2. How it can differ between cultures?

- EFFICIENCY: How to achieve it?

October 4, 1990

Figure 8. Conditions of Success: Issues from Interviews.
financing for a $250 million theme park. The companies sponsoring it felt their proposal was such a good idea, based on the economic analysis that did (involving traditional measures of employment gains and economic spin-offs), that they didn’t bother with environmental concerns. Their proposal is still on hold due to English environmental review and a neighborhood that was more interested in its rolling hills than its needs for employment. The companies later agreed that the stoppage probably could have been avoided had environmental values been included in the community discussions; i.e., if the non-rational been included in the design and proposing of the project the later “irrationality” could have been avoided.

Further down the list were other issues dealing with technology, quality and efficiency. It is worth looking more closely at the one of quality.

- Quality and its Cultural Bias

Quality was important in the study since it had grown into such topical area for international production firms during the latter part of the 1980s. It emerged in this study but not as rational phenomena that needed to be increased. Quality came instead to be defined in the non-rational camp due to its definition varying between nations and cultures. This was most clearly illustrated in the study be the different definitions given by each national grouping of companies.

Quality in Swedish construction was described via attributes of thermal integrity of the building envelop. It was measured in terms of centimeters of insulation (30 was optimum) and panes of window-glass (3 was optimum). Quality in Japan was seen quite differently. It was measured in terms of the visual alignment of surfaces and components. If the ceiling and walls of a room lined up perfectly you then had the basis of a quality building. Many of these same buildings had single pane windows but quality was associated with the same variables as in Sweden. It was seen in the fit of details and detailed components. Quality in the US was in yet a third indicator. It was most often referenced relative how many projects a firm had completed since last being taken into the courtroom.

We in the project steering committee considered this to be both interesting and important. It was the basis for why we began to look for a set of measures that were less culturally biased than quality. The result was a shift in emphasis towards efficiency, and how best to improve it as the key measure of success. This shift turned out well. During the study we uncovered situations
where an attempt to improve efficiency actually ended up with increased quality as a by-product of better efficiency.

The Questionnaire Phase of the Study.

Another level of information was gained from questionnaires. These were sent to the firms about three months after interviews. I have almost never used questionnaires in my research. What made this project different was the input from the participants in designing a questionnaire and insuring its importance. The idea for a questionnaire began in the early interviews. At the end of the first few I asked what they would like to ask the “industry” if they could ask any question they wanted. Their responses provided such probing questions that I suggested to the project group that we organized the questions into a formal questionnaire. The questions proved to be quite sensitive and close to the core of operations for each company, but no one was forced to fill out a questionnaire. The only stipulation was that to gain access the composite results a firm had to fill out and submit a questionnaire. Most ended up submitting theirs. The twenty page questionnaire covered such topics as:

a. How much did you make last year?
b. Which business area was most profitable?
c. What do you consider the most important R&D subjects over the next ten years?
d. What technologies will be most important to the industry in ten years?
e. What countries to you want to set up operations in?
f. Who would you like to team up with in that country?
g. Who is now your biggest competitor?
h. Who will it be in ten years?

Some illustrations of the composite national results follow. (Each individual company's responses was combined into national categories.)

- Organizational Layers:

Figure 9 depicts an important aspect of the information resulting from the questionnaires as it relates to management. The question addressed the average number of layers of the company. In the 1990s this is seen as an important topic to management change, in that fewer levels are
## LAYERS IN ORGANIZATIONS/
### IS THIS OPTIMUM?/
### HAS IT CHANGED?

<table>
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<tr>
<th>Language</th>
<th>Number</th>
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<td>Has decreased</td>
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<td>Should be reduced</td>
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<tr>
<td>Swedish</td>
<td>7</td>
<td>Optimum</td>
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</table>

Figure 9. Number of layers existing within different organizations on national basis.
presumed to be better. Along with the prime question was the question of how optimal this was felt to be. US firms had the most layers, with an average of eight, and this was considered about right. Japanese firms had less with an average of seven point five, and they wanted to reduce this. The English were surprising. They ended with the least. They averaged six and felt this to be optimal. It was surprising because they are considered to be the most hierarchical in practice in international business education.

- **Major problem for the coming Decade.**

  Figure 10 illustrates a listing of what each national cluster felt would be the major problem during the next 10 years. Everybody, except the Swedes, saw their most difficult challenge to be attracting higher quality people into the industry. The Swedes felt their major problem to be finding ways to decentralize their operations and responsibilities, which is consistent with what is going on in Swedish business culture.

- **Reasons for Acquisitions.**

  Figure 11 displays the major reasons behind companies in the study making acquisitions. For German companies it was to acquire new technology. For Americans it was to acquire some expertise. Both the Japanese and Finnish companies felt that acquisitions were primarily a means to grow larger.

- **Factors Impeding International Expansion.**

  Figure 12 illustrates the list of factors considered important for international expansion. In all countries except the US and Germany the most important factor for internationalization was to find appropriate management skills. For the US firms it was developing a local presence and for German firms is was having the right technology. This is more or less in line with the prevailing logic of the business cultures of the various countries, especially that seen in their business schools.
KEY MANAGEMENT PROBLEMS DURING NEXT 10 YEARS

Attracting Qualilty People Retention Lowering Production Costs Decentralizing Operations Incorporating Technical Change Continuing Education Other

<table>
<thead>
<tr>
<th></th>
<th>Attracting</th>
<th>Retention</th>
<th>Lowering Production Costs</th>
<th>Decentralizing Operations</th>
<th>Incorporating Technical Change</th>
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Figure 10. Key management problems for the next ten years.
### REASONS FOR MAKING ACQUISITIONS

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<thead>
<tr>
<th>Language</th>
<th>To Grow</th>
<th>To Broaden Home Market</th>
<th>To Access Foreign Markets</th>
<th>To Acquire Technology</th>
<th>To Acquire Expertise</th>
<th>To Vertically Integrate</th>
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Figure 11. Reasons for making Acquisitions.
### FACTORS IMPORTANT FOR INTERNATIONAL EXPANSION

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<tr>
<th>Language</th>
<th>Local Presence</th>
<th>Global Perspective</th>
<th>Technical Knowledge</th>
<th>Management Skills</th>
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</table>

Figure 12. Factors Important for International Expansion
• National Opportunities from International Operations.

Figure 13 displays some of the significant national opportunities for international operations. For Swedish companies it was to help process integration. For US and German firms internationalization was seen as a means to smooth out national economic cycles. (i.e., This meant going overseas when the home economy had turned down.) The English saw it as a means to get access to Asian markets while the Japanese saw it as a means to access European markets.

• Degree of Vertical Integration.

Figure 14 is one of the more important items. It depicts the level of vertical integration of a single company common in each country in construction. Swedish companies tended to include and integrate most aspects of the entire building stream. They saw this as a major business strategy for product integration and client service. They included the range from materials to money. American companies, on the other hand, tended to focus very narrowly on parts of the total building process. They saw this as a means to specialize and do what they do more efficiently and cheaper than anyone else. Not only might a firm specialize in finance, or managing the construction of a specific type of building, it would specialize in certain financial instruments or certain size buildings. The problem with the Swedish approach is that they may not be the best at everything but, on the other hand, if you can accomplish a well-integrated product you may not need to be the best at each thing. The trouble with the US approach is how to integrate the activities of the ten to twenty firms involved in each project. In addition, whatever you may have specialized in may disappear from the market. If you are highly skilled at managing relations with other firms, and clients, and can quickly adapt what you do then you may do well with the US approach. As buildings become more complex the management challenge becomes large.

• Anticipated Company Growth During Coming Decade.

Figure 15 illustrates what each national cluster felt to be the probable growth of their companies during the next decade. The French were the most optimistic, with an expectation of
## SIGNIFICANT NATIONAL OPPORTUNITIES

<table>
<thead>
<tr>
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<th>Process Integration</th>
<th>Ecological Shifts</th>
<th>Industrial Expansion</th>
<th>European Markets</th>
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<th>Future Infrastructure</th>
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</table>

Figure 13. Significant National Opportunities.
Figure 14. Vertical integration in companies by country.
Figure 15. Anticipated company growth during the next ten years (By country).
700% growth. The Germans were the most pessimistic, with an expectation of 20% growth. The others were in between.

- Anticipated Growth in Revenue per Employee During Decade.

Figure 16 shows what the composite national groups expected in term of their revenue per employ change over the next ten years. Once again, the French and Germans defined the edges of the industry with everyone else falling in between. For the French the expectation was that they would gain 400%/employee. For the Germans it was 100%/employee.


A comprehensive research conclusion came from identifying a value-adding description of the building process. The objective was to get a sense of where future value-adding activities would lie the total building process. Figure 17 lists some of the key changes in from where new value adding has entered the building process over the past few decades. During the seventies construction management reorganized the value-adding process. During the eighties it was through new methods of financial planning. During the early nineties it seems to lie with improved product design, methods of industrialization and procurement. It is critical to point out here that within the study design capabilities came to be defined as different from what architects and engineers do. Many participants in the study saw both groups as weak aspects in the total process. The executives in the study generally saw design talent as becoming a combination of organizing and managing skill. This required someone who could fit very diverse parts into dynamic patterns. They saw no specific disciplines capable of training this type of designer. In fact, the individual needed to be multi-disciplinary in attitude and skill.

Figure 18 puts Figure 17 within a larger context. This is give a sense of to where ideas are going in the changing building process. The chart begins with the ideas that launch a building project that arise from some articulation of human need(s). Once there is an idea the process of making or modifying a facility begins. The right side of this value-adding stream is like a mine from where new topics or approaches are taken that change the way in which the process operates. In each era some new approach is mined. In the industry this is often called a “hot button.” Once things seem to stabilize around the new approach another approach begins to
Figure 16. Anticipated company revenue/employment during the next ten years (By country).
<table>
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<th>Conditions of Success: The Construction Value-Added Chain</th>
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<td>- Construction Management: 1970s</td>
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<tr>
<td>- Financial Planning: 1980s</td>
</tr>
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<td>- Design and Organization: 1990s</td>
</tr>
<tr>
<td>- Procurement and Industrialization: 1990s</td>
</tr>
<tr>
<td>- Other... Beyond...</td>
</tr>
</tbody>
</table>

October 4, 1990

Figure 17. Conditions of Success: The Construction Value-Added Chain
Figure 18. The Building Industry - Value Adding Chain.
germinate. Sometimes these are internal to the industry but often they come from an outside influence, e.g., clients. This can be seen in looking at the building idea phase. In the 70s the hot idea was “marketing to clients.” In the 80s it was speculative development. During the 90s it is was “creation of clients.” Keep in mind that this is where and when the new approaches get introduced, not when they find mainstream acceptance. (It is only now that the mainstream is looking at client creation as a way to add value.)

Within the site phase of the process the important item for adding value during the 70s was site acquisition. During the 80s it was real estate development and during the 90s it is product development as a way to overcome the problems of repeated development approvals. Within the design phase the interest in the nineties is to transcend the limitations of architecture and engineering and find organizing capabilities that include both plus more. For finance the current interest is with methods of arranging instead of practices of borrowing or procedures for lending. Procurement is now moving into industrialized systems development. Assembly has moved from construction management to project management and now to program management. Within ownership the current potential for adding more value is directed at facility utilization instead of facility management. This means getting rid of space, or even facilities, instead of managing their energy use. This relates to new office management techniques and technologies in use in Northern Europe and Japan that allow more workers to use less office space. In some instances it reduces peoples’ need for offices up to 75% while enhancing teamwork.

6. In Conclusion

I offer three recommendations to conclude my portion of this symposium. They look a bit abstract but hopefully I can explain a bit of what each means. See Figure 19.

1. Shifting from a passion for productivity towards an emphasis on efficiency.

Instead of worshipping the objective of achieving more product with fewer people we need to seek better product from reduced use to all resources. This will require a change in the way in which we measure success. I believe the concept of efficiency is a much better evaluator of what we do. It is closer to total-factor productivity, as distinct from labor productivity, and is
RECOMMENDATIONS:

I. Shifting From a Passion for Productivity to an Emphasis on Efficiency

_Instead of more product from fewer people, we seek better product from fewer resources._
_(This will require improving our measures of success.)_

II. Shifting to Distinctions that Integrate instead of Differences that Disintegrate.

_Instead of explicit criteria of male/female, black/white, buildings/bridges we look to implicit differences in ignorance/knowledge, hard/soft, wasteful/effective._
_(This will require learning to learn.)_

III. Shifting to Continuous Organization of Discontinuous Parts instead of Orders that Alienate.

_Instead of relying on methods found in traditional models of design, production and management, that tend to disorganize, we seek approaches that tend to integrate._
_(This will require appreciation of the environment.)_

Figure 19. Recommendations
concerned with everything that comes in and everything that goes out, including the pollution, diseconomies and legal process.

2. Shifting to conceptual distinctions in construction that can integrate and away from differences that disintegrate.

Instead of spending a great deal of time with differences between male/female, black/white, roads/bridges, etc. we need to direct our concern to differences between: ignorance/knowledge, wasteful/efficient, worthless/valuable, etc.

3. Shifting to management styles that continuously reorganize discontinuous parts and away from strict orders that alienate.

Instead of continuing to rely on classical methods of design, production and management we need to find ways to continuously improve how we do all three of these. Recent evidence suggests that we might want to even drop the traditional walls between these three activities. This can be seen by looking at what is happening in other industries. As other industries move towards the idea of single-copy production they might also be able to learn from construction.
COMMENTARY FROM INDUSTRY

Stanley P. "Mickey" Steinberg
Executive Vice President
Walt Disney Imagineering

The best way to start is by answering David Hawk's three questions:

1. Should Construction be an industry?

   In my opinion, it has always been, it still is and it will continue to be. It is just disjointed, and we have not been able to put it all together. There are a lot of people that I know of and that I have talked with during the last thirty or forty years who felt that all along. They just have not been able to put it all together. Most of us at that time were too young to do something about it, and now we are too old or too tired to do something about it.

2. Will it have a global dimension?

   It already has, whether we like it or not.

