Fundamental Analysis and Conceptual Model for Corporate Strategy in Global Engineering and Construction Markets

by

Yuen Jen Cheah

B.Eng. (Hons) (Civil)
Nanyang Technological University, Singapore, 1997

M.Sc. (International Construction Management)
Nanyang Technological University, Singapore, 1999

Submitted to the Department of Civil and Environmental Engineering
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in Construction Engineering and Management

at the

Massachusetts Institute of Technology

September 2002

Signature of Author: _____
Department of Civil and Environmental Engineering
July 26, 2002

Certified by: _____
John B. Miller
Associate Professor of Civil and Environmental Engineering
Thesis Supervisor

Accepted by: _____
Oral Buyukozturk
Chairman, Departmental Committee on Graduate Studies

Fundamental Analysis and Conceptual Model for Corporate Strategy in Global Engineering and Construction Markets

by

Yuen Jen Cheah

Submitted to the Department of Civil & Environmental Engineering
on July 26, 2002 in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy in
Construction Engineering and Management

ABSTRACT

Strategic management as an academic field of study has spanned over four decades. As an interdisciplinary subject that enjoys concurrent contributions by allied disciplines such as economics and social science, numerous industries have benefited from applying tools and concepts developed within strategic management that are subsequently tailored to match their specific contexts. Strangely, although postured as one of the oldest and largest industries, the construction industry has largely chosen to omit the relevance of the subject in daily business operations. This is especially true in the United States, compared to the British who have embarked on such studies as early as the 1970s. Recent literatures have commented on inadequate management knowledge and systems perspective of civil engineers as they rise through the ranks and shoulder higher responsibilities of management. This is manifested by lackluster performance and failure of several international construction firms sampled in this research, the causes of which were least attributed to technical engineering issues and project management aspects.

This doctoral research aims to bridge the knowledge gap in strategy and formulates a conceptual model suited for construction. Twenty-four large international construction firms originating in the U.S., Europe and Japan are selected for the study. Fundamental analysis, a common methodology used in economics and investment studies, forms the quantitative approach to extract information from publicly available data. The theoretical foundation is then drawn from the intellect of different schools of strategic thought that have accumulated over the years. Both complementary components combine for the development of the conceptual model, which is supported and refined in consideration of factual information observed from the firm sample.

The conceptual model builds on seven strategic fields, two organizational mechanisms and a boundary notion that divides the external environment from the internal aspects of a firm. The model works as a process that runs parallel to mainstream strategic management functions. Two main conclusions are derived: (1) fields and mechanisms should function as variables to react dynamically to ever changing external conditions; (2) interaction among these variables automatically promotes higher order differentiation factors that enhance the strategic outlook of a firm.

Thesis Supervisor: John B. Miller
Title: Associate Professor of Civil & Environmental Engineering

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENT

Individually, my thesis committee members have each made the completion of this research and fulfillment of my degree come true in very different ways, for which I find the lack of words to express my gratitude. I am definitely indebted to Dr. John Miller, who is serving concurrently as the Chair of the committee and as my academic and faculty advisor. His largest influence comes from making me a system-thinker, and the philosophy of problem solving introduced to me during the process will benefit me for the rest of my life in many aspects. Dr. Fred Moavenzadeh has always inspired me with his thoughtful insights that come from his unique experience spanning across various fields, which raise the intellectual level of this research that bears an interdisciplinary nature. On the other hand, Dr. Massood Samii often alleviates my struggle in search of direction by providing specific guidance on research methodology and sharing his knowledge on finance and management.

I would also like to thank Nanyang Technological University of Singapore that has primarily sponsored my study here at MIT.

My research life in 1-331 is very much disciplined by my colleagues, Mike, Steve and Marko, who would ensure that our time was well spent towards productive studies. Beyond serious working hours, the joy and laughter that we shared have added colors to my black-and-white understanding of the American culture.

Among the many friends whom I met during my short stay in Cambridge, Jin deserves special mentioning for her kind support and help especially to see me through the General Exam. The many unselfish things that she has done will always live in the memories of my life at MIT. In addition, Kent and I-Tsung, thanks for the accompaniment in searching for more pleasant meals than this vicinity can offer.

Last but not least, I dedicate all my achievements to my family members and my fiancée Jenny, whom I know I can always fall back on during both good and bad times. Thank God that I have not failed them. Mum, Sis, Adi, Kar Woh, Yat Seng and Jenny, I love you all. Although my dad could not live long enough to see this day, he has always been, and will always be, the most important motivator in all my pursuits.

BIOGRAPHY

Charles Y.J. Cheah was awarded First Class Honours and admitted to the degree of Bachelor of Engineering (Civil) in 1997 by Nanyang Technological University (NTU) of Singapore. He then received a Master of Science in international construction management from NTU in 1999. The highlight of his academic experience comes from his admission to MIