RISK MANAGEMENT IN CAPITAL PROJECT DELIVERY
A Value Study of Changing Trends in Contractual Risk Allocation

by
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ABSTRACT

As said by Michael E. Porter in the preface of his book, *Competitive Advantage: Creating and Sustaining Superior Performance*, "the success or failure of any firm depends on competitive advantage-delivering the product at lower cost or offering unique benefits to the buyer that justify a premium price." In an industry as large and competitive as a ours this represents an immense challenge. How exactly can this knowledge be transferred to the construction industry in a way that will help us improve a system that is failing to provide a efficient environment for the delivery of capital projects.

This research examines the current practice of contractual risk shifting between the classical tri-partite arrangement of Design-Bid-Build, as well as in more recent approaches to the problem, such as Design-Build and Construction Management. The study considers in detail the relationships between degree of exposure, strength of negotiation and project complexity. Two models were developed for this research. First, the Venture Risk Analysis Model (VRAM) is used as framework to analyze current project delivery systems with the purpose of providing proof to the underlying concept that a reversal in the risk aversion tendency will not only improve delivery, but also strengthen the eroded position of design professionals in our industry. After a study of risk allocation current practices, a second model is developed from the application of the various concepts discussed. The Single Liability Insurance Model (SLIM), is proposed as a new option to solving the current problems in contractual risk allocation and the increasing costs of insurance coverage.

As legal costs and liability litigation rise, we must understand and face the fact that our reliance on outmoded allocations of project risk has lead to unrealistic expectations which have only added to the problems of an industry plagued with disappointment and disputes. Lawyer's use of exculpatory language in contract documents, in order to keep owners, contractors and designers at arm's length, has been extremely damaging to the industry. By establishing adversarial relationships among the participants in an industry that is inherently full of unknowns, we have not only damaged the industry and its professionals, but has also limited its advancement by hampering incentives for innovation.

Design professionals, ever more aware of legal implications, have stepped away from many of the services they used to provide. As legal considerations become more important than other aspects of their business, professionalism is slowly obscured. As design professionals limit their services to reduce liability, their ability to stay up to date with new technologies and change decreases. As project complexity increases with the push of outside technologies and performance requirements, the professional differentiation promoted by risk shedding has given birth to a new generation of consultants with deep technical ability but limited scope of expertise.

By designing and implementing delivery methods which can promote team participation through shared profit and risk, everyone involved in the delivery of capital projects will have a better incentive to cooperate. Through increased cooperation, not only will the industry benefit, but designers will have the opportunity to gain a more active position. Only then, when designers have this, will they be able to reinforce what today is an increasingly eroded position in the value system.

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Title: Senior Lecturer

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I. Introduction

1.1 Changing Trends in Project Delivery

As society moves forward, the constant adaptation to market pulls and technology push continually serves as a catalyst for innovation. The construction industry is no different than any other market sector, and as society moves ahead, it must continually adapt to changing conditions. Yet, we have an industry which appears not to have changed much in the memory span of anyone reading this thesis. Some might argue this is not true. Materials, computers, equipment, all are examples of the areas were great change has been achieved. Yet the industry is still perceived by many as an archaic dinosaur stuck in the ways of the past. The problems exist not in the incorporation of new technology into the process, but in the evolution of the process itself. The changes seen by the industry, with few recent exceptions, have been mostly influenced by the pressure from outside sectors which affect project delivery.

The real problem lies not in the components of the product, but in the methods used to incorporate and manage the wide array of parts that encompass the delivery of the final product. It was not until fairly recently, that a second look was taken at how industry provides and delivers it services. The construction industry is now beginning to react to the pressures of an increasingly complex environment. As other industries move ahead, optimizing their process and continually creating a flow of new technology to be incorporated into our infrastructure, the construction industry must play catch up to the rest of the market.

As the industry grew in the United States, it developed a series of pre-defined ways in which things were "supposed" to be done. Statutes, regulations, contracts and the common law all regulate a process under a set of outdated premises. As the industry struggles to change, many excellent ideas are blocked by a framework that it, and not the lawyers created. The industry, and specially designers, have created a web of regulation that is backfiring. As professionals step away from the process because of an overwhelming fear of legal exposure, the are not only hurting their profession, but also adding to the sub-optimization of a process which already is failing to provide adequate services to a client who has ever increasing demands and diminishing construction knowledge.

The roles of the three basic players in the industry have not only changed, but are continuing to change even as this document is written. Corporate restructuring, "rightsizing," or downsizing (or whatever terminology describes the changing role of corporate engineering departments) is having strong effects on the industry, not only affecting the owner but also the other two. Large companies have in many cases completely eliminated in-house corporate engineering departments. As this happens, the contractor is pressured by circumstances that will increase his responsibility for the planning and execution of mayor capital construction projects. As owners have less control over the execution of capital construction projects, they are looking for ways to shed their increased risk position, through acquiring services with single source responsibility. As this happens, more and more designers are becoming a part of construction company teams.

Another effect of corporate restructuring has been the evolution of corporate organizational branches with increasing power and involvement in capital planning expansion programs. Because of the very nature of these groups, construction is required to provide services to people which have little or no previous experience in construction and thus lack capabilities to determine if projects are being planned, executed or managed properly.

A third consequence of corporate capital restructuring affecting the industry has been the creation of strategic alliances. As the competitive environment becomes more complex, and companies continue to streamline their operations, new alliances are providing challenges for the industry, specially in contracting strategies. Alliances with suppliers are forcing design services that were previously provided by the owner, to be the responsibility of the supplier. This, combined with increasing demand for design services to be provided by the contractor, are only some of the many drivers for change affecting the industry and its participants.

1.2 Thesis Objectives

1.2.1 *Overview of the Work*

The issues explored through this document are based on an incremental process designed to build the reader's awareness and understanding of a set of problems and conditions which are critical to the conveyance of its intent.

The first two chapters provide the author's perspective on current problems and inefficiencies in capital project delivery. These chapters are key to the validation and understanding of the theoretical framework underlying the work. After this, the third chapter gives an in depth explanation of VRAM, developed in order to provide an easy to use tool to simply portray what can sometimes be very complex inter-relationships between parties. In order to determine the role that certain decisions regarding risk imply for the overall level of exposure of project participants, VRAM is used in chapter four to perform an analysis of typical risk allocation practices over various organizations. Because it is critical to the purpose of this work to provide a clear understanding of the implications of risk aversion tendencies for different organizations, the analysis performed in chapter four through the use of the Venture Risk Analysis Model instrumental to understanding the proposals made in chapter five..

Chapters two, three and four are the building blocks for the model explained in chapter five, The Single Liability Insurance Model (SLIM). This chapter is the heart of the research as it provides not a mapping of the problems, but a mapping of the solutions.

The concepts presented in all of the chapters, are the result of a combination of ideas developed through the analysis of professional and research literature, and nine interviews with professionals in the areas of design, construction, insurance, and public works. While informal communication was maintained with other parties, the more formal interviews were as follow:

2 Contractors
2 Architects
2 Consulting firms (A/E's)
1 Construction Manager
1 Public Agency
1 Insurance Broker

1.2.2 *Risk Acquisition Benefits*

The work performed here is meant to demonstrate that there are indeed ways to control risk and not be controlled by it. With the help of the Venture Risk Analysis Model and the Single Liability Insurance Model, this thesis will hopefully open eyes to new opportunities in risk management. Yet, not only do I want to demonstrate that risk acquisition (under the right circumstances) can be beneficial, but I want to show that it can also be profitable.

1.2.2 *The Author's Motivation*

Trained both as an architect and an engineer in a combined program of five years at Tulane University in New Orleans (1995), I became highly aware of the problems faced by architects in the industry. In the search to become a better designer, I thought I not only had to know design, or engineering, but know how things are really built. From personal experience, I felt that architects (with few exceptions) generally tend to neglect many of a complex set of conditions which all play an equally important role in the delivery of any capital facility.

In my desire to know more about construction I came to the Center for Construction Research in the Massachusetts Institute of Technology. As I went through my studies at MIT, I found that the problems which I thought were only typical of architects, were indeed shared at various levels by the whole industry. In a desire to find a solution to the dilemma, this research was initiated. While I know my life will be dedicated to improving this industry which I love, I sincerely hope my work will push others to do the same.

1.3 The Move Away from Risk

1.3.1 *Pressures from a Changing Market*

Together with the trends affecting the key players in the industry, there is also a series of changes which have affected the characteristics of the projects themselves. Looking back, we see the 1930's as a period for expansion. The Great Depression pushed forward the development of mega-projects like the Hoover Dam in Nevada and the Grand Coulee Dam in the State of Washington. Yet as the years went by, the construction industry changed slowly. Though the 1940's, 50's ,60's, 70's and 80's saw the development of large projects like the interstate highway program, nuclear powerplants, the growth of the air travel industry and the development of the computer and service industry, the projects of the 90's are considerably smaller in both financial and engineering aspects. Remodeling and re-utilization of previously constructed sites is far more common than the greenfield project which was common only a decade ago.

Large construction companies are facing difficulties never encountered before. In the last decades, the competition for overseas markets was minimal. The US could come in with their expertise and easily dominate them. Today, as many companies are finding out, this is no longer the case.

As mentioned by Dr. J.K. Yates from the University of Colorado at Boulder, the last decade saw the share of the Gross National Product contributed by the United States construction industry drop from approximately 11 percent, to almost 7 percent.[1] In 1980,

[1] J.K. Yates. "International Competitiveness of U.S. Construction Firms," *Project Management Journal March* 1991

US construction firms acquired 46 percent of the international market. Comparing this to the market share of overseas contracts for 1994, which constituted only 16.1 percent of all international contracts, there was a drop to less than half of the market share of a decade ago.[2]

Table 1.1 Comparative Market Share 1991/1994

CONTRACTORS NATIONALITY	# OF FIRMS	INTL. REVENUE $ mil.	1991 MARKET SHARE	1994 MARKET SHARE	POPULATION (millions)	MARKET SHARE/ POPULATION 1994
American	52	14,851.5	**31.3%**	**16.1%**	234	0.07
Canadian	2	156.2	7.0%	0.2%	56	0.17
European	87	48,640.4	41.2%	52.7%	55	0.13
British	12	11,411.5	15.4%	12.4%	25	0.00
German	17	10,169.7	6.6%	11.0%	12	0.55
French	9	11,614.8	9.4%	12.6%	61	0.05
Italian	21	7,543.0	1.9%	8.2%	119	0.04
Dutch	5	3,302.6	5.3%	3.6%	14	0.00
Other	23	4,598.8	2.6%	5.0%	6	0.32
Japanese	26	18,783.9	**3.3%**	**20.4%**	5	0.46
Chinese	22	2,901.4	1.9%	3.1%	5	0.38
Korean	10	2,951.7	2.3%	3.2%	57	0.05
All other	26	3,946.3	6.9%	4.3%	N/A	N/A
All firms	**225**	**92,231.4**		**100.0%**	**649**	

Source : Project Management Journal March 1991 & ENR August 28, 1994

A series of conditions is affecting the position of US firms in the International Market. The world economy, financing and government intervention are all factors affecting firms. The international problems faced by the industrial sector are blamed on a "noncompetitive set of policies and institutions (U.S. government) or misalignment of fiscal policy, which has lead to budget deficits, high interest rates, and overvalued dollar." Interest rates are a main concern. As Yates explains, "an interest rate advantage of one-half of a percentage point is equivalent to a 5 percent edge in price (European/Japanese firms offer financial packages with two percentage points lower than the United States which results in a 20 percent advantage in

[2] Gary J. Tulacz, *The Top 225 International Contractors*, ENR August 28 1994 &
J.K. Yates. "International Competitiveness of U.S. Construction Firms," *Project Management Journal March* 1991

price)"[3]. On another plane, many blame U.S. government policies against subsidies for the decline. There has always been a feeling among construction industry participants, that tax laws, and regulatory processes of the U.S. government inhibit the ability of U.S. construction firms to compete effectively in foreign markets[4]. European and Asian governments have developed mixed financial packages in which the government makes from 50 to a 100 percent loans at very low or zero interest. Together with this, governments of European nations offer subtler forms of aid to their domestic construction industry, like contractor's inflation insurance and foreign exchange insurance. Still, though the United States is faced with economic and policy problems, blaming them as the sole source of disadvantage would be unrealistic.

Putting the blame on micro or macro-economic financial , political or policy factors is only looking at the easiest way to blame the problem on some body else. Though it is true that US construction firms are competing not only against international competitors, but also against rising interest rates, uneven international practices and a fluctuating dollar; its important to understand that the decline of US firms is equally or more influenced by other factors. As mentioned before, and as will be reinforced throughout this thesis, the success or failure of participants lies not only in conditions like the ones previously mentioned but on the means by which the service is provided. The construction industry is at a point were it must react and change. As Yates says, there are many options for regaining the competitive edge the industry once had. We have the technology, the resources and the people to do it.

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[3] Project Management Journal March 1991
[4] Project Management Journal March 1991

All we need is the willingness to see ahead and understand that things must change so that our industry will be able to jump ahead of the competition .

1.3.2 *The Increased Legal Exposure*

Legal exposure has become a guiding concern in the building environment of today. From its beginning almost two centuries ago in England, negligence has slowly dominated the law of civil liability. It was not long ago when the English common law recognized differences between duties owed as the result of mutual consent ("contract") and duties arising as a matter of public policy to act with the reasonable care, skill and diligence so as not to injure others ("negligence").[5] Blackstone's Commentaries, a popular legal Treatise for Britain and the Colonies which was published in 1776, established the framework from which the concept of negligence developed to what it is today. As explained in the document, the action which today it's referred to as negligence, is derived from:

> *"contracts implied by reason and construction law," that "arise upon the supposition that everyone who undertakes any office, employment, trust or duty, contracts, with those who employ or entrust him, to perform it with integrity, diligence, and skill. And, if by want of either of those qualities, any injuries accrues to individuals, they have therefore their remedy in damages by a special action on the case."*[6]

Though much time has passed since the development of this document, the A/E of today continues to face a seemingly uncontrollable sea of uncertainty that contractual customization has failed to resolve. Technology keeps on moving ahead and nobody seems to

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[5] Architect/Engineer Liability Trough the Year 2000 (Is it Absolute???). January 31,1992
[6] Commentaries, III, Blackstone, PP. 163-5.

know how to get a grip on the problem. Courts and non A/E's clients continue to misunderstand the role of the different players in the industry, and specially that of A/E's. Creating more and more specific contracts has only caused more and more specific claims. As A/E's look for ways to clarify these misconceptions through contractual customization, courts have slowly made them not forget that they are the professionals on any site.

In this lies the essence of this research. As most practitioners are finding out, now neither can they hide from the responsibilities inherent to their respective professional practices, nor can they exert today, the level of control necessary to efficiently deal with the problems the industry is facing. The industry has created a web of regulation that is being forced to fit in an environment that is no longer the same.

1.3.3 *Industry Fragmentation*

One of the main and most detrimental consequences of the adversarial relationship created by the use of exculpatory language in contract documents has been the gradual fragmentation of the construction industry. The industry, in essence, has turned into a place where the us versus them and the adversarial approach has flourished for many years, but at a great cost to all who are directly or indirectly related to it. The contracting process has become a lengthy, complicated and expensive system in which project schedules more often than not become unduly long.

In 1976, Moavenzadeh and Rossow described the industry's fragmentation as one which gives firms flexibility and makes regrouping of participants reasonably feasible, which in turn, helps lessen the necessity for contraction and expansion of individual firms as they adjust to the frequent changes in the type and level of construction demand. Still today, with a faster pace of technological change, fragmentation is working against an industry which it was once able to help.

Many organizations are aware of these problems and are looking for solutions. Still, most are too quick to point to the legal community for the development of solutions. For example, the report for the American Bar Association's Forum on the Construction Industry states, and I quote:

"Now we're attempting to re-tool the lawyers. We're revamping the project environment in an attempt to create a win-win situation for everyone involved. The legal community again is key to seeing that such an opportunity is there."[7]

Yet, even though the CII (Construction Industry Institute) refers to the legal community as KEY to the creation of a win-win situation for all involved in project delivery, they soon come closer to one of the main ideas driving this research[8]. Dr. Richard Tucker, Director of CII made the following remarking in a report on that topic,

"partnering, incentive contracting, strategic alliances: the task of bridging differences and identifying commonalties now comes to the forefront. What we must do is focus on the things that make successful projects. The problems are still there to be solved, but our approach must be different. First, we must better communicate our ideas and our values, those things that can help us be mutually successful."[9]

Fragmentation in the construction industry has promoted competition among project participants over shares of construction dollars and has blurred the individual responsibilities

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[7] *Changing Trends in Project Delivery: The Move to Design/Build*
11th Annual Meeting, April 26-29, 1995 Fairmont Hotel San Francisco California

[8] The CII was established at the University of Texas to motivate a closer partnership among academic, government, and private sector members of the industry.

[9] *Changing Trends in Project Delivery: The Move to Design/Build*

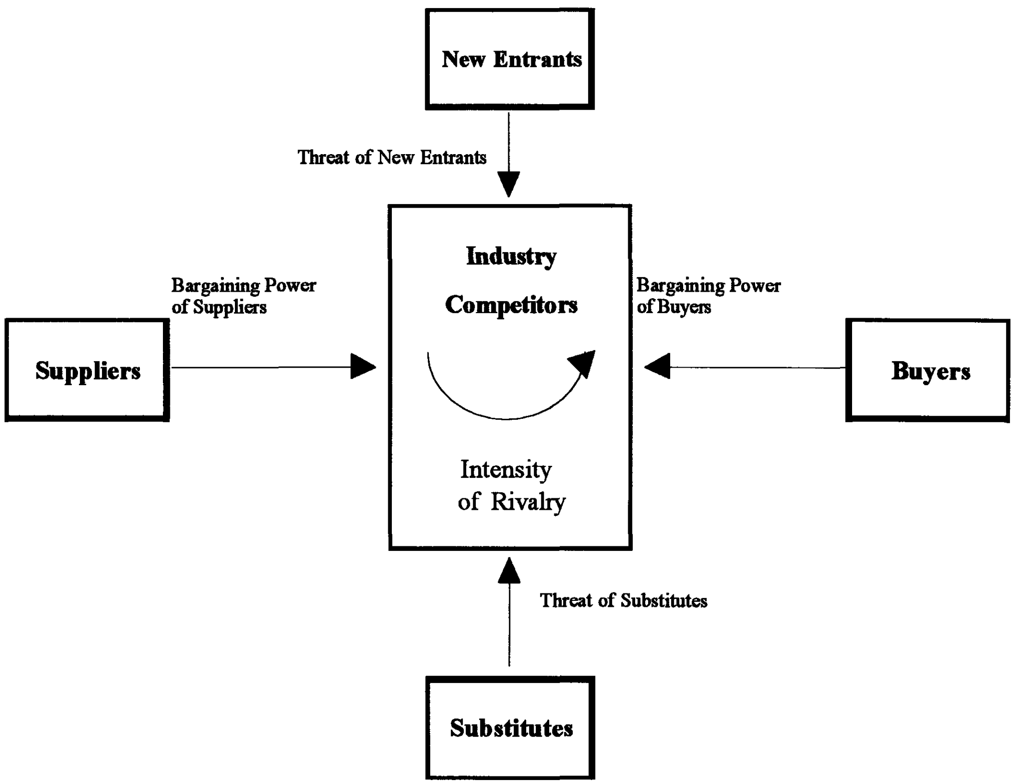
of its participants. By nature, this fragmented environment leaves little or no resources for investment in research and development of materials and production methods, therefore adding to the industry's resistance to technological change. The system of incentives and risk allocation which was developed under the traditional method, encourages each participant to maximize his or her own share of resources and fails to reward team integration for total project performance.

1.3.4 *An Inefficient System*

As project complexity and owner requirements change, any industry must adapt to the forces which mold its environment. Our industry has failed to gradually adapt to these forces and now is ripe for a drastic change. The construction industry, though more complex than most other industries, must still adapt not only is product but also its services to changes in what Michael E. Porter describes as the Elements of Industry Structure or more commonly known as the five forces. As mentioned previously, most of the change experienced by the industry today, comes from pressures exerted by outside organizations and by more demanding owners.

The industry struggles in the development of a proactive approach to its problems. As mentioned by Dr. Porter, though understanding the five forces better than your competitors is the essence of any competitive strategy, a firm is not a prisoner of its competitive strategy.

Figure 1.1 Porter's Elements of Industry Structure
Five Forces



Source: *Competitive Advantage: Creating and Sustaining Superior Performance*

" ***Firms through their strategies can influence the five forces. If a firm can shape structure, it can fundamentally change an industry's attractiveness for better or for worse.*** " [10]

In this lies the essence of change for our industry: A/E's, contractors, suppliers or anyone else involved in the construction environment needs not look outside for others to give them answers, but look at what the market demands, and develop ways to supply it.

The separation of services and fragmentation which our industry faces, inhibit the industry's ability to respond to market conditions. For the construction industry, response to risk and responsibility has been a double edged sword. While trying to make

[10] *Competitive Advantage: Creating and Sustaining Superior Performance,* Michael E. Porter 1985

the system more clear and efficient, the industry has hampered its ability to react by tightening what was once an organic and flexible form. Outdated allocation of project risk, together with a large public misconception on the judgmental nature of A/E's practice, has damaged the industry's structure and taken profitability to the levels were it is today. Though few would argue against the idea that any project's success depends on the efficient incorporation of all of the trades involved in its delivery, the industry still is reluctant to do so. *"New products which require reorientation of corporate goals or production facilities tend to originate outside organizations devoted to a "specific" production system; or, if originated within, to be rejected by them."*[11]

New delivery systems, though aiming at solving the problem by providing a "seamless" integration of services, are in most cases falling short of doing so. As companies or industry sectors are more resistant to change, they often create barriers between themselves and the market. The S-curve phenomenon explained by Richard N. Foster in his book, *Technology in the Modern Corporation: A Strategic Perspective* [12], portrays what is happening to the construction industry today. Products and systems, such as Design-Bid-Build for example, have inherent limitations in their future applicability. While other sectors are moving to new ground, the construction industry stubbornly holds on to products and especially systems which are rapidly approaching their final slopes on their respective life cycle curves. An unrealistic faith in outdated customer needs, has masked for many years a

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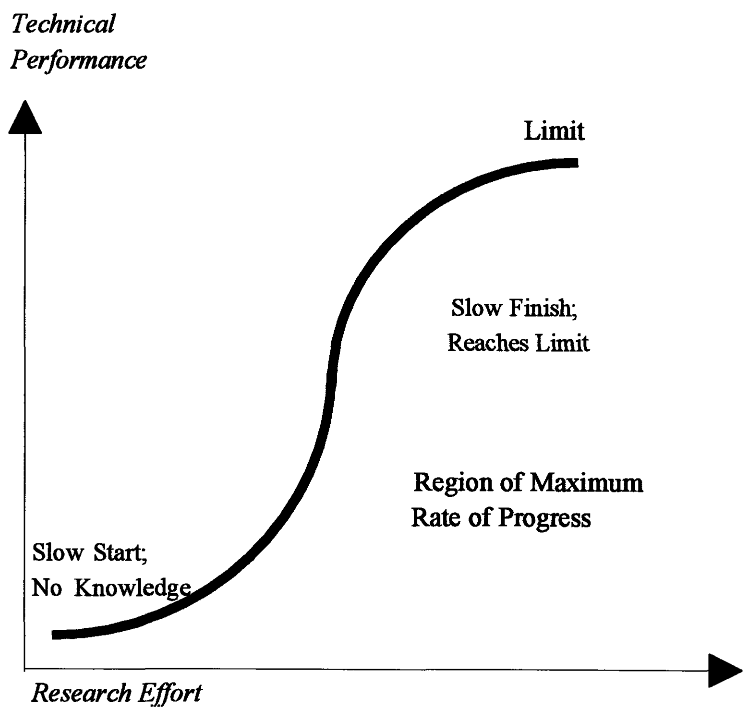
[11] *Patterns of Industrial Innovation*, William J. Abernathy & James M. Utterback
[12] *Technology in the Modern Corporation: A Strategic Perspective, 1986*

mislead approach that is becoming more clear today with an even faster pace of technological change.

Figure 1.2 The S-Curve Phenomenon



Source: *Technology in the Modern Corporation: A Strategic Perspective*

1.3.5 *Obscured Professionalism*

The burden of legal considerations created by the more "sophisticated" system of rules and regulations has not only induced a fragmentation of the industry, but has in many ways damaged professionalism itself. In the industry of today, the burden of legal considerations has reached the point where in many cases is poses a bigger worry than business considerations themselves. As A/E's step away from responsibilities which were once theirs, they are creating the seeds of their own end. By stepping away from responsibilities, their role in the value system is decreasing continually.

The one way flow of information from the A/E to the contractor has disconnected design from economic realities, created inefficiencies in management and inhibited technological progress. The structure of the building industry, (in which many smaller firms operate in narrow geographic areas and lack vertical integration), together with a complex regulatory framework with many locally administered building codes, concentrated attention on reducing the initial cost of facilities (often at the expense of higher operating and maintenance costs), and the exposure to litigation that increases business risks of new products and processes; are all factors deterring the advancement of the industry. [13]

Too often designers do not have direct experience with costs, products, or procedures even despite their acquisition of such services from "special" consultants. Because of the fragmentation created by the professional separation which exists today, the design process often does not account for critical field based information until it is too late to be of use. As a result of this inefficiency, the ultimate loss comes to the owner, who must face longer than necessary project schedules, and increased project costs. As this happens, owners increasingly attempt to shed both design and construction phase liability, the result of this being a shift towards the provision of design services contracted directly to the builder.

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[13] *New Technology and Innovation In the U.S. Building-Related Industries* , The Role of Public Agencies In Fostering New Technology And Innovation In Building; Committee on New Technology and innovation in Building, Washington 1992

1.4 Contractual Risk Shifting -Greater Costs than Gains-

1.4.1 Architect Engineer Liability

" *One who undertakes to render professional services is under a duty to the person for whom the service is to be performed to exercise such care ,skill, and diligence as men in that profession ordinarily exercise under like circumstances.*"[14]

Under this applicable legal principle the court concluded that the A/E's failure to determine the actual size of piping, as it was required by contract, was a breach of its duty to the City and actionable in tort for negligence. This decision in City of Eveleth V. Ruble[15], was based, like many other cases, on a very specific allegation of negligence. In this case the designer was required to "analyze the piping, valving, and structural characteristics of the existing plant" prior to the preparation of plans, specifications, costs estimates, and contract documents. Even though the A/E went in and did as the documents specified, the designer failed to recognize the actual size of existing intake piping, therefore designing a system inadequate for handling required volume of water.

This case is one of the many cases discussed by John B. Miller in his paper, Architect/Engineer Liability Through the Year 2000 (Is it Absolute?) .[16] As one of my professors, and as author of numerous articles in the areas of architect engineer liability, construction claims, and dispute resolution in the construction industry, the ideas of Mr. Miller have had a deep influence in my work. As he explains, the typical contractual agreements between owner (or turnkey developer) and A/E have blurred the distinction

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[14] Eveleth, supra, at 253, 225 N.W.2d at 254
[15] 302 Minn. 249, 225 N.W.2d 521 (1974)
[16] Gadsby & Hannah Boston & Washington DC January 31, 1992

between the duties assumed by contract and those imposed by the law of negligence. "Where the A/E and its client dispute the quality of A/E's work, negligence and contract theories nearly coincide, because nearly every claimed breach of contract duty by the A/E may also be cast as negligence"[17]

What is "ordinary" for our industry? How far can you take the "ordinary" in order to establish that anyone in your position would have done the same ? Where is the line between breach of contract and negligence? As I have mentioned before, most of us simply blame lawyers for having obscured a system that was once "straightforward". Yet it is the purpose of this document to prove otherwise.

The SLIM (discussed in chapter five), is a first cut at demonstrating that we, and not lawyers, can take control over risk; and that doing so will not only be to the benefit of designers, contractors and suppliers, but also to the benefit of all those involved directly or indirectly in the construction industry. While the ideas presented in the model by no means are perfect or final, I hope they will open the eyes of those seeking to explore new roads in an industry, that though old and mature, will never stop evolving.

1.4.2 *A Better Contract?: Static Risks and Diminishing Returns*

One of the strongest arguments in favor of a complete reversal in the risk aversion tendencies which the industry faces today, lies in the success of the contractual risk shifting

[17] Architect/Engineer Liability Trough the Year 2000 (Is it Absolute?) Gadsby & Hannah Boston & Washington DC January 31, 1992

practices of A/E's. Courts have proved that the bullet proof contract doesn't exist. As designers contractually step away from liability, they are at the same time giving away control over that liability. Negligence disputes between A/E's and third parties continue to be a heavy concern among professionals. Even in the absence of privity of contract between the designer and the third-party, courts have in many cases imposed responsibility to the law of negligence over designers.

An excellent example of this is seen in architects. The relationship between the Architect and the Owner, different to that of the Architect and third parties, relies on a contractual duty between the parties involved. Though at common law the lack of contractual relationship with a third-party bars actions for both negligence and breach of contract, court rulings have obscured these lines of responsibility[18]. A perfect example of courts obscurement of the law is given by Miller in the case of Shoffner Industries, Inc. v. W.B. Lloyd Construction Company. In this case, a series of roof trusses collapsed during erection, even after the A/E advised the General Contractor that the proper bracing of the trusses was critical to the structural stability during construction.

The law imposes upon every person who enters upon an active course of conduct the positive duty to use ordinary care as to protect others from harm. A violation of that duty is negligence. It is immaterial whether the person acts in his own behalf or under contract with another.

Shoffner, supra at 54

Like many other cases where courts have been tempted to apply a general standard of care to A/E's, irrespective of contract, the court in this case adopted Florida's rule as stated in A.R. Moyer. Inc. v. Graham[19]. In this rule, a General Contractor has an action against an architect for negligence without privity of contract. In Shoffner Industries, Inc. v. W.B. Lloyd Construction Company, the court went as far as to refer to the broad policies in MacPherson v. Buick Motor Co. [20], where consumers were given the right to sue manufacturers for injury caused by defective products. Cases like this, which are not uncommon in our industry, reinforce what I intend to prove and provide alternate solutions for.

Many designers today feel that the return on their investment is not moving at an even pace with their share of risk and responsibilities. With design only adding between 10 and 15 percent of the total cost of a project, the share between risk and return is becoming more and more unbalanced. Many A/E's constantly feel squeezed to provide a level of service for which they don't have the financial resources needed to effectively do so. Yet, as designers contractually step away from liability, they are themselves limiting their participation, therefore limiting their return, and constantly giving away their place on the value chain. No matter what designers do, their risks will always be there. Contractual customization is not a way out, but a way in. Design/Build, Construction Management and Turnkey are all great ideas, but are ideas that not only need a change in a contract, but a change in the system. This is no dream and is simpler than anyone thinks, but we just have to look at things from a different perspective. What can be changed is the degree of control which one has over risk, not the amount of risks. Risks, like matter, can be transformed but

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[18] Forte Brothers. Inc. v. National Amusements. Inc., 525 A. 2d 1301 (R.I. 1987)
[19] 285 So.2d 397 (Fla. 1973)
[20] 217 N.Y. 382, 111 N.E. 1050 (1916)

never destroyed. As mentioned before, SLIM is a first look at how this can be done; the same cards, the same players, just a different way of playing the game.

1.4.3 *Decreased Bonding and Increased Issue Percentages*

Current practice gives little or no opportunity for designers to obtain competitive levels of financial leverage. Due to the nature of the Design-Bid-Build process, designers are rarely in the position to achieve contract volumes which might compare with that of the average contractor. Thus, the nature of the system places the designer in a disadvantageous bargaining position.

The unbalanced bargaining power of the different participants in the delivery of most capital projects not only hurts those who are at a disadvantage in the process, but the industry as a whole. The environment of litigation nurtured by this type of system creates a win lose situation.

The use of contractual risk shifting strategies, which has nurtured the adversarial relationship that exists today, has negatively influenced the cost efficiency of the industry. Always having someone on the loosing side has only caused increased mark-ups, decreased bonding capacities, and escalating insurance costs.

1.4.4 *Increased Time & Costs*

The misallocation of contractual risk is considered in my work as one of the mayor inefficiencies of the system. It is common knowledge that in construction, time is money, therefore it is here were mayor improvements can be made. The inefficiencies created by the inherently adversarial relationship which exists today, not only cost money to builders, designers and owners, but inflate costs all the way down the value system.

The birth of design/build, and its newly gained acceptance, not only by the private sector but also by various public agencies, is the beginning of a new era for construction. Still, the success or failure of new delivery systems like design/build or Construction Management is heavily reliant on better and more efficient allocations of risk. The benefits created by having the increased communication and overlapping of design and construction services which design/build provides, can be easily undermined by ill-judged allocations of responsibilities. In design/build, for a project to be successful, the design/builder must work as a single unit, taking evenly all the responsibility together with all of the risk.

As many firms have found out, this can be tricky. Partnering, incentive contracting and strategic alliances now come to the forefront. In an industry thirsty for improvement, these methods have offered participants with a way of finding a previously blurry common ground. In different ways, they all have provided incentives for long-term commitment, shared vision, trust, and an understanding of each other's goals. While none of these goals are "easily" reached, they are indeed the keys to new and better ways of overcoming roadblocks which have slowed the industry in its search for: improved efficiency, higher cost effectiveness, faster technological advancement, better service and improved quality.

While an effective team building process can bring significant, not just marginal improvements, it must yet be understood this is not just a matter of gathering good people and working together. As long as friction for potential unbalanced risks exists between the parties involved, none of this will ever work. The incorporation of a diverse group of individuals willing to resolve differences, remove roadblocks, and proactively build and develop a group into an aligned, focused and motivated team striving for a common mission of shared goals, objectives and priorities, cannot be self-sustaining if an organizational, legal and financial framework is not developed to support the entity under a balanced sharing of risk, return and responsibilities.

1.5 Closed Boxes -From Professional Education to Practice-

Closed boxes is what the industry nurtured for many years. Since the separation of Architects and Engineers after Napoleon's division of L'Ecole Politecnique in France, the professions which once worked as one in the delivery of any project, now were pushed to grow apart. This tendency is still prevalent, and is encouraged in many ways by the current educational system.

Architecture and Engineering programs have different students, different buildings, different classes, different ideas, different methods and yet are supposed to graduate professionals willing to work as a team for a single goal. The friction that exists today is not caused by lawyers, architects or engineers, but by a system that breeds a nurtured separation between individuals which have "no choice" but to work together. The ideas presented in my work are intended to open up new alternatives. By providing a framework for a system that will efficiently support and encourage the joint participation of all those involved in project delivery, there is an opportunity to reverse engineer a system that must change.

In order to effectively reach the previously mentioned goals, team participation and goal sharing are not only goals to strive for in the field, but also in professional programs. Architects, owners and engineers all have essential pieces of the puzzle, and without any of them the puzzle is not complete.

This section entails all that guides me to find better ways. My studies as an architect/engineer gave me a first glance at the division. "Architecture" by architects, "Engineering" by engineers, buildings by who? The failure, or opposition by professional schools to "surrender" their status, is not only failing its students, but failing the industry. Still, the construction industry-archaic, adversarial, with a poor public image and a history of projects gone bad-continues on alive and well, and most importantly changing. Good or bad as it may be, our industry is still society's measure of quality of life, and is up to us to change it for the better, and provide our market with nothing less than our best.

II. An Industry View of Project Delivery

2.1 A Critical Look at the Procurement System

2.1.1 *The Declining Role of the Architect*

Where once the architect was capable of providing a whole range of services to the owner as his complete representative during both the design and construction stages, the architects of today face great threats to this once established framework. The planning service provided by architects during the eighteenth and nineteenth centuries included most of what is provided by sub-consultants today. An increased project complexity, together with outdated approaches to design and construction, has taken a huge toll on the once key position of the architect in the value system. Were once the architect was key in the initial planning stages of a project, this no longer necessarily the case.

Architects have found themselves overwhelmed with rapidly changing technologies and project types. The proliferation of project delivery methods has eroded the boundaries of traditional practice[21]. Management consultants are expanding strategy-based services into the traditional realm of architects, construction managers are developing consulting services based on technical knowledge traditionally reserved for support of construction services, and developers are offering broad skill sets to provide planning services similar to those traditionally given by architects (See Figure 2.1).

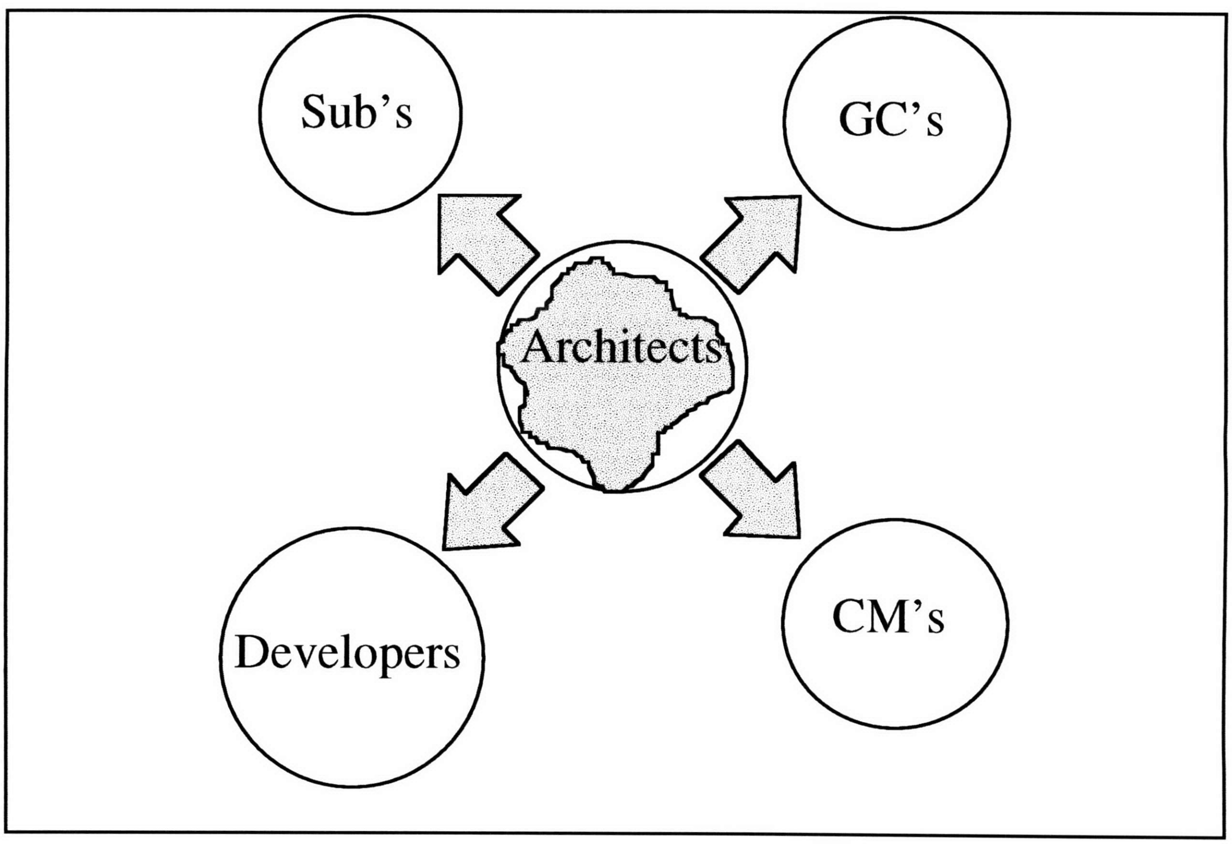
Yet, looked at from a different perspective, the proliferation of project delivery methods has only been a way of filling gaps left in the industry. One could say that new

[21] RECORD, March 1995, pages 28-33

methods of project delivery are not eroding the boundaries of traditional practice, but taking the slack left by A/E's.

Shifting demands in the services required of planners indicates that traditional architects are less likely to have the required capabilities to provide these services. At the AIA's summit on Expanding Architectural Services, held in September 1995 in Nashville Tennessee, speakers defined different market forces challenging the current role of the architect as the synthesizer and problem-solver.

Figure 2.1 Erosion of Planing Services



These included[22]:

- The encroachment of related professions such as interior design , landscape architecture, and program management.
- The increasing number of architects choosing "alternative" careers in fields such as facilities management , construction management, and community advocacy.
- The chipping away of architects' traditional turf, not just by allied professionals, but also by consultants lacking architectural training and licensing, such as real-estate professionals, accountants, and management consultants.

The challenges presented today lie not in the capacities of the specialist, but in the liaison characteristics which once were the strength of architects. The construction industry is a living organism of checks and balances that evolves continually, but yet requires direction. The gap in coordination created by risk aversion tendencies has created inefficiencies for which owners are no longer willing to pay. Architects have to step up to new services if they intend to stay in the game.

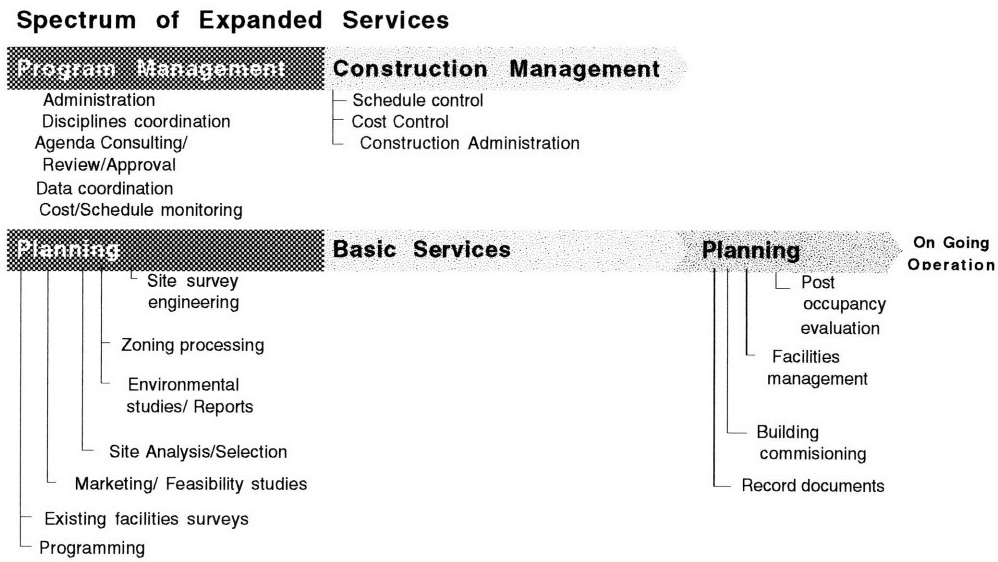
2.1.1.1 *Redesigning the Architect*

What services? AIA's Richard Hobbs and California Council's George Chong give a very good example of the possibilities[23]. Yet, the industry induced changes which architects are facing today will require more than a change in the spectrum of services provided by the architect. They will require a redefinition of their roles within the value system. As architects step back from the traditional roles, they are widening a gap in the system that has greatly

[22] Architectural Record, February 1996

diminished their value position. If architect's intend to regain a main role in the system of value activities for project delivery, they must get back into the game.

Figure 2.2 Expanded Spectrum of Services



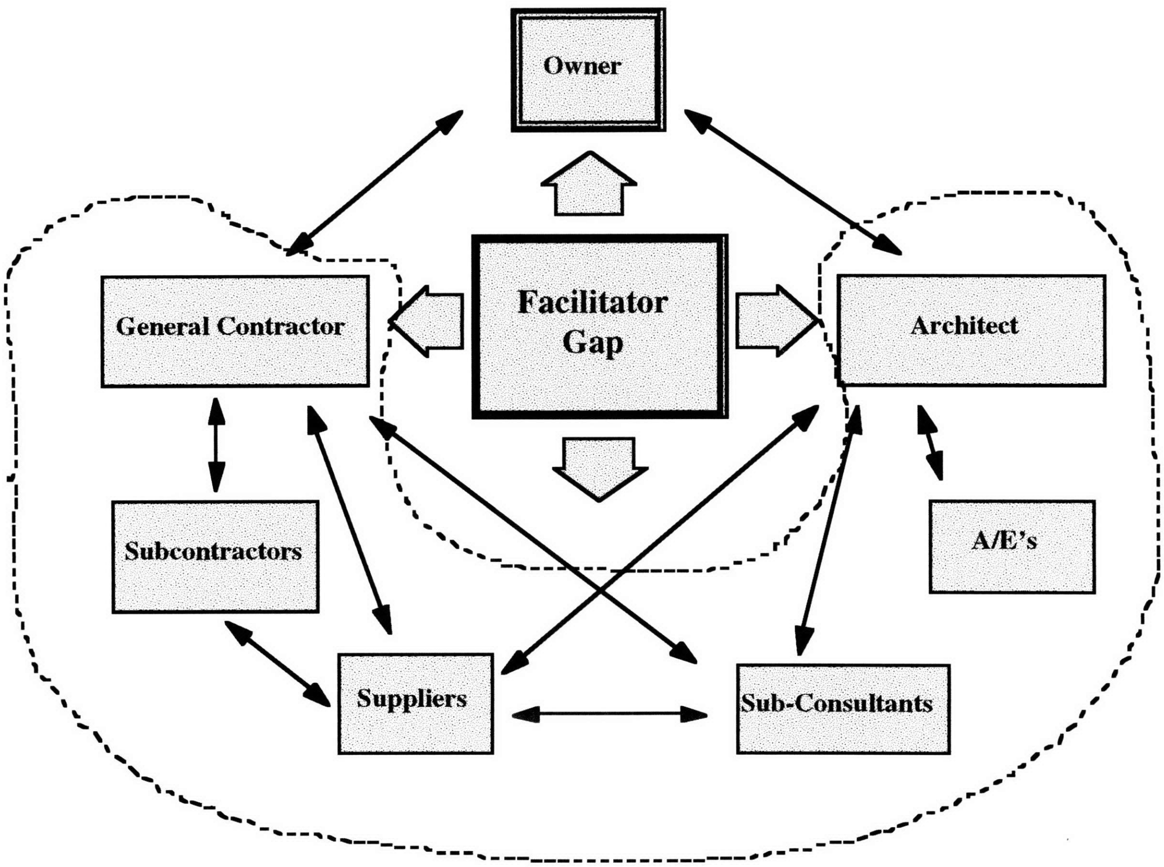
Source: Architectural Record *February 1996*

Architects, more than just expanding their services, need to regain the characteristics that once made them valuable in the delivery process. As the traditional owner representative, the architect was both a catalyst and a facilitator for the process. To regain stature and the full confidence from clients, architects must overcome a general lack of understanding of business strategy. Architects have no choice but to acquire and efficiently implement the management and communication skills they have failed to incorporate in their education. Changes in industry composition should not be something to fear, but blocks to build on. As

[23] Architectural Record, February 1996

shown in figure 2.3, if architects don't step up to the bat and try to become the facilitators the industry no longer has, somebody else will.

Figure 2.3 The Facilitator Gap



2.1.2 *Win- Loose Relationships: A barrier that Information Technology won't overcome*

Yet for architects, or anyone else stepping up to become a facilitator in the process, the quick answer would be: " We first have to improve communication!". No, we don't have to first improve communication!. Improving communication is worthless if people don't have a common interest in sharing information. Lotus Notes, the Inter-Net, video conferencing, are all useless if we don't first fix the way we do business. The Win-lose environment in which the construction industry has matured even to this day works completely against the fundamental ideas behind any will to share anything. Design/Build, Construction Management and Partnering, all great approaches to the problem that are discussed in later chapters, have found ways to make common goals profitable for all. Still, there is much to learn from these approaches, and in my opinion, a lot to be improved with a careful rethinking of how we do things. Team work is worthless if the team doesn't win or lose together. No matter how many architects, engineers and consultants you have on a project, there is only one project. This is in the core of what SLIM is pushing to achieve. As will become evident in chapter five, if you take apart what the model provides, you have nothing more than what we have today. Yet, if you put the pieces together working for a common purpose of success, or failure, the strength gained from synergy can be more than anyone can imagine.

2.1.3 *Risk Aversion.- The effects on Innovation*

Risk aversion tendencies have been extremely detrimental to rates of innovation within the construction industry. New construction in the United States (which includes major alterations and renovations of existing facilities) is a more than a $500 billion per year industry that employs some 6.7 million people. Construction alone accounts for approximately 7 to 9 percent of the gross domestic product (GDP). However, if government action to foster innovation in the building industries could increase overall productivity by as little as 1 percent, the likely payoff nationwide could be more than $5 billion dollars annually[24]. A study by the office of Technology Assessment characterized U.S. engineering and construction firms as" content to adopt construction technologies pioneered elsewhere," but blamed the design-bid-build, or traditional delivery method, for weakening incentives to adopt new technologies[25]

Observers, like Dr. J.K Yates of the University of Colorado[26],have expressed concern that the declining position of U.S. construction firms in global markets is due, at least in part to declining commitment to R&D in building-related industries. Being about 0.4 percent of annual construction output, the aggregate spending by industry and government on research and development in these industries is definitely well below levels that the industries' aggregate size and importance warrant[27]. Comparing the construction industry to other mature industries such as appliances (at 1.4%), or textiles at(0.8%). the amount of R&D allocated to the industry is still low[28]. A 1990 evaluation of Japan's construction industry, which was sponsored by the National Science Foundation, found that the aggressive and productive research by both industry and government, have put the nation at the forefront of construction technology.[29] With so much talk about design/build and partnering, it is even more interesting to hear that a subsequent study of major Japanese R&D facilities sponsored by the Civil Engineering Research Foundation (1991), attributed much of Japan's apparently

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[24] D.R. Dibner and A.C. Lemer. "New Technology and Innovation in the U.S. Building-Related Industries", in *The Role of Public Agencies in Fostering New Technology and Innovation in Building*, National Academy Press, Washington, DC, 1992.
[25] Office of Technology Assessment, 1987
[26] J.K. Yates. "International Competitiveness of U.S. Construction Firms," *Project Management Journal* 22(1) (1991)
[27] D.R. Dibner and A.C. Lemer. "New Technology and Innovation in the U.S. Building-Related Industries",
[28] D.R. Dibner and A.C. Lemer. 1992
[29] Tucker et al., 1991

substantial ability to move from the "lab" to the field, to very close ties between researchers and construction professionals.

There are many reasons why the U.S. is falling behind in global construction markets. However as this thesis reinforces, many of the problems faced by the industry are caused by outdated approaches to construction that deprive the construction industry of the liberty and flexibility it needs to change. The structure of building industries, (in which many smaller firms operate in narrow geographic areas and lack vertical integration), a complex regulatory framework with many locally administered building codes, concentrated attention on reducing initial costs (often at the expense of higher operation and maintenance costs), and exposure to litigation that increases the business risks of new products and processes- are all among the factors that have deterred the spread of new ideas.

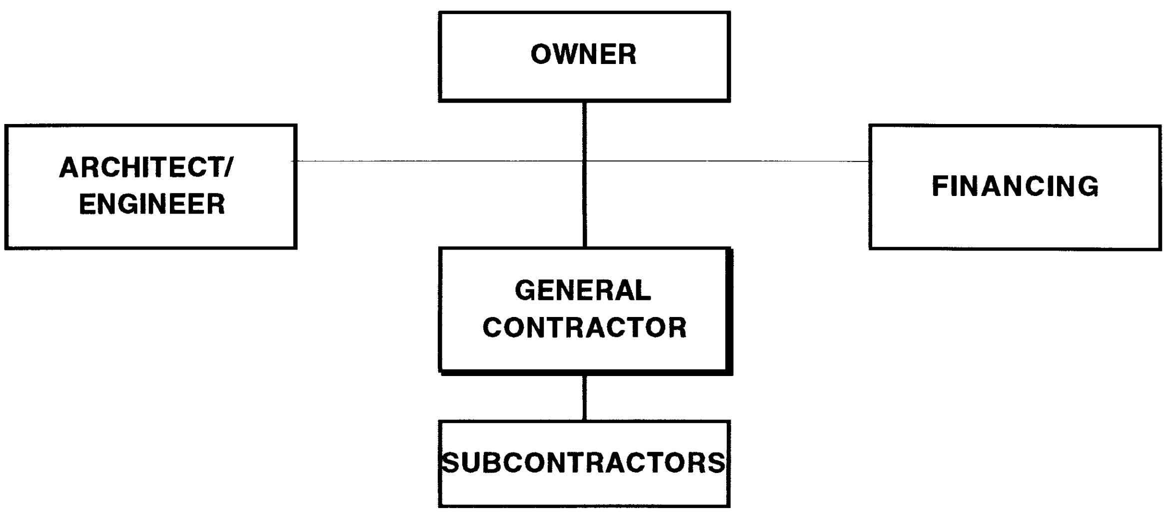
Traditional procurement methods are probably one of the biggest producers of barriers to innovation. First, award of contracts on low bid basis, for example, increases the bidder's risk in trying new things because he must bear both (costs and responsibility) while the owner may obtain the benefits over the longer term. Secondly, rigid budgeting and construction contracting practices that focus on low price often preclude higher spending to build a facility that will cost less to maintain or will yield more reliable service in the future. Designers, owners, and managers are understandably reluctant to try new technology that may lead to expensive litigation if an accident occurs of if the new technology fails to perform adequately. Though pre-selection of bidders, design/build, and other mechanisms can be used to encourage cooperation among participants in order to ease the introduction of new ideas, as long as there is not a framework which makes cooperation profitable for all, the industry will never move any faster than it is moving today.

2.2 The Traditional Method

2.2.1 Relationship of Parties

In the most traditional construction project, the typical parties include the owner, the owner's lender, an architect, a contractor , a contractor's subcontractors, everybody's insurance companies, and, perhaps a surety (See Figure 2.4).

Figure 2.4 The Traditional Organization



The owner is the person or entity commissioning and pursuing the project, and the owner's lender is the person or entity providing the financing for the project. The architect or other designer is the person or entity hired by the owner to design the project and to watch over construction of the project to "assure"(to a certain degree) it is built according to the final design. The contractor is the entity or person hired by the owner to construct the project, and his most basic obligations to the owner are to do the project for an agreed price, within a specified time, and according to certain standards of quality. The general contractor retains the subcontractors to assist in the construction of the project by providing labor and/or materials for the project. The insurance company, which is involved with parties on an individual basis, can provide coverage to one or all for damages to persons or property depending on the particular need of the different parties. Finally, if a surety is involved, the surety provides a bond or other form of assurance giving the owner someone to fall back on in the event of default by the contractor.

2.2.2 *The Limitations of Contractual Risk Shifting*

Ideally, allocation of risk should be based upon the ability to control risk. The party who has the greatest ability to control a risk factor should assume responsibility for that risk. Conversely, the party with the least amount of control should not be expected to assume the loss for matters over which that party has no control. However, few construction contracts are negotiated this way. Instead, in today's market all too often the intent is to shift risk to somebody else in the contract chain without regard to who controls the risk. Without concern for ability to control risk, each participant wants to protect itself by shifting the risk to the next person in the contract chain. The willingness to accept risk increases in direct proportion to the amount of reward. If the potential of reward is great, those involved will be willing to accept more risk.

2.2.3 *Where has the System Failed?*

Under the traditional system, the share of risks and rewards has been unbalanced. With decreasing rewards, there have been increasing attempts to use contract language as means of shifting risks. When risks cannot be eliminated for everyone, the natural reaction is to attempt to have everybody else bear the risk. Contract language tries to meet this goal, but has constantly failed. Risk shifting has only blurred control of responsibilities, therefore creating a greater exposure to risk.

Figure 2.5 Exposure to risk in the Traditional Method

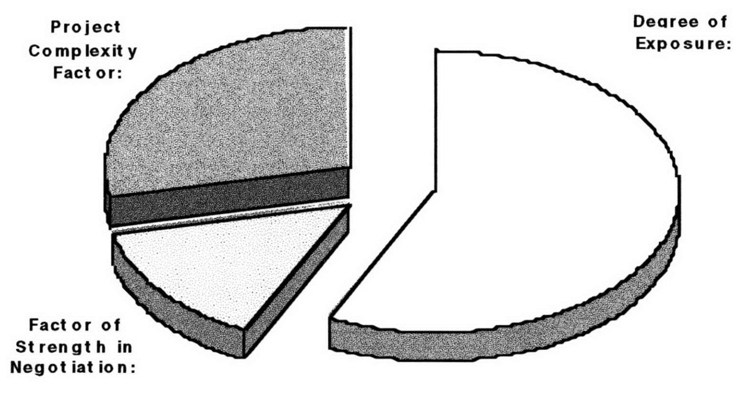


Figure 2.5 gives a graphic representation of how the typical project participant (owner, A/E, or builder), is positioning himself today on the delivery of any capital project under the traditional method. As project complexity varies, the degree of exposure of project participants in the traditional system adjusts proportionally. Contractual risk shifting only

serves to hide risks temporarily, placing them in someone else's hands. By giving away responsibility, participants are not only increasing their exposure relative to project complexity, but also in terms of their ability to control risk. By shifting risks, the participant gives away control, while at the same time weakening his negotiating position with a directly proportional share in the decision process and monetary reimbursement for the risk. Interestingly enough, when the initial desire was to reduce exposure to risk, more often than not, participants today are equally or more exposed than they would have been if a more careful allocation of risks and returns had been conducted.

If contractual risk shifting tries to impose risks to those who are least able to control it, exposure will not only increase to the one with the least amount of control, but to all involved in the delivery process. Still, the truth is that the risk is always there, in many cases hidden to those who can control it and visible to those who probably don't have the ability to do anything about it. Contracts are not bulletproof, and their increased level of detail indicates that there is something wrong. The solution to the problem will not come with better contracts, but instead with the development of a better foundation from which those contracts can be built.

2.2.4 *Increased Complexity and Decreased Participation*

While technology and project complexity continue to increase, the framework established by the traditional method is working against the ability of participants to adapt and respond to new challenges. As pointed out earlier in this chapter, the adversarial environment affects, innovation, profitability and productivity. At the same time, everybody has joined a game of risk shifting strategy. Still, there is one factor that has a profound effect on the structuring of the industry which hasn't been mentioned yet; insurance. Insurance serves as perfect proof for what was presented in table 2.5. As projects become more complex, and the degree of participation in the risk sharing scheme becomes more blurred, insurance has become a steadily increasing financial weight on project delivery. By stepping away from risk, the construction industry has increased overall exposure. The increased overall exposure created by miss-allocated risks has translated to higher insurance fees, increased deductibles and inflated delivery costs.

2.3 The Traditional Coverage

2.3.1 *Designer: Professional Liability Insurance*

Although A/E's have turned to contractual customization for liability shelter, they have instead found decreasing returns and increasing litigation. Contract clauses, such as limitation of liability, no-forfeiture, or foreshortened statute of limitations, may not protect designers as intended. These contract clauses, at best, will only be effective between the designer and the client, but cannot bind third parties. These clauses may not be effective at all if there is an anti-indemnity statute or if a limitation of liability or foreshortened statute of limitations has been determined to be against public policy, and therefore unenforceable.

Another method that is not as effective as A/E's anticipated is the professional corporation. In almost every state, there is a distinction between professional corporation and business cooperation. The statutes specifically provide that as to professional negligence, there is personal liability similar to a partnership, so that the corporate structure is not a total shield to liability[30]. Some exceptions do exist. For instance, if there is a large judgment against the professional corporation, it can wipe out all of the corporate assets except for the pension fund, because there is a provision by the Federal Employees Retirement Income Security Act, which permits such pension funds to be immune from attachment for the satisfaction of a judgment against the professional corporation.

Professional liability coverage, be it in the form of a "claims made" or "occurrence policy" is to many A/E's a gamble with no clear return. Why get insurance? Is it worth it? To many designers it is not a question of whether they want insurance, but more a question of whether they can afford it. The defense of a professional liability-suit, if it goes to trial, can be in the range of $50,000-$500,000. Most of these claims and suits are settled or dismissed, and the statistics from insurance companies indicate that the greatest expenditure is toward the legal defense, not for the claims themselves. Many recommend not to buy insurance at all, but instead develop funds for covering litigation fees that might arise. In report presented by the *Journal of Management in Engineering*, some general guidelines are given for this type of fund. A designer may want to have a fund in the vicinity of $150,000. A firm of 6 to 20 professionals may need a fund in the range of $300,000. For a larger firm, though it is mentioned that having no professional liability coverage is inadvisable, a minimum of $1,000,000 would be more than justified. Still, the potential exposure to a catastrophic loss is definitely be overwhelming. Is there a better way?

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[30] Liability Insurance for Design Professionals, *Journal of Management in Engineering*/ March/April 1994

2.3.2 *Builder: Builder's Risk, General Liability, Worker's Compensation*

Suits for damages to property, contracted entities, workers or third parties are the everyday life of General Contractors. Different to A/E's, contractors have much larger cash flows and thus are able to cover the costs of insurance with much less suffering. Still, this is not without any suffering at all. Costs of insurance for general contractors range between 7 and 15 percent of their total contract volume. The typical insurance coverage for a contractor includes Builder's Risk, General Liability and Worker's Compensation.

Builder's Risk covers damage to physical structures. Covered property, as used in the Coverage part for the Builder's Risk Coverage Form by Commercial Risk Services Inc.[31], includes: foundations, property in or within 100 feet of premises (fixtures, machinery, equipment, building materials and supplies, and temporary structures built or assembled on site). Additional coverage can be provided for debris removal, preservation of property, fire department service charges, pollutant clean up and removal and building materials and supplies of others. Builder's Risk does not cover land (including land on which the property is located) or water, signs (other than sign attached to the building) and the following property when outside of buildings: lawns, trees, shrubs or plants, and radio or television antennas. Covered property does not include the value of buildings or structures existing prior to construction of the improvements, alterations or repairs.

General Liability, on the other hand, will pay for "those sums that the insured becomes legally obligated to pay as damages because of bodily injury or property damage to which the

[31] Builder's Risk Form, *ISQ Commercial Risk Services, Inc.*, 1983, 1987

insurance applies." The insurance policy applies to "bodily injury" and property damage only if:

(1) The "bodily injury" or "property damage" is caused by an "occurrence" that takes place in the "coverage territory"; and

(2) The "bodily injury" or "property damage" occurs during the policy period

Damages because of "bodily injury" include damages claimed by any person or organization for care, loss of services or death resulting from "bodily injury". The insurance does not apply to: expected or intended injuries, liquor liability, workers compensation, employers liability, pollution, mobile equipment, war, damage to property, damage to the product, damage to the work, damage to impaired property, property not physically injured or recall of products, work or impaired property.

Finally Workers Compensation covers for "bodily injury" caused to any contracted worker at the site. In various countries, such as in the case of Puerto Rico, Worker's Compensation insurance is not provided by private insurance companies, but instead by the Government of Puerto Rico.

2.3.3 *Owner :Wrap-Up insurance*

Owners, or contractors, on the other hand have the option of buying what is called Wrap Up or "All Risks" insurance. Although expensive, this has proved to be a wise way to eliminate added overhead costs of sub-contractor insurance reimbursements and other associated costs of individual insurance packaging. In some cases, Wrap Up Insurance can be prohibitively costly with premiums costing almost as much as the amount of coverage provided[32]. Yet, in cases like this, cost is increased because of the bundling of Errors & Omissions insurance with the rest of the coverage. The normal coverage for this type of insurance includes[33]:

> a) Property in the course of construction, reconstruction or repair whilst at the risk of the Assured and whilst at the location of the said construction, reconstruction or repair operations which are subject of the contract or contracts described in the Schedule attached to the policy.
>
> b) Property of every kind and description (including materials an supplies) used or to be used in or part of the construction operations wherever the said property may be located within the Continental United States of America, Employees tools and personal property.

Still, as said before, though sometimes tremendously costly, all coverages can be bundled together in one policy. This becomes an extremely challenging problem. How to provide single coverage, but yet make it attractive enough so that it can be feasible?

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[32] Information provided in interview with Maureen McDonough from the Massachusetts Ports Authority
[33] " All Risk" Form, *ISO Commercial Risk Services, Inc.*, 1983, 1987

2.4 Increasing costs of Coverage

2.4.1 *The Insurance Industry's Position*

The insurance industry, like all of the participants involved in project delivery, faces a time of change. As competition becomes stronger, and as customers develop better perspectives of what they want from them, insurance companies are faced with the pressure to take a second look at their services. As acknowledged by a report in Engineering News Record[34] ,

" *Many now realize that risk management cannot be delegated with a premium payment. This passive approach simply increases costs and results in a non-competitive posture*".

Insurance companies are there to make money, and this can't be forgotten. The construction industry must look for better ways to handle risk, instead of expecting passively for insurance companies to cover their backs. This type of attitude is exactly what has taken insurance costs to were they are today. As stated by Danny B. Parrish, "Contractors need to get past the idea that it is the insurance company's problem. This is really our money."[35] You can't state the issue any clearer than this. Although some industry groups have dealt better with the situation, the industry in general still has far to go. The report in ENR tries to make it sound as if the insurance industry is the one that is suffering, it is worth noting that for 1995, the industry expected to realize a net profit of 26 billion dollars after-tax (See Figure 2.6).

[34] *ENR Special Advertising Section: Insurance,* August 28,1995

On the other hand, insurance companies know there is a lot of competition and that they will have to do everything possible to get as much as they can from the available premium pool. As explained by Tim Gow[36];

"Insurance companies are being buffeted by two separate distinct pressures. One is the excess capacity resulting from favorable results and recent investments. Simultaneously, self-insurance and the other risk retention alternatives are lurking. This forces insurance carriers to decrease their prices or to improve their coverage (or both) to retain their clients or attract new ones."

Figure 2.6 U.S. Property and Casualty Insurance Industry Results

U.S. PROPERTY AND CASUALTY INSURANCE INDUSTRY RESULTS

(Billions)

	Net Written Premiums	Underwriting Profit (Loss)	Investment + Income	Pre-Tax Income	Taxes Paid - (Credit)	Total** Capital Gains + (Losses)	After Tax = Income
1978	79.1	1.30	7.3	8.6	1.0	(0.5)	7.1
1979	86.9	(1.30)	9.3	8.0	0.8	2.3	9.5
1980	92.4	(1.30)	11.1	9.8	0.8	4.8	13.8
1981	95.7	(6.30)	13.2	6.9	0.4	(2.4)	4.1
1982	99.4	(9.90)	15.1	5.2	(0.3)	3.5	9.0
1983	109.3	(13.30)	16	2.7	(0.8)	3.5	7.0
1984	118.6	(21.70)	17.7	(4.0)	(1.6)	0.2	(2.2)
1985	144.9	(25.00)	19.5	(5.5)	(1.9)	10.7	7.1
1986	175.3	(16.10)	21.9	5.8	(0.6)	8.9	15.3
1987	193.7	(9.90)	23.9	14.0	2.8	0.3	11.5
1988	202.3	(11.50)	27.7	16.2	3.6	5.4	18.0
1989	208.8	(19.60)	31.2	11.6	2.6	12.9	21.9
1990	218.1	(21.20)	32.9	11.7	3.8	(2.2)	5.7
1991	223.3	(19.80)	34.3	14.5	4.4	18.2	28.3
1992	227.8	(36.00)	33.8	(2.2)	1.3	9.8	6.3
1993	241.7	(17.80)	32.6	14.8	4.8	10.7	20.7
1994	249.8	(22.40)	33	10.6	2.3	0.1	8.4
1995	258	(12.50)	34.2	21.7	5.6	10.0	26.1

* Estimates

** Realized and unrealized capital gains on stocks/bonds

[35]Vice President-Finance and Risk Management of Jame N. Gray Construction Company, Lexington, Kentucky *ENR*, August 28,1995

[36] President of Gow & Hanna , Inc., New York

Source: *ENR* Special Advertising Section: Insurance, August 28,1995

Still, the litigation environment makes change risky. As long as the construction industry relinquishes it control over risk, the insurance industry will be a significant unmanaged influence on project delivery costs.

III. The VRAM (Venture Risk Analysis Model)

3.1 Model Methodology

The Venture Risk Analysis Model is used as a graphic tool to better understand the implications of risk aversion in capital project delivery. Participant risk positioning during project delivery is examined by mapping the way a person (or an entity) places himself (relative to risk) in the delivery of any project. In order to do this, the model measures three primary conditions: (1) Project Complexity,(2) Factor of Strength in Negotiation, and (3) Degree of Exposure.

The risks selected for the measurement of each of the three conditions, derive from two earlier studies which were examined as part of the literature read previous to the development of the model. Using *Primary Consultant Options for Capital Project Planning: A Market Analysis and Selection Methodology*[37], and *Contrasting Design-Bid-Build with Design Build*[38] as building blocks, two sets of risk variables were developed. The first of these set of variables is used in the modeling of Project Complexity and the second, in the calculation of Degree of Exposure and Factor of Strength in Negotiation.

In order to perform a numerical approximation of an individual's positioning in the delivery of a capital project, a scale of 1 to 4, with four being the best possible alternative (in terms of its exposure implications), is used for each of the risks. Each risk is then measured in relation to a set of factors of influence. For each condition, each of the risks is measured against two factors. After giving a value to each of the risks, an average is

[37] Thomas K. Davies, Massachusetts Institute of Technology 1994
[38] Jeffrey L. Beard, Design-Build Dateline, Design Build Institute of America, July-August 1995

calculated from the two and then a single average is determined for all of risks in each of the conditions.

3.1.1 Project Complexity

In order to accurately measure project complexity, one must examine a multitude of specific issues, each of which has a direct influence on the overall complexity of any given project. As shown in Figure 3.1, a qualitative measurement of project complexity is performed by aggregating project and delivery complexity as physical, temporal, financial, and external. Using a scale of 1 to 4, with four indicating the highest possible effect on overall exposure which a single factor may imply, specific values are assigned to different subcategories.

Figure 3.1 Project Complexity

Complexity Factors	Complexity				Average	Criticality			
	None	Low	Medium	High		High	Medium	Low	None
PHYSICAL	1	2	3	4	0	4	3	2	1
Scale Challenge									
Technology									
Site Complexity									
Program									
TEMPORAL	1	2	3	4	0	4	3	2	1
Adequacy of Time									
Continuity									
FINANCIAL	1	2	3	4	0	4	3	2	1
Budget Complexity									
Coverage									
EXTERNAL	1	2	3	4	0	4	3	2	1
Regulatory									
Economic									
Socio Political									

Project Complexity Factor:

3.1.1.1 *Physical*

Physical complexities are the least abstract, and easily measured of all four primary categories used in the mapping. For the purpose of the research, physical complexity is measured as an aggregate of four sub-categories :

(1) *Scale Challenge* : While fairly straight forward in its implications, it is also a factor of project modularity. While a project may be extremely large, its complexity could be greatly reduced by the degree to which it is integrated into or is the prototype for a larger facility.

(2) *Technology* : As probably one of the fastest changing factors of physical complexity today, technological complexity is highly correlated with project types .Technological sophistication of a project can be affected by the use or lack of prototypical elements, the tolerances of systems specifications, the integration of physical systems, and the effect of aesthetics on the complexity of physical systems.

(3) *Site Complexity* : Site issues, like hidden subsurface or site conditions, represent significant risks which may affect a project at all levels. Because of this, site complexity becomes an important factor in the measurement of physical complexity. Apart from the already mentioned possibility of subsurface conditions, weather, topography, and the completeness of site information, can all add to the complexity of a project.

(4) *Complexity of Program* : Depending on the intended use of a facility, programmatic sophistication may become an important source of complexity.

As a result of this, a design can be made more complex by a diversity of inter-relationships between design elements, longer required life spans of structures built, and the need for programmatic flexibility.

3.1.1.2 *Temporal*

Adequacy of time and discontinuity in delivery are two main indicators of temporal complexities. Inadequate or segmented amounts of time allocated to various project phases (relative to industry standard practices), may have serious effects on the delivery of a project. While a project may begin with an adequate schedule, a project's complexity can be greatly increased by inflexible milestones and discontinuities influenced by high levels of rework throughout the duration of the project.

3.1.1.3 *Financial*

Depending on the financing vehicles and payment methods chosen for a project, financial complexity may become a highly influential consideration. Cost plus or unit priced projects for example, may present a higher flexibility, and thus lower levels of financial complexity for the contractor, but higher levels of contract supervision to the owner. Lump sum contracts on the other hand, more concerned with budget adequacy, can require the inverse. While an owner may enjoy lower levels of financial complexity through a fixed price, the contractor is often pressured with a much larger level of financial strain due to the budget limitations which competitive bidding tends to induce. Underpriced projects can bring large amounts of friction, and end up costing more through change orders than if started out under an adequate budget.

3.1.1.4 *External*

Under increasing market globalization, external complexity considerations become more important than ever. Depending on where a project is to be built, environmental considerations may be key to the success of a project. Regulatory, economic, and socio-political factors comprise the relation of a project to its environment. Exchange rates, governments and their regulations, labor requirements and professional practice guidelines, market conditions, and political stability and support, all play key roles in the delivery of capital projects.

After an analysis is made for all of these factors, the effect of each of these sub-categories on Project Complexity is then calculated as an average of the relationship between their individual levels of complexity, and how critical each of them is to the project being examined. For example, socio-political considerations in a project done in the United States (by a U.S. firm) would play a much less critical role, than if the project was done in Iraq. To consolidate all of the calculations, the values are then assigned to each of the four sub-categories and again averaged to reach a final calibration of Project Complexity.

3.1.2 Factor of Strength in Negotiation

A party's factor of strength in negotiation is one of the most difficult areas to map in order to determine overall exposure. Given a defined set of risks, two main factors will influence a party's strength in negotiation: participation, and professional expertise. For the purpose of the model, participation is defined as a party's ability to directly influence any decision made towards the resolution of a problem. A total of 23 areas of potential conflict (or risks) were selected for this. For each of these, a qualitative estimate

Figure 3.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews									
Differences between design criteria & 100% Design									
Errors or Omissions revealed During Construction									
Project Site Safety									
Constructability of Design									
Establishment of Project Cost									
Redesign if Over Budget									
Coordination of Construction									
Permits and Approvals									
Environmental Impact Review									
Coordinating with Other Work									
Quality Control & Quality Assurance									
Differing Subsurface Conditions									
Design Defects									
Construction Defects									
Strikes or Labor Disputes									
Weather Conditions									
Catastrophes- Fire, Flood, Earthquake									
Unidentified Utilities Affecting Sites									
Inflation									
Hazardous Waste; Environmental Clean-Up or Encapsulation									
Third Party Litigation									
Warranties for Facility Performance									

Factor of Strenght in Negotiation:

of participation is made based on a scale of none to high (or 1 to 4), with the highest value given to best condition, and then averaged against that given to the level of professional expertise. Based on four secondary variables, the best condition is then defined as the one which can provide the highest level in strength of negotiation to the party -or entity- under analysis (high participation = 4). Based on this, an individual's level of participation is seen as the resultant of the following four forces:

3.1.2.1 *Contractual*

Depending on the organization chosen, an individual (or party) will be positioned to have a more or less active participation with respect to certain risks. For example a contractor under design/build would have more participation during design, than if a design-bid-build delivery was chosen.

3.1.2.2 *Financial*

Financial participation in the delivery of a capital facility is probably the best source of leverage for increasing a party's strength of negotiation. The best example here is the owner. Even if he has no professional expertise, and decided to shift a large portion of the risk to other parties, the owner would still possess a high level of strength in negotiation given his financial stake in the project.

3.1.2.3 *Professional*

Professional leverage is also important. Because of the risks involved in the delivery of capital projects, and the often limited expertise of the owner, participants will thus benefit from a higher capacity to make decisions. A good example of this could be the structural engineer. Even though he has little financial or contractual power to change the design, he has a great amount of influence on extremely important decisions made during a project.

3.1.2.4 *Individual*

Finally, all of the previous factors are also derivatives of each party's individual ability to negotiate. Even if an entity is perfectly positioned to influence decisions made, the negotiation process will still be conducted by individuals. If one of those individual does not have the required negotiation skills to positively influence the process, the other factors could potentially be weakened.

After this, professional expertise is measured. For this, each of the 23 risks is mapped against specific levels of professional expertise. Professional expertise is here defined as an individual's (or entity's) level of professional training to appropriately manage any conflicts arising as a result of a given risk. Similar to the measurement of participation, professional expertise is measured on a scale ranging from none to high (1 to 4), with 4 being the highest level of professional expertise.

3.1.4 Degree of Exposure

Individual exposure to specific risks must not be confused with overall degree of exposure. For any project, overall exposure will vary proportionally to project complexity and strength of negotiation. On the other hand, an individual's degree of exposure will only depend on the level of responsibility assumed over a given risk.

As in strength of negotiation, degree of exposure is measured using 23 basic risks which are mapped against two influencing factors: Degree of control and Criticality. For each of the 23 recognized risks, degree of control is given values from none to high (1 to 4) depending on an individual's ability to control the risk. Since a person with a higher

Figure 3.3 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews									
Differences between design criteria & 100% Design									
Errors or Omissions revealed During Construction									
Project Site Safety									
Constructability of Design									
Establishment of Project Cost									
Redesign if Over Budget									
Coordination of Construction									
Permits and Approvals									
Environmental Impact Review									
Coordinating with Other Work									
Quality Control & Quality Assurance									
Differing Subsurface Conditions									
Design Defects									
Construction Defects									
Strikes or Labor Disputes									
Weather Conditions									
Catastrophes- Fire, Flood, Earthquake									
Unidentified Utilities Affecting Sites									
Inflation									
Hazardous Waste; Environmental Clean-Up or Encapsulation									
Third Party Litigation									
Warranties for Facility Performance									

degree of control would obviously be less exposed, the lowest number is given to it (high = 1). Inversely, a person with the least amount of control would be under the greatest exposure (none = 4). Using this, values are given to all of the risks and then averaged against the second factor, criticality.

Typically the various aspects identified are interrelated; thus the definitions and indicated implications overlap. Criticality, similar to project complexity, is defined as the level of potential influence a risk may have on the overall success of the project. Depending on the potential losses which a problem in any given area may carry, the criticality of that specific risk will then vary proportionally. As a function on the delivery method chosen, a party's level of exposure can be associated with one or more of the following areas.

3.1.4.1 *Design*

Under newer delivery methods like design/build and construction management, design risk is being shared more and more by other parties. Construction managers and design/builders are directly and indirectly becoming more and more responsible over design. While the exposure of the design/builder is explicit in the contract, the construction manager assumes under some circumstances, implicit responsibility over certain issues.

3.1.4.2 *Construction*

While an owner may wish to participate in construction risk through various means (like the selection of cost-plus or unit price contracts) this is most commonly not the case. Through the use of lump sum contracts, owners can transfer all of the construction risk to the contractor. Yet, acknowledging that is not necessarily the best scenario, new variations in delivery methods try to find a better allocations of risk. When this is the case, one or more of the participants in a project may be accepting non traditional risks, thus proportionally affecting his level of exposure.