3. Does it have a role in the future?

   There is no question about it! Construction had a role since the first cave-man moved into a cave in order to occupy it. Since then we have been into the construction business, and will stay in it.
However, there are a lot of things that Dr. Hawk said and my viewpoint is different than his. In order to understand my viewpoint you have to understand where I come from. As I said, I have been in construction for many years and I have worked in many cities in the U.S.A. (Atlanta, Chicago, San Francisco, Detroit, Dallas and Los Angeles among others). I have worked in many foreign countries (Singapore, Brussels, Tokyo, People's Republic of China and Hong Kong). Lately I have been working in New York. I do not care where the project is; if you have certain things in place that occur, the project is a success. If those things do not occur, then the project is not a success. I have listed a few of these factors. At the top you must have an owner who knows what he wants and who will make the decisions. You have to have financing that is run by knowledgeable people. You must have someone who will manage the entire process. Everyone has to understand what is expected of him. You must have a procurement plan in place. You ought to have a management of construction that is clear and makes quick decisions. You must have conflict of resolution that is quick and fair. You must have coordination and communication throughout. There has to be trust and integrity and finally everybody involved must make a fair profit. If you do not have these things, no matter how well organized or no matter where you come from, it will not be a good job.

I am not defensive about Americans. There are a lot of things we need to improve but there is nothing we have to apologize for. I have a different point of view about some of the companies and some of the things that Dr. Hawk talked about. My point of view is just different than his because, with the sixteen different companies I have worked in the past, I have worked at a different
level; I have worked as an executive for those companies. Either I had people working with me or people working for me.

Next, I will tell you my observations, based on my experience in three countries: Japan, France and the U.S.A. I consider this to be very important in order to have a balanced view before we decide what we do about things. I think that what is most important about companies in foreign countries is to examine what conditions existed that they grew out of.

Starting with Japan, I have been involved with the Tokyo Disneyland for the last six years and before that I have worked with Japanese companies at other places. First of all, the construction industry in Japan has been, as far as business practices go, one of the most unique I have ever seen. It works very simply: they sit around in a room and decide who gets what job and the chosen company decides how much he will charge them to complete the job. So far, they have been able to do that because they have had far more work than they can do since they were allowed to keep any foreign company out. This has been their business practice for years but these things will soon change since many countries have decided to retaliate. The Japanese have so much work to do that they can pick and choose. Some of the results that Dr. Hawk showed are results of a country that had much fewer people than they had work for them to do, so they made huge capital investments. We finished the Disneyland in Orlando six months earlier than the Disneyland in Tokyo although we started nine months later. Their cost was 87% higher than ours because the Japanese government was getting very high taxes out of the Japanese workers. That money was
used either for R&D or used to buy real estate in the United States. On the other hand when Japanese come to the United States to undertake construction projects they do what the American companies do: they hire local subcontractors and designers. I do not wish to degrade what the Japanese are capable of, but they had certain advantages that right now are disappearing. As a proof of that is the fact that the cost of construction in Japan is dropping rapidly simply because they don't have enough work, they are in a recession.

I also worked in France. I spent three years building the Eurodisneyland. The cost was 1.4 billion U.S. dollars. We used contractors from eight different countries, and major suppliers from sixteen different countries. It was a very interesting experience, but you have to understand the French method of construction. The French method of construction grows out of laws just as the Japanese method of construction grows out of business practices. These laws were based on Napoleonic law which makes contractors responsible for everything built in France. So the law puts the responsibility and therefore the control into the hands of contractors. The architects became nothing more than providers of very quick preliminaries. So what we did was to go along with an international contractor. The French government gave us permission to be ultimately responsible for everything, because there were examples of public companies in France (e.g., the railroad) that had done the same thing in the past. And this is the reason why we managed to finish the Eurodisney project on time and on budget. After the project was finished I was approached by somebody in the British Government and he asked me if I would attend a Symposium where I would explain how we managed to finish the first major construction project of high quality that
was built in Europe, on time and on budget. I refused because the shocking truth was that everybody who worked for the project on site knew that the project would not finish on time and on budget. They believed it and they acted that way. When they start a major project in Europe they know that it is not going to finish on budget and on time. They expect it, and they act this way.

The last country I wanted to mention and that I worked in is the United States. I have a lot of heartache with the United States because I think we could do a lot better. It seems to me that our industry is shaped by liability, litigation and in the past by Unions. It is shaped by the concept of everybody trying to pass liability on to somebody else. It goes around in circles. Everybody is to be blamed: the A.I.A, the contractors, the owners, etc. We have to decide who is liable for what. All the parties involved think they ought to have control, and not be responsible for it.

One of the unhappiest things that happened in the construction industry is the current concept of construction management. Most people would disagree with that, but in my opinion the concept of construction management practically has been going on forever. In the past contractors performed construction management until problems in New York forced contractors to the point that they could not accept the liability of building in New York. Out of this came the concept of professional construction managers who came and assumed all the control and no responsibility. Beyond that, in order to prove themselves worthy, they took the contractors and broke down their work in pieces. They started trade packaging and squeezing everybody down. I think that is a horrible mistake. In order to correct it, we must take the industry and develop processes that will be
easily understood and that will work. The existing processes worked then, but I agree with Dr. Hawk they are cumbersome and very expensive. All this coordination we do is costing us a lot of money.

I think the bottom line of what we need is better owners. In the past in our attempt to fill the gap we used professional surrogate owners, but I do not think that this is the answer. A lot of people call themselves program managers, project managers, integrators and professional developers. But until we include the owners as part of the industry and until we explain to them how the process works, it will never be integrated. In my opinion there is a big difference between a construction manager and an owner. A construction manager is driven by only one thing: money. He wants to do everything in the cheapest way possible, not in the quickest way but in the most cost-effective time; and he wants to provide the quality he is contracted to provide but in the cheapest way possible. There is nothing wrong with that, if we do not have that we will lose it. On the other hand the owner must have a look at the broader picture, he must look at everything. He has to know what he really wants, and what he is willing to pay. Therefore, the construction manager and the owner are not one and the same thing. People who have tried to make them one and the same have gotten into trouble. Our problem is that we do not have a clear picture of the total industry.

Here I would like to mention something that Dr. Hawk wrote in his book: that in our industry there are a lot of badly trained people. For years, contractors have relied on unions to train
people. We do not train them on how to use new tools and on how to accept new tools. We have not accepted information management yet, but we simply use the new technological innovations as a method to produce a paper.

Although there are a lot of things I agree with David Hawk, I do not believe that a lot of the companies at the top of his charts really produce in the way their position reflects, or in a way that reflects what their organization at the high level says they ought to produce. I think that a lot of foreign companies are buying American companies in their effort to expand, to acquire management skills and get knowledge bases. But on the other hand I agree with Dr. Hawk that we must learn how to integrate the construction industry but not necessarily vertically. The model of vertical integration was tried by the automobile industry and especially by the Ford Company. It did not work and as a result that plant was closed. We have an opportunity to bring a concept to the construction industry and develop it, and this is what the Construction Research Center ought to be doing. Otherwise, contractors will always be at great risk, never make a proper profit, and they will continue going in and out of business. In my opinion American companies still manage to do a good job, but we can do a lot better.
In order to get things in order, I will highlight some of the dimensions that I see surrounding the problem of defining construction as an industry. We have four traditional sectors of construction (building construction, civil infrastructure construction, industrial construction, and residential construction), executed within the private or public sectors, where each one of the “facilities” built is different. What percentage each one represents depends on whom you ask, and what you want to use as a source of your data. In addition, two additional types of construction today are affecting how we do things: environmental remediation and infrastructure rehabilitation. Although these are outside the scope of construction as we traditionally think of it, they still fall within the realm of the construction industry.

Another dimension is the fact that we are living in a world of 200 different countries, each one with a nationalistic focus, and yet we are forced to live in an economy that is more global, in a world of communications that is more global, in a world where Coca Cola and English can be found at the smallest and most distant village. Therefore, we have to face the fact that we function in a wide arena, from very local to very global.

Furthermore, when we are talking about construction, what portion of the life-cycle of a facility are we addressing? Does construction include that initial need or idea that states: “We need to have a facility.” Does the word construction include planning and all the preliminary studies that were performed during the initial stage of the process? Does it include the design, not only the architectural design, but every subspecialty of engineering design combined with every subspecialty of interior landscaping, acoustical and every other specialty?
And then we have to build the facility. We have companies that will do the management of construction or programs of construction. We have contractors and subcontractors, vendors of equipment, and material suppliers. Are all these part of the industry? Are we including the people that dispose (demolish) of built facilities as part of the industry? If we look at the construction industry as a life-cycle that never ends, what are the boundaries?

Also, we have to ask the question: Who are the stakeholders of the construction industry? Are they the consumers, the owners (whether private or government), the designers, the constructors, the suppliers, the material vendors? Do we include the lawyers who benefit from the highly litigation-prone environment we operate in; or the agencies that underwrite the regulations and impose standards; or the financial entities that provide the money for the completion of the project? This is another dimension we cannot avoid.

Then we get down to basics. If you want to build a facility, you need an owner who knows what he/she wants; who needs to have a good scope. Without a scope you do not have a facility. Once you have a scope, you have an execution plan that will guide you in building that facility. Then you break the plan into three different stages: the design process, the construction process, and eventually the utilization process. In addition, we need to find ways to pay to design the facility, to buy everything that goes into the facility, to build the facility and to use that facility. At the general level you need to define the context surrounding these processes: contractual arrangements, strategies or alliances, communication processes, decision making processes and conflict resolution processes among all project parties. At the specific construction
level, you need to define labor, materials, equipment, and the methods of combining these
elements.

All the above are the true dimensions of what we are dealing with, and this is quite a
challenge! While we are trying to define the construction industry, and decide to include or
exclude any of these parts, the following questions will arise: "How can we do it better? Is it
worth doing at all?

I look at construction in very simple terms: whether for business or for government every
new facility needs to have very specific objectives. Those objectives become the primary drivers
for the total development process. However, one needs to understand and to distinguish between
what drives the organization developing the facility, and what drives the process of facility
development. Each one is half of the equation.

A facility must support the objectives of the organization; otherwise it is only an exercise.
In addition, the facility must have a functional purpose. To achieve these two goals there are two
paths that develop in parallel and which one cannot neglect, each one with its own set of
challenges and characteristics. One of them is the technical definition of the facility which
defines the "what," the product itself, whether it is a tunnel connecting a continent with an island,
or a downtown highrise. This is not a simple process, because the coordination that is involved
and the lack of integration between all the participants in this part of the process pose a great
challenge. Although there are technologies emerging to support this process, they are not yet part
of the process.
The second path is the management process required to make the facility become reality. There are three different areas of management: **Technology**, whether this is information technology or technology in the field; **Resources**, whether these are people, equipment, financial space or energy; and **Processes** - scope definition, conflict resolution, decision-making, construction methods, change orders, etc.

And if all this were not enough, we also have the other traits that Dr. Hawk discussed. I will cite a list of things that the construction industry need to be:

1. The construction industry must be responsive to client needs. These needs are changing at both organizational and project-specific levels.

2. As an industry, construction needs to be innovative. Innovation refers to products, to processes (technical or management), and to markets (we need to pursue things that are not traditional).

3. As an industry, construction needs to be value-adding, fast-paced, more effective in its delivery and much better in optimizing the use of its resources.

4. As an industry, construction needs to be contextually sensitive. It cannot driven only by its own goals, but it also has to be sensitive to local, national and global needs.

5. As an industry, construction needs to define and create a true knowledge base.

6. As an industry, construction needs to be less self-centered and less self-contained, and really learn from other industries.
7. As an industry, construction has to be culturally and organizationally responsive to the current competitive arena. We need to incorporate strategic planning processes into the construction industry, as well as other ideas taught in the different Schools of Business.

8. Finally, as an industry, construction must have a focus on life-long learning. The construction industry must learn to learn. In the USA we are facing one particular problem: the complete erosion, degradation and diminishing number of skilled workers. Unfortunately, we are not using today’s technology to try to train workers.

Finally, as far as research is concerned, we need to come down from just being able to identify the problem and making intellectual discourses about what is wrong or how things could be done, to the real nitty-gritty solutions that have the opportunity to have an impact. Such an example is one research project that is being done under the auspices of the Construction Research Center: an effort to develop a knowledge shell that will be used to teach and train people in cost estimating.
David Hawk: By the way I'm sorry I did point out to you that read the booklet. I mentioned that there were 60 participating companies yet only 59 companies are formally listed in the booklet. This was because one wanted its name to remain unknown to the other participants. I think it name is now largely unknown to its former clients as well.

I should make a couple of responses. In his comments Mickey raised the issue of collusion. I agree with him, "collusion" between companies in construction is quite important in Japan, certainly more explicitly important than it is in the US, but that does not mean that the US has no collusion. (Collusion is where the major construction firms get together and divide up the major projects.) What has irritated the US companies is how the Japanese companies openly met to see who was capable of doing how much of each governmental project. In the US we are more discrete about this allocation process, except where politicians favor a local firm back home, or minority bidding enters the picture. As one major US firm pointed out why the "pre-organization" of bids is important, "It costs us .5% of a total project cost to make a formal pre-design and produce the bidding documents on it. If we loose a half a dozen of these large projects we are out of business. Because of the governmental requirements of the bidding process we cannot afford to lose many." In all countries we looked at there were mechanisms for the major companies to "allocate" major public works.
In both Japan and the US there is less "collective consultation" (collusion) for work in the private sector. Private work is highly competitive, even when a client seems secure. The major difference with Japanese firms is that the decision of clients is based on the kinds of R&D the construction firm does while in the US R&D it is more on price. Perhaps the lesson to be learned is that in the complexities of the international marketplace it is possible to do and say almost anything we want, at least once.

As far as the issue of research is concerned I think we can learn something from the Japanese. Construction research in Japan has less to do with public works than we might want to think. The idea that it does comes from US contractors being upset that the Japanese government requires a company to dedicate 1% of turnover to R&D in order to pre-quality for public bidding. US firms thus conclude that research is a government cover to keep US firms out. Even if true the consequences of it go well beyond being a cover. If you look closely at the R&D operations in these $100 to $200 million per year company labs you will see that much of it impresses and get contracts from the private sector, including many US clients like Motorola. In the private sector the competition of construction work is much harsher than we have in the US.

As far as the Disney experience in Japan and Europe goes, and what might have been involved in it, I don’t know. There were quite a number of articles about both in the Wall Street Journal but I assume that Mickey knows more than the Journal about both ventures.

I do have documentation on another US managed major construction project in Europe. It is the Mesa Building in downtown Frankfurt, Germany. It is the tallest building ever built in Europe. It was done by an American group. Its process, product and the financial results are not
reassuring. (By the way a good share of the money behind it was Japanese.) Although the US
development firm was excellent in their US operations, and was filled with talented people, they
somehow never learned to adapt to and get organized around the qualities of the European
context. The US managers somehow thought that international standards were synonymous to
New York City standards. They were not and are not.

Another point I should clarify comes from the Stockholm Symposium that I mentioned at
the outset. I repeat that there are two major formats for going international. One is on a technical-
physical stream, which entails a great deal of R&D and homework. Two is a financial-
developmental stream, which entails analysis and being fortunate. The Japanese firms are clearly
in the first camp. The US firms are just as clearly in the second. What do I mean by a “technical-
physical” stream? For the Japanese it means having a production system that can produce a
twenty-story building with essentially no workers. It is interesting that a great deal of the money
the US firms are playing with, such as that used in the Mesa Project, is Japanese money; money
made from the technical-physical fascination with the long-term.

I would recommend that we find a way to take the Japanese approach seriously. I do agree
with Mickey that if we need a model for the construction industry that we should look at
automobiles. Just look what happened in the 1970s relative to the US auto industry. The US
companies may be finding ways to come back but we should be careful in thinking the storm is
over. Construction seems to be just now going into the events of the 1970s.

As far as Jorge’s response goes I appreciated the fact that he raised more questions than
provided answers but I guess that is what academics do best. He raises the concern about too
much of the CRC research program dealing with issues of environmental wastes, and how that may not directly relate to buildings. Perhaps direct relations are not as easy to see as they once were. We may need new ways to follow and find relationships. I am reminded by a recent lecture that the CEO of TECHWIPE gave one of my classes. His firm has about 50% of the US and Japanese markets for providing materials for cleaning clean rooms. He pointed out that this doesn’t mean much with companies like Toshiba verses Intel. Toshiba has virtually no waste to clean up while the US factories are covered with wastes. He traced it back to the facilities they were each in as well as the way in which they were managed.

Jorge rightly points out how low the profitability is in the US construction industry, especially in the design and construction parts. Those two parts are primarily responsible due to the wastes they generate and the way in which they manage operations. They must both learn to do better.

Bob Silverman: I am disappointed in that we did not discuss the benefit and the strength of our diversity and our fragmentation. I thought about doing everything in our construction site with my own forces and it would be absolute insanity. I have looked at other countries where companies do that and I have looked at our own country where big projects and big corporations do that kind of thing and the cost is astronomical. When we have small companies that manage at risk and care so much about those small projects we find that there is a sense of community and a sense of pride but there is also a sense of hands on management. It is a
tremendous benefit to us and a uniqueness of our industry when we do that. I wish that we had talked about this benefit.

I went to Finland and I have dealt with the companies that were vertically integrated and I have seen their R&D. They proudly showed me an office building that was being built for an insurance company. At the same time I was building a similar building with a similar square footage here in the United States. I was really taken by the pride of the craftsmanship and the way they treated their craftsmen with respect. An office with hot running water was created for the craftsmen to take a shower before leaving job. Our men do not shower before leaving their job, they do not change their clothes and they are not served a hot meal as every Finnish worker by law must be served one meal every day on the construction site. But their buildings cost over twice as much as the same buildings in the United States.

I also looked at the power plants that we built and the huge integrated corporations that delivered them and I see such horrible inefficiencies. When I was building in Georgia I was losing workers everyday because the word on the street was that you do not have to work and you get paid three times as much. Why do the big companies even tolerate that? It is only because of the ownership. The owner lets them get away with that.

Cecil Alexander: Mickey, your comment that we need more intelligent and better owners reminded me of something that Governor Maddox said: "The problem with our prison system is that we need a better class of prisoners". Nevertheless, I think you are right on and I am wondering if one of the programs that the Georgia Tech core curricula presents is a program of
instruction for building owners? It would give to the owners the information needed so they would know what to expect from the building industry and what to expect from the architects or the contractors; and how to position themselves internally to get the most out of the product that they are paying for.

**Mickey Steinberg:** My reaction to that would be; "That is an excellent idea." We should start with something. I get so tired with somebody telling me: "I hired the best architect and contractor I could, and I do not understand how I have gotten into this trouble". I think the more opportunities we have of educating the owners the better off we will be. There are a lot of potential owners who would not know where to go to get that, and I think that if Georgia Tech did it would be the first School with such a program in the country.

In my opinion, our problem is how to produce in our education system a human being who can deal with what has been talked about here, in a knowledgeable, informed and successful way. And more importantly, what is the educational background that leads somebody to become a capable and informed practitioner or contractor.

**Jorge Vanegas:** I believe that unless the industry provides the leverage in the form of financial support to academia, that academia will not change on its own. I think there is no culture yet to promote that idea.
Ennis Parker: We are sitting in a microcosm of what we are talking about right now. This is the Institute of Paper Science and Technology. This has three purposes for existence:

1. Teaching
2. Information Transfer
3. Research

Twenty six member firms own this organization and financially support all these functions. In order to become a member a firm has to pay dues ranging from $250,000 to one million dollars per year. The only purpose for its existence is to support the development of the paper industry in the United States. The reason it exists is because of the competition that comes from the Scandinavian countries as well as other countries of the world, and because there is a huge investment in research. It seems to me that if we took this as an example (although the paper industry is neither as complex as the construction industry nor has as many components), nevertheless the challenge that we set for ourselves to attempt to do is this sort of integration. In order to do that, I agree with Jorge, we have to do those three things. We have to find a mechanism to bring the industry together and fund research, both specific and general research. This is a digression but I think that the orientation that Construction Research Center has at this time is toward a product research, toward technological research and that is not the problem. The problem in our industry in my opinion, is finding a way of doing things, not so much what to do but a way to do things that is more efficient and more effective than the way we do things right now.
Georgia Tech in my opinion is the best place in the United States to address these kind of issues, because we have a fine Engineering School, we have one of the largest Architectural Schools in the world and we also have a great Management Organization; and the Engineering curriculum spans all the disciplines that are involved in Construction. It seems to me that the mission of the CRC should be to attempt to draw on all the resources of this institution here, and try to focus all those resources on all these processes which contemplate our industry. In my opinion research should involve more than technological research, and part of the research should focus on all the processes from the very inception of the idea of building the building through to the actual end of the life of the building:

**Bob Silverman:** I totally agree with what Bill said. I wish that the architectural profession would stop thinking of its own professionals as professional designers. I wish that Architecture could be the Liberal Arts of the construction industry, and that all of us sitting around the tables who have studied Architecture at Georgia Tech whether we would be in government or whether we would be the manager of design and construction for Disney or whether we would be contractors, that we would share this common body of language and this way of looking at the world. Owners and developers and politicians and government people should look at the world the way architects do. That would be a better world. And we should also accept some people that do not design very well and then we should tell those guidance counsellors in Junior High Schools that you do not just look for artists to go and study Architecture. We must redefine the profession!
Mickey Steinberg: The truth is that the problem is not that big. There are architects spread throughout the construction industry. I run into them as bankers, as owners etc., but that is not the problem. The problem is with the practicing, bored architects. It is really a small segment of the architectural graduates that have created a problem. Although I agree with you I just do not like the rap that all architects are that way because I myself am in a practicing firm and I still consider myself an architect.

Attendee: There was a major paradox shift in architectural education in the 1960s which really ruined the profession. We went from a profession that was oriented in Architectural Engineering and Construction disciplines here at Georgia Tech to "Architecture as Design" and completely ignored technology. Every major Architectural School in the United States has focussed on "Design/Theory/History". I have visited several academic situations in which they do not care about technology, they do not care how you construct it. I think that Tech's trend is that way. Four years ago I interviewed a Georgia Tech graduate who was presenting me his thesis. It was absolutely amazing that he had to deal with the Civil Engineering Department, the Mechanical Engineering Department and other departments that helped him to integrate all the systems in his high rise building. And that has been completely left out by the academic structure that we now have in professional education of the architect. Yes, we ought to be more involved with the technical aspects of construction because that is where the answer for the design of the future is. It is not in what you put on the boards, it is in how to construct the building so "it does not leak, does not crack, does not expand, and you do not sleep on the floors".
SUMMARY

Thomas D. Galloway, Ph.D
Dean, College of Architecture
Georgia Institute of Technology

From the various presentations and commentary of this seminar, it is clear that we collectively view construction as a diverse, fragmented, disjointed profession, not only on the practice side, but we also have a similar situation on the academic side. On the academic side, there is little theory of or in construction, and what exists does so in bits and pieces. More disconcerting is the fact that there is little fundamental research development with the industry itself. Halprin's question remains: "Is construction a researchable topic, or is it like running a bakery or a beauty parlor? Is construction a purely practice-oriented discipline that is applied, not basic?

This parallels the question of how to redefine the mission of the CRC for the future. As suggested today, we have at least two ways to look at that question. One is saying, "Yes, construction as an industry is in need of redefinition, and, yes, we can approach this task either by looking at units and components of the processes, or alternatively, by viewing its performance on the basis of conditions for success. Dr Hawk and Mr. Steinberg argued there are alternative ways by which such criteria or conditions can be defined.

On the other hand, Dr. Vanegas suggested that the industry is so complex and that consensus is so ephemeral that the definition of the industry may defy a solution. However, at the same time, in the chemistry of complexity outlined by Dr. Vanegas, I saw the shaping of a possible
definition and/or classification system that would help us bound the problem. Although we may leave some things out in the beginning, such an activity is the central purpose of theory building and development within the university.

Dr Vanegas also suggested an alternative way to look at the problem. He suggested that it may not be useful to build a comprehensive dynamic model, simulated with respect to multitudinous dimensions of the construction industry. Rather, we could accept the diversity of the industry, enjoy the richness of its decentralized setting, and refrain from an intellectual reframing of the problem. In this view, according to Dr. Vanegas, we should identify what are the most critical issues within that fragmented environment and choose those issues that have the great promise in benefitting the industry and also make sense given the constraints, strengths, context of Georgia Tech, the College of Architecture, and CRC. If nothing else, today's debate has raised at least those two alternatives for future articulation. I will tell you, our comfort level should be a lot higher knowing that our perspectives have come from this type of discussion, as opposed to a frame of reference, almost ten years ago, emanating from the Business Round Table which looked at the issues in a much different way.

In Conclusion I want to thank all the participants and especially the presenters. It has been a most worthwhile experience for us here at Georgia Tech; I hope it was the same for you as well.
SYMPOSIUM ANNOUNCEMENT

THE CONSTRUCTION RESEARCH CENTER
will present

A SPECIAL MINI-SYMPOSIUM

THE GLOBAL FUTURE OF THE CONSTRUCTION INDUSTRY

Friday, June 3, 1994
2:00 p.m. - 5:00 p.m.
Seminar Room
Institute of Paper Science and Technology
500 10th Street, N.W.
Atlanta, Georgia 30318-5714

2:00 WELCOME
Thomas D. Galloway, Ph.D., Dean, College of Architecture
Louis J. Circeo, Ph.D., Director, CRC

2:15 INTERNATIONAL BUILDING CONSTRUCTION
David L. Hawk, Ph.D., Professor
Schools of Architecture and Industrial Management
New Jersey Institute of Technology

3:15 Break

3:30 Commentary from Industry
Stanley P. Steinberg, Executive Vice President
Walt Disney Imagineering

4:00 Commentary from Academia
Jorge A. Vanegas, Ph.D., Professor
School of Civil Engineering, Georgia Tech

4:30 Group Discussion

4:50 Summary
Thomas D. Galloway, Ph.D., Dean, College of Architecture
Louis J. Circeo, Ph.D., Director, CRC

5:00 Adjournment

Attendees at the symposium are invited to a reception at the residence of the Dean and Mrs. Galloway, from 6:00 p.m. - 7:30 p.m. at 830 Myrtle Street, NE, Atlanta, Georgia 30308. Spouses are most welcome.

Reservations Required. To register for the Symposium and the reception call the Construction Research Center at 894-2069 by Friday, May 27, 1994.
APPENDIX B

LIST OF ATTENDEES

Thomas D. Galloway, Ph.D.
Dean, College of Architecture
Georgia Institute of Technology
Atlanta, Georgia 30332-0155

Louis J. Circeo, Ph.D.
Director, Construction Research Center
Georgia Institute of Technology
Atlanta, Georgia 30332-0159

David L. Hawk, Ph.D., Professor
Schools of Architecture
and Industrial Management
New Jersey Institute of Technology
Newark, N.J. 07102-1982

Ray A. Nixon, Jr.
Manager Region Facilities
Georgia Power Company
333 Piedmont Avenue - 6th Floor
Atlanta, Georgia 30308

Stanley P. Steinberg.
Executive Vice President
Walt Disney Imagineering
1401 Flower Street
Glendale, California 91201

Larry Lord, FAIA
Lord, Aeck & Sargent
1201 Peachtree Street
400 Colony Square - Suite 300
Atlanta Georgia 30361

Jorge A. Vanegas, Ph.D.
Professor, School of Civil Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332-0355

Thomas Ventulett, FAIA
Thompson, Ventulett, Stainback & Associates
2700 Promenade Two
1230 Peachtree Street, N.E.
Atlanta, Georgia 30335

Richard H. Bradfield, FAIA
President, Bradfield, Richards & Associates
3025 Piedmont Road, NE
Post Office Box 52426
Atlanta, Georgia 30355

William F. Roberts
Georgia State Financing
and Investment Commission
2 Martin Luther King, Jr. Drive, - Suite 472
Atlanta, Georgia 30334

Robert L. Silverman
Chairman of the Board
The Winter Group of Companies
530 Means Street, N.W. - Suite 200
Atlanta, Georgia 30318-5730

C. Ernest Edgar, III
President
Rosser Lowe
7100 Peachtree Dunwoody Road, N.E.
Atlanta, Georgia 30328

William R. Sims
Senior Vice President
Walt Disney Imagineering
2 Epcot Resort Boulevard
Lake Buena Vista, Florida 32830

Cecil Alexander
College of Architecture
Georgia Institute of Technology
Atlanta, Georgia 30332-0155
W. Ennis Parker, AIA
Rosser FABRAP
Suite 100
100 Peachtree Street, N.W.
Atlanta, Georgia 30303