3.1.4.3 *Financing*

Last, but not least, there is the risk of financing. Similar to design and construction risks, project financing risks have experienced certain deviations from traditional allocation strategies. Turnkey and BOT projects are examples of this. Under these two methods, contractors may acquire risks which were traditionally held by the owner.

Depending on the organization chosen, certain risks may be more or less critical to a project participant. While under a lump sum contract a builder could afford to have little or no concern over time, the selection of a turnkey methodology would highly "encourage" him to worry about time, thus making that risk much more critical than it was before.

3.2 A Tool to the Owner

The Venture Risk Analysis Model, other than for the purpose of this research, may also be a useful for anyone interested in having a general perspective of what committing to a certain contract may imply. While VRAM was not designed for people with limited knowledge of construction, anyone with a fair understanding of the delivery process may find it very useful in representing a sometimes overwhelming amount of considerations. More than a source to find solutions, the Venture Risk Analysis Model can serve as a source to ask the right questions.

In a time where projects are becoming increasingly more complex, and project delivery is constantly changing to adapt to stricter requirements, owners are finding it harder to keep up. Tools like the Venture Risk Analysis Model, must be developed to aid project leaders in proactively allocating risks prior to any commitment to a specific delivery method.

IV. Innovative Contract Strategies for Project Delivery: The Search for a Better Way

4.1 Contracting Strategies for Design Services

In order for new delivery methods to be increasingly accepted by owners and the industry in general, they must provide the opportunity for players to position themselves better than in traditional delivery methods.

The first two chapters of this thesis provided a historical framework meant to pull together some of the major difficulties which the industry faces today. Though many of the ideas presented in the previous chapters might seem to cover mostly known facts for practitioners today, a clarification and reinforcement of the environmental conditions involved is an essential part in building the foundation needed for the analysis to follow.

4.1.1 *Negligence Disputes*

For project delivery to be improved, it is first necessary to provide a framework which minimizes friction between parties. Those who promote different "new" delivery systems, strongly believe that they provide better alternatives to traditional project delivery methods. Although I do not question the potential of the "new" options, I do question how these ideas translate into better alternatives given the static legal environment in which they exist. For a new delivery method to be faster, or cheaper, or of higher product quality, it must first be more efficient (both in terms of time and money) in the delivery of the facility.

The history of the Traditional Method (or Design-Bid-Build project delivery), which was presented in chapters 1 & 2, provides an excellent preamble to what will be discussed further on. With the aid of a comparative value model (VRAM), chapter 4 takes a look at how the potential benefits of many of the "new" delivery methods are obscured by the static allocation of risk. Using VRAM as an analysis tool, this chapter takes a closer look at how the different "new" methods of project delivery have (or have not) efficiently served the construction industry by diminishing the amount of litigation in project delivery. Still, in order to have a basis of comparison for determining whether or not the "new' methods provide a better alternative to traditional organizations, it must first be established how the different parties compare in terms of their risk position, if the choice of "traditional" project delivery is used.

4.2 Participants' Risk Position under the "Traditional Method"

While risk in project delivery cannot be eliminated, it definitely can be managed both, to the advantage and disadvantage of the process. While owners commonly are not the most knowledgeable in terms of means and methods of construction, it is interesting to see that relative to other parties involved in project delivery, they carry a major portion of the risk. Even though the degree of exposure which different factors may imply varies with relation to the person managing the risk, the conscious acceptance of risk is essential to any successful project .

4.2.1 *The Owner*

Based on a list of 23 common risks involved in project delivery, the traditional method places the most exposure on the shoulders of the owner (See Figure 4.11). Figure 4.1 charts the "typical" owner's position in the traditional project delivery by looking at the level of control and exposure that these risks may represent. Depending on the owner's level of control over a given risk, his exposure to any problem related to that risk. The degree of exposure faced by an owner is relative to the financial liability implications of failing to adequately manage a given risk.

Figure 4.1 Owner's Contractually Accepted Risks under the Traditional Method

Risk/ Responsibility	Degree of Exposure				Problem Drivers	Degree of Control			
	None	Low	Average	High		Minimal	Weak	Average	High
Design Reviews				■			■		
Differences between design criteria & 100% Design		■				■			
Errors or Omissions revealed During Construction			■				■		
Constructability of Design				■	■	■			
Establishment of Project Cost				■				■	
Redesign if Over Budget				■	■	■			
Permits and Approvals				■				■	
Environmental Impact Review				■			■		
Coordinating with Other Work				■	■	■			
Quality Control & Quality Assurance				■	■	■			
Differing Subsurface Conditions				■	■	■			
Design Defects				■	■	■			
Strikes or Labor Disputes				■	■	■			
Weather Conditions				■	■	■			
Catastrophes- Fire, Flood, Earthquake				■	■	■			
Unidentified Utilities Affecting Sites			■				■		
Hazardous Waste; Environmental Clean-Up or Encapsulation				■			■		
Third Party Litigation				■				■	
Warranties for Facility Performance				■	■	■			

While owner control will vary on an individual basis, the structure of traditional project delivery promotes the creation of "points of friction" (See drivers in figure 4.1). The former map presents the "average" condition of an owner under traditional project delivery. However all of the shown drivers would be pre-determined in all Design-Bid-Build projects by a delivery system which statically distributes them among the participants involved. Given their limited control, owners are faced with inflated levels of legal and financial exposure.

Looking at figure 4.1, owners share a very large portion of risks which are "critical" to a project's success. Even though an owner is highly exposed to all of the risks shown, his ability to adequately manage those risks (as compared to the other parties) is considerably weaker. Out of 19 risks outlined in figure 4.1, 53% of them negatively position the owner to deal with potential difficulties encountered during the life of a project. From the total amount of risks analyzed, more than half raise serious questions as to the reasoning behind the established risk distribution scheme. Risks with the weakest relationship between potential exposure and degree of control are those which have prompted most of the contractual customization seen in recent years:

- Differences between Design Criteria and 100% Design
- Constructability of Design
- Redesign if Over Budget
- Coordinating with other Work
- Quality Control & Quality Assurance
- Differing Subsurface Conditions
- Design Defects
- Strikes or Labor disputes
- Weather Conditions
- Catastrophes- Fire, Flood, Earthquake

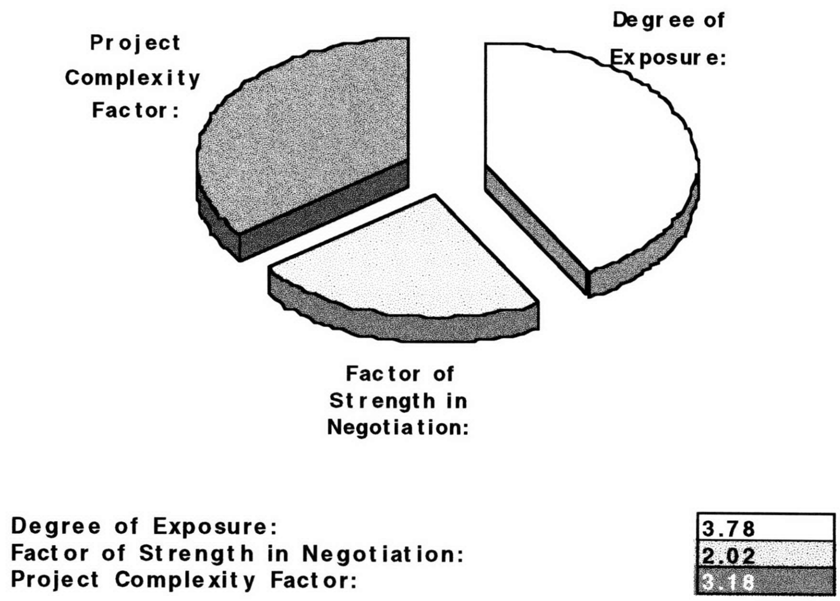
- Warranties for Facility Performance

Due to the large share of risks which are allocated to the owner under traditional project delivery, the profitability and success of not only the project, but of all parties involved, becomes highly sensitive to an owner's ability to control risk (See Figure 4.11).

To give an example, lets assume an owner with an average knowledge of construction (where most owners build 1 or two projects in their life span) and a project of average complexity (say corporate headquarters). The project would consist of a traditional agreement based on AIA contract forms (A- 111/A-201/A-141) and a lump sum contract between the GC and the Owner. For the purpose of analysis, cost and time of completion will not be specified, but instead will be established under the assumption of a fair estimate of both. Though the model takes into consideration over 110 variables which address very specific conditions over a wide range of project variations, the general position of an individual can be approximated with fair accuracy from the previously mentioned variables (See Chapter 3 for a detail view of the VRA model). Having established the former, the risk position undertaken by him would be affected by his comparative capacity to manage accepted risks through: Professional Expertise, Participation on the problem resolution process, the Criticality of the risk relative to the exposure of the participant, Criticality of a risk relative to the success of the project, the level of Complexity of the project, and the Degree of Control over the potential risk.

Using these variables under the former project and analyzing how they would be relative to the position assumed by the owner, his overall risk positioning in the described venture would be as follows:

Figure 4.2 Owner's Risk Positioning in the Traditional Method



Source: *See Appendix: B-1 for Calculation of Values*

Under traditional contracts, the owner bears the responsibility and risk for design errors discovered during construction. Using the traditional approach, it is the owner who essentially takes ownership of the drawings and specifications, and it is the owner who warrants to the construction contractor that the drawings and specifications are complete and free from error.

Yet under most circumstances (as shown in Figure 4.2), owners have a limited comparative capacity to control risks. As said before, by statically allocating risks to project participants without considering the potential increased exposure caused by their ability to control them, the traditional method puts most owners in a weak position to manage their level of exposure. Because owners will be financially exposed to any escalation in cost, their limited ability to control the direction of the venture limits their ability to properly position themselves. Given their weak positioning in terms of risk control, the traditional delivery system causes owners to be both defensive and conservative during the construction process. Still, what is most interesting is that the other parties are no better off. Though the contractual risk allocations are not equivalent for all of the parties involved, the ability of an owner to control the risks will directly influence all three main participants (designer, builder, owner).

4.2.2 *The Builder*

Of the three main participants in the "traditional" delivery of a project, the builder is the second most at risk relative to the "typical" risk sharing scheme. Compared to the owner, the builder or GC, accepts the second largest amount of risk. Figure 4.3 shows some of the major risks which are assigned to the builder by traditional project delivery. Looking at the mapping of risk in the table, it can be seen that the builder is in an advantageous position compared to the owner. Given the risks which the builder "contractually" accepts, one would expect him to be in a safe position in the venture. Yet if this was so, builders would theoretically face minimal amounts of litigation. As most know, this is not exactly the case. As agreed by many, and as explained in previous chapters, the United States construction

Figure 4.3 Builder's Contractually Accepted Risks under the Traditional Method

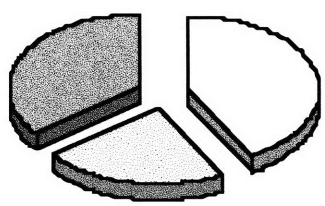
Risk/ Responsibility	Degree of Exposure				Drivers	Degree of Control			
	None	Low	Average	High		Minimal	Weak	Average	High
Project Site Safety				■					■
Coordination of Construction				■					■
Permits and Approvals		■							
Coordinating with Other Work									■
Quality Control & Quality Assurance				■					■
Differing Subsurface Conditions				■			■		
Construction Defects				■					
Strikes or Labor Disputes				■					
Weather Conditions			■			■			
Catastrophes- Fire, Flood, Earthquake			■			■			
Inflation			■			■			
Warranties for Facility Performance		■					■		

industry is plagued with litigation. As portrayed in the previous table, the contractor has probably as much exposure as the owner. However his ability to control the risk he has contractually accepted is sharply improved. Because the owner can potentially accept risks which directly influence his level of exposure, but yet has little ability to control, a great amount of "friction" gets built into the system. By analyzing their respective position on a traditional Design-Bid-Build venture, it can be seen that there is a strong disparity in their respective conditions.

As the model points out in Figure 4.4, the builder enjoys a much lower exposure, for the most part because of a higher capacity to control the risks received through the contract. Still, even though degrees of risk and exposure vary between participants, their potential exposure grows as a correlated function of each other's position. As this shows, no matter where the risk is put in the contract, it will find a way of affecting those who have the higher capacity to control it. For example, if a contractor indemnifies the owner from "all" liability for unidentified underground conditions, it does not mean the risk has disappeared, but just means that it has changed form into a premium.

Figure 4.4 Contractor vs. Owner's Risk Positioning

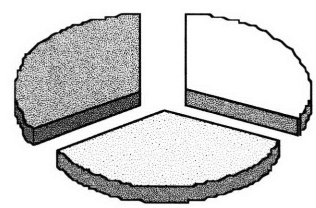
Owner



Degree of Exposure: 3.77
Factor of Strength in Negotiation: 2.04
Project Complexity Factor: 3.18

Source: *See Appendix: B-1*

Builder



Degree of Exposure: 2.93
Factor of Strength in Negotiation: 3.17
Project Complexity Factor: 3.18

Source: *See Appendix: B-2*

Yet, if the risk of underground conditions is given to someone who is not able to have control over it (with a premium for example), the risk could potentially induce increased costs to all involved by increased litigation and time.

4.2.3 *The Designer*

Of the traditional tri-partite arrangement used for project delivery, the designer is probably the one with the least amount of contractually placed responsibility. Still, A/E's present the best example of how contractual risk shifting has ultimately served as a weakening tactic for the design industry. Applying the model to the same project which was used for the owner's example, the cause for the currently weakening position of designers in traditional project delivery becomes more clear. To show this, figure 4.5 outlines the risks which an A/E would traditionally accept on a contract of this type. Having already seen the risk scheme for the owner and the contractor, the disparate position between the architect and the other two participants becomes highly evident.

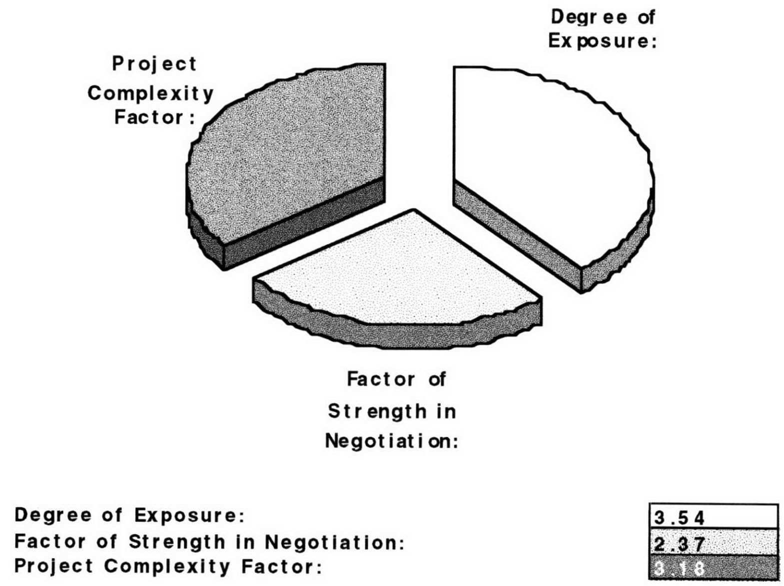
Figure 4.5 Designer's Contractually Accepted Risks under the Traditional Method

Risk/ Responsibility	Degree of Exposure				Drivers	Degree of Control			
	None	Low	Average	High		High	Average	Low	None
Differences between design criteria & 100% Design									
Design Defects									

Still, many designers neglect too see the problem. By choosing to step away from risk, they are facing an ever increasing exposure to liability. As explained in the beginning chapters, by diminishing their share of contractually accepted risks, designers are not strengthening their position, but instead eroding it more and more. The VRA model graphically represents this trend by plotting the previously mentioned relationships between control, project complexity and strength of negotiation, as they affect the position of the participants in the delivery of a capital project.

Figure 4.6 demonstrates how the relationship of the overall exposure of designers increases as they relinquish their ability to control risk. The model shows in their negotiating position, how their diminished participation has weakened their position in the value chain. From the previous table, one might expect designers to have a minimal level of exposure. Still, designers today feel increasingly exposed to risk. The following figure demonstrates how this it true by taking into consideration how risk aversion has affected their ability to control risk. Figure 4.6 depicts not only what is happening to designers, but to all involved in misguided practices of risk allocation.

Figure 4.6 Designer's Risk Positioning in the Traditional Method



Source: *See Appendix: B-3 for Calculation of Values*

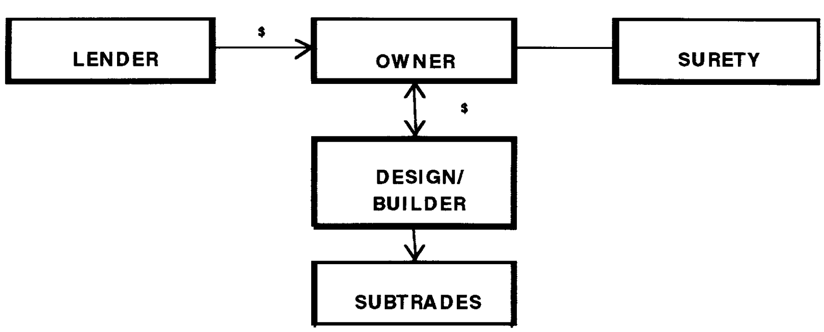
As demonstrated through the model, participant exposure diminishes in direct proportion to control over risks. Eliminating risks from the contract (as seen in the case of the Designer), causes the reverse effect of that which could be "logically" expected. As risk is given away, those who really have the capacity to manage the risk loose control over it, thus affecting the riskiness of the project as a whole. With the model the research is able to show that contrary to general belief risk aversion weakens, instead of strengthening, the position of project participants. The misguided allocation of risk has increased the friction in the system by supporting the establishment of disparate bargaining powers in the process.

4.3 Design/Build -A Step in the Right Direction

4.3.1 *How is it Different?*

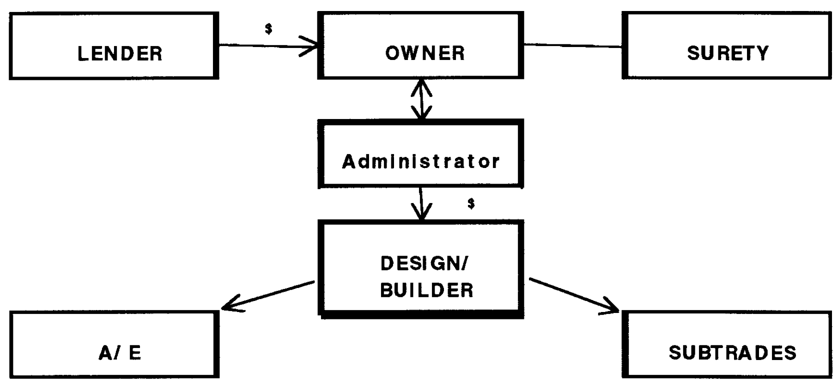
Unlike traditional project delivery which divides the design and construction services between the two separate entities, design/build places the design and construction responsibility under a single entity. For the most part, design/builders provide services in one of three forms: (1) architect subcontracting construction; (2) contractor subcontracting design; or (3) joint venture of an architect and a contractor. Though there are specialized entities that work solely on design/build, it is far more common to encounter one of the three previously mentioned forms (See Figure 4.7).

Figure 4.7 Design/Build Delivery System



Because there exist far fewer relationships in which an owner must participate or over which an owner need exercise supervision, some owners have modified the process to what is known as Bridging[39] (See figure 4.8).

Figure 4.8 Design/Build Delivery with Bridging



All that bridging does is place a fiduciary party for the owner between himself and the design/builder. This fiduciary agent is normally an architect or construction manager that serves as an administrator of the project for the owner. The responsibilities of this administrator may include project definition, selection of the design/builder, review of the design and construction documents, and supervisory responsibilities over the actual construction project. While the design/builder provides owners with today's version of the master builder, "the enlightened builder, or the architect trained in construction who, once upon a time, integrated design and construction at the building site". The supervisor covers for the time and management capabilities that while necessary, most owners don't have.

[39] The term "bridging" was developed by George Henry, FAIA.
Charles B. Thomsen, *Bridging,* The Architects Handbook of Professional Practice

In terms of contractual and financing methods there exist various options for the owner. Design/Build allows for more liberty in creative financing than the traditional method. Though there are many possibilities in terms of financing, the following four are some of the most used ones[40]:

1. *Traditional Design/Build* : Closest to traditional financing. Owner pays the design/builder throughout the design and construction of the project. Further analysis on risk allocation for design/build will focus on this type of project, though the general ideas may apply to all of the other three options.

2. *Turnkey* : In this option the design/builder provides the financing for the project. The design/builder delivers the project for a set price and by a certain date. Upon completion and payment by the owner, the design builder turns the project (key) to the owner.

3. *Build-Leaseback* : In a build leaseback the design/builder provides the financing for the project and retains ownership at completion. The design/builder then leases the building back to the owner as if he were only a client. The lease terms are usually negotiated prior to the commencement of the construction.

4. *Build-Operate-Transfer* : This option, which has been mostly used for large infrastructure projects in developing countries, recurs once again to the design/builder for financing. Here the design/builder operates the project for a pre-determined amount of time and then returns the project to the owner.

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[40] Thomas J. Ragonetti & William H. Brierly, *Assessing the Owner's Risk in Design Build Projects,* American Bar Association Forum on the Construction Industry San Francisco, California April 1995

Likewise, and similar to traditional project delivery, design/build can also be defined in terms of the method chosen for payment. As described by the same authors mentioned before, some of the most common varieties include[41]:

1. *Lump Sum* : In this type of contract the design/builder agrees to build the project, including supplying all labor and materials, for a specified dollar amount or "lump sum".

2. *Cost-Plus-a-Fee* : For this contract, the design/builder agrees to do the project for all of the subcontractors' prices for labor and materials (the "costs") plus a design/builder's fee of either a specified dollar amount or a percentage of the costs of the project. Whether included as part of the design builder's fee, or separately stated as a cost of the project, the design/builder will also be typically paid for "overhead" and "general conditions", that is, a share of the design/builder's general overhead costs which may be fairly apportioned to the project, as well as reimbursement for the general collection of typical construction project tasks and materials performed or supplied by a design/builder which are essential to the smooth running of the project, but generally defy precise categorical description. In a pure Cost-Plus-a-Fee contract, at the outset there is theoretically no cap set on the ultimate project price because the project price will be the result of all the individual subcontract costs, then unknown, plus the design/builder's fee.

3. *Cost Plus a Fee Subject to a GMP* : In this version of the Cost-Plus-a-Fee contract, the design/builder will agree with the owner that those costs plus the design/builder's fee, will not exceed a guaranteed maximum price. Unlike the lump sum approach where the owner's cost is known at the time of contracting, and unlike the pure cost-plus-a-fee option where the owner's ultimate cost for the project is unknown at the time of contracting, here the owner will know since the first day he may pay less than, but never more than, the guaranteed maximum price set.

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[41] Thomas J. Ragonetti & William H. Brierly, *Assessing the Owner's Risk in Design Build Projects*, American Bar Association Forum on the Construction Industry San Francisco, California April 1995

4. *Unit Price* : This contract is done by having the design/builder agree to specified unit prices for specific items of material and labor. Here the ultimate contract price becomes the sum of the total number of "units" of material and labor required to build the project.

Still, while all of the above mentioned could be seen as common variations of the design/build process, there are some other approaches which have rendered equally good effects using a very different approach.

4.3.1.1 *Partnering for Design/Build*

The term partnering is being used with more and more frequency today. Incorporating no formal contractual agreement between the participants, the approach has been a new way of addressing the friction that has negatively influenced the relationship between participants in traditional project delivery. As explained by Daniel M. Yamshon:

" In light of the history of not only construction disputes, but of the field experience with the unexpected constantly present, it makes sense that a method that can be considered analogous to "premediation" of conflicts before they arise might be extremely useful [42].

Partnering is a collaborative contracting process that focuses on dispute prevention, rather than on dispute resolution. The concept was created in response to many of the relationship problems which were mentioned in the first two chapters. The partnering process thus tries to create a framework for teambuilding, where open communication, commitment to common goals, mutual respect, and trust, can be developed. In an article by

[42] Daniel M. Yamson, *Partnering for Design/Build,* American Bar Association Forum on the Construction Industry San Francisco, California April 1995

David P. Johnson, Senior Counsel, U.S. Army Corps of Engineers, partnering is traced to contracts involving DuPont Engineering and Fluor Daniel in the 1980's[43].

To better illustrate what a partnering agreement encompasses, a copy of the American Arbitration Association's sample clause is reproduced in Figure 4.9.

Figure 4.9 AAA's Sample Partnering Clause

"In order to complete this contract most beneficially for all parties, the parties to this contract agree to form a partnering relationship. This partnering relationship will draw on the strengths of each party in achieving a quality project. Within ____days of the date of execution of this contract, the parties will request form the American Arbitration Association the appointment of a neutral facilitator for the partnering retreat. The partnering retreat will take place as soon as is practicable, but in any case within____days of the date of execution of this contract. The parties to this contract agree to good faith participation in such a partnering retreat. Individual participation in such partnering retreat shall be agreed upon by the parties, but shall include at least the following project personnel:

[list personnel here]

The cost of administering the partnering retreat and the fees and expenses of the partnering facilitator shall be borne equally by the contracting parties"

Source: *Dispute Resolution Journal,* Vol. 48, No. 2 June 1993

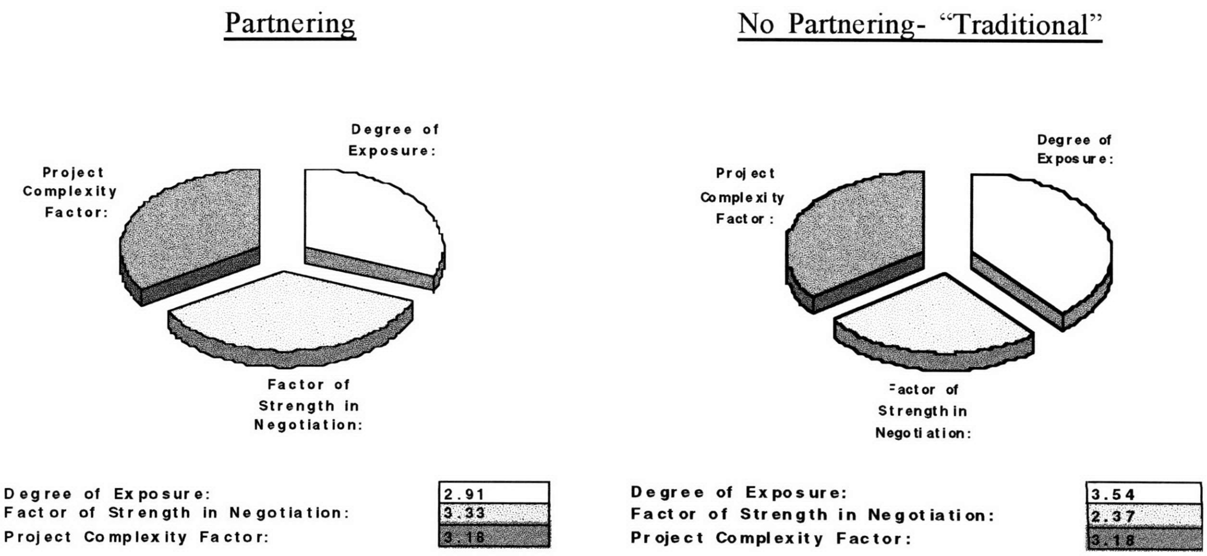
The idea of partnering can be applied over a wide array of contractual arrangements. However an analysis of the general effects under a traditional contract shows how it is that so many industry participants have found great success in its application[44].