Thomas Porter, AIA
Thompson, Ventulett, Stainback & Associates
2700 Promenade Two
1230 Peachtree Street, N.E.
Atlanta, Georgia 30309-3591

James Moynihan
Heery International, Inc.
5999 Peachtree Street, N.E.
Atlanta, Georgia 30367-5401

John'Busby
Jova Daniels Busby
1389 Peachtree Street
Atlanta, Georgia 30309

David Standard
MSTSD
1401 Peachtree Street, Suite 640
Atlanta, Georgia 30309

Brian Gracy, AIA
Carter and Associates
1275 Peachtree Street, N.E.
Atlanta, Georgia 30367

Grant Moseley
MSTSD
1401 Peachtree Street, Suite 640
Atlanta, Georgia 30309

Joseph Rabun
Robun Hatch & Associates
805 Peachtree Street, N.E.
Suite 610
Atlanta, Georgia 30308

COLLEGE OF ARCHITECTURE

Thomas Debo
Jean Wineman
John Peponis
Steven French
Rufus Hughes
Garvin T. Dreger
Saied Sadri
F. A. Hilenski

OTHERS

Kevin Carry
Steve Backman
Proceedings of the Symposium on:

THE GLOBAL FUTURE OF THE
CONSTRUCTION INDUSTRY

Final Report: Contract D48-A76

WALT DISNEY IMAGINEERING
1401 FLOWER STREET
GLENDALE, CALIFORNIA 91221

June 3, 1994

CONSTRUCTION RESEARCH CENTER
COLLEGE OF ARCHITECTURE
GEORGIA INSTITUTE OF TECHNOLOGY
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INTRODUCTION

Thomas D. Galloway, Ph.D.
Dean, College of Architecture
Georgia Institute of Technology

This Mini-Symposium is the first for the Construction Research Center at Georgia Tech and it springs from the Center's advisory board which has been asking probing questions and seeking answers to the critical issues facing the American construction industry. A central question, and one to which this seminar is directed, is where the construction industry is going nationally, as well as internationally. Obviously, this question therefore necessitates the definition of what is the "construction industry" to begin with. It also raises the issue of what are the most needed and productive elements of this industry's future; not only for the purpose of the industry, but more strategically for the reassessment of the mission of the Construction Research Center here at Georgia Tech, a mission that attempts to assist the construction industry in realizing its future.

I do not believe there is anyone that can help us think about these questions better than our keynote speaker, Dr. David Hawk. Dr. Hawk received his Bachelor degree in Architecture from Iowa State University in 1971. He received a Masters Degree in Architecture as well as a Masters in City Planning from the University of Pennsylvania; and he received his Ph.D. degree in Systems Sciences from the Wharton School at Pennsylvania in 1979. Presently Dr. Hawk is a Professor of Industrial Management as well as Professor of Architecture at the New Jersey Institute of Technology where he has been since 1981. He has taught at the Stockholm School of Economics, the Chalmers University of Technology, the Tokyo Metropolitan University, the College of Design and the College of Engineering at Iowa State University, and has consulted widely throughout Europe and Asia. He is a prolific writer and a well known researcher throughout the world in the areas of Construction Sciences and Industrial Management. He has published over 50 articles, and his latest book Forming a New Industry: International Building Production has received special recognition in the April, 1994 issue of Progressive Architecture.
THE GLOBAL FUTURE OF THE CONSTRUCTION INDUSTRY

David L. Hawk, Ph.D.
Professor, Schools of Architecture and Industrial Management
New Jersey Institute of Technology

Introduction

I begin with a slide that portrays a dysfunctional attitude that has been creeping into business-as-usual over the past years, including those of construction. It is from the Calvin and Hobbes cartoon series. Let me quickly take you through it (Figure 1).

As illustrated in the cartoon, many aspects of traditional business have become ineffective and inefficient. This can be seen across industrial and national borders. New models of business are needed. While it has not fully emerged I will show you aspects of a new model of international construction business that are becoming major forces for change. Some audiences, especially some filled with younger students, accuse me of using international comparisons to “bash America” instead of teaching them. I am critical of some of what we do in the U.S., especially in construction, but I’m just as critical of what other countries do when lecturing there. It is far too easy to find examples of inefficient, low quality operations in all countries in the construction industry.

I have been hard on audiences in Japan, France, Finland and Sweden, but they have never accused me of “bashing” them. Perhaps it’s because I’m an American, but I think it’s more than that. When I spoke in Tokyo two years ago, about the study described here, I was quite critical of the attitudes behind their highly successful construction operations. The audience was made up of about 300 construction company and government officials, and others involved in the financing and using of their products of construction. My presentation was about an hour in length. During it I accused them of being too ethnocentric in their operations and egocentric in their attitudes. I mention the Tokyo meeting because the responses, questions and discussion that followed my formal lecture turned the event into an exciting forum. I felt the questions
The scene is of a lemonade stand where Calvin plays the role of the entrepreneur businessman and Susie plays the role of the prospective client.

Susie: “15 bucks a glass?”
Calvin: “That’s right, want some?”
Susie: “How do you justify charging 15 dollars?”
Calvin: “Supply and Demand.”
Susie: “Where’s the demand? I don’t see any demand!”
Calvin: “There’s Lots of demand!”
Susie: “Yeah?”
Calvin: “Sure! As the sole stockholder in this enterprise, I demand monstrous profit on my investment! And as president and CEO of the company, I demand an exorbitant annual salary! And as my own employee, I demand a high hourly wage and all sorts of company benefits! And then there’s overhead and actual production costs!”
Susie: “But it looks like you just threw a lemon in some sludge water!”
Calvin: “Well, I have to cut expenses somewhere if I want to stay competitive.”
Susie: “What if I got sick from that?”
Calvin: “Caveat Emptor” is the motto we stand behind! I’d have to charge more if we followed health and environmental regulations.”
Susie: “You’re out of your mind! I’m going home to drink something else.” (She walks off the set.)
Calvin: “Sure! Put me out of a job! It’s you anti-business types who ruin the economy!” (He then sits and grumbles to himself while staring at the ground before getting up and going to confer with his mother.)
Calvin: “Mother, I need to be subsidized.”
raised by the audience were more probing than my lecture. I believe that they were less interested in being offended than in discussing improvement.

Several dilemmas face those interested in bringing change into the construction industry. A twin dilemma is that much of the industry doesn’t know that it needs to change and in those instances where it accepts the need it doesn’t know how to change. It seems to only know that it doesn’t want to invest resources in the research that could illustrate why and how change should occur. One consequence of these unresolved dilemmas is that construction does not attract the kind of new people it needs for adapting, innovating and constructively changing. Warranted or not, the industry’s reputation fuels a self-fulfilling philosophy.

1. Two Dilemmas Concerning Construction

A. “Why would someone be interested in joining the construction industry or the disciplines that form it, or in doing research for those who do not value new knowledge?”

- We should realize that many outside our industry see construction as a low-tech operation, and thus scientifically disinterested and technologically uninteresting. Corners of the industry even appear anti-tech. The implications that arise from this perception tend to lower the esteem of an industry that can only survive in a technologically-based society by being seen as valuable to that society.
- Construction says it is pragmatic but this comes across as being anti-idealistic. It is proud of having its feet planted firmly on the ground, which is seen as being firmly impeded in concrete. It should not appear to be so proud of this in the face of a society that is beginning to value visions and ideas.
- Construction activities are often perceived as controlled by local politicians, zoning and code officials, and union leaders. In some places construction is even seen as a hand-maiden of Mafia operations (e.g., New York, Rome, Tokyo, Moscow, etc.). This supports a perception that it cannot be expected to be innovative, in any good sense, and must be closely regulated.

Even if wildly unfounded, there is a composite perception of construction that it lacks vision, is steeped in ignorance, is overfilled with arrogance and is not an interesting place for young people to work out new ideas on product improvement, industrial advancement and
societal development. Consumers see construction as a non-industry collection of fragments. Construction is seen as very different from computer and electronic industries where consumers gain the benefits from continual raises in product quality and reductions in product costs. Those industries are seen as constant innovators. Meanwhile the results of construction, as seen in roofs that cost more and leak, and air conditioners that harm the environment while not working, are disappointing.

Construction is even seen as cynical of its clients. Building designers are fond of quoting Frank L. Wright’s dictum: “I have clients in order to build buildings, I don’t build buildings in order to have clients.” (This was a Gary Cooper quotation in the movie version of Ayn Rand’s book *The Fountainhead.*) From this it is easy for industry leaders to refer to clients as bad and arguing that industry improvement requires better clients. Some industry representatives have suggested a need to educate clients about construction.

Perhaps the clients of construction already know too much. If so, we need to change the basis of what they believe and know. The research described here today documents that, while many of the clichés above are partially true, they are relatively easy to change. In fact, on the more innovative fringes of the industry, change is already underway. Much of this change seems to be in response to the emergence and growth of international markets. In international transactions the demands for learning are great and the role of R&D is essential. A new kind of construction industry has already begun to form and started to emerge to meet international challenges. Some of the major players in defining that edge come from outside traditional construction.

Before looking at international construction, let’s look at why traditional construction has been so resistant to change. The resistance can easily be seen in the lore of the university training. The environment of architecture, engineering and construction disciplines is clearly in motion, yet the disciplines appear to work hard to keep their traditional packages sacred and secure. These departments are known on campus for their resilience. More energy seems to go into resisting change than would be needed to carry out changes. The academic disciplines that serve construction need to find a way out from such self-imposed restrictions. The classic
distinctions between design, buildings, civil works and construction have long been accepted in schools, even if they have always been somewhat fuzzy in practice. Now they are becoming clearly counter-productive to the preparation of students and the needs of industry clients. Even the classic distinction between buildings and infrastructures has begun to stand in the way of designing and producing facilities that serve the integrated needs of dynamic organizations. Traditional differences no longer serve the needs of construction, nor its clients.

**Suggestion:** Perhaps we can locate a new conceptual framework around the idea of “facilities.” Buildings, structures, civil works and other kinds of construction projects are all, in their best sense, facilities. They are to “facilitate” the operations of users. Where they can’t help a client, they at least shouldn’t get in the way.

This idea of moving towards the concept of facilities (as industrial products), and away from the concept of construction (as complex projects), comes from the activities of a small group of construction firm executives. They participated in the project I am presenting today. I think it is clear that we need to improve the conceptual framework that lets others, and ourselves, know what we are doing. It is also clear that the framework needs to be inclusive and integrative. Traditionally we concentrated on dividing reality up into parts, and then parts of parts. In this way each individual and firm could specialize in a part and let someone else worry about the whole. We now need to relearn how to manage wholes, the location of the consequences of interactions between parts.

Once we could respond to the most usual of questions: “What do you do?” with some vigor, and even pride, by pointing out that “I do roads, I don’t do buildings or bridges and because I do roads I have little interest in buildings, or those who do them.” Knowledge and responsibility would stop at the street curb. The results of the study pointed out that U.S. schools and firms were especially prone to the fragmented approach to construction. The reasons behind this were suggested before. If we want to move on from this we can learn from a number of companies that appear to have successfully reorganized industry differences and are now managing a very different kind of industry. A number of major foreign firms ($8 billion and above in annual turnover) have even found it to be in their interest to drop the term
“construction” from their titles as they shifted towards an integrative agenda. They now concentrate on producing facilities that intend to facilitate human interactions and purpose.

B. “Why should we/do we internationalize construction business, especially since we have trouble with it at home?”

Human history is filled with arguments for the importance of national identity and the sanctity of the nation state. While clear societal gains have been made through the historic strengthening of nationhood there have clearly been costs associated with it. During the 20th century the costs have grown. It is time to set the logic of nationalism against the need to improve world-wide socio-economic well-being. This issue is especially important to construction. Construction activities are closely tied to nationalism and management of national economies. Construction is frequently used in most countries by politicians and bureaucrats to gear-up or slow-down economic activity, and/or to distribute public moneys to interests they find special.

Regardless of the historic rationale for nationalism, a new rationale for reduction of nationalism is emerging and gaining strength in business circles. Many resources required in construction have already moved beyond the control of single nations; including: ideas, designs, finances, technologies, materials and clients. Even if construction wanted to remain firmly cushioned in the comforts of nationalism it no longer has this option. The debts of many nations are too great to support such behavior and collusion.

Another reason why the international arena of business is intriguing is that it allows (requires) a greater emphasis on the local, coupled to a greater awareness of the global. While this may seem like a contradiction, it in practice is not contradictory since the local is essentially the individual consumer. We see more and more companies recognizing and placing comments to this effect in their mission statements. The most global is where environmental issues, efficiencies in economic exchange, and a rich variety of resources and ideas about business find each other; topics of prime interest to consumers. Nationalism has become an impediment to efficiency in the industries infected with it. It is interesting to see how the local and state levels of government find ways around national impediments and set up trade offices in Tokyo, Paris.
and St. Petersburg. Consumers also largely ignore nationalism, when given a clear opportunity to do so.

Conflict between the local and national has been growing in most industrialized nations, including Japan and Germany, with the local consistently winning. The local level is increasing its responsibility for public welfare and becoming a growing source of the tax revenues and funds management. It is also becoming a sponsor of privatization schemes. The new-found authority that comes with this is being used to bypass the inefficiencies of national markets and seek the possibilities in the international. Signs of the possible impact of this shift in public authority on construction are becoming clear. International business people now see some sense in the hundred-year senseless definition of Ambrose Bierce regarding the true meaning of: “National Boundaries: An invisible line separating the invisible rights of one side from the invisible rights of the other side.” (*Devil’s Dictionary*, 1888.)

Another definition, important to today’s discussion and closer to the management of construction operations, is seen in Bierce’s insightful definition of “logic.” This is portrayed in Figure 2. It illustrates why traditional logic, as well as traditional business beliefs, are caught up in such difficult times. This implies that even the framework behind the logic within which we operate will need to be changed.

Traditional industrial engineering logic, as shown in Bierce’s definition, has permeated the construction industry. It continues to be used to organize and manage construction operations. We clearly need to do better. One place to discuss “better” is via three core issues of what construction is, is becoming, and should be. These are outlined in Figure 3.