Looking at Figure 4.10, it can be seen how the position of a participant would be affected. Though this figure uses the A/E as the basis for comparison, the example is applicable to the general effect of partnering on capital project delivery. Figure 4.10

[43] David P. Johnson, *Partnering in Government Contracts, The Ultimate Dispute Resolution?,* World Arbitration and Mediation Report October, 1990

demonstrates how partnering influences the strength of negotiation of a "partner", thus diminishing his overall risk exposure.

Figure 4.10 The Effect of Partnering on a Participant's Risk Exposure



Source: *See Appendix: B-4*

Source: *See Appendix: B-3*

Partnering is a perfect example of what changing the system and not the contracts means. As many owners have found out (Industry Task Force on Partnering 1989), the diminished friction achieved by the lubrication effect of partnering has translated to financial gains for all involved in the process. Addressing the problems which were depicted by the application of the VRA model on the traditional method analysis, partnering is the most recent search for finding balance between the participants in project delivery. The introduction of partnering has helped to induce increased fluidity in the process.

[44] Specification of project or contract type is not necessary due to the fact that the effectiveness of partnering depends not on contract type, but on the willingness of participants to adopt the process.

4.3.2 *The Benefits of Design/Build*

Design/Build addresses many of the inefficiencies that have created problems on traditional project delivery. In essence, design/build brings both design and construction together under varying configurations in order to address the previously mentioned barriers affecting time, construction costs and flexibility to innovate. Design/Build achieves this in various ways.

First of all, design/build helps "fast-track" projects. By combining and overlapping the design and construction functions, the contractor can begin work on excavation, site work, and possibly foundation work before the final plans are finished. Because of its approach, design/build allows the construction project to begin work at a point where under traditional project delivery, the designer is still preparing the plans in order for the owner to later send out the RFPs. For owners who will incur in heavy financing costs, or for whom time of completion is of extreme importance (such as pharmaceuticals), the fast-track nature of design/build allows them to finish projects in less time than the traditional method.

Second, and most relevant as compared to other methods, design/build allows owners the benefit (or advantage) of having single entity responsibility. Because of the nature of design/build, the owner needs to look to only one entity in order to address any design or construction problem. As is expressed by many owners, this is a welcome alternative to the situation commonly found in the "traditional" method were the contractor typically points his finger at the architect, and the architect points his at the contractor.

Finally, design/build may offer savings on specific projects because of its combination of design and construction services. Time associated savings will be achieved as a result of the "fast-track' nature of the process. In addition design/build also allows for savings on projects where the design is not detailed and may be repeated in several locations. In industries where an owner may require a single type of building with the same design details in every location, the design build method offers substantial savings over the traditional method option. Design/Build could also be the only option, as in the case of extremely complex projects that require close interaction between design and construction.

4.3.3 *Legal Exposure of its Participants*

An analysis of design/build's risk allocation presents interesting contrasts between its practices and those of the traditional method. Looking at the basic scheme of risk for design/build, it can be seen that the owner faces a totally different environment of contractual obligations.

As seen in Figure 4.11, design/build takes much of what was traditionally the owner' s responsibility and puts it on the hands of the design/builder. Different from the traditional method, design/build brings up front the allocation of risk and thus provides an environment which rewards risk acceptance. In this way, Design/Build's structure acknowledges the idea that risk is like energy: neither created nor destroyed, but instead capable of assuming different forms (and residing in different hands) depending upon project delivery methodology and contract format. While design/build provides an excellent opportunity for most applications, it is not what may be called a "perfect" solution. For design/build to work under the currently available formats owners must be aware of were potential obstacles may reside, and how they stand on the overall risk sharing scheme, depending on the risks they accept.

Figure 4.11 Traditional Risk Allocation Compared to the Typical Design-Build Contract

Risk/Responsibility Category	Typical Risk Allocation in "Traditional" Design-Bid-Build			Typical Risk Allocation in Design/Build	
	Owner	Designer	Constructor	Owner	Designer
Design Reviews	Owner			Reviews for compliance with design criteria	Design/Builder
Differences between design criteria & 100% Design	Owner	Only if Negligent			Design/Builder
Errors or Omissions revealed During Construction	Owner				Design/Builder
Project Site Safety			Constructor		Design/Builder
Constructability of Design	Owner				Design/Builder
Establishment of Project Cost	Owner				Design/Builder
Redesign if Over Budget	Owner				Design/Builder
Coordination of Construction			Constructor		Design/Builder
Permits and Approvals	Obtains overall approvals		Obtains most permits	Limited to major approvals	Obtain most permits or approvals
Environmental Impact Review	Owner			Negotiable	Negotiable
Coordinating with Other Work	Owner		Coordinates subs only		Design/Builder
Quality Control & Quality Assurance	Significant inspection and testing		Responsible for quality in workmanship	Oversight only	Design/Builder
Differing Subsurface Conditions	Owner		Responsible for conditions inherent in type of work	Negotiable, responsible for information given	Negotiable, but typically responsible for most conditions
Design Defects	Owner	Only if Negligent			Design/Builder
Construction Defects			Constructor		Design/Builder
Strikes or Labor Disputes	May be responsible for some		May be responsible for some		Usually, but negotiable
Weather Conditions	May be responsible for some		May be responsible for some		Usually, but negotiable
Catastrophes- Fire, Flood, Earthquake	May be responsible for some		May be responsible for some	Negotiable	Usually, but negotiable
Unidentified Utilities Affecting Sites	Owner				Design/Builder
Inflation			Constructor	Negotiable	Negotiable
Hazardous Waste; Environmental Clean-Up or	Owner			Owner	Negotiable, but may not be cost-effective for owner to shift
Third Party Litigation	Owner			Owner	
Warranties for Facility Performance	Owner		Typically resp. for matl's & Workmanship for 1yr		Supplying design & product perf. warranties negotiable

Source: *Design-Build Dateline: Design-Build Institute of America, July-August 1995 Volume II, Number 4*

4.3.3.1 *The Owner*

One of the biggest potential risks to an owner using design/build is single source responsibility. Under the traditional project delivery the owner can recover, both from the contractor and the architect. In most cases this provides the owner with at least two sources of recovery in case something goes wrong. Because in design/build there is only one source for recovery, owner's must pay special attention to the financial situation of the design/builder chosen for the project.

In some cases, closely related to the risks attendant with single source liability are the risks associated with a special purpose entity formed to do the project. Very often design/build contracts are performed under special purpose entities or one-time joint ventures between a contractor and an architect. Because of the legal and financial characteristics of these entities, owners must be careful to make sure that in the case of a claim those entities will have the financial capabilities to respond, and that their organizational structures will not shield them from liability. Owners must make sure that entities formed posses the financial merits and are formed legally in such a way that their resources are available to respond to any claims encountered during the delivery process.

One of the most mentioned criticisms regarding design/build is the alleged lack of check and balances. Contrasting design/build, in the traditional method the contractor theoretically review the plans before bidding/negotiation and before and during the construction. On the other hand the architect has some level of responsibility to review the contractors work and thus serve in a fiduciary relationship to the owner. Given that design/build blends both capabilities into one entity, owners must pay close attention to the capabilities of the design/builder chosen as otherwise there will not be any other checks and balances.

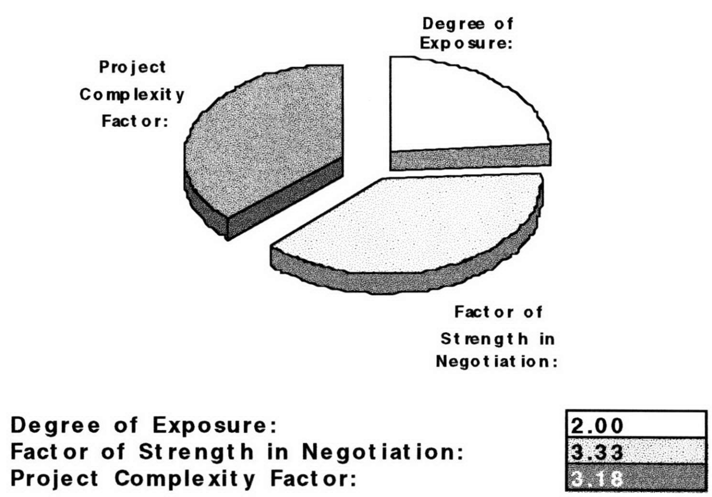
Another problem also commonly associated with design build is that the combination of services may result in a loss of independent design or architectural functions. In design/build the designer is vulnerable to be pressured by the contractor to maintain or increase profit margins in the project at the possible expense of design quality.

Adding to the above concerns, there is also the problem of insurance coverage. Insurance companies, though currently increasing their available range of coverage for design/build ventures, have traditionally been a major obstacle to the process. By combining design and construction into a single entity, projects may lack the necessary coverage for design errors and omissions. The combination of functions may also result in the design/builder not carrying sufficient liability insurance. Owners should pay careful attention to this and consult with a knowledgeable broker or insurance company representative who will be able to determine if the design/builder possesses the necessary insurance capabilities to cover losses in case the project runs into problems.

Finally, many states' licensing requirements affect whether an architect or contractor may perform design/build legally. In some states, architects that do not have a contractor's license may be blocked for delivering construction services, and vice versa. Other states require a separate license for the design build entity. As in all the other cases, owners better make sure that the entity formed is legal, and how the local state laws and regulations may affect the operation of the design builder chosen.

Still, even though design/build does have a lot of potential pitfalls, it is yet an excellent response to what the market is asking form the construction industry. Owners want less problems, more speed, and a better product. Design/build does require a high level of expertise from the owner and it offers definite advantages if managed well. Different from the traditional method, which establishes a more rigid allocation of risk, design/build allows the owner to, and I say again, "potentially", mold the risk allocation to his level of expertise and thus assume better control over the project. If a project like the one used for the traditional method example was used to represent the participants position in the project, it would be seen that the owner may significantly lower his exposure by actively allocating risks which he

Figure 4.12 Owner's Risk Positioning in Design/Build.



Source: *See Appendix: B-5 for Calculation of Values*

may feel unable to control. Applying the VRA model to a hypothetical situation similar to the one mentioned in section 4.2.1, but using design/build as the delivery vehicle for the project, the situation of the owner can be represented clearly (See Figure 4.12).

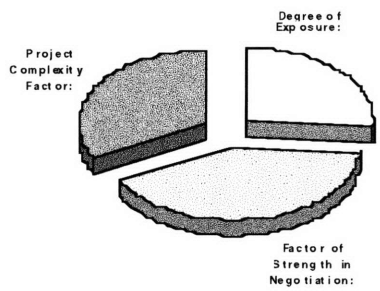
Interestingly enough and different to design-bid-build, design/build though limiting the degree of "Control" an owner may have over decisions regarding potential risks for the project, proportionally decreases the "Criticality" of the risks by consciously allocating control over them to the design/builder. While an owner may chose to carry more or less risk personally, the relationship would remain constant thus always helping to diminish his "Exposure' in the project. In terms of project complexity and strength of negotiation, the owner has complete initial negotiation capabilities to allocate risk as the design/builder and he see fit and are able to compensate for. Because of this capacity to consciously allocate risks, the owner thus increases his "Strength of Negotiation", but puts it all up front in the project delivery process. Still, it must be admitted that this gives him an initial level of flexibility, but does limit his capacity to exert pressure later on if any changes come along.

4.3.3.2 *The Design/Builder*

The design/builder presents an excellent example of what the benefits of risk acquisition means. While is true that the benefits and control which individual design/builders may have will be directly proportional to their respective capacities to manage and control the risk they accept, they are much better positioned to take full advantage of their position relative to risk allocation. As is reflected in the risk positioning map presented in Figure 4.13, design/builders are favored by an extremely high negotiating position. Given that the design/builder has a high level of control and expertise over the potential risk sources, his negotiating position is therefore strengthened. Serving both as designer and builder, the design/builder enjoys a high factor of strength in negotiation that is influenced by his larger participation in conflict resolution and his strengthened professional capabilities to mange situations which may potentially affect his overall exposure. Though the owner has a slightly weaker negotiating position as compared to the design/builder, he compensates by having a potentially lower exposure (See Figure 4.13)

Figure 4.13 Design/Builder's vs. Owner's Risk Positioning in Design/Build.

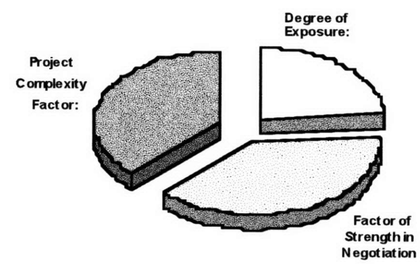
Design/Builder



Degree of Exposure:	2.54
Factor of Strength in Negotiation:	4.00
Project Complexity Factor:	3.18

Source: *See Appendix: B-6*

Owner



Degree of Exposure:	2.00
Factor of Strength in Negotiation:	3.33
Project Complexity	3.18

Source: *See Appendix: B-5*

Looking at the calculation for both of the model applications, it can be seen that the design builder, as compared to the owner, has a much higher level of control over risk. Still, the owner maintains a safe level of exposure by lowering the criticality of the risk relative to his exposure by transferring it to a single source, the design/builder. The design/builder on the other hand, though having a larger share of risk, has more control and thus will (theoretically) be compensated accordingly, as agreed by both at the beginning of the venture.

4.4 Construction Management

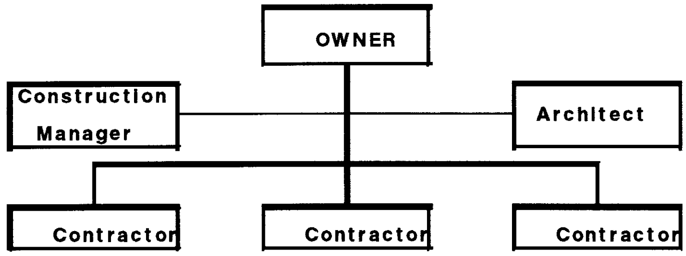
The Construction Management system was developed as an alternative to general contracting (GC) and design/build (DB). Though the three systems use the same construction industry resources, they differ significantly in the way they contract for the necessary resources. In construction management, the CM becomes an extension of the owner's capabilities in contracting and construction, just as an A/E becomes an extension in areas of design. As a fiduciary agent to the owner, a peer relationship is created between the CM and the A/E through appropriate provisions in their separate contracts. A functional delivery team consisting of the owner, A/E and CM is established. Through this relationship the owner and the architect have the necessary resources to analyze design and construction alternatives as they relate to the overall cost and schedule of the project. As mentioned by John L. Tishman[45] in The Robert B. Harris Inaugural Lecture given in 1988 at The Center for Construction Engineering and Management in the University of Michigan, the most important aspect of the approach is that the owner is made totally aware of aesthetic, schedule and cost trade-offs before making program and design decisions.

4.4.1 *The Construction Management Approach*

Though construction management originates from what its known as it's "pure" form or Agency CM (ACM) (see Figure 4.14), there have been many variations to the

[45] Tishman Realty & Construction Co., is generally acknowledged to have pioneered Construction Management as a *professional service, during the 1960's.* Their first construction management assignment was Madison Square Garden, in 1963. This was shortly followed by the John Hancock Center (1965) and New York's World Trade Center (1967).

Figure 4.14 Agency Construction Management



approach. There are three main branches (with their respective individual forms) coming out of the strict agent form of the CM system[46](See Figure 4.15) :

(a) *Extended Services Forms (XCM)* : This form of construction management permits the CM to perform a multi-role as either an AE/CM or a CM/CONTRACTOR and or CONSTRUCTOR. Though XCM has variations of its own, in each variation, the initially contracted services are extended to include one or more additional services.

(b) *Guaranteed Maximum Price (GMPCM)* : Also referred to as "contractor" CM, this version of construction management permits the CM, at a late point in design, to amend the agency agreement in order to provide a GMP to the owner. Once the GMP is given, the CM becomes involved in a dual role as both a CM and a Contractor. The role introduces several options to the contract (See Figure 4.15). Because the CM assumes contracting risk, he is generally permitted to mitigate risks through various options such as : negotiating with the owner, competing with bidders and/or holding some or all construction contracts. GMPCM requires exact contract definition and mutual understanding of responsibilities.

(c) *Owner Construction Management (OCM)* : This final variation of the ACM system places the owner in the performance position of the CM. The owner absorbs the CM responsibilities according to his in-house capabilities. If the total requirement exceeds his

[46] Committee on Construction Management, Qualification and Selection of Construction Managers with Suggested Guidelines for Selection Process, *Journal of Construction Engineering and Management*, Vol. 113, No. 1, March, 1987

capabilities, he strengthens them by adding appropriate staff for the project or hires specific services from a CM firm.

Figure 4.15 Fundamental Matrix of Services Provided by the CM

Construction Mangement		Construction Mangement Services	Provide Design Services	Provide Construction Services	Hold Construction Contracts	Provide Guaranteed Maximum Price
Form	**Variatio**					
Agency construction management (ACM)	none	*				
Extended services construction management (XCM)	Design extended services CM (design XCM)	*	*			
	Construct services CM (construct XCM)	*		*		
Guaranteed maximum price construction management (GMPCM)	Contract Extended Services CM (contract XCM)	*			*	
	Construct-contract extended services CM (contr-contr XCM)	*		*	*	
	Construct guaranteed maximum price CM (contract GMPCM)	*		*		*
	Contract guaranteed maximum price CM (contract GMPCM)	*			*	*
	Construct contract guaranteed maximum price CM (constr-contr GMPCM)	*		*	*	*

Source: *Journal of Construction Engineering and Management*, Vol. 113, No. 1, March, 1987

Still, for the purpose intended in this research, the "pure" approach provides the best empirical environment to study the relationships and risk sharing practices involved in construction management. Because "pure" construction management retains a strict agency posture throughout project delivery, it's form permits a better analysis of participant positioning.

4.4.2 *The Risk Scheme*

An important point regarding the risk sharing scheme of construction management is that under the "pure" agency form, CM services are considered as a literal extension of the owner's ability and capacity to deliver a project. As mentioned by Committee on Construction Management:

"By engaging the services of a CM, the owner gainfully mitigates the risks inherent to project delivery through an agreement to expertly manage them. He does not transfer any risks as he does when engaging a general contractor. Therefore, the services of the CM (though different in content) should be considered from the same perspective as those of the design professional and *not* the general contractor[47]".

The function of the CM in agency construction management is to help the owner deal with the potential of liability generated by the complex interaction of the numerous contractors on the job. As expressed by the Committee on Construction Management, by equating risk exposure to risk value, the CM identifies the risks, evaluates them, and appropriately allocates them in the owner's best interests. Though in essence most risks in project delivery are operational rather than financial, the CM is responsible for adequately managing the project in order to diminish the potential for those risks to result in financial liability to the owner.

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[47] Qualification and Selection of Construction Managers with Suggested Guidelines for Selection Process, *Journal of Construction Engineering and Management*, Vol. 113, No. 1, March, 1987

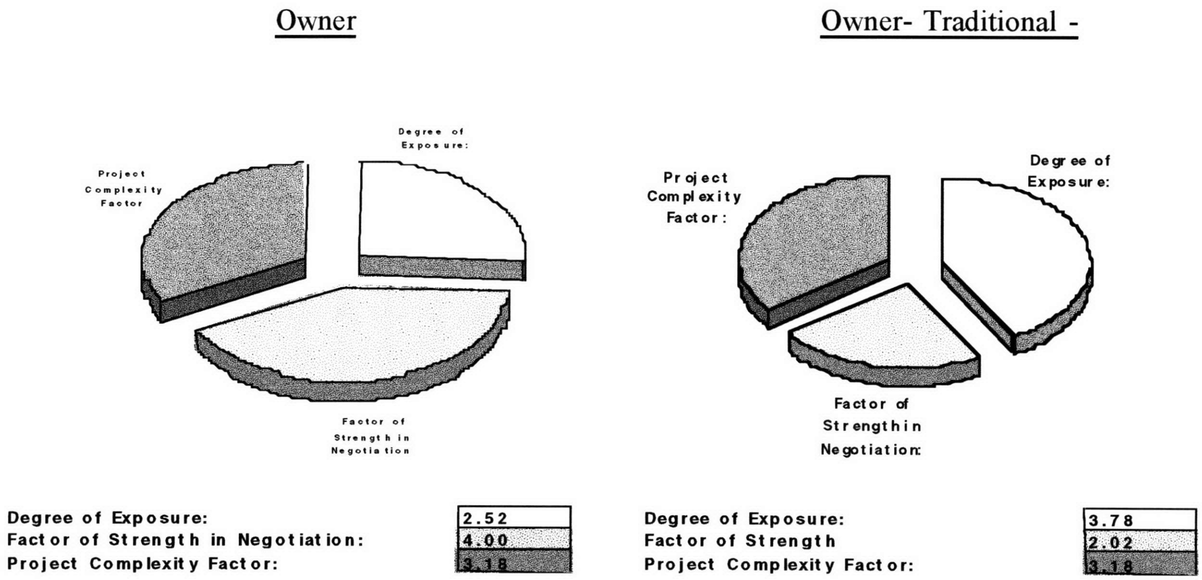
4.4.2.1 *Owner*

As the movement away from traditional project delivery has continued, the role of the owner has been under a constant redefinition. Construction Management, like Design/Build, gives the owner a level of flexibility never before available. The level of flexibility provided to the owner is even greater considering the variations in construction management (like GMPCM) which transfer a large part of the financial risk to the construction manager. The advent of construction management has placed the owner in a much better position than he ever was. When once the owner was able to count on the architect as his expert agent, the architect now is extremely reluctant to take the risk which his expert management would impose.

Still, construction mangers not only found that they could mange the risk efficiently without incurring in the owners risk (ACM), but that they could share the risk of the owner and contractor (GMPCM) and still find high levels of profits in the acquisition of those risks. Construction Management is extremely helpful in proving what this research puts forward by helping to answer a simple question. How have construction managers been able to control the risks which architects found overwhelming?

The answers to this question are readily explained by applying VRAM to the position of the participants. Using the ACM form of construction management provides the best example for demonstrating why construction mangers are able to profit from risk management and risk acquisition. Because in agency construction management the construction manger merely performs as an agent to the owner, he does not take any of the owner's risk but agrees to expertly mange it. As said before, owners do not have the necessary capabilities to do so.

Figure 4.16 Position of Owner in CM vs. Traditional Project Delivery



Source: *See Appendix: B-7*

Source: *See Appendix: B-1*

When architects stepped away form risk management, they opened the doors to those who were willing to manage the risk. By pro-actively managing risk, CMs were able have a higher level of control which not only benefited them as professionals, but placed the owner on a much better position. The owner was now given a way to acquire the management capabilities which had made him vulnerable under traditional project delivery. As seen in Figure 4.16, when you compare the position of the owner in ACM, to that in the traditional project delivery, his degree of control is greatly improved.

Construction managers realized that owners were not able to adequately control the risk. Construction management accepts and takes advantage of the fact that risk exposure is relative to control. In ACM the exposure faced by the owner is greatly reduced by his increased level of control. Still, as the model shows, not only does the owner enjoy a higher level of control through construction management, but also has much stronger bargaining power. By placing the construction manager as fiduciary agent, the owner increases his ability to participate in the resolution of conflicts by acquiring the expert services of someone with a much higher level of professional expertise to mange the situation.

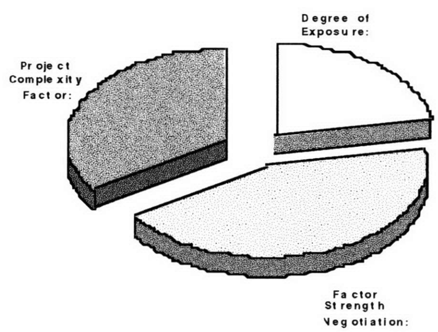
4.4.2.2 *Construction Manager*

The construction manager is the perfect example of the profit potential attainable by actively seeking to manage (ACM) or acquire risk (GMPCM). Under the agency form of construction management, the CM gains competitive advantage by expertly managing a set of risks which were otherwise left to chance. By managing the risk, not only does the construction manger increase his control capacity on the given project, but acquires the expertise that architects are losing by neglecting to deal with the problem. As mentioned in the introductory chapters, as professionals step away from responsibilities, they force themselves out of the value chain by decreasing their number of value activities.

If the position of the construction manger is plotted against that of the architect in traditional project delivery, it can be seen that the CM is under much less exposure. This decreased exposure in many ways is similar that of the owner which he serves. As an agent of the owner, the construction manager becomes the owner himself. Still, different to the real owner, the construction manger is an expert which benefits by a high level of experience and control.