2. Shifting the Core of Construction

A: Should Construction be Conceived of as an Industry?

Yes. There is a distinct trend towards industrialization of construction. This was clearly seen in the companies involved in the research project “Conditions of Success.” This is the study from which I speak today.
LOGIC, a noun

“The art of thinking and reasoning in strict accordance with the limitations and incapacities of the human misunderstanding. The basis of logic is the syllogism, consisting of a major and minor premise and a conclusion: thus-

Major Premise:
60 men can do a piece of work sixty times as quickly as one man.

Minor Premise:
1 man can dig a post hole in 60 seconds: therefore

Conclusion:
60 men can dig a post hole in 1 second, by combining logic and mathematics, we obtain a double certainty and are twice blessed.”

Ambrose Bierce, The Devil’s Dictionary

Figure 2. Reasons for the Construction Industry to move on from business as usual.
3 KINDS OF QUESTIONS:

- Should Construction be an Industry?
  YES____ NO____

- Will it have a global dimension?
  YES____ NO____

- Does it have a role in the future?
  YES____ NO____

Answers to these requires knowledge which we do not yet have, yet which we can approximate with research, meaning to search again.

Figure 3. Three kinds of questions about the Construction industry.
Many argue that construction cannot and should not be conceived of as an industry. Some say that, at most, construction is a sector in each national economy. They argue that construction is not sufficiently integrated to be seen as an industry, and that this is its strength. The remainder, including clients, argue that construction is simply a mess. Those inside construction who hold the “mess belief” often use it as the basis to argue that, “Only by the grace of God, and through my innate and uneducated intelligence, do things get organized in construction.” These people, often in the positions of management in construction companies, seem gleefully miserable about the state of construction. They essentially argue that you cannot learn from others how to do well in construction. It is only through first-hand experience, and many years of it, do you acquire the skill needed to understand construction activities. Henry Ford felt the same about early automobile production. Thomas Watson had similar beliefs about early adding machines. Both the auto and computer industries have come to depend on highly trained graduates.

The clients of construction, who usually work in highly dynamic industries, are meanwhile getting increasingly upset with the products from the building industry. The clients need more performance and often end up with less. Architects rise up to tell them that “less is indeed more.” Construction urgently needs to better respond to the rational expectations of its clients. This will require some schema for the rational integration of the parts of the construction process prior to consultations with clients over their needs. In this way, construction and its clients can invest their scarce resources in managing the non-rational aspects of reality.

There are other advantages to organizing the parts of construction into an industry. One is that we can better learn from other industrial groups about what efficiency means and how they manage to achieve it. From this basis we can also begin to conceive of buildings as products which then allows us to truly evaluate their qualities and performances. Seeing buildings as projects allows us to discuss when the process should begin and when it will optimally end, but leaves the in-between as a black box. Perhaps we prefer it this way but we shouldn’t. Many clients already see our projects as products, albeit not very sophisticated ones. Looking at the
complex network of parts and interconnections between them as an industry provides a
beginning.

B. Should Construction have a Global Dimension?

Here too I will argue yes. In fact, as the study results point out, it is the transformation of
companies out from their traditional nationalistic base camps towards a global orientation that is
doing the most to bring the disparate parts of construction together as an industry. As was
mentioned before, since many of the resources of construction, as well as its clients, are already
international, the industry needs to move to find ways to organize this reality. (Elsewhere I argue
that international is a primitive form of global since international can be defined as interactions
between only two nations, e.g., U.S. and Canada. Global is a more fundamental transformation
of outlook and actions, and tends to transcend nations.)

C. Does Construction have a Future Role?

I argue yes to this question as well. Some members of the construction industry are not
aware that this is even a question. They believe that of course there will always be a need for
construction firms, even though economic cycles will cause construction operations to
periodically expand and contract. A number of economists outside construction have instead
argued that as a national economy develops the role for construction necessarily declines. Ranko
Bon, Bovis Professor at Reading University, England, knows most about this question. Those
who believe this to be true often use U.S. statistics, and the declining percentage of GDP seen in
the U.S. economy, as their best example. I think they are wrong but on the other hand just
because there is a continuing need for facilities does not guarantee who will be able to design and
build them. The research presented here found that some of the most exciting changes in why,
what and how we build are coming from outside traditional construction firms. One of the these
examples, a house built as a demonstration in Tokyo, was designed by a computer scientist.

Various discussions about these three concerns will go a long way towards informing the
future of construction. To make the discussions more knowledgeable will require more research
than the industry is used to supporting. By research I here mean “Re-Search, i.e., to again search
those things that are most closely believed.” Construction has traditionally supported some
limited research into restricted areas of concrete. Topics like new mixes and methods of forming concrete are thought to be okay, as long as they aren’t overdone. Current research needs in construction are well above concrete. Some researchers from other industries have suggested that construction R&D suffers tremendously from the scientific problem of “misplaced concreteness.” Some institutional R&D, similar to what was done in micro-electronics and information systems, is needed. Three possible topics for this kind of research are illustrated in Figure 4.

3. Three Possible Research and Development Topics for the International Construction Industry

A. An Industry - Who and What is it?

It was previously pointed out that there is a client need to see construction activities organized into an industry. The major impediment to this seems to be internal. Research needs to be taken into the reasons for construction’s reluctance to become an industry.

Many people within construction dislike the concept of industry. They see it as a means to force parts together around a highly rational process that eliminates the freedom and flexibility they have. They feel that if they are part of such an organized entity they will have less ability to control it. Thus, they do not like it. This belief comes from an outdated view of industry and industrialization. Industrialization has changed a great deal from the days of spinning machines and Henry Fords. It is now simply a reasonable way to organize rational things so there is more time and energy for managing the non-rational, a category of growing importance in today’s world. Where it is disregarded, or mis-managed, the non-rational becomes the irrational. This includes politics, poetics, religions and aesthetics. Industrialization is a way to simply organize those things that can be organized so we can better deal with those items that have traditionally been ignored and which now demand our attention.

Within the report on the research, you will note that I make a distinction between crafts, trades and industries. Most architects feel warm and fuzzy about the term “crafts”. Much of the rest of the industry like the term “trades”, but almost no one relates to being in an industry. We
3 TOPICS:

1. AN INDUSTRY - What is it?
   - Using technocratic process to reduce variety and eliminate the unpredictable, or...
   - Using reason to organize the rational and allow negotiation with the non-rational.
     (Experiences under the streetlight...)

2. THE FUTURE - Where is it?
   - Using consultants to prepare for the next major trend, or...
   - Using employees to create that which ought to be.
     (Is there life after strategic thinking...)

3. THE GLOBAL - What means it?
   - An enlarged playing field for more business-as-usual, or...
   - A setting without the insulation of the usual.
     (Definitions of political boundaries...)

Figure 4. Three topics of discussion about the Construction Industry.
need to look at the three categories more closely. There are serious limitations in the activities of crafts and trades. These limits can be easily managed with sophisticated forms of industrialization while keeping the known advantages of both.

B. The Future - Where Does It Lie?

Companies in other industries have traditionally relied on consultants to answer this question. Most of what was learned was that they shouldn’t have hired consultants to do such important work. They could have gained more by investing in their employee infrastructure and preparing themselves to create a desirable future while trying to find out what the future would be. This would have been a better investment than paying someone else to predict a future out of control, and which no one particularly likes. Some construction companies are just now beginning to worry about their uncertain future and what role they will have in it, and are following the pattern of hiring some of the same consultants to tell them where their future lies.

Construction should leap over this pattern and move directly to doing its own internal research into what its future ought to be, instead of paying others to project where they are headed in spite of what they do.

C. The Global Arena - What Does It Mean?

In its most limited meaning, “global” is a term for an enlarged economic playing field where a firm can get a greater share of the world’s business-as-usual. This attitude has generally led to disaster in other industries. Those who moved traditional operations into the global arena by adding an international division missed most of the new opportunities and found many new problems. To have global operations you must be prepared to manage a very different kind of corporate phenomenon. You cannot simply export your home operations manual. A number of large U.S. companies got away with doing this during the Fifties because they were the only producers still producing; most other countries were involved in war reconstructions. Now there are more and varied providers; goods and services client expectations are greatly enhanced. As long as one firm is willing to change what it does to meet client expectations there is trouble for all those that won’t, or can’t, or who have a cynical attitude towards clients.
It is with these things in mind that the project “Conditions of Success: Internationalization of the Building Industry” was formed and begun in 1989. Figure 5 outlines the three locations where the work was based. The scope of the project was to examine what the conditions would be that surround future construction activities, and what responses would best find success in these arising conditions. The key was with the phenomena of internationalization. Of major interest was who was being attracted to the international marketplace and who would do well in it. The project came to include sixty participating companies who came from seven different countries. See Figure 6.

Many of the participating companies specialized in certain areas of construction such as: materials process, component production, design, assembly, general construction, construction management, real estate development, finance and facility management. This was a very broad range but was essential to the research since we were trying to determine how much a single organization should include and some included the entire range. In this way we could evaluate whether, for international operations, it is better to specialize in limited functional areas or try to include many areas.

Some of you might ask why some of the major U.S. companies joined this study, since you must know that they generally shun spending any resources on these types of ventures. Since U.S. companies are the biggest and best why would they take part? Many joined because some of their major clients were participants early on. Those who took part became aware that they were neither the biggest or best at much of construction. Some of the foreign firms were ten times the size of the U.S. counterparts and were better at several aspects of construction.

4. Conditions of Success: Schematic Results from the Study

There were three stages in the research:

A. To visit and hold interviews with the key executives in the participating companies around five major question areas. The interviews were usually with the CEO or general managers, or executive vice presidents.

B. To formulate, distribute and analyze a questionnaire resulting from stage one interviews.

C. To organize and hold a symposium around the tentative research results for the participants so they might participate in the articulation of the results they found useful.
CONDITIONS OF SUCCESS
Internationalization of the Building Industry

Institute of International Business: Sweden
New Jersey of Technology: United States
Tokyo Metropolitan University: Japan

David Hawk

September 1989 - June 1992

Figure 5. Project: “Conditions of Success”.
STUDY SAMPLE PROFILE

60 COMPANIES IN 7 COUNTRIES

SIZE:
18 of the world’s largest construction companies
3 largest architecture and engineering service firms
3 of the largest materials producers
2 of the largest private developers

TURNOVER:
Ranged from $50+ million to $28 Billion. Mean - $3.9 Billion

AGE:
Ranged from 187 to 2 Years. Mean - 66 Years

STUDY RANGE INCLUDES:
■ Materials
■ Components
■ Design
■ Engineering
■ Construction
■ Construction Management
■ Real Estate
■ Finance
■ Facility Management

Figure 6. Outline of the 60 companies studied.
Figure 7 outlines the areas of inquiry used during the interview stage. Interviews required from between 2 to 3 hours up to 2 to 3 days depending on the breadth of the person/firm being interviewed.

Figure 8 illustrates the ranking of what the executives felt to be the most important issues for construction over the next decade.

Dominant Issues for Reorganizing Future Construction Activities

- Environmental Concerns

  The list is topped by environmental concerns as the most important. It came to be defined during the project in two respects: a) as short-term environmental clean-up being an area of major work and b) the growth in long-term environmental values in the client base which would require rethinking of design and construction. An example of the second involves the growing importance of environmental concerns to the approval process. In one instance there was a plan, design and financing for a $250 million theme park. The companies sponsoring it felt their proposal was such a good idea, based on the economic analysis that they did (involving traditional measures of employment gains and economic spin-offs), that they didn’t bother with environmental concerns. Their proposal is still on hold due to English environmental review and a neighborhood that was more interested in its rolling hills than its needs for employment. The companies later agreed that the stoppage probably could have been avoided had environmental values been included in the community discussions; i.e., if the non-rational had been included in the design and proposing of the project, the later “irrationality” could have been avoided.

  Further down the list were other issues dealing with technology, quality and efficiency. It is worth looking more closely at the one of quality.

- Quality and its Cultural Bias

  Quality was important in the study since it had grown into such a topical area for international production firms during the latter part of the 1980s. It emerged in this study but not as rational phenomena that needed to be increased. Quality came instead to be defined in the non-rational camp due to its definition varying between nations and cultures. This was most
CONDITIONS OF SUCCESS
Internationalization of the Construction Industry

- **Construction Product**: Consequences of Process Construction as an Industry, a Sector, Ambiguity, a Mess?
- **Company Size**: Breadth, Depth, and/or Vision.
  - How big should you be? Does it matter? Why?
- **Locational Focus**: Local-National-International
  - How should you perceive yourself? How should you be perceived?
- **Employees**: The critical resource
  - How to attract good employees. How to keep them
- **Models of Operation**: European, Japanese, American
  - What will be important in the 1990s? Who will be successful?

October 4, 1990

Figure 7. Conditions of Success: Internationalization of the Construction Industry.
CONDITIONS OF SUCCESS
Issues from Interviews

■ ENVIRONMENTAL CONCERNS
   1. Environmental clean-up as a potential
   2. Environmentally conscious design & approvals

■ TECHNOLOGY
   1. Where are they?
   2. How do you enter them?

■ QUALITY
   1. How to raise it?
   2. How it can differ between cultures?

■ EFFICIENCY: How to achieve it?

October 4, 1990

Figure 8. Conditions of Success: Issues from Interviews.
clearly illustrated in the study by the different definitions given by each national grouping of companies.

Quality in Swedish construction was described via attributes of thermal integrity of the building envelope. It was measured in terms of centimeters of insulation (30 was optimum) and panes of window-glass (3 was optimum). Quality in Japan was seen quite differently. It was measured in terms of the visual alignment of surfaces and components. If the ceiling and walls of a room lined up perfectly you then had the basis of a quality building. Many of these same buildings had single pane windows but quality was associated with the same variables as in Sweden. It was seen in the fit of details and detailed components. Quality in the U.S. was yet a third indicator. It was most often referenced relative to how many projects a firm had completed since last being taken into the courtroom.

We in the project steering committee considered this to be both interesting and important. It was the basis for why we began to look for a set of measures that were less culturally biased than quality. The result was a shift in emphasis towards efficiency, and how best to improve it as the key measure of success. This shift turned out well. During the study we uncovered situations where an attempt to improve efficiency actually ended up with increased quality as a by-product of better efficiency.

The Questionnaire Phase of the Study

Another level of information was gained from questionnaires. These were sent to the firms about three months after interviews. I have almost never used questionnaires in my research. What made this project different was the input from the participants in designing a questionnaire and insuring its importance. The idea for a questionnaire began in the early interviews. At the end of the first few I asked what they would like to ask the “industry” if they could ask any question they wanted. Their responses provided such probing questions that I suggested to the project group that we organize the questions into a formal questionnaire. The questions proved to be quite sensitive and close to the core of operations for each company, but no one was forced to fill out a questionnaire. The only stipulation was that, to gain access to the
composite results, a firm had to fill out and submit a questionnaire. Most ended up submitting theirs. The twenty-page questionnaire covered such topics as:

- How much did you make last year?
- Which business area was most profitable?
- What do you consider the most important R&D subjects over the next ten years?
- What technologies will be most important to the industry in ten years?
- What countries do you want to set up operations in?
- Who would you like to team up with in that country?
- Who is now your biggest competitor?
- Who will it be in ten years?

Some illustrations of the composite national results follow. (Each individual company’s responses were combined into national categories.)

- Organizational Layers
  
  Figure 9 depicts an important aspect of the information resulting from the questionnaires as it relates to management. The question addressed the average number of layers of the company. In the 1990s this is seen as an important topic to management change, in that fewer levels are presumed to be better. Along with the prime question was the question of how optimal this was felt to be. U.S. firms had the most layers, with an average of eight, and this was considered about right. Japanese firms had less with an average of 7.5, and they wanted to reduce this. The English were surprising. They ended with the least. They averaged six and felt this to be optimal. It was surprising because they are considered to be the most hierarchical in practice in international business education.

- Major Problem for the Coming Decade
  
  Figure 10 illustrates a listing of what each national cluster felt would be the major problem during the next 10 years. Everybody, except the Swedes, saw their most difficult challenge to be attracting higher quality people into the industry. The Swedes felt their major problem to be finding ways to decentralize their operations and responsibilities, which is consistent with what is going on in Swedish business culture.
<table>
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<th>Language</th>
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<td>Should be reduced</td>
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<tr>
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<td>Optimum</td>
<td>Decreased</td>
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Figure 9. Number of layers existing within different organizations on national basis.
<table>
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<tr>
<th></th>
<th>Attracting Quality People</th>
<th>Retention</th>
<th>Lowing Production Costs</th>
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Figure 10. Key management problems for the next ten years.
• Reasons for Acquisitions

Figure 11 displays the major reasons behind companies in the study making acquisitions. For German companies it was to acquire new technology. For Americans it was to acquire some expertise. Both the Japanese and Finnish companies felt that acquisitions were primarily a means to grow larger.

• Factors Impeding International Expansion

Figure 12 illustrates the list of factors considered important for international expansion. In all countries except the U.S. and Germany the most important factor for internationalization was to find appropriate management skills. For the U.S. firms it was developing a local presence and for German firms it was having the right technology. This is more or less in line with the prevailing logic of the business cultures of the various countries, especially that seen in their business schools.

• National Opportunities from International Operations

Figure 13 displays some of the significant national opportunities for international operations. For Swedish companies it was to help process integration. For U.S. and German firms internationalization was seen as a means to smooth out national economic cycles. (i.e., This meant going overseas when the home economy had turned down.) The English saw it as a means to get access to Asian markets while the Japanese saw it as a means to access European markets.

• Degree of Vertical Integration

Figure 14 is one of the more important items. It depicts the level of vertical integration of a single company common in each country in construction. Swedish companies tended to include and integrate most aspects of the entire building stream. They saw this as a major business strategy for product integration and client service. They included the range from materials to money. American companies, on the other hand, tended to focus very narrowly on
### REASONS FOR MAKING ACQUISITIONS

<table>
<thead>
<tr>
<th></th>
<th>To Grow</th>
<th>To Broaden Home Market</th>
<th>To Access Foreign Markets</th>
<th>To Acquire Technology</th>
<th>To Acquire Expertise</th>
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Figure 11. Reasons for making Acquisitions.
### FACTORS IMPORTANT FOR INTERNATIONAL EXPANSION

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<th>Local Presence</th>
<th>Global Perspective</th>
<th>Technical Knowledge</th>
<th>Management Skills</th>
<th>Alliances</th>
<th>Integration</th>
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Figure 12. Factors Important for International Expansion.
### Significant National Opportunities

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<th>Process Integration</th>
<th>Ecological Shifts</th>
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<th>Future Infrastructure</th>
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Figure 13. Significant National Opportunities.
Figure 14. Vertical integration in companies by country.
parts of the total building process. They saw this as a means to specialize and do what they do more efficiently and cheaper than anyone else. Not only might a firm specialize in finance, or managing the construction of a specific type of building, it would specialize in certain financial instruments or certain size buildings. The problem with the Swedish approach is that they may not be the best at everything but, on the other hand, if you can accomplish a well-integrated product you may not need to be the best at each thing. The trouble with the U.S. approach is how to integrate the activities of the ten to twenty firms involved in each project. In addition, whatever you may have specialized in may disappear from the market. If you are highly skilled at managing relations with other firms, and clients, and can quickly adapt what you do then you may do well with the U.S. approach. As buildings become more complex the management challenge becomes large.

- Anticipated Company Growth During Coming Decade

Figure 15 illustrates what each national cluster felt to be the probable growth of their companies during the next decade. The French were the most optimistic, with an expectation of 700% growth. The Germans were the most pessimistic, with an expectation of 20% growth. The others were in between.

- Anticipated Growth in Revenue per Employee During Decade

Figure 16 shows what the composite national groups expected in terms of their revenue per employee change over the next ten years. Once again, the French and Germans defined the edges of the industry with everyone else falling in between. For the French the expectation was that they would gain 400% per employee. For the Germans it was 0% per employee.

5. A Summation: Construction as a Value-Adding Process

A comprehensive research conclusion came from identifying a value-adding description of the building process. The objective was to get a sense of where future value-adding activities
Figure 15. Anticipated company growth during the next ten years (By country).
Figure 16. Anticipated company revenue/employment during the next ten years (By country).
would lie in the total building process. Figure 17 lists some of the key changes where new value adding has entered the building process over the past few decades. During the 1970’s construction management reorganized the value-adding process. During the 1980’s it was through new methods of financial planning. During the early 1990’s it seemed to lie with improved product design, methods of industrialization and procurement. It is critical to point out here that design capabilities came to be defined as different from what architects and engineers do. Many participants in the study saw architects and engineers as weak aspects in the total process. The executives in the study generally saw design talent as becoming a combination of organizing and managing skill. This required someone who could fit very diverse parts into dynamic patterns. They saw no specific disciplines capable of training this type of designer. In fact, the individual needed to be multi-disciplinary in attitude and skill.

Figure 18 puts Figure 17 within a larger context. This gives a sense of where ideas are going in the changing building process. The chart begins with the ideas that launch a building project that arises from some articulation of human need(s). Once there is an idea the process of making or modifying a facility begins. The right side of this value-adding stream is like a mine from where new topics or approaches are taken that change the way in which the process operates. In each era some new approach is mined. In the industry this is often called a “hot button.” Once things seem to stabilize around the new approach another approach begins to germinate. Sometimes these are internal to the industry but often they come from an outside influence, e.g., clients. This can be seen in looking at the building idea phase. In the 1970’s the hot idea was “marketing to clients.” In the 1980’s it was speculative development. During the 1990’s it is “creation of clients.” Keep in mind that this is where and when the new approaches get introduced, not when they find mainstream acceptance. (It is only now that the mainstream is looking at client creation as a way to add value.)

Within the site phase of the process the important item for adding value during the 1970’s was site acquisition. During the 1980’s it was real estate development and during the 1990’s it is product development as a way to overcome the problems of repeated development approvals. Within the design phase the interest in the nineties is to transcend the limitations of architecture
CONDITIONS OF SUCCESS
The Construction Value-Added Chain

- Construction Management 1970s
- Financial Planning 1980s
- Design and Organization 1990s
- Procurement and Industrialization 1990s
- Other... Beyond...

October 4, 1990

Figure 17. Conditions of Success: The Construction Value-Added Chain.
Figure 18. The Building Industry - Value Adding Chain.
and engineering and find organizing capabilities that include both plus more. For finance the
current interest is with methods of arranging instead of practices of borrowing or procedures for
lending. Procurement is now moving into industrialized systems development. Assembly has
moved from construction management to project management and now to program management.
Within ownership the current potential for adding more value is directed at facility utilization
instead of facility management. This means getting rid of space, or even facilities, instead of
managing their energy use. This relates to new office management techniques and technologies
in use in Northern Europe and Japan that allow more workers to use less office space. In some
instances it reduces people's need for offices up to 75% while enhancing teamwork.

6. In Conclusion

I offer three recommendations to conclude my portion of this symposium. They look a
bit abstract but hopefully I can explain a bit of what each means. See Figure 19.

1. Shifting from a passion for productivity towards an emphasis on
efficiency.

Instead of worshipping the objective of achieving more product with fewer people we
need to seek better product from reduced use of all resources. This will require a change in the
way in which we measure success. I believe the concept of efficiency is a much better evaluator
of what we do. It is closer to total-factor productivity, as distinct from labor productivity, and is
concerned with everything that comes in and everything that goes out, including the pollution,
diseconomies and legal process.

2. Shifting to conceptual distinctions in construction that can integrate and
away from differences that disintegrate.

Instead of spending a great deal of time with differences between male/female,
black/white, roads/bridges, etc. we need to direct our concern to differences between:
ignorance/knowledge, wasteful/efficient, worthless/valuable, etc.
RECOMMENDATIONS:

I. Shifting From a Passion for Productivity to an Emphasis on Efficiency

Instead of more product from fewer people, we seek better product from fewer resources.
(This will require improving our measures of success.)

II. Shifting to Distinctions that Integrate instead of Differences that Disintegrate.

Instead of explicit criteria of male/female, black/white, buildings/bridges we look to implicit differences in ignorance/knowledge, hard/soft, wasteful/effective. (This will require learning to learn.)

III. Shifting to Continuous Organization of Discontinuous Parts instead of Orders that Alienate.

Instead of relying on methods found in traditional models of design, production and management, that tend to disorganize, we seek approaches that tend to integrate. (This will require appreciation of the environment.)
3. Shifting to management styles that continuously reorganize discontinuous parts and away from strict orders that alienate.

Instead of continuing to rely on classical methods of design, production and management we need to find ways to continuously improve how we do all three of these. Recent evidence suggests that we might want to even drop the traditional walls between these three activities. This can be seen by looking at what is happening in other industries. As other industries move towards the idea of single-copy production they might also be able to learn from construction.
COMMENTARY FROM INDUSTRY

Stanley P. "Mickey" Steinberg
Executive Vice President
Walt Disney Imagineering

The best way to start is by answering David Hawk’s three questions:

1. **Should Construction be an industry?**

   In my opinion, it has always been, it still is, and it will continue to be. It is just disjointed and we have not been able to put it all together. There are a lot of people whom I know and with whom I have talked during the last thirty or forty years who felt that all along. They just have not been able to put it all together. Most of us at that time were too young to do something about it and now we are too old or too tired to do something about it.

2. **Will it have a global dimension?**

   It already has, whether we like it or not.

3. **Does it have a role in the future?**

   There is no question about it! Construction had a role since the first caveman moved into a cave in order to occupy it. Since then we have been in the construction business, and it will remain with us.

   However, there are a lot of things that Dr. Hawk said, but my viewpoint is a little different. In order to understand my viewpoint you have to understand my experience with these issues. As I said, I have been in construction for many years and I have worked in many cities in the U.S.A. (Atlanta, Chicago, San Francisco, Detroit, Dallas and Los Angeles among others). I have worked in many foreign countries (Singapore, Brussels, Tokyo, People’s Republic of China and Hong Kong). Lately I have been working in New York. I do not care where the project is; if you have certain things in place, the project is a success. If those things are not in place, then the project is not a success. I have listed a few of these factors. At the top you must have an owner who knows what he wants and who will make the decisions. You have to have financing that is run by
knowledgeable people. You must have someone who will manage the entire process. Everyone has to understand what is expected of him. You must have a procurement plan in place. You ought to have construction management that is clear and makes quick decisions. You must have a process for conflict resolution that is quick and fair. You must have coordination and communication throughout. There has to be trust and integrity; and, finally, everybody involved must make a fair profit. If you do not have these things, no matter how well organized or no matter where you come from, it will not be a good job.

I am not defensive about Americans. There are a lot of things we need to improve, but there is nothing for which we have to apologize. I have a different point of view about some of the companies and some of the things that Dr. Hawk talked about. My point of view is just different than his because, in the sixteen different companies where I have worked in the past, I have worked at a different level; I have worked as an executive for those companies. Either I had people working with me or people working for me.

I would like to share with you my observations, based on my experience in three countries: Japan, France and the U.S.A. I consider this to be very important in order to have a balanced view before we decide what we do about things. I think that what is most important about companies in foreign countries is to examine the conditions that shaped their performance.

Starting with Japan, I have been involved with the Tokyo Disneyland for the last six years; and before that, I worked with Japanese companies at other places. First of all, the construction industry in Japan has been, as far as business practices go, one of the most unique I have ever seen. It works very simply: company representatives sit around in a room and decide who gets what job and the chosen company decides how much it will charge to complete the job. So far, they have been able to do that because they have had far more work than they can do since they were allowed to keep any foreign company out. This has been their business practice for years; but these things will soon change since many countries have decided to retaliate. The Japanese have so much work to do that they can pick and choose. Some of the results that Dr. Hawk showed are results of a country that had much fewer people than they had work for them to do, so they made huge capital investments. We finished the Disneyland in Orlando six months earlier than the Disneyland in
Tokyo although we started nine months later. Their cost was 87 percent higher than ours because the Japanese government was getting very high taxes out of the Japanese workers. That money was used either for R&D or used to buy real estate in the United States. On the other hand, when Japanese come to the United States to undertake construction projects they do what the American companies do: they hire local subcontractors and designers. I do not wish to degrade what the Japanese are capable of, but they had certain advantages that right now are disappearing. A proof of that is the fact that the cost of construction in Japan is dropping rapidly simply because they don't have enough work; they are in a recession.