Figure 4.17 Position of CM vs. that of the Designer in Traditional Project Delivery

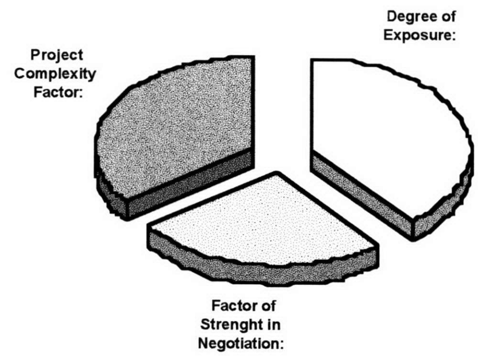
Construction Manager



Degree of Exposure: 2.07
Factor of Strength in Negotiation: 4.00
Project Complexity Factor: 3.18

Source: *See Appendix: B-8*

Designer



Degree of Exposure: 3.54
Factor of Strength in Negotiation: 2.37
Project Complexity Factor: 3.18

Source: *See Appendix: B-3*

On the other hand, as shown in previous sections, the architect under traditional project delivery has a very low level of control over risk. When once his professional expertise to mange risk was competitive to that of other professions, his aversion tendencies lead him to lose these capabilities by diminishing his participation in the decision process.

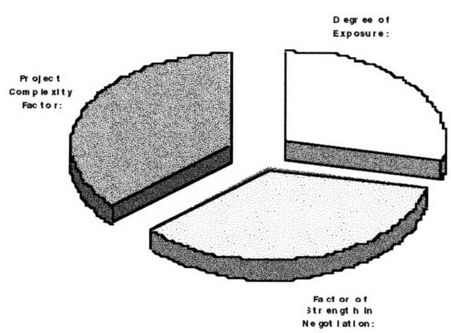
4.4.2.3 *Designer*

Architects are facing an ever weakening position in the value system that lead to the advent of construction management to cover for gaps in their services. By covering the gaps which architecture had left behind, construction management relieved part of the pressure that their mismanagement of risk was having on the profession. As has been said before, the biggest problem faced by architects under traditional project delivery is a weak control over risk, which when coupled with a decreasing level of professional expertise, has weakened their negotiating position and increased their level of exposure.

Under a contract for construction management the architect becomes better able to manage risk. Though some architects have maintained the necessary skills to appropriately manage risk, most have not. Comparing the models for both, those professional capabilities that architecture has lost by lack of practice become evident (See Figure 4.18).

Figure 4.18 Position of Architect in CM vs. Architect in Traditional Project Delivery

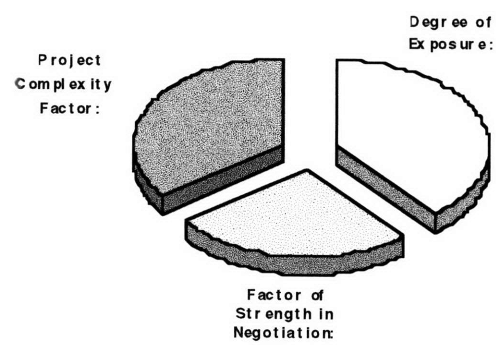
<u>Construction Management</u>



Degree of Exposure: 2.46
Factor of Strength in Negotiation: 3.04
Project Complexity Factor: 3.18

Source: *See Appendix: B-9*

<u>Traditional Project Delivery</u>



Degree of Exposure: 3.54
Factor of Strength in Negotiation: 2.37
Project Complexity Factor: 3.18

Source: *See Appendix: B-3*

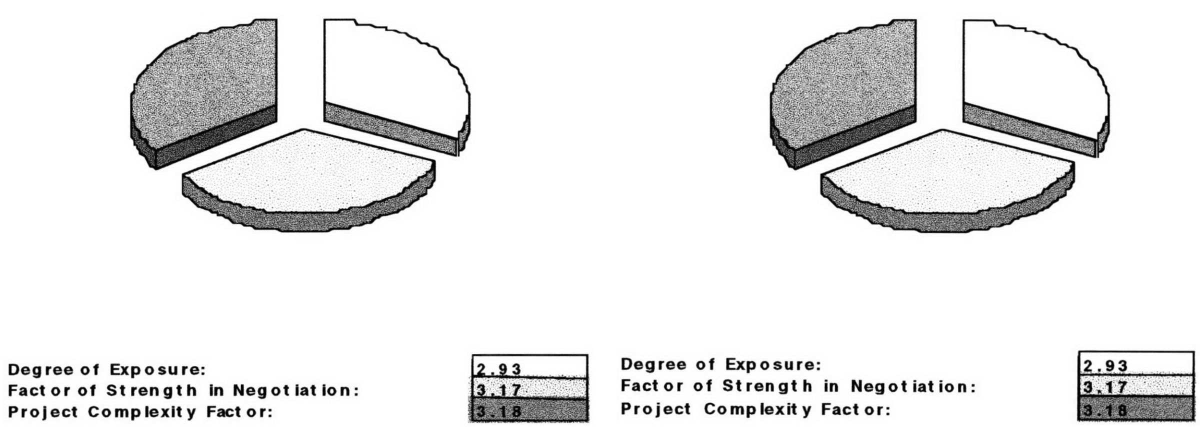
What the previous models fail to show is the relationship of decreased responsibility to profitability. By decreasing their scope of services, architects also gave away part of their fees. The decreased levels in profitability experienced by architects in the last decade were caused by their increased reluctance to manage construction. Now that they have given this capacity away, they face an uphill battle to gain it back as they have split the market by lowering the barriers of entry into the traditional realm of architecture.

4.4.2.4 *Contractor*

Contrary to the previously examined parties, the contractor faces little change in his risk scheme as a result of adopting ACM. Though under guaranteed maximum price a contractor begins to share his risk with the construction manager, the agency form leaves his contractual exposure intact (See Figure 4.19).

Figure 4.19 Position of Contractor in CM vs. Builder in Traditional Project Delivery

Builder Traditional | Contractor CM



Source: *See Appendix: B-2* | **Source:** *See Appendix: B-10*

For small to medium sized projects the need of a construction manager could easily be questioned. However, large projects have proved CMs to be an invaluable resource. As project complexity begins to increase, exerting a high level of control over the project becomes increasingly harder. Even though a contractor may have the necessary professional capabilities to adequately manage risk, the ratio of Degree of Exposure and Strength in Negotiation, relative to Project Complexity, will decrease. It is when this ratio decreases that the presence of the construction manager becomes an asset to the contractor. By having a construction manager on board, the contractor can maintain (or maybe increase) his degree of control of risk and also limit a possible escalation in the criticality of issues due to the higher complexity of the project.

V. The SLIM Project Delivery System

5.1 The SLIM System

Owners, designers, contractors, construction managers and others have a number of options to protect themselves from liability. Risk management may be defined as an organized approach to identifying and dealing with risk. As most would acknowledge, adequate risk management (through insurance or otherwise) is to the benefit of all involved in project delivery. Yet, how can it be effectively achieved if everyone is looking out for their individual interests?

The development of the Single Liability Insurance Model comes from the search for common ground in this highly fragmented industry. As was demonstrated in the previous chapter, even in the most "promising" of delivery alternatives, there is an inescapable level of friction that's always carried by the system. Risk assessment, risk allocation and risk prevention are only useful when one has the control and the interest to make use of them.

Insurance plays a major role in the development of any risk management program designed to shift designated risks to a financially strong party who, for an agreed premium amount, is willing to assume some or all of the liability for the loss. Yet, while insurance is the one instrument in which most participants rely in order to manage their risks, it is the exact same one over which the industry has the least amount of control. While an individual firm may have a better loss history than an another and therefore influence their cost of insurance, it would never be able to directly influence the overall level of exposure which it may represent to commercial carriers, as this will vary relative to the actions of various other participants which have no direct interest in the potential losses faced by the former. While the concept of insurance rests on this fact, if one could indeed develop a pool large enough as to have the capacity to negotiate with commercial carriers, the potential for savings could be quite substantial.

Insurance costs today represent from 5-20% of all costs incurred by participants in project delivery. While owners may chose to directly carry insurance for projects (Wrap-Up insurance), most will indirectly carry its costs through the contracts with the different parties. Why not take advantage of this? If there was anyway to diminish coverage costs, not only would profitability increase overall, but whoever is able to do so would enjoy significant competitive advantage. In the search to answer the same question, various other industries have come up with what are called "captive" insurance companies.

5.1.1 The Captive Insurance Company

Captives work much like commercial carriers do, in the sense that they are in the business of insuring and reinsuring risks. Still, what differentiates them from other commercial carriers is their concentration on providing coverage for their sponsors.

There are two common arrangements under which captives furnish protection. First, owners remit premiums to their insurance subsidiaries, which retain a predetermined amount of liabilities on both an individual loss and aggregate yearly basis and cede the remainder to commercial carriers. In the second form, referred to as fronting, parents insure risks directly with conventional insurance companies which then reinsure specific portions of the coverages with the captives of the insureds, thus gaining profits from otherwise sunk costs.

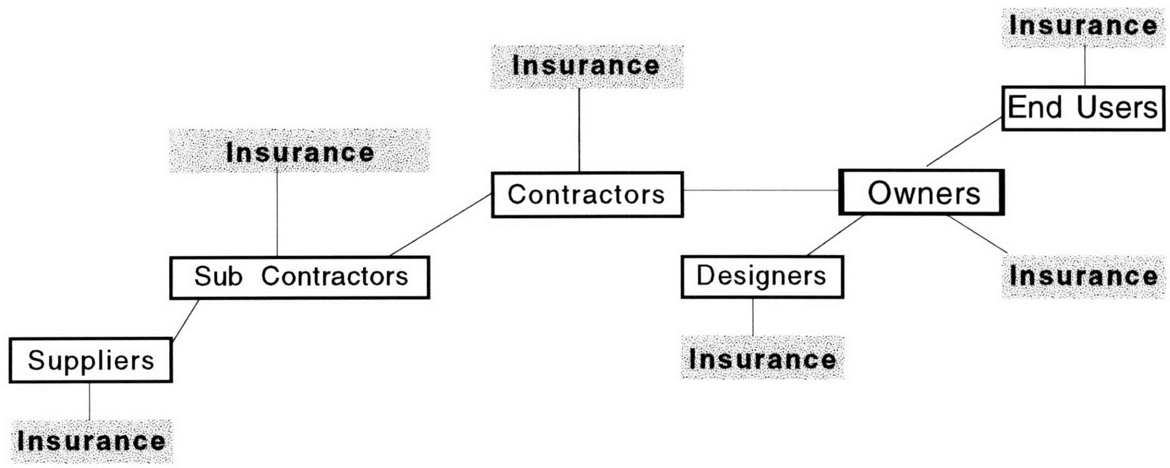
For most companies risks are assumed to be in the form of speculative risks, or fluctuations in demand for products. Given most company's capacity to adequately mitigate these risks through good management, and also due to an absence of suitable transfer mechanisms, most firms retain these risks in-house. For the construction industry, speculative risks take the form of fluctuations in material and equipment costs. Yet, as is the case of other industries, construction has been able to cope with these risks. Escalation clauses and limited contract periods give sufficient shelter for most well managed projects.

Pure risks on the other hand, have proved harder to tame. Most construction firms attempt to protect themselves from catastrophic losses (those beyond their financial ability to withstand) through external sources. Many, unwilling to trust to luck, shift the burden of ruin from chance events such as fires or accidents to commercial insurers. These carriers indemnify companies (often for losses in excess of stipulated amounts) in return for payment of premiums.

The construction industry is heavily dependent on insurance at all levels in the value chain (See figure 5.1). In 1995 the U.S. Property and Casualty Insurance industry wrote an estimated 258.00 billion dollars in premiums[48]. As most participants seek protection from insurance, there has been created what may be called "insurance redundancy". Given the highly fragmented nature of the construction industry, insurance coverage (with the exception of wrap-ups) is commonly procured individually by the different participants.

[48] ENR *Special Advertising Section: Insurance*, August 28, 1995

Figure 5.1 Insurance Redundancy in the Construction Industry



Because there is no way of precisely knowing how claims are going to flow, insured parties obtain "overlapping" coverages. The redundancy created, together with the inherent uncertainty which insurers face in providing coverage for a capital projects, add up to significant increases in the cost of delivery and promote litigation between insurers, and also between insureds.

Yet, how willing are insurance companies to support models like this? In an interview with Maureen McDonough, Contract Director for the Massachusetts Port Authority, the answer was quite clear. Similar to what will be explained in more detail for the Single Liability Insurance Model, Massport developed an insurance setup that will yield an estimated 35,000,000 million dollars in savings for Logan 2000[49]. The model works quite simply. In exchange for insuring all of their workers compensation contracts with a single carrier, the carrier provides Massport with a 30% reduction in premiums. With an expected total cost (in

[49] Renovation project for Boston's International Airport, 1996

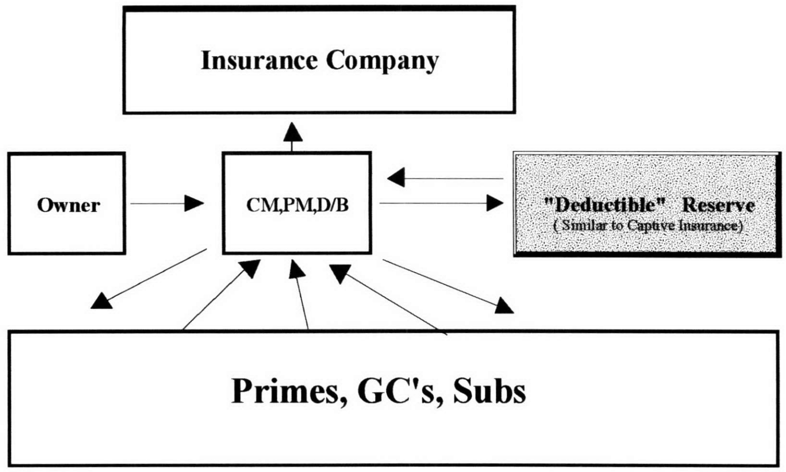
losses and premiums) of 84 million dollars, Massport gambles a potential 30% savings by accepting to pay for any losses in excess of the reduced premium and up to the otherwise 100 percent of the cost. Massport is thus counting on its ability to manage the project in order to keep losses under the reduced price. By placing 35 million dollars in potential savings (under good management), the commercial carrier is giving Massport an excellent incentive, while at the same time assuring for themselves a large pool of secured premiums, definitely a win/win situation.

5.1.2 *Single Liability Insurance Model*

Captive insurance theory is the foundation for what consequently was named as the *Single Liability Insurance Model*. In the search to reduce litigation and provide owners with a single source of liability in the delivery of capital projects, industry participants developed things like Design/Build, Partnering, and Construction Management. Yet, my work is founded on the belief that in order for any of these methods to work to their fullest potential, a framework that supports them must be developed first. Given that all of these approaches are heavily dependent on team interaction, an appropriate environment for them must adequately support three main things: (1) sharing of information, (2) cooperative risk management through a centralized structure, and (3) an adequate balance of risk and return between <u>all</u> participants.

The Single Liability Insurance Model was developed in the search to achieve this. As its seen in the next figure, SLIM is structurally very similar to a captive insurance

Figure 5.2 SLIM (Single Liability Insurance Model)



company. Yet, the model contains a few, but extremely important deviations from the traditional form of a captive. In the Single Liability Insurance Model form, there is what is called a "deductible reserve". Even though this seems very similar to a captive (and in many ways is) there is one main difference. For a captive there is normally a parent corporation (a single entity) providing premium payments that go the their subsidiary (the captive) and where return on the investment (from the premium payments) is kept for the "subsidiary". Capital projects on the other hand, are not normally delivered by the construction industry through any single entity, but instead through what many refer to as "virtual" corporations. Virtual corporations are business entities which are built for a limited time with the purpose of achieving a common goal. Even though these may take the form of joint ventures, or partnerships (limited or general), most are simply arranged through the temporary contractual relationship between the different participants in project delivery.

If correctly harnessed there is great strength in the nature of the virtual organization. While the development of a captive reserve in any other industry would depend on the financial capacity of a single corporation, and also place all of the exposure on it alone, virtual organizations have a natural way of diversifying that risk. Virtual organizations in construction are formed by designers, consultants, contractors, sub-contractors, manufacturers and dozens of other organizations which at different levels can be potentially exposed to both the risk and return emanating form the project.

The SLIM system places the "deductible reserve" or "captive reserve" in such a way as to benefit from the fragmented nature of the industry. Instead of having one company pay and benefit from the investment in a captive, the SLIM model uses the "virtual" corporation as the entity which will support the system. Every participant (designers, builders, sub-contractors, and sub-consultants) adds to the pool. Contributions to the deductible pool are based on the level of exposure, return and control of the participant. Further underwriting for the individual, as in the case of use of normal carriers, would then be based on claim history. Yet different from normal carriers, the entity participates in the establishment of the team. Optimal conditions for this would be under the Design/Build or Construction Management environments. As was shown in the analysis performed in chapter four with the application of the Venture Risk Analysis Model, design/build and construction management provide the levels of participation and control that are necessary to appropriately manage the underwritten risk.

5.2 Providing Protection Without Limiting Incentive

Another difference between SLIM and the "pure form" of captive insurance is in how risk and return are allocated. In order for participants to be willing to share information and actively participate in an entity of this kind, a balance between risk and return is necessary. In order to do this the Single Liability Insurance Model does two things:

(1) proportionally distributes underwriting losses through all of the participants based on the individually established contribution to the "deductible reserve"; and
(2)) proportionally distributes underwriting profits through all of the participants based on the individually established contribution to the "deductible reserve".

5.2.1 Return on Investment

Standard insurance arrangements call for the insured to pay premiums in advance of estimated losses. Carriers subsequently pay claims from these accumulated funds. But the payout period, especially for nonproperty losses, may extend over a lengthy period, perhaps as much as five or ten years. Often, as in the case of the construction industry, claims with "long tails" (those taking considerable time to settle), provide carriers with investment opportunities. Premiums collected but not distributed as claims payments can be invested and earn interest (often enough to cover for any underwriting losses incurred).

Using a system like the Single Liability Insurance Model, project delivery participants may get a return on the money they invest for insurance. Like in captives, where sponsors seek cash-flow benefits similar to those enjoyed by commercial carriers, under SLIM the different reserve pool participants may enjoy the same benefits (for a better understanding of this see sample Pro-Forma in Figure 5.3).

Figure 5.3 Sample Ten-Year Pro Forma Captive Income Statement

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Financial Statement										
Paid Premiums (Deductible Reserve)	4,000	4,400	4,840	5,324	5,856	6,442	7,086	7,795	8,574	9,432
Taxes and Fronting (1)	-560	-616	-678	-745	-820	-902	-992	-1,091	-1,200	-1,320
Claims Handling (2)	-336	-379	-511	-400	-518	-649	-595	-524	-684	-888
Letter of Credit Cost (3)	-15	-27	-31	-38	-44	-49	-54	-59	-65	-72
Gross Premiums to Captive	3,089	3,378	3,620	4,141	4,475	4,842	5,445	6,121	6,625	7,151
Reinsurance Costs (4)	0	0	0	0	0	0	0	0	0	0
Earned Premiums	3,089	3,378	3,620	4,141	4,475	4,842	5,445	6,121	6,625	7,151
Losses Incurred	-2,800	-3,160	-4,259	-3,336	-4,319	-5,411	-4,960	-4365	-5,696	-7,404
General and Administrative Expenses(5)	-35	-37	-39	-41	-43	-45	-47	-49	-52	-54
Underwriting Income	254	181	-678	763	113	-614	438	1,707	877	-307
Investment Income	200	440	642	869	1,015	1,163	1,353	1,551	1,738	1,973
Net Income	454	621	-36	1,632	1,128	549	1,791	3,258	2,615	1,666
Income Taxes Paid by Captive	-209	-286	17	-751	-518	-253	-824	-1,499	-1,203	-767
Cash Dividend	0	0	0	0	0	0	0	0	0	0
Net After Dividends and Taxes	245	335	-19	881	610	296	967	1,759	1,412	899

1 Consists of policy-issuing carrier's administrative charges (9 percent plus premium taxes (5 percent).
2 12 Percent of Incurred Losses
3 Includes a one-half percent interest charge on both reserves and an $800,000 letter of credit used to fulfill a portion of the capitalization requirement for a domestic captive
4 This line would normally include outside reinsurance purchased by the captive.
5 Captive management fees

Source: *Adapted from Managing Risks Through Captive Insurance Companies, The Conference Board, 1979*

Participants in the "virtual" organization can expect to realize investment income on their individual input to the reserve. In addition to this, less demanding premium payment schedules may be organized.

5.2.2 Stockholder Opportunity

Because different participants (like sub-contractors) may want be reimbursed for their investment sooner than others, the money placed in the deductible reserve may take various forms. Because the idea is to have the money for as long as possible, "participants" in the pool could use the money to buy participation (in the form of stock or otherwise) in the risk which the captive may take on other projects. Yet, depending on the participant's position, the insurance money invested may be reimbursed as soon as the project is done, or kept for as long as the statute limitations may require in the given state (normally seven years).

5.2.3 Less Exposure for the Participants

By evenly distributing both risk and return, the system establishes a clear incentive to cooperate. If the project goes well, everybody benefits, if the project goes wrong everybody pays. Yet, under this system losses will never be catastrophic. The name "deductible" reserve comes from the fact that all the money invested for insurance purposes, becomes in essence a large deductible for the commercial carrier who will insure the excess risk over that deductible. As a result of this, not only will every participant be covered for any claims which may come up as result of negligence from any of the parties involved, but the captive places a cap on the incurred risk. The Single Liability Insurance Model strives to achieve a win-win situation for everyone involved. Still, since people are people, and conflicts at a smaller or larger scale will inevitably exist, all participants in the reserve must agree to resolve any disputes through an openly selected binding arbitration committee.

5.2.4 Lower Cost of Coverage as Incentive for Good Performance

Given that human nature always seems to work against the possibility of a zero dispute environment, even in a system which promotes cooperation, conflict will always arise. In order to have better control over this, SLIM makes participants understand that their influence on the profitability of the "team" will not only affect the success of the organization as a whole, but that it will proportionally affect their individual standing in it.

The Single Liability Insurance Model gains its strength from the capacity to use the diversity of participants in the delivery of any capital project. Together with the capacity to gain a return on the insurance investment, SLIM provides an incentive system similar to that provided by insurance companies, but as in the various other parts of the system, it too contains some differences from "traditional" insurance. As participants invest money in projects, they may take the money out (with interest if no losses have occurred) or leave it (in whole or in part) in the deductible reserve. If a participant decides to leave (or not) the money invested in the system, he could be remunerated through a percent reduction in future premiums. This "reward" would be calculated as a function of two things: (1) the total amount of money invested in the "deductible" reserve, and (2) his loss history with the "captive". In this way, good performance could theoretically lead to "free" insurance for the participant depending on the size of future projects, and the overall risk exposure which they might represent.

5.3 Risk Management under a Controlled Environment

Adequate risk management must permit the person assuming the risk to take both physical and financial control over risk. In the development of SLIM, this was one of the most difficult questions. How can a single entity assume all risk and yet have enough control and financial stability to do so? When an insurance company assumes a certain amount of risk in the construction industry, it is doing so with a limited amount of direct control over the circumstances which may affect a project site. Even though commercial carriers take only what are called "measured" risks, they still have no direct control (other than through insurance inspectors) over the everyday affairs of a site.

On the other hand, design/build and construction management firms are in a much better position. As was seen and demonstrated in the previous chapter, these two forms of project delivery permit participants to have large amounts of "physical" control over risk. Participants in these methods have more participation in decisions, higher professional expertise, and higher control over decisions made. Because of this, both of these methods serve as perfect frameworks on which to build the Single Liability model.

5.3.1 Centralized Decision Structure

Under a construction management or design/build form, a firm covered by the Single Liability Insurance Model would have clear advantages over any commercial carrier assuming the same amount of risk. While collecting premiums, and thus having the same investment benefits as a commercial carrier , the "captive" would be much better positioned to handle the assumed risks. In both design/build and construction management, participants benefit from a more centralized decision structure which limits the negative effects of fragmentation through the centralization of the decision process. By having direct control over both design and construction, the private carrier can greatly reduce his exposure to risk, thus placing him at a competitive advantage with the commercial carrier.

5.3.2 Involvement of Ultimate Decision Maker

In order to have adequate control over risk, and the necessary influence over the decision process, the owner must be an active participant in the allocation of risk. Static allocation of risk through traditional documents has only served to blur the boundaries of responsibility in project delivery. Owners (under most circumstances) have little knowledge about construction, and thus tend to make uninformed decisions through the traditional contracts.

Design/build and construction management not only provide a centralized decision structure for everyone involved in the process, but also acknowledge the owner as the ultimate decision maker through a dynamic allocation of risk. Serving as agents, design/builders and construction managers have the capacity to help the owner early in the process identify what are the risks involved and what accepting them implies. Using a model like the one being proposed here, is extremely useful, not only as a mitigation mechanism, but also as a marketing tool to the captive group. Even if the owner is being provided with a single source of liability, it is extremely important that he takes an active position in the risks the project may have. Like the designer, the contractor, and the subcontractor, the owner is also a participant in the distribution of risk. As the party with the biggest vested interest in the project, the owner is key to achieving an adequate distribution of risk.

Depending on an owner's level of sophistication, he might be more or less interested in assuming specific risks. Depending on this, the model would (as for every other participant in the captive) provide the opportunity for him to assume direct risks through the contract (cost-plus, unit pricing, specific clauses, etc.) and with that adjust his premiums. Different from traditional project delivery (were risks are statically allocated many times under unbalanced distributions), an unsophisticated owner, may decide to shift all risk to the design/builder or construction manager, but yet leave a balanced organization which will be able to balance risk and return without increasing the potential for internal conflict.

5.4 Benefits to the Participants

The adoption of a system like the one provided by the Single Liability Insurance Model provides participants with a wide range of benefits. As has been explained in the previous sections, participants would enjoy benefits in the form of decreased exposure, higher return on investment and decreased litigation. Still, these are not by any means the only benefits that could potentially be derived from the system. While there is no way of accurately predicting extreme cost years, self insurance models have the capacity to adjust and deal with such conditions much better than large commercial carriers can.

5.4.1 Decreased Costs

When an owner, contractor or designer buys insurance from a commercial carrier he is paying as part of his premium the overhead costs of the often extremely large commercial carriers. Because overhead for commercial insurers can consume 30 percent or more of their premiums, the provision of self insurance through a model like SLIM could significantly reduce, if not eliminate, such expenses.

During years such as of 1985, 1990, 92 & 94, when U.S. Property and Casualty Insurance results showed losses of 25, 21.2, 36 and 22.4 billion dollars respectively, huge rate increases can have a major impact on the cost of project delivery[50]. Because commercial premiums charges tend to reflect average group experiences, years in which underwriting losses have been extreme, general market losses normally translate to rates which can be excessive relative to the losses which a specific individual may have experienced. When this happens, self insurance models like the one discussed here, can provide substantial savings to anyone who is buying coverage.