I also worked in France. I spent three years building the Eurodisneyland. Its cost was 1.4 billion U.S. dollars. We used contractors from eight different countries and major suppliers from sixteen different countries. It was a very interesting experience, but you have to understand the French construction methods. The French method of construction grows out of laws, just as the Japanese method of construction grows out of business practices. These laws were based on Napoleonic law which makes contractors responsible for everything built in France. So the law puts the responsibility and therefore the control into the hands of contractors. The architects became nothing more than providers of very quick preliminaries. So what we did was to go along with an international contractor. The French government gave us permission to be ultimately responsible for everything, because there were examples of public companies in France (e.g., the railroad) that had done the same thing in the past. And this is the reason why we managed to finish the Eurodisney project on time and on budget. After the project was finished I was approached by somebody in the British Government and he asked me if I would attend a Symposium where I would explain how we managed to finish the first major construction project of high quality that was built in Europe, on time and on budget. I refused because the shocking truth was that everybody who worked for the project on site knew that the project would not finish on time and on budget. They believed it and they acted that way. When they start a major project in Europe they know that it is not going to finish on budget and on time. They expect it, and they act this way.

The last country I want to mention is the United States. I have a lot of heartache with the United States because I think we could do a lot better. It seems to me that our industry is shaped by
liability, litigation and in the past by unions. It is shaped by the concept of everybody trying to pass liability on to somebody else. It goes around in circles. Everybody is to be blamed: the A.I.A, the contractors, the owners, etc. We have to decide who is liable for what. All the parties involved think they ought to have control, but not be responsible for it.

One of the unhappiest things that happened in the construction industry is the current concept of construction management. Most people would disagree with that, but in my opinion, the concept of construction management practically has been going on forever. In the past, contractors performed construction management until problems in New York forced contractors to the point that they could not accept the liability of building in New York. Out of this came the concept of professional construction managers who came and assumed all the control and no responsibility. Beyond that, in order to prove themselves worthy, they took the contractors and broke down their work in pieces. They started trade packaging and squeezing everybody down. I think that is a horrible mistake. In order to correct it, we must take the industry and develop processes that will be easily understood and that will work. The existing processes worked then, but I agree with Dr. Hawk, they are cumbersome and very expensive. All this coordination we undertake is costing us a lot of money.

I think the bottom line of what we need is better owners. In the past, in our attempt to fill the gap, we used professional, surrogate owners; but I do not think that this is the answer. A lot of people call themselves program managers, project managers, integrators and professional developers. But until we include the owners as part of the industry and until we explain to them how the process works, it will never be integrated. In my opinion there is a big difference between a construction manager and an owner. A construction manager is driven by only one thing: money. He wants to do everything in the cheapest way possible, not in the quickest way but in the most cost-effective time; and he wants to provide the quality he is contracted to provide, but in the cheapest way possible. There is nothing wrong with that; if we are not cost effective, we will lose competitiveness. On the other hand, the owner must look at the broader picture; he must look at everything. He has to know what he really wants, and for what he is willing to pay. Therefore, the construction manager and the owner are not one and the same thing. People who have tried to
make them one and the same have gotten into trouble. Our problem is that we do not have a clear picture of the total industry.

Here I would like to mention something that Dr. Hawk wrote in his book: that in our industry there are a lot of badly trained people. For years, contractors have relied on unions to train people. We do not train them on how to use new tools and on how to accept new tools. We have not accepted information management yet, but we simply use the new technological innovations as a method to produce a paper.

Although there are a lot of areas where I agree with David Hawk, I do not believe that a lot of the companies at the top of his charts really produce in the way their position reflects; or in a way that reflects what their organization at the high level says they ought to produce. I think that a lot of foreign companies are buying American companies in their effort to expand, to acquire management skills and get knowledge bases. But on the other hand I agree with Dr. Hawk that we must learn how to integrate the construction industry but not necessarily vertically. The model of vertical integration was tried by the automobile industry and especially by the Ford Company. It did not work and as a result that plant was closed. We have an opportunity to bring a concept to the construction industry and develop it, and this is what the Construction Research Center at Georgia Tech ought to be doing. Otherwise, contractors will always be at great risk, never make a proper profit, and they will continue going in and out of business. In my opinion American companies still manage to do a good job, but we can do a lot better.
I am here as a representative of Georgia Tech and its academic environment. Georgia Tech provides a very nourishing environment for having the kind of impact on the industry that we have heard about so far.

I have several concerns when research is presented in a way that asks more questions than it answers. The construction industry is an example of how difficult it is to arrive at a common language, or "construction Esperanto," in which everyone is talking about the same thing. Unless we are able to define a theoretical base and some kind of common set of definitions we will never get anywhere. Without these two tools, how are we supposed to teach students? In academia, we are a mirror reflection of what is going on in the industry at a bigger level.

To begin, I think that trying to define the construction industry in simple terms is a futile exercise; one cannot get consensus among the different companies in the industry. I think that my background as an architect, as well as a civil and construction engineer, gives me some insight into how different people in our industry think. Through my research in the area of design construction integration, I have been trying primarily to answer one fundamental question: "Things that need to be designed also have to be built; so, if designers design and builders build, and there is a big gap separating these two, how can we ever get anything done?"

In order to get things in order, I will highlight some of the dimensions that I see surrounding the problem of defining construction as an industry. We have four traditional sectors of construction (building construction, civil infrastructure construction, industrial construction, and residential construction), executed within the private or public sectors, where each one of the "facilities" built is different. What percentage each one represents depends on whom you ask, and what you want to use as a source of your data. In addition, two additional types of construction today are affecting how we do things: environmental remediation and
infrastructure rehabilitation. Although these are outside the scope of construction as we traditionally think of it, they still fall within the realm of the construction industry.

Another dimension is the fact that we are living in a world of 200 different countries, each one with a nationalistic focus, and yet we are forced to live in an economy that is more global, in a world of communications that is more global, in a world where Coca Cola and English can be found at the smallest and most distant village. Therefore, we have to face the fact that we function in a wide arena, from very local to very global.

Furthermore, when we are talking about construction, what portion of the life-cycle of a facility are we addressing? Does construction include that initial need or idea that states: “We need to have a facility.” Does the word construction include planning and all the preliminary studies that were performed during the initial stage of the process? Does it include the design, not only the architectural design, but every subspecialty of engineering design combined with every subspecialty of interior landscaping, acoustical and every other specialty?

And then we have to build the facility. We have companies that will do the management of construction or programs of construction. We have contractors and subcontractors, vendors of equipment, and material suppliers. Are all these part of the industry? Are we including the people that dispose (demolish) of built facilities as part of the industry? If we look at the construction industry as a life-cycle that never ends, what are the boundaries?

Also, we have to ask the question: Who are the stakeholders of the construction industry? Are they the consumers, the owners (whether private or government), the designers, the constructors, the suppliers, the material vendors? Do we include the lawyers who benefit from the highly litigation-prone environment we operate in; or the agencies that underwrite the regulations and impose standards; or the financial entities that provide the money for the completion of the project? This is another dimension we cannot avoid.

Then we get down to basics. If you want to build a facility, you need an owner who knows what he/she wants; who needs to have a good scope. Without a scope you do not have a facility. Once you have a scope, you have an execution plan that will guide you in building that facility. Then you break the plan into three different stages: the design process, the construction
process, and eventually the utilization process. In addition, we need to find ways to pay to design the facility, to buy everything that goes into the facility, to build the facility and to use that facility. At the general level you need to define the context surrounding these processes: contractual arrangements, strategies or alliances, communication processes, decision making processes and conflict resolution processes among all project parties. At the specific construction level, you need to define labor, materials, equipment, and the methods of combining these elements.

All the above are the true dimensions of what we are dealing with, and this is quite a challenge! While we are trying to define the construction industry, and decide to include or exclude any of these parts, the following questions will arise: “How can we do it better? Is it worth doing at all?

I look at construction in very simple terms: whether for business or for government every new facility needs to have very specific objectives. Those objectives become the primary drivers for the total development process. However, one needs to understand and to distinguish between what drives the organization developing the facility, and what drives the process of facility development. Each one is half of the equation.

A facility must support the objectives of the organization; otherwise it is only an exercise. In addition, the facility must have a functional purpose. To achieve these two goals there are two paths that develop in parallel and which one cannot neglect, each one with its own set of challenges and characteristics. One of them is the technical definition of the facility which defines the “what,” the product itself, whether it is a tunnel connecting a continent with an island, or a downtown high-rise. This is not a simple process, because the coordination that is involved and the lack of integration between all the participants in this part of the process pose a great challenge. Although there are technologies emerging to support this process, they are not yet part of the process.

The second path is the management process required to make the facility become reality. There are three different areas of management: Technology, whether this is information technology or technology in the field; Resources, whether these are people, equipment, financial
space or energy; and **Processes** - scope definition, conflict resolution, decision-making, construction methods, change orders, etc.

And if all this were not enough, we also have the other traits that Dr. Hawk discussed. I will cite a list of things that the construction industry needs to be:

1. The construction industry must be responsive to client needs. These needs are changing at both organizational and project-specific levels.
2. As an industry, construction needs to be innovative. Innovation refers to products, to processes (technical or management), and to markets (we need to pursue things that are not traditional).
3. As an industry, construction needs to be value-adding, fast-paced, more effective in its delivery and much better in optimizing the use of its resources.
4. As an industry, construction needs to be contextually sensitive. It cannot driven only by its own goals, but it also has to be sensitive to local, national and global needs.
5. As an industry, construction needs to define and create a true knowledge base.
6. As an industry, construction needs to be less self-centered and less self-contained, and really learn from other industries.
7. As an industry, construction has to be culturally and organizationally responsive to the current competitive arena. We need to incorporate strategic planning processes into the construction industry, as well as other ideas taught in the different Schools of Business.
8. Finally, as an industry, construction must have a focus on life-long learning. The construction industry must learn to learn. In the U.S.A we are facing one particular problem: the complete erosion, degradation and diminishing number of skilled workers. Unfortunately, we are not using today's technology to try to train workers.

Finally, as far as research is concerned, we need to come down from just being able to identify the problem and making intellectual discourses about what is wrong or how things could be done, to the real nitty-gritty solutions that have the opportunity to have an impact. Such an example is one research project that is being done under the auspices of the Construction
Research Center: an effort to develop a knowledge shell that will be used to teach and train people in cost estimating.
David Hawk: I am sorry I did not point out to you something in the booklet. I mentioned that there were 60 participating companies, yet only 59 companies are formally listed in the booklet. This was because one wanted its name to remain unknown to the other participants. I think its name is now largely unknown to its former clients as well.

I should make a couple of responses. In his comments Mickey raised the issue of collusion. I agree with him, "collusion" between companies in construction is quite important in Japan, certainly more explicitly important than it is in the U.S. But that does not mean that the U.S. has no collusion. (Collusion is where the major construction firms get together and divide up the major projects.) What has irritated the U.S. companies is how the Japanese companies openly meet to see who is capable of doing how much of each governmental project. In the U.S. we are more discrete about this allocation process, except where politicians favor a local firm back home, or where minority bidding enters the picture. One major U.S. firm pointed out why the "preorganization" of bids is important: "It costs us 0.5% of a total project cost to make a formal pre-design and produce the bidding documents on it. If we lose a half a dozen of these large projects we are out of business. Because of the governmental requirements of the bidding process, we cannot afford to lose many." In all countries we looked at where there were mechanisms for the major companies to "allocate" major public works projects.

In both Japan and the U.S. there is less "collective consultation" (collusion) for work in the private sector. Private work is highly competitive, even when a client seems secure. The major difference with Japanese firms is that the decision of clients is based on the kinds of R&D the construction firm does; in the U.S., R&D is more based on price. Perhaps the lesson to be
learned is that in the complexities of the international market place it is possible to do and say almost anything we want, at least once.

As far as the issue of research is concerned, I think we can learn something from the Japanese. Construction research in Japan has less to do with public works than we might want to think. The idea that it does comes from U.S. contractors being upset that the Japanese government requires a company to dedicate 1% of turnover to R&D in order to pre-qualify for public bidding. U.S. firms thus conclude that research is a government cover to keep U.S. firms out. Even if true the consequences of it go well beyond being a cover. If you look closely at the R&D operations in these $100 to $200 million per year company labs you will see that much of it is impressive, and it gets contracts from the private sector, including many U.S. clients like Motorola. In the private sector the competition of construction work is much harsher than we have in the U.S..

As far as the Disney experience in Japan and Europe goes, and what might have been involved in it, I don’t know. There were quite a number of articles about both in the Wall Street Journal but I assume that Mickey knows more than the Journal about both ventures.

I do have documentation on another U.S. managed major construction project in Europe. It is the Mesa Building in downtown Frankfurt, Germany. It is the tallest building ever built in Europe. It was done by an American group. Its process, product and the financial results are not reassuring. (By the way, a good share of the money behind it was Japanese.) Although the U.S. development firm was excellent in their U.S. operations, and was filled with talented people, they somehow never learned to adapt to, and get organized around, the qualities of the European context. The U.S. managers somehow thought that international standards were synonymous with New York City standards. They were not and are not.

Another point I should clarify comes from the Stockholm Symposium that I mentioned at the outset. I repeat that there are two major formats for going international. One is on a technical-physical stream, which entails a great deal of R&D and homework. Two is a financial-developmental stream, which entails analysis and being fortunate. The Japanese firms are clearly in the first camp. The U.S. firms are just as clearly in the second. What do I mean by a
"technical-physical" stream? For the Japanese it means having a production system that can produce a twenty-story building with essentially no workers. It is interesting that a great deal of the money the U.S. firms are playing with, such as that used in the Mesa Project, is Japanese money; money made from the technical-physical fascination with the long-term.

I would recommend that we find a way to take the Japanese approach seriously. I do agree with Mickey that if we need a model for the construction industry that we should look at automobiles. Just look what happened in the 1970s relative to the U.S. auto industry. The U.S. companies may be finding ways to come back but we should be careful in thinking the storm is over. Construction seems to be just now going into the events of the 1970s.

As far as Jorge’s response goes I appreciated the fact that he raised more questions than provided answers but I guess that is what academics do best. He raises the concern about too much of the CRC research program dealing with issues of environmental wastes, and how that may not directly relate to buildings. Perhaps direct relations are not as easy to see as they once were. We may need new ways to follow and find relationships. I am reminded by a recent lecture that the CEO of Techwipe gave one of my classes. His firm has about 50% of the U.S. and Japanese markets for providing materials for cleaning clean rooms. He pointed out that this doesn’t mean much with companies like Toshiba versus Intel. Toshiba has virtually no waste to clean up while the U.S. factories are covered with wastes. He traced it back to the facilities they were each in as well as the way in which they were managed.

Jorge rightly points out how low the profitability is in the U.S. construction industry, especially in the design and construction areas. Those two parts of the industry are primarily responsible for low profitability due to the wastes they generate and the way in which they manage operations. They must both learn to do better.

Bob Silverman: I am disappointed in that we did not discuss the benefit and the strength of our diversity and our fragmentation. I thought about doing everything in our construction site with my own forces and it would be absolute insanity. I have looked at other countries where companies do that and I have looked at our own country where big projects and big
corporations do that kind of thing and the cost is astronomical. When we have small companies that manage at risk and care so much about those small projects we find that there is a sense of community and a sense of pride; but there is also a sense of "hands-on" management. It is a tremendous benefit to us and a uniqueness of our industry when we do that. I wish that we had talked about this benefit.

I went to Finland and I have dealt with the companies that were vertically integrated and I have seen their R&D. They proudly showed me an office building that was being built for an insurance company. At the same time I was building a similar building with a similar square footage here in the United States. I was really taken by the pride of the craftsmanship and the way they treated their craftsmen with respect. An office with hot running water was created for the craftsmen to take a shower before leaving the job. Our men do not shower before leaving their job. They do not change their clothes and they are not served a hot meal. Every Finnish worker by law must be served one meal every day on the construction site. But their buildings cost over twice as much as the same buildings in the United States.

I also looked at the power plants that we built and the huge integrated corporations that delivered them, and I see such horrible inefficiencies. When I was building in Georgia I was losing workers every day because the word on the street was that you do not have to work and you get paid three times as much. Why do the big companies even tolerate that? It is only because of the ownership. The owner lets them get away with that.

**Cecil Alexander:** Mickey, your comment that we need more intelligent and better owners reminded me of something that Governor Maddox said: "The problem with our prison system is that we need a better class of prisoners". Nevertheless, I think you are right on and I am wondering if one of the programs that the Georgia Tech core curricula presents is a program of instruction for building owners? It would give to the owners the information needed so they would know what to expect from the building industry and what to expect from the architects or the contractors; and how to position themselves internally to get the most out of the product that they are paying for.
Mickey Steinberg: My reaction to that would be: "That is an excellent idea." We should start with something. I get so tired with somebody telling me: "I hired the best architect and contractor I could; and I do not understand how I have gotten into this trouble". I think the more opportunities we have of educating the owners the better off we will be. There are a lot of potential owners who would not know where to go to get that; and I think that if Georgia Tech did it would be the first school with such a program in the country.

In my opinion, our problem is how to produce in our education system a human being who can deal with what has been talked about here, in a knowledgeable, informed and successful way. And more importantly, what is the educational background that leads somebody to become a capable and informed practitioner or contractor.

Bill Sims: One of the questions is: "Are we producing in our educational system people who can deal with construction in a knowledgeable, informed, and successful way?" And more importantly, what is the educational background that would lead one to be a capable, informed, practitioner or contractor. Is the person that we are sending out to put all this diversification together capable of doing it? Where do you get this foundation and understanding? There is only one place: The Educational Institution.

Jorge Vanegas: I believe that unless the industry provides the leverage in the form of financial support to academia, that academia will not change on its own. I think there is no culture yet to promote that idea.

Ennis Parker: We are sitting in a microcosm of what we are talking about right now. This is the Institute of Paper Science and Technology. This has three purposes for existence:

1. Teaching
2. Information Transfer
3. Research
Twenty six member firms own this organization and financially support all these functions. In order to become a member a firm has to pay dues ranging from $250,000 to one million dollars per year. The only purpose for its existence is to support the development of the paper industry in the United States. The reason it exists is because of the competition that comes from the Scandinavian countries as well as other countries of the world, and because there is a huge investment in research. It seems to me that if we took this as an example (although the paper industry is neither as complex as the construction industry nor has as many components), nevertheless the challenge that we set for ourselves to attempt to do is this sort of integration. In order to do that, I agree with Jorge, we have to do those three things. We have to find a mechanism to bring the industry together and to fund research, both specific and general research. This is a digression but I think that the orientation that Construction Research Center has at this time is toward a product research, toward technological research and that is not the problem. The problem in our industry in my opinion, is finding a way of doing things, not so much what to do but a way to do things that is more efficient and more effective than the way we do things right now.

Georgia Tech in my opinion is the best place in the United States to address these kind of issues, because we have a fine Engineering School, we have one of the largest Architectural Schools in the world and we also have a great management organization; and the engineering curriculum spans all the disciplines that are involved in construction. It seems to me that the mission of the CRC should be to attempt to draw on all the resources of this institution, and try to focus all those resources on all the processes which compose our industry. In my opinion research should involve more than technological research. Part of the research should focus on all the processes from the very inception of the idea of building the building, through to the actual end of the life of the building.

**Bob Silverman:** I wish that the architectural profession would stop thinking of its own professionals as professional designers. I wish that Architecture could be the Liberal Arts of the construction industry, and that all of us sitting around the tables who have studied Architecture at Georgia Tech whether we would be in government or whether we would be the manager of design
and construction for Disney or whether we would be contractors, that we would share this common body of language and this way of looking at the world. Owners and developers and politicians and government people should look at the world the way architects do. That would be a better world. And we should also accept some people that do not design very well and then we should tell those guidance counselors in Junior High Schools that you do not just look for artists to go and study Architecture. We must redefine the profession!

**Mickey Steinberg:** The truth is that the problem is not that big. There are architects spread throughout the construction industry. I run into them as bankers, as owners etc., but that is not the problem. The problem is with the practicing, bored architects. It is really a small segment of the architectural graduates that have created a problem. Although I agree with you, I just do not like the rap that all architects are that way because I myself am in a practicing firm and I still consider myself an architect.

**John Busby:** There was a major paradox shift in architectural education in the 1960s which really negatively affected the profession. We went from a profession that was oriented in Architectural Engineering and Construction disciplines here at Georgia Tech to "Architecture as Design" and completely ignored technology. Every major Architectural School in the United States has focused on "Design/Theory/History". I have visited several academic situations in which they do not care about technology, they do not care how you construct it. I think that Tech's trend is that way. Four years ago I interviewed a Georgia Tech graduate who was presenting me his thesis. It was absolutely amazing that he had not dealt with the Civil Engineering Department, the Mechanical Engineering Department and other departments that he needed to help him to integrate all the systems in his high rise building. And that has been completely left out by the academic structure that we now have in professional education of the architect. Yes, we ought to be more involved with the technical aspects of construction because that is where the answer for the design of the future is. It is not in what you put on the boards, it is in how to construct the building so "it does not leak, does not crack, does not expand, and you do not slip on the floors".
SUMMARY

Thomas D. Galloway, Ph.D.
Dean, College of Architecture
Georgia Institute of Technology

From the various presentations and commentary of this seminar, it is clear that we collectively view construction as a diverse, fragmented, disjointed profession, not only on the practice side, but we also have a similar situation on the academic side. On the academic side, there is little theory of or in construction, and what exists does so in bits and pieces. More disconcerting is the fact that there is little fundamental research and development within the industry itself. Halprin's question remains: "Is construction a researchable topic, or is it like running a bakery or a beauty parlor? Is construction a purely practice-oriented discipline that is applied, not basic?"¹

This parallels the question of how to redefine the mission of the CRC for the future. As suggested today, we have at least two ways to look at that question. One is saying, "Yes, construction as an industry is in need of redefinition; and yes, we can approach this task either by looking at units and components of the processes, or alternatively, by viewing its performance on the basis of conditions for success." Dr. Hawk and Mr. Steinberg argued there are alternative ways by which such criteria or conditions can be defined.

On the other hand, Dr. Vanegas suggested that the industry is so complex and that consensus is so ephemeral that the definition of the industry may defy a solution. However, at the same time, in the chemistry of complexity outlined by Dr. Vanegas, I saw the shaping of a possible definition and/or classification system that would help us bound the problem. Although we may leave some things out in the beginning, such an activity is the central purpose of theory building and development within the university.

Dr. Vanegas also suggested an alternative way to look at the problem. He suggested that it may not be useful to build a comprehensive dynamic model, simulated with respect to multitudinous dimensions of the construction industry. Rather, we could accept the diversity of the

industry, enjoy the richness of its decentralized setting, and refrain from an intellectual reframing of the problem. In this view, according to Dr. Vanegas, we should identify what are the most critical issues within that fragmented environment and choose those issues that have the great promise in benefiting the industry and also make sense given the constraints, strengths, and the context of Georgia Tech, the College of Architecture, and the CRC. If nothing else, today's debate has raised at least those two alternatives for future articulation. I will tell you, our comfort level should be a lot higher knowing that our perspectives have come from this type of discussion, as opposed to a frame of reference, almost ten years ago, emanating from the Business Round Table which looked at the issues in a much different way.

In conclusion I want to thank all the participants and especially the presenters. It has been a most worthwhile experience for us here at Georgia Tech; I hope it was the same for you as well.
THE CONSTRUCTION RESEARCH CENTER
will present

A SPECIAL MINI-SYMPOSIUM

THE GLOBAL FUTURE OF THE CONSTRUCTION INDUSTRY

Friday, June 3, 1994
2:00 p.m. - 5:00 p.m.
Seminar Room
Institute of Paper Science and Technology
500 10th Street, N.W.
Atlanta, Georgia 30318-5714

2:00 WELCOME
Thomas D. Galloway, Ph.D., Dean, College of Architecture
Louis J. Circeo, Ph.D., Director, CRC

2:15 INTERNATIONAL BUILDING CONSTRUCTION
David L. Hawk, Ph.D., Professor
Schools of Architecture and Industrial Management
New Jersey Institute of Technology

3:15 Break

3:30 Commentary from Industry
Stanley P. Steinberg, Executive Vice President
Walt Disney Imagineering

4:00 Commentary from Academia
Jorge A. Vanegas, Ph.D., Professor
School of Civil Engineering, Georgia Tech

4:30 Group Discussion

4:50 Summary
Thomas D. Galloway, Ph.D., Dean, College of Architecture
Louis J. Circeo, Ph.D., Director, CRC

5:00 Adjournment

Attendees at the symposium are invited to a reception at the home of the Dean and Mrs. Galloway, from 6:00 p.m. - 7:30 p.m. at 830 Myrtle Street, NE, Atlanta, Georgia 30308. Spouses are most welcome.

Reservations Required. To register for the Symposium and the reception call the Construction Research Center at 894-2069 by Friday, May 27, 1994.
APPENDIX B

LIST OF ATTENDEES

Thomas D. Galloway, Ph.D.
Dean, College of Architecture
Georgia Institute of Technology
Atlanta, Georgia 30332-0155

Louis J. Circeo, Ph.D.
Director, Construction Research Center
Georgia Institute of Technology
Atlanta, Georgia 30332-0159

David L. Hawk, Ph.D., Professor
Schools of Architecture
and Industrial Management
New Jersey Institute of Technology
Newark, N.J. 07102-1982

Ray A. Nixon, Jr.
Manager Region Facilities
Georgia Power Company
333 Piedmont Avenue - 6th Floor
Atlanta, Georgia 30308

Stanley P. Steinberg.
Executive Vice President
Walt Disney Imagineering
1401 Flower Street
Glendale, California 91201

Larry Lord, FAIA
Lord, Aeck & Sargent
1201 Peachtree Street
400 Colony Square - Suite 300
Atlanta Georgia 30361

Jorge A. Vanegas, Ph.D.
Professor, School of Civil Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332-0355

Thomas Ventulett, FAIA
Thompson, Ventulett, Stainback&Associates
2700 Promenade Two
1230 Peachtree Street, N.E.
Atlanta, Georgia 30335

Richard H. Bradfield, FAIA
President, Bradfield, Richards & Associates
3025 Piedmont Road, NE
Post Office Box 52426
Atlanta, Georgia 30355

William F. Roberts
Georgia State Financing
and Investment Commission
2 Martin Luther King Jr. Drive, Suite 472
Atlanta, Georgia 30334

Robert L. Silverman
Chairman of the Board
The Winter Group of Companies
530 Means Street, N.W. - Suite 200
Atlanta, Georgia 30318-5730

C. Ernest Edgar, III
President
Rosser Lowe
7100 Peachtree Dunwoody Road, N.E.
Atlanta, Georgia 30328

William R. Sims
Senior Vice President
Walt Disney Imagineering
2 Epcot Resort Boulevard
Lake Buena Vista, Florida 32830

Cecil Alexander
College of Architecture
Georgia Institute of Technology
Atlanta, Georgia 30332-0155
W. Ennis Parker, AIA  
Rosser FABRAPS  
Suite 100  
100 Peachtree Street, N.W.  
Atlanta, Georgia 30303

Thomas Porter, AIA  
Thompson, Ventulett, Stainback & Associates  
2700 Promenade Two  
1230 Peachtree Street, N.E.  
Atlanta, Georgia 30309-3591

James Moynihan  
Heery International, Inc.  
5999 Peachtree Street, N.E.  
Atlanta, Georgia 30367-5401

John Busby  
Jova Daniels Busby  
1389 Peachtree Street  
Atlanta, Georgia 30309

David Standard  
MSTSD  
1401 Peachtree Street, Suite 640  
Atlanta, Georgia 30309

Brian Gracy, AIA  
Carter and Associates  
1275 Peachtree Street, N.E.  
Atlanta, Georgia 30367

Grant Moseley  
MSTSD  
1401 Peachtree Street, Suite 640  
Atlanta, Georgia 30309

Joseph Rabun  
Rabun Hatch & Associates  
805 Peachtree Street, N.E.  
Suite 610  
Atlanta, Georgia 30308

**COLLEGE OF ARCHITECTURE**

Thomas Debo  
Jean Wineman  
John Peponis  
Steven French  
Rufus Hughes  
Garvin T. Dreger  
Saied Sadri  
F. A. Hilenski

**OTHERS**

Kevin Carry  
Steve Backman