[50] ENR *Special Advertising Section: Insurance*, August 28, 1995

5.4.2 Less Exposure to Risk for Insurance Companies

SLIM delivers two substantial advantages for commercial carriers:

(1) First, by having the "safety" of a deductible like the one SLIM provides, commercial insurance carriers would face a much smaller and better measured risk.

(2) Maintaining an adequate level of control over projects, adds up to large overhead costs which carriers must incur in paying inspectors, and any other sub-consultants which may aid in managing the risk. The Single Liability Insurance Model can significantly cut these costs by providing carriers with a much better level of risk management, and thus a lower exposure to risk.

5.4.3 Acquiring Tax Benefits

As explained by Patrick J. Davey in his report, *Managing Risks Through Captive Insurance Companies,* captives like commercial carriers, establish reserves that defer taxes. Because premiums paid to insurance companies are deductible, captives offer a potential means of lowering income taxes for the participants in organizations like the one formed through the Single Liability Insurance Model.

Through the establishment of insurance subsidiaries in selected foreign countries, companies can sometimes gain additional tax advantages. Taxes, in places like Bermuda, offer huge advantages to subsidiaries established there. Profits earned by these captives on the insurance of overseas risks of their sponsors are, for the most part, non taxable domestically until repatriated.

5.4.4 Increased Bonding Capacity

Together with other benefits deriving from the investments made in the "deductible reserve", the money invested there can be used to back up a larger bonding capacity. The Single Liability Insurance Model can potentially increase the bonding capacity and costs of reserve participants by providing sureties with three main advantages:

(1) *stronger financial structure of insured* : The establishment of the "deductible reserve" may serve not only as a source of recovery for commercial carriers, but also strengthen the financial standing of all participants by placing them under a financial umbrella. Instead of having an individual contractor's capacity counting towards his overall bonding capacity, the project leader (CM or D/B) would now be able to insure the completion of the project based on the joint capacity of the "team".

(2) *single source of accountability* : Both to the owner and the surety, there would be a single source of accountability. As a single entity, the "deductible reserve" group would perform in the same way a contractor would in the provision of a performance bond to the owner. Because the "reserve' group would be insuring the proper completion of the whole job, they (as a single entity) can provide the owner and the surety with a single source of liability.

(3) *better control over risk* : Working under the form of a construction manager or a design/builder, and placing both the risk and return under a single roof, the SLIM model provides a system with less potential for conflict. As single entity with complete control over what occurs on site, entities under the SLIM model would be able to provide sureties with a clearer and more manageable set of risks.

5.4.5 A Better Way to Provide Wrap-Up Insurance

With the exception of very large projects like Boston's Central Artery Project and Logan 2000 where wrap-up has provided the owner with significant savings due to economies of scale, most circumstances preempt the use of wrap-ups by making the choice unduly expensive. Yet savings like this, proved on large scale projects such as the above, could be brought down to smaller projects by diminishing the level of exposure that commercial insurance carriers face when taking on a project. Instead of having the owner carry, both directly and indirectly, the costs of insurance through the contracts with the designer, contractor, or design/builder, he could have a "wrap-up" backed by this deductible reserve.

5.4.6 Leveling the Playing Field?

Using the aggregate strength of the virtual corporation, the Single Liability Insurance Model can serve as a leveling tool. With the group increases on bonding capacity, financial strength, and risk coverage, good (but smaller) participants can have the opportunity to go head to head with bigger competitors in large scale projects. Still, this might lead to a consolidation of the industry. Similar to Japan, a model like this could develop large conglomerates which could overrun smaller competitors. While SLIM does not intend to preempt competitive bidding, it does support a qualifications screening. By doing so, the system could nurture the creation of powerful groups with high barriers to entry.

As many architectural innovations do, a system like the one provided by the Single Liability Insurance Model could have a direct effect on the value system. Because of this, the model tries to balance internal forces within the system. Yet, I do accept that a balanced value chain does not necessarily imply a balanced value system; -maybe this is a totally new question.....-

6.1 Thesis Summary

The core hypothesis presented here is that:

> *A reversal in the risk aversion tendencies of construction industry participants will not only improve a system which is failing to provide an efficient environment for the delivery of capital projects, but also strengthen the eroded position of design professionals in it.*

In order to derive higher benefits from existing methods of delivery, it is not the methods which must be changed (or improved), but the system in which they all operate. While politics and "law", do play a role in the achievement of something like this, it is primarily on our hands to support an environment conducive to change. Static allocations of project risk have only lead industry participants to unrealistic expectations, and added to the erosion of an industry already plagued with disappointment and disputes.

Design professionals, ever more aware of legal implications, have stepped away from many of the services they used to provide. Legal considerations have gone over those of business, and professionalism has been slowly obscured. Limiting services to reduce exposure to liability, design professionals have truncated their ability to stay up to date with new technologies. And while this is happening, outside technologies and performance requirements continue to increase project complexity, forcing a level of professional differentiation promoted by risk shedding that has given birth to a generation of consultants with deep technical ability but limited scope of expertise.

VI. Conclusions: Unrealized Potential for Competitive Advantage

The SLIM or (Single Liability Insurance Model), is proposed as a radical departure from current practices. Based on many of the ideas discovered through the analysis performed using the Venture Risk Analysis Model (or VRAM), the thesis developed a set of guidelines that formed the foundation for what SLIM should achieve. Taking advantage of overlapping insurance coverages which try to define a "blurry" risk allocation boundary, the Single Liability Insurance Model puts forward a "new" way of attacking an "old" problem with a set of very "common" tools. While the model is developed in a very schematic way, I sincerely hope it plants seeds which will spark the imagination of those, who like me, believe that there must be a better way.

6.2 Implications of Research

It is the purpose of this research to open the eyes of anyone reading it to new opportunities. While firmly believing that the industry can be greatly improved, it is important to reinforce that it still an industry full of life and potential . The following sections point to how, where, and when we can improve the way we do things. Risk and risk allocation, go to the very root of all the problems which the industry faces. Yet, if we want to find better way to do things, we must first admit to the problems, before trying to find ways of resolving them.

6.2.1 Lawyers or Us? Are we the ones Failing the System?

Lawyers do only what we let them do. If I only get this point through, my research has served it purpose. It is important that we all understand this, as it to our benefit (and not theirs) to improve the system. Because it is us and not them who will benefit from better approaches to project delivery, the responsibility to find better ways is in our hands. With systems like the Single Liability Insurance Model, we must push towards two main goals:

6.2.1.1 *Pro-Active Allocation of Risk*

Risk, like matter, is neither created nor destroyed. Yet, we have the power to control its state. Careful allocation of risk does this. When risks are pushed aside, they do not disappear, but instead become more dangerous by becoming temporarily invisible. Risks can many times be handled with simple strategies like choosing a lump sum contract versus a unit priced one (or vice-versa), yet these strategies are only successful if founded on a solid understanding of their implications. A balanced and well thought out allocation of risk relies on the ability to work as a team. The continuous support given to the adversarial relationships which exists today, only works to block this from happening.

6.2.1.2 *Control to those better able to do so*

In order to create an environment which supports team interaction, risk must be placed in the hands of those parties best able to handle it. Mishandled risks double exposure by giving team members a false sense of security. A failure on the part of any participant to adequately manage risk, will inevitably affect all parties involved either in time, cost, or (in most instances) a combination of both. Because mishandled risks can potentially affect the exposure of all participants in the delivery of a capital facility, risk management programs must incorporate pro-active allocations of risk which adequately distribute not only risk, but also return to those parties carrying the largest amount of responsibility.

6.2.2 An Opportunity to Revitalize the Industry: The SLIM Model

The Single Liability Insurance Model is a first shot at how something like this could be achieved. In form it is nothing new, but yet in our industry it is definitely innovative. By adopting and adapting the captive insurance concept from the other industries (like manufacturing), the construction industry can do with insurance what it once did with project control and computer aided design.

Insurance is a powerful risk mitigation mechanism that links the whole industry together. Yet, even with its inherent strength, the true force comes not from reducing insurance costs, but from giving project participants a reason to work together. With information technology moving at a faster pace than ever, those with the will to "share" will have the competitive edge. But why share?

Under a system like the one provided by the Single Liability Insurance Model, there are many reasons why someone might be willing to share information and work together.

6.2.2.1 *Decreased Litigation*

In an environment like the one in which the industry operates today, a system capable of reducing the amount of litigation would be extremely welcome. SLIM, by providing a single source of liability, gives a strong incentive to cooperate. By sharing both profits and losses under the form of a "deductible reserve", every participant will have the best incentive (money) to do his/her best to make sure that things go right. Under the current system there is no incentive to cooperate. While design/build, construction management, and partnering are beginning to explore the strength of sharing information, there is still a lot of friction to be eliminated.

6.2.2.2 *Better Control over Risk*

In addition to providing a single source of liability, the model also gains in strength by permitting a better control over risk. While insurance companies rely on the performance of many parties all of which add to a pool of risk, under SLIM there is only one: the "reserve" group which in essence is only one entity with a very strong interest in the overall success of the project. Either under the form of a construction manager or a design/builder, the model develops a central mechanism with both the technical and the financial capabilities, to assume full control over risk.

6.2.2.3 *Opening doors to Innovation*

By limiting the threat of financial loss and damage to professional careers , SLIM provides an environment conducive to innovation. While adversarial relationships have been the basis of a litigious environment that stifles innovation and cooperation in implementing new technology, SLIM tries to promote just the opposite.

Firms today are loath to adopt technologies pioneered elsewhere, and as many observers have expressed, the declining position of U.S. construction industries in global markets is due to in part to a declining commitment to R&D in building-related industries. The separation of responsibilities in Design-Bid-Build together with the rigid budgeting and construction practices, discourage innovations which could reduce initial cost. By placing all responsibility under one roof, and limiting the potential for catastrophic losses, the Single Liability Insurance Model encourages people to look for better ways to do things, faster, cheaper, and safer.

6.2.2.4 *Sustainable Competitive Advantage*

The Single Liability Insurance Model provides participants with a powerful source of sustainable competitive advantage. SLIM enables teams to be built to offer services over a wide variety of project types, and to do so cheaper and faster than the competition. By diminishing litigation and insurance costs, the model places its participants in an advantageous position. Because the creation of a " deductible reserve" is an incremental process that could take the competition years to build, the model places high barriers of entry to those who follow.

Owners, tired of increasing levels of litigation and construction costs, want a single source of responsibility. For smaller organizations the provision of a single source of liability could imply a high degree of exposure. However SLIM participants can do so under much less stress. By diversifying both risk and return over all of the "reserve" participants, the model creates a natural incentive to cooperate, thus making a single source of liability not only financially, but organizationally feasible.

6.2.2.5 *Promoting Team Participation: Joint Interest in a Successful Outcome*

By creating a common financial interest, the Single Liability Insurance Model is able to induce a higher level of cooperation than would be achievable otherwise. Because of the adversarial relations inherent in other delivery methods, there is a huge amount of friction built into those systems. The friction created by the unwillingness to cooperate, affects projects at all levels.

Having a better reason to work together, participants under SLIM have better opportunities to innovate, reduce time, diminish litigation costs, and maintain longer relations with customers. In an industry plagued with litigation, those who can control conflict will have a strategic marketing tool which will provide them with high level of competitive advantage.

6.2.3 An Opportunity to Strengthen A/E's Position in the Industry

Originally trained both as an architect and an engineer, the problems faced by designers have always made me look for ways to strengthen their position. This group of professionals, whose decisions are probably the most important in the delivery of any project, have cornered themselves through the years by stepping away from risk. Yet, as they have done this, their influence and participation in the decision process has proportionally decreased. This is something that should worry us all, since design decisions affect all aspects of a project; physical, structural (balloon frame v. structural steel), financial(life-cycle costs, materials, structural systems, mechanical systems, lighting systems, etc.), marketability (appearance, location, environment, codes), and so forth.

Because of this, the Single Liability Insurance Model was designed to try and place A/E's in a better bargaining position. Based on the idea that a well managed project is completely dependent on a well managed design, the model addresses five major conditions obstructing A/E participation in traditional project delivery.

6.2.3.1 *The Closed Box - Nurturing Fragmentation and Adversarial Relationships*

On of the biggest problems affecting A/E's today is their lack of participation in the construction process due to its liability implications. Designers have stepped into what I call "closed boxes" that separate them from everything going on around them. In order for A/E's to step back into where they used to be, they have to find ways to better control risk, without letting risk control them.

By permitting A/E's to better handle risk, the Single Liability Insurance Model permits them to have a higher level of participation in the delivery of a project without having the fear of a catastrophic loss. Stimulating designers to re-accept responsibilities which where once theirs, will increase their profitability and diminish the fragmentation of their field. Bringing A/E's as part of the "team" will not only be to their benefit but to the benefit of all.

6.2.3.2 *Inhibited Market Responsiveness*

Inhibited market responsiveness is another of the problems caused by the stepping away from liability. In order to keep up with changing technologies and project requirements, designers need to be involved in the process. Design, being close knitted with construction, grows in conjunction with what is done at the site. Designers cannot expect to provide better designs, if they are unwilling to take bigger responsibilities.

By giving away responsibilities to others such as construction management, designers are outdating their capabilities and forcing themselves out of the industry. The responsibilities which they give away do not disappear, but are accepted by other parties more capable of handling them.

SLIM gives architects a tool to reverse this. Having a lower level of exposure, designers might begin to seek to regain lost ground. They need to participate actively in the whole process, thus becoming essential to it. Design decisions can be the key between a successful project and a disastrous one. As the Japanese believe, "one can't be a good designer, without first being a master-builder".

6.2.3.3 *Limited Exposure to New Technology*

In order to improve their services, designers need to be constantly aware of changing technologies. The team approach proposed by the Single Liability Insurance Model gives A/E's an opportunity to not only see new technologies, but also have a good reason to use them. Under traditional methods designers have little incentive to share information in any collaborative way, or accept the increased exposure potentially beneficial innovations might imply. By potentially benefiting everyone involved in the system, SLIM not only gives incentives to try out new technology, but provides the support that innovative A/E's need in order to break with traditional methods of design and construction.

6.2.3.4 *A Better Negotiating Position*

Strength of negotiation is a factor of two things: Control, and Professional Expertise. Through the Single Liability Insurance Model designers get the opportunity to have a larger share of both. Working under the "deductible reserve" an A/E can benefit from the aggregate capabilities of the team, and get a better grip on risk. By increasing their negotiating position, designers will be able to have increased ability to influence decisions which are of extreme importance. Because designers have the power to determine the final form and impact of objects which will be part of the built environment for years to come, it is imperative that they have the capacity to influence a process which can positively (or negatively) affect the quality of life.

6.2.3.5 *Negligence Disputes Between A/E and other parties*

Having a better degree of control, professional expertise, and participation in the decision process, A/E's will be much better positioned to handle risk and manage negligence disputes. Also adding to this is the fact that the contractor will then be on the same side. Knowing that most claims against A/E's come from(or as a result of) problems with the contractor, having him on board can greatly diminish the amount of friction in the system. Friction will not only be diminished because they have joint interests in the project, but because the system promotes early interaction between the two.

6.2.4 International Competitiveness

The United States Construction industry is facing an ever increasing level of competition in international markets. Measures need to be taken to permit U.S. firms to compete better in those markets. The Single Liability Insurance Model provides the industry with two substantial sources of competitive advantage.

6.2.4.1 *Cost Advantage*

As proved by the Massachusetts Port Authority[51], bundling project insurance can provide a significant source of savings. Programs (such as Logan 2000 and SLIM) which provide insurance carriers with better and assured premium sources, can reduce insurance costs by as a much as 40 percent, while maintaining a healthy business for commercial carriers. With costs of insurance ranging form 10 to 20 percent of total project costs, a forty percent reduction in insurance could imply as much as an 8 percent advantage over the competition right from the start. While the insurance practices and restrictions on the international market may vary, programs like these lend themselves to a wide array of circumstances.

Cost advantage through the Single Liability Insurance model will also be the source of a better functioning system. Adding to the direct savings achieved through lower insurance

[51] Logan 2000 Project. Information provided by Maureen McDonough, *Contract Administration Manager*, Massachusetts Ports Authority, March 1996

costs, the model also permits SLIM participants (through a higher incentive to cooperate and share information) to benefit from improved efficiency in the management and resolution of conflicts. Having less litigation, projects will save money through claim reduction (**time**), a faster resolution process (**time**), and diminished legal fees (**time**). By reducing friction, the model can potentially reduce delivery costs by taking advantage of time otherwise lost in unnecessary litigation.

6.2.4.2 *The Virtual Organization*

By harnessing the strength of an organizational form used for years in the industry, the Single Liability Insurance Model can take construction groups one step ahead of everyone else. With SLIM, risk and return are not the only things getting shared. While the model definitely provides financial advantages, an even greater advantage can be extracted from its ability to easily diversify, and thus add any required capabilities.

Captive groups don't necessarily have to be national. In fact, the model provides a perfect tool to enhance the bringing of international participants under one roof in the delivery of capital projects. With local expertise in the different international markets being one of the major worries of international U.S. firms, a model like SLIM can provide a framework to develop international conglomerates that can easily acquire local expertise through their pool of captive participants. Having a strong participation in both risk and return, international parties can be built on a much stronger foundation than otherwise possible.

6.3 Additional Research Required

The use of Self-insurance forms is nothing new in the United States. With escalating insurance costs, and record high stock market performance, programs like the Single Liability Model will be increasingly tried out in various sectors of the market. By examining the organizational and risk implications of the Single Liability Insurance Model in the construction industry, my research only lays out the plan of what needs to be done. Future research should go deeper, and use real projects to financially model the potential savings a system like this could provide. While some of the models effects are quite intangible, the financial framework is not. After a detailed financial model is built for the system, future research should then use different investment options, incentive layouts, delivery methods and project participants. With the preliminary financial design done, added advancement will only be reached by putting it in place. Programs like that of the Massachusetts Port Authority (Logan 2000 e.g.), private and public insurance funds, and self insurance programs of large corporations can serve as perfect sources of information for future research.

With technology rapidly advancing and making the world a smaller place, the construction industry is presented with great challenges. As people begin to realize that lawyers are neither the answer nor the cause of our problems, the industry will have no option but to change. The construction industry is key to the development of any country. With a strong influence over every aspect of our daily lives, designers, builders, and everyone involved in improving our built environment has a huge responsibility to make our country (and the world)a better place to live.

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APPENDIX A

Interview Script

*** Questionnaire is intended to serve as tool to direct the interview ***
-- Questions are only a guiding framework -

1. **INTERVIEW SCRIPT**

HYPOTHESIS: THE ASSOCIATED VALUE OF RISK, DIRECTLY INFLUENCES A FIRM'S POSITION IN THE INDUSTRY

- How does your exposure to risk compare to other participants in the industry?
- Do you find that your firm's risk to return ratio is well justified?
- How does your risk position affect the firm's leverage on the decision process?
- In your experience, has reliance on outmoded allocations of project risk and project control, lead to unrealistic expectations?
- owner disappointment?
- legal disputes?
- Are legal issues a guiding concern in the services you provide?
- Have you ever intended to expand your range of services and not done so because of the increased legal exposure this might implicate?
- Would a clearer distribution of risk be to the advantage of your firm?
- of the client?
- of the process?
- of the product?
- How do you feel owners perceive your participation in the process?
- How would increased responsibility affect owners perception of your firm?
- Should you intentionally insulate from liability?
- How?
- Would you be willing to undertake a bigger share of responsibility?
- Why or why not?
- Would the prospect of an increased risk to return ratio make this option feasible?

Appendix: A

HYPOTHESIS: SERVICE DIFFERENTIATION TROUGH INCREASED PARTICIPATION WILL ENHANCE A FIRM'S COMPETITIVE ADVANTAGE

- Do you see marketing as an essential part of your organization?
- How is strategic marketing incorporated into your selection of services?
- Is any research done on market trends?
- Are you currently addressing any?
- What barriers inhibit your firm from adopting a wider range of services?
- Have you ever jointly participated on initial planning with another firm?
- Do you offer project management services?
- feasibility studies?
- constructability studies?
- cost analysis?
- What professions are more apt to do these?
- Do you feel you are addressing all of your clients needs?
- If not, why?
- How do your services compare to those of the competition?

HYPOTHESIS: RISK AVERSION INHIBITS MARKET RESPONSIVENESS

- Has pressure from exposure to claims limited your range of services?
- Have your services changed in the last years?
- Has innovation been important?
- methods, organizational, management, contractual techniques
- on any particular type of projects?
- owners?
- Are any professions better capable of doing this?
- Why?
- What is the most common source of change in your company? competition
- strategic marketing

*** Questionnaire is intended to serve as tool to direct the interview ***
-- Questions are only a guiding framework -

- What role do legal concerns play in your contractual methodology?
- Do you provide inter-disciplinary services?
- should you?
- Is your firm constrained by any statutes or regulations which limit services you believe should be provided by you?
- Do you think you could provide a wider set of services?

HYPOTHESIS: RISK AVERSION LIMITS A/E'S CAPACITY TO ESTABLISH A STRONG NEGOTIATING POSITION

- How would you classify your strength of negotiation compared to others involved in the decision process?
- Does this affect your capacity to work effectively?
- How do you think the typical owner perceives your services?
- To what extent should designers be involved in the process of design and construction?
- schedule and cost analysis
- cost reduction efforts
- Life-cycle analysis
- costructability studies
- financial issues
- project safety
- Has your role been as an outside agent?
- or part of a comprehensive service?
- Has your position on any of these issues limited you ability to influence final decisions?
- In what projects might architects be appropriate as consultants during initial planning?

HYPOTHESIS: THE "TYPICAL" CONTRACT SUB-OPTIMIZES THE BUILDING PROCESS BY NURTURING AN ADVERSARIAL ENVIRONMENT WHICH LIMITS INNOVATION AND INCREASES COSTS

- Organizationally, how would you classify your company's decision structure? (Centralized, Decentralized, Adhocratic)
- Is this decision structure affected by the type of project?
- Within a typical project, does risk tend to be shifted towards lowers tiers?
- alternatives & risk association?
- Has innovation been important for your firm? (or is it better to use what works)
- methods, materials, financial alternatives, contractual techniques, management, organizational approach
- What professions are more skilled in the introduction of innovative ideas?
- Has this been especially important on certain project types?
- which contractual methods have provided you with the most flexibility?
- have you been able to repeat their success on other projects?
- Has contractual shifting of responsibility served its purpose or just led to more litigation?

HYPOTHESIS: ARCHITECT'S CONTRACTUAL SHIELDING FROM CONSTRUCTION RISK HAS CREATED A SERVICE GAP THAT IS BEING FILLED BY CM'S

- What is the role of an architect in the typical Design-Bid-Build project?
- When does he come in?
- When should he?
- What is his share on construction risk?
- safety, constructability, schedule, quality, defects, third party litigation
- To what level are they concerned with financial implications?
- Do clients appreciate this?

- what influence does it have on owners?
- Do aesthetic concerns bias architects decisions?
- Do architects emphasize long-term planning?
- should they?
- To what extent should architects reach beyond the present scope?
- Are architect's facilitators of team integration?
- interdisciplinary understanding
- How much should the architect get involved in the construction process?
- What are architects weaknesses?
- Financial, technological, managerial, social
- Do they facilitate team communication?
- Do they maintain project focus and effectively lead the team towards reaching expected goals?
- To what extent are architects concerned with process proficiencies?

HYPOTHESIS: A MORE SOPHISTICATED MARKET IS PUSHING TOWARDS THE PROVISION OF HIGH QUALITY DESIGNS WITH SINGLE SOURCE ACCOUNTABILITY AND SEAMLESS INTEGRATION OF SERVICES

- How often do owners know what they want ?
- Have mismatched contracting methods been a cause for poor quality on projects? (GC, CM, D/B or Turnkey, Build/Lease Back)
- pricing methods (GMP, Cost Plus, Unit price, Cost with incentive fee)
- Do you see an owner trend toward single source liability?
- Would this affect the process?
- the relationship between participants?
- design quality?
- quality of the product?
- Have you worked under a design-build arrangement?
- what was your experience?
- Was the project completed on time?

- Was the project on budget?
- Were there any personal conflicts?
- Did conflicting interests have a negative effect on quality?
- Did you face any problems with your coverage? (Insurance, Bonding)
- risk to return?
- What has been your experience with Construction Management?
- Has it been a positive relationship?
- On specific projects, clients?

HYPOTHESIS: PROFESSIONAL SCHOOLS ARE NOT PROVIDING THE INTER-DISCIPLINARY SKILLS NEEDED TO REVERSE OUTDATED APPROACHES TO DESIGN AND CONSTRUCTION

- Has poor interdisciplinary understanding lead to conflicts which otherwise could have been avoided?
- Should architects get involved in finance?
- Do they have the required skill to do it?
- Should they?
- What influence has designer's knowledge of constructability had on the quality of your projects?
- Have you benefited from inter-professional understanding?
- Is it to your disadvantage to have the initial planning consultant be an outside agent?
- Have added layers created a communication problem?

HYPOTHESIS: THE OVERBURDEN OF LEGAL CONSIDERATIONS OBSCURES PROFESSIONALISM AND LIMITS ADVANCEMENT

- How often does unfair risk allocation end up having detrimental effects on project quality?
- Has this influenced your inclination towards innovation?
- How varied is your range of services?

- Has this affected your capacity to make educated decisions?
- What kind of projects does your firm look for?
- Could this change?
- If it did, would you be able to adequately compete with others already providing those services?
- Could you then provide them in-house?
- How does your firm keep up with changes in today's competitive environment?
- Could some of your capabilities be outsourced as a result of this?

HYPOTHESIS: A/E'S CANNOT CONTINUE TO OPERATE ON A MIDDLE GROUND WHICH HAS FAILED TO PROVIDE ADEQUATE BALANCE BETWEEN RISK & RETURN ON RISK

- Have professional associations been successful in shifting risk through contractual customization?
- Has your firm been able to reduce litigation cost as a result of contractual customization?
- What effect has this had on the industry?
- on your firm?
- Have indemnity clauses been a positive source for shelter?
- No-Fault-Forfeitures
- How has your contracting methodology changed over the years?
- Has the adversarial relationship created by the exculpatory language used in contracts been detrimental to project quality?
- What contract forms do you use?........AIA, EJDC, AGC, Design /Build
- Do they provide an adequate environment for team building?
- How does this influence the process?
- When are owners introduced to contractual alternatives?
- How often do owners know what they want?
- What has been your experience with added premiums for risk shifting?
- What has been the average client's reaction?

Appendix: A

HYPOTHESIS: CONTRARY TO THE CURRENT TREND OF RISK AVERSION, CAREFUL ALLOCATION OF RISKS WILL NOT ONLY BE TO THE BENEFIT OF DESIGNERS, BUT ALSO PROVIDE LOWER EXPOSURE TO OWNERS

- How are owners introduced to risk?
- Is the development of contracts done form lawyer to lawyer, or do owners take a pro-active approach to the problem?
- Does your firm actively approach risk ? (opposed to just sheltering from it)
- Is there any method established for the allocation of risk associated premiums?
- What are the choices given to them?
- Why?
- Would the opportunity cost of doing so balance the amount of risk?
- Does this give you better control over it?
- How does the typical client react to this?
- Does your typical project risk allocation differ in any way to that of the "traditional" Design-Bid-Build contract?
- How?

HYPOTHESIS: THE PUSH FROM OWNERS TO SHED DESIGN AND CONSTRUCTION PHASE LIABILITY IS WEAKENING A/E'S POSITION IN THE INDUSTRY BY FAVORING THE PROVISION OF DESIGN SERVICES BY THE BUILDER

- Has the number of projects decreased in the last years?
- What has been your experience on this?
- Have you ever worked with a contractor as owner?
- Under what contract?
- Was the project finished on time?
- Was the owner satisfied?
- Was design quality sacrificed for cost reduction?
- Was litigation a problem?
- How did you face the potential conflict of interests?
- For owners who want the contractor as his representative, has Design-Build been a better option than the traditional system?

APPENDIX B

Venture Risk Analysis Model (VRAM) Calculations:

1. Owner's Risk Positioning in the Traditional Method

1.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews		3			3.5	4			
Differences between design criteria & 100% Design		3			3.5	4			
Errors or Omissions revealed During Construction	4				4	4			
Project Site Safety	4				4	4			
Constructability of Design	4				4	4			
Establishment of Project Cost		3			3.5	4			
Redesign if Over Budget	4				4	4			
Coordination of Construction	4				4	4			
Permits and Approvals			2		3	4			
Environmental Impact Review			2		3	4			
Coordinating with Other Work	4				4	4			
Quality Control & Quality Assurance	4				4	4			
Differing Subsurface Conditions	4				4	4			
Design Defects	4				4	4			
Construction Defects	4				4	4			
Strikes or Labor Disputes	4				4	4			
Weather Conditions	4				4	4			
Catastrophes- Fire, Flood, Earthquake	4				4	4			
Unidentified Utilities Affecting Sites	4				3.5		3		
Inflation	4				3.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation	4				4	4			
Third Party Litigation	4				4	4			
Warranties for Facility Performance	4				3.5		3		

Degree of Exposure: 3.78

*** Questionnaire is intended to serve as tool to direct the interview ***
-- Questions are only a guiding framework -

1.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews		2			**2**			2	
Differences between design criteria & 100% Design				4	**3**			2	
Errors or Omissions revealed During Construction				4	**2.5**				1
Project Site Safety		2			**1.5**				1
Constructability of Design		2			**1.5**				1
Establishment of Project Cost				4	**3**			2	
Redesign if Over Budget				4	**2.5**				1
Coordination of Construction	1				**1**				1
Permits and Approvals			3		**2.5**			2	
Environmental Impact Review				4	**3**			2	
Coordinating with Other Work		2			**1.5**				1
Quality Control & Quality Assurance		2			**1.5**				1
Differing Subsurface Conditions			3		**2**				1
Design Defects	1				**1**				1
Construction Defects		2			**2**			2	
Strikes or Labor Disputes		2			**2**			2	
Weather Conditions	1				**1**				1
Catastrophes- Fire, Flood, Earthquake	1				**1**				1
Unidentified Utilities Affecting Sites		2			**1.5**				1
Inflation				4	**3.5**		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation			3		**2**				1
Third Party Litigation				4	**3**			2	
Warranties for Facility Performance			3		**2**				1

Factor of Strength in Negotiation: 2.02

1.3 Project Complexity Factor

Complexity Factors	Complexity					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
PHYSICAL					**2.625**				
Scale Challenge		2					3		
Technology			3					2	
Site Complexity			3					2	
Program			3				3		
TEMPORAL					**3.25**				
Adequacy of Time			3			4			
Continuity			3				3		
FINANCIAL					**3.5**				
Budget Complexity			3			4			
Coverage			3			4			
EXTERNAL					**3.3333**				
Regulatory			3			4			
Economic			3			4			
Socio Political		2				4			

Project Complexity Factor: 3.18

2. Builder's Risk Positioning in the Traditional Method

2.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews	4				4	4			
Differences between design criteria & 100% Design	4				4	4			
Errors or Omissions revealed During Construction				1	2.5	4			
Project Site Safety				1	2.5	4			
Constructability of Design				1	2.5	4			
Establishment of Project Cost			2		3	4			
Redesign if Over Budget			2		3	4			
Coordination of Construction				1	2.5	4			
Permits and Approvals			2		3	4			
Environmental Impact Review			2		3	4			
Coordinating with Other Work				1	2.5	4			
Quality Control & Quality Assurance				1	2.5	4			
Differing Subsurface Conditions		3			3.5	4			
Design Defects		3			3.5	4			
Construction Defects				1	2.5	4			
Strikes or Labor Disputes			2		3	4			
Weather Conditions	4				4	4			
Catastrophes- Fire, Flood, Earthquake			2		3	4			
Unidentified Utilities Affecting Sites	4				3.5		3		
Inflation		1			2		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	2.5	4			
Third Party Litigation			2		3	4			
Warranties for Facility Performance				1	2		3		

Degree of Exposure: 2.93

Appendix: B

2.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews	1				2		3		
Differences between design criteria & 100% Design	1				1.5			2	
Errors or Omissions revealed During Construction				4	4	4			
Project Site Safety				4	4	4			
Constructability of Design				4	4	4			
Establishment of Project Cost				4	4	4			
Redesign if Over Budget		3			3		3		
Coordination of Construction				4	4	4			
Permits and Approvals			3		3		3		
Environmental Impact Review			3		3		3		
Coordinating with Other Work				4	4	4			
Quality Control & Quality Assurance				4	4	4			
Differing Subsurface Conditions			3		3.5	4			
Design Defects	1				2.5	4			
Construction Defects				4	4	4			
Strikes or Labor Disputes				4	3.5		3		
Weather Conditions	1				1				1
Catastrophes- Fire, Flood, Earthquake			3		2.5			2	
Unidentified Utilities Affecting Sites		2			2.5		3		
Inflation			3		3		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation			3		2.5			2	
Third Party Litigation				4	3.5		3		
Warranties for Facility Performance				4	4	4			

Factor of Strength in Negotiation: 3.17

Appendix: B

2.3 Project Complexity Factor

Complexity Factors	Complexity				Average	Criticality			
	None	Low	Medium	High		High	Medium	Low	None
PHYSICAL					**2.625**				
Scale Challenge		2					3		
Technology			3					2	
Site Complexity			3					2	
Program			3				3		
TEMPORAL					**3.25**				
Adequacy of Time			3			4			
Continuity			3				3		
FINANCIAL					**3.5**				
Budget Complexity			3			4			
Coverage			3			4			
EXTERNAL					**3.333**				
Regulatory			3			4			
Economic			3			4			
Socio Political		2				4			

Project Complexity Factor: 3.18

3. Designer's Risk Positioning in the Traditional Method

3.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				1	2.5	4			
Differences between design criteria & 100% Design				1	2.5	4			
Errors or Omissions revealed During Construction	4				4	4			
Project Site Safety	4				4	4			
Constructability of Design	4				4	4			
Establishment of Project Cost		3			3.5	4			
Redesign if Over Budget	4				4	4			
Coordination of Construction	4				4	4			
Permits and Approvals		3			3.5	4			
Environmental Impact Review	4				4	4			
Coordinating with Other Work	4				4	4			
Quality Control & Quality Assurance		3			3.5	4			
Differing Subsurface Conditions		3			3.5	4			
Design Defects				1	2.5	4			
Construction Defects	4				4	4			
Strikes or Labor Disputes	4				4	4			
Weather Conditions	4				4	4			
Catastrophes- Fire, Flood, Earthquake	4				3.5		3		
Unidentified Utilities Affecting Sites		3			3.5	4			
Inflation		3			3		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	2.5	4			
Third Party Litigation	4				4	4			
Warranties for Facility Performance		3			3.5	4			

Degree of Exposure: 3.54

Appendix: B

3.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				4	4	4			
Differences between design criteria & 100% Design				4	4	4			
Errors or Omissions revealed During Construction	1				1.5			2	
Project Site Safety	1				1.5			2	
Constructability of Design		2			2			2	
Establishment of Project Cost		2			2			2	
Redesign if Over Budget		2			2			2	
Coordination of Construction	1				1				1
Permits and Approvals		2			2.5		3		
Environmental Impact Review		2			2.5		3		
Coordinating with Other Work		2			2			2	
Quality Control & Quality Assurance			3		2.5			2	
Differing Subsurface Conditions	1				2.5	4			
Design Defects				4	4	4			
Construction Defects	1				1.5			2	
Strikes or Labor Disputes	1				1				1
Weather Conditions	1				2		3		
Catastrophes- Fire, Flood, Earthquake		2			2.5		3		
Unidentified Utilities Affecting Sites		2			2.5		3		
Inflation		2			2.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation	1				1.5			2	
Third Party Litigation				4	3.5		3		
Warranties for Facility Performance			3		3.5	4			

Factor of Strength in Negotiation: 2.37

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3.3 Project Complexity Factor

Complexity Factors	Complexity					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
PHYSICAL					**2.625**				
Scale Challenge		2					3		
Technology			3					2	
Site Complexity			3					2	
Program			3				3		
TEMPORAL					**3.25**				
Adequacy of Time			3			4			
Continuity			3				3		
FINANCIAL					**3.5**				
Budget Complexity			3			4			
Coverage			3			4			
EXTERNAL					**3.333**				
Regulatory			3			4			

Project Complexity Factor: 3.18

Appendix: B

4. Partnering Effect on the A/E's Position: The Traditional Method

4.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews			2		3	4			
Differences between design criteria & 100% Design			2		3	4			
Errors or Omissions revealed During Construction			2		3	4			
Project Site Safety			2		3	4			
Constructability of Design			2		3	4			
Establishment of Project Cost			2		3	4			
Redesign if Over Budget			2		3	4			
Coordination of Construction			2		3	4			
Permits and Approvals			2		3	4			
Environmental Impact Review			2		3	4			
Coordinating with Other Work			2		3	4			
Quality Control & Quality Assurance			2		3	4			
Differing Subsurface Conditions			2		3	4			
Design Defects				1	2.5	4			
Construction Defects			2		3	4			
Strikes or Labor Disputes			2		3	4			
Weather Conditions			2		3	4			
Catastrophes- Fire, Flood, Earthquake			2		2.5		3		
Unidentified Utilities Affecting Sites			2		3	4			
Inflation			2		2.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	2.5	4			
Third Party Litigation			2		3	4			
Warranties for Facility Performance			2		3	4			

Degree of Exposure: 2.91

4.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				4	4	4			
Differences between design criteria & 100% Design				4	4	4			
Errors or Omissions revealed During Construction				4	3			2	
Project Site Safety				4	3			2	
Constructability of Design				4	3			2	
Establishment of Project Cost				4	3			2	
Redesign if Over Budget				4	3			2	
Coordination of Construction				4	2.5				1
Permits and Approvals				4	3.5		3		
Environmental Impact Review				4	3.5		3		
Coordinating with Other Work				4	3			2	
Quality Control & Quality Assurance				4	3			2	
Differing Subsurface Conditions				4	4	4			
Design Defects				4	4	4			
Construction Defects				4	3			2	
Strikes or Labor Disputes				4	2.5				1
Weather Conditions				4	3.5		3		
Catastrophes- Fire, Flood, Earthquake				4	3.5		3		
Unidentified Utilities Affecting Sites				4	3.5		3		
Inflation				4	3.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				4	3			2	
Third Party Litigation				4	3.5		3		
Warranties for Facility Performance				4	4	4			

Factor of Strength in Negotiation: 3.33

[Note: Since the same project type will be used throughout the analysis, project complexity calculation remains constant in all of the examples.]

5. The Owner's Position on Design/Build

5.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				1	1.5			2	
Differences between design criteria & 100% Design			2		2			2	
Errors or Omissions revealed During Construction			2		2			2	
Project Site Safety			2		2			2	
Constructability of Design			2		2			2	
Establishment of Project Cost			2		2			2	
Redesign if Over Budget			2		2			2	
Coordination of Construction			2		2			2	
Permits and Approvals			2		2			2	
Environmental Impact Review			2		2			2	
Coordinating with Other Work			2		2			2	
Quality Control & Quality Assurance			2		2			2	
Differing Subsurface Conditions			2		2			2	
Design Defects			2		2			2	
Construction Defects			2		2			2	
Strikes or Labor Disputes			2		2			2	
Weather Conditions		3			2.5			2	
Catastrophes- Fire, Flood, Earthquake			2		2			2	
Unidentified Utilities Affecting Sites			2		2			2	
Inflation			2		2			2	
Hazardous Waste; Environmental Clean-Up or Encapsulation			2		2			2	
Third Party Litigation			2		2			2	
Warranties for Facility Performance			2		2			2	

Degree of Exposure: 2.00

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5.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				4	4	4			
Differences between design criteria & 100% Design				4	4	4			
Errors or Omissions revealed During Construction				4	3			2	
Project Site Safety				4	3			2	
Constructability of Design				4	3			2	
Establishment of Project Cost				4	3			2	
Redesign if Over Budget				4	3			2	
Coordination of Construction				4	2.5				1
Permits and Approvals				4	3.5		3		
Environmental Impact Review				4	3.5		3		
Coordinating with Other Work				4	3			2	
Quality Control & Quality Assurance				4	3			2	
Differing Subsurface Conditions				4	4	4			
Design Defects				4	4	4			
Construction Defects				4	3			2	
Strikes or Labor Disputes				4	2.5				1
Weather Conditions				4	3.5		3		
Catastrophes- Fire, Flood, Earthquake				4	3.5		3		
Unidentified Utilities Affecting Sites				4	3.5		3		
Inflation				4	3.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				4	3			2	
Third Party Litigation				4	3.5		3		
Warranties for Facility Performance				4	4	4			

Factor of Strength in Negotiation: 3.33

[Note: Since the same project type will be used throughout the analysis, project complexity calculation remains constant in all of the examples.]

6. The Design/Builder's Position on Design/Build

6.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				1	2.5	4			
Differences between design criteria & 100% Design				1	2.5	4			
Errors or Omissions revealed During Construction				1	2.5	4			
Project Site Safety				1	2.5	4			
Constructability of Design				1	2.5	4			
Establishment of Project Cost				1	2.5	4			
Redesign if Over Budget				1	2.5	4			
Coordination of Construction				1	2.5	4			
Permits and Approvals				1	2.5	4			
Environmental Impact Review				1	2.5	4			
Coordinating with Other Work				1	2.5	4			
Quality Control & Quality Assurance				1	2.5	4			
Differing Subsurface Conditions				1	2.5	4			
Design Defects				1	2.5	4			
Construction Defects				1	2.5	4			
Strikes or Labor Disputes				1	2.5	4			
Weather Conditions		3			3.5	4			
Catastrophes- Fire, Flood, Earthquake			2		3	4			
Unidentified Utilities Affecting Sites				1	2		3		
Inflation			3		3		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	2.5	4			
Third Party Litigation				1	2.5	4			
Warranties for Facility Performance				1	2		3		

Degree of Exposure: 2.54

6.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				4	4	4			
Differences between design criteria & 100% Design				4	4	4			
Errors or Omissions revealed During Construction				4	4	4			
Project Site Safety				4	4	4			
Constructability of Design				4	4	4			
Establishment of Project Cost				4	4	4			
Redesign if Over Budget				4	4	4			
Coordination of Construction				4	4	4			
Permits and Approvals				4	4	4			
Environmental Impact Review				4	4	4			
Coordinating with Other Work				4	4	4			
Quality Control & Quality Assurance				4	4	4			
Differing Subsurface Conditions				4	4	4			
Design Defects				4	4	4			
Construction Defects				4	4	4			
Strikes or Labor Disputes				4	4	4			
Weather Conditions				4	4	4			
Catastrophes- Fire, Flood, Earthquake				4	4	4			
Unidentified Utilities Affecting Sites				4	4	4			
Inflation				4	4	4			
Hazardous Waste; Environmental Clean-Up or Encapsulation				4	4	4			
Third Party Litigation				4	4	4			
Warranties for Facility Performance				4	4	4			

Factor of Strength in Negotiation: 4.00

[Note: Since the same project type will be used throughout the analysis, project complexity calculation remains constant in all of the examples.]

7. The Owner's Position in Construction Management

7.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				1	2.5	4			
Differences between design criteria & 100% Design				1	2.5	4			
Errors or Omissions revealed During Construction				1	2.5	4			
Project Site Safety				1	2.5	4			
Constructability of Design				1	2.5	4			
Establishment of Project Cost				1	2.5	4			
Redesign if Over Budget				1	2.5	4			
Coordination of Construction				1	2.5	4			
Permits and Approvals				1	2.5	4			
Environmental Impact Review				1	2.5	4			
Coordinating with Other Work				1	2.5	4			
Quality Control & Quality Assurance				1	2.5	4			
Differing Subsurface Conditions				1	2.5	4			
Design Defects				1	2.5	4			
Construction Defects				1	2.5	4			
Strikes or Labor Disputes				1	2.5	4			
Weather Conditions		3			3.5	4			
Catastrophes- Fire, Flood, Earthquake			2		3	4			
Unidentified Utilities Affecting Sites				1	2		3		
Inflation			2		2.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	2.5	4			
Third Party Litigation				1	2.5	4			
Warranties for Facility Performance				1	2		3		

Degree of Exposure: 2.52

7.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				4	4	4			
Differences between design criteria & 100% Design				4	4	4			
Errors or Omissions revealed During Construction				4	4	4			
Project Site Safety				4	4	4			
Constructability of Design				4	4	4			
Establishment of Project Cost				4	4	4			
Redesign if Over Budget				4	4	4			
Coordination of Construction				4	4	4			
Permits and Approvals				4	4	4			
Environmental Impact Review				4	4	4			
Coordinating with Other Work				4	4	4			
Quality Control & Quality Assurance				4	4	4			
Differing Subsurface Conditions				4	4	4			
Design Defects				4	4	4			
Construction Defects				4	4	4			
Strikes or Labor Disputes				4	4	4			
Weather Conditions				4	4	4			
Catastrophes- Fire, Flood, Earthquake				4	4	4			
Unidentified Utilities Affecting Sites				4	4	4			
Inflation				4	4	4			
Hazardous Waste; Environmental Clean-Up or Encapsulation				4	4	4			
Third Party Litigation				4	4	4			
Warranties for Facility Performance				4	4	4			

Factor of Strength in Negotiation: 4.00

8. The Construction Manger's Position

8.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				1	2		3		
Differences between design criteria & 100% Design				1	2		3		
Errors or Omissions revealed During Construction				1	2		3		
Project Site Safety				1	2		3		
Constructability of Design				1	2		3		
Establishment of Project Cost				1	2		3		
Redesign if Over Budget				1	2		3		
Coordination of Construction				1	2		3		
Permits and Approvals				1	2		3		
Environmental Impact Review				1	2		3		
Coordinating with Other Work				1	2		3		
Quality Control & Quality Assurance				1	2		3		
Differing Subsurface Conditions				1	2		3		
Design Defects				1	2		3		
Construction Defects				1	2		3		
Strikes or Labor Disputes				1	2		3		
Weather Conditions		3			3		3		
Catastrophes- Fire, Flood, Earthquake			2		2.5		3		
Unidentified Utilities Affecting Sites				1	2		3		
Inflation			2		2.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	1.5			2	
Third Party Litigation				1	2		3		
Warranties for Facility Performance				1	2		3		

Degree of Exposure: 2.07

8.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				4	**4**	4			
Differences between design criteria & 100% Design				4	**4**	4			
Errors or Omissions revealed During Construction				4	**4**	4			
Project Site Safety				4	**4**	4			
Constructability of Design				4	**4**	4			
Establishment of Project Cost				4	**4**	4			
Redesign if Over Budget				4	**4**	4			
Coordination of Construction				4	**4**	4			
Permits and Approvals				4	**4**	4			
Environmental Impact Review				4	**4**	4			
Coordinating with Other Work				4	**4**	4			
Quality Control & Quality Assurance				4	**4**	4			
Differing Subsurface Conditions				4	**4**	4			
Design Defects				4	**4**	4			
Construction Defects				4	**4**	4			
Strikes or Labor Disputes				4	**4**	4			
Weather Conditions				4	**4**	4			
Catastrophes- Fire, Flood, Earthquake				4	**4**	4			
Unidentified Utilities Affecting Sites				4	**4**	4			
Inflation				4	**4**	4			
Hazardous Waste; Environmental Clean-Up or Encapsulation				4	**4**	4			
Third Party Litigation				4	**4**	4			
Warranties for Facility Performance				4	**4**	4			

Factor of Strength in Negotiation: 4.00

[Note: Since the same project type will be used throughout the analysis, project complexity calculation remains constant in all of the examples.]

Appendix: B

9. The Designer's Position

9.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				1	2.5	4			
Differences between design criteria & 100% Design				1	2.5	4			
Errors or Omissions revealed During Construction				1	2.5	4			
Project Site Safety				1	2.5	4			
Constructability of Design				1	2.5	4			
Establishment of Project Cost				1	2.5	4			
Redesign if Over Budget				1	2.5	4			
Coordination of Construction				1	2.5	4			
Permits and Approvals				1	2.5	4			
Environmental Impact Review				1	2.5	4			
Coordinating with Other Work				1	2.5	4			
Quality Control & Quality Assurance				1	2.5	4			
Differing Subsurface Conditions				1	2.5	4			
Design Defects				1	2.5	4			
Construction Defects				1	2.5	4			
Strikes or Labor Disputes				1	2.5	4			
Weather Conditions		3			3.5	4			
Catastrophes- Fire, Flood, Earthquake			2		3	4			
Unidentified Utilities Affecting Sites				1	2		3		
Inflation			2		2.5		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	1.5			2	
Third Party Litigation				1	2		3		
Warranties for Facility Performance				1	2		3		

Degree of Exposure: 2.46

9.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews				4	4	4			
Differences between design criteria & 100% Design				4	4	4			
Errors or Omissions revealed During Construction	1				2.5	4			
Project Site Safety	1				2.5	4			
Constructability of Design		2			3	4			
Establishment of Project Cost		2			3	4			
Redesign if Over Budget		2			3	4			
Coordination of Construction	1				2.5	4			
Permits and Approvals		2			3	4			
Environmental Impact Review		2			3	4			
Coordinating with Other Work		2			3	4			
Quality Control & Quality Assurance			3		3.5	4			
Differing Subsurface Conditions	1				2.5	4			
Design Defects				4	4	4			
Construction Defects	1				2.5	4			
Strikes or Labor Disputes	1				2.5	4			
Weather Conditions	1				2.5	4			
Catastrophes- Fire, Flood, Earthquake		2			3	4			
Unidentified Utilities Affecting Sites		2			3	4			
Inflation		2			3	4			
Hazardous Waste; Environmental Clean-Up or Encapsulation	1				2.5	4			
Third Party Litigation				4	4	4			
Warranties for Facility Performance			3		3.5	4			

Factor of Strength in Negotiation: 3.04

[Note: Since the same project type will be used throughout the analysis, project complexity calculation remains constant in all of the examples.]

10. The Contractor's Position

10.1 Degree of Exposure

Risk/ Responsibility	Degree of Control					Criticality			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews	4				**4**	4			
Differences between design criteria & 100% Design	4				**4**	4			
Errors or Omissions revealed During Construction				1	**2.5**	4			
Project Site Safety				1	**2.5**	4			
Constructability of Design				1	**2.5**	4			
Establishment of Project Cost			2		**3**	4			
Redesign if Over Budget			2		**3**	4			
Coordination of Construction				1	**2.5**	4			
Permits and Approvals			2		**3**	4			
Environmental Impact Review			2		**3**	4			
Coordinating with Other Work				1	**2.5**	4			
Quality Control & Quality Assurance				1	**2.5**	4			
Differing Subsurface Conditions		3			**3.5**	4			
Design Defects		3			**3.5**	4			
Construction Defects				1	**2.5**	4			
Strikes or Labor Disputes			2		**3**	4			
Weather Conditions	4				**4**	4			
Catastrophes- Fire, Flood, Earthquake			2		**3**	4			
Unidentified Utilities Affecting Sites	4				**3.5**		3		
Inflation		1			**2**		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation				1	**2.5**	4			
Third Party Litigation			2		**3**	4			
Warranties for Facility Performance				1	**2**		3		

Degree of Exposure: 2.93

Appendix: B

10.2 Factor of Strength in Negotiation

Risk/ Responsibility	Participation					Professional Expertise			
	None	Low	Medium	High	Average	High	Medium	Low	None
Design Reviews	1				2		3		
Differences between design criteria & 100% Design	1				1.5			2	
Errors or Omissions revealed During Construction				4	4	4			
Project Site Safety				4	4	4			
Constructability of Design				4	4	4			
Establishment of Project Cost				4	4	4			
Redesign if Over Budget		3			3		3		
Coordination of Construction				4	4	4			
Permits and Approvals			3		3		3		
Environmental Impact Review			3		3		3		
Coordinating with Other Work				4	4	4			
Quality Control & Quality Assurance				4	4	4			
Differing Subsurface Conditions			3		3.5	4			
Design Defects	1				2.5	4			
Construction Defects				4	4	4			
Strikes or Labor Disputes				4	3.5		3		
Weather Conditions	1				1				1
Catastrophes- Fire, Flood, Earthquake			3		2.5			2	
Unidentified Utilities Affecting Sites		2			2.5		3		
Inflation			3		3		3		
Hazardous Waste; Environmental Clean-Up or Encapsulation			3		2.5			2	
Third Party Litigation				4	3.5		3		
Warranties for Facility Performance				4	4	4			

Factor of Strength in Negotiation: 3.17

Appendix: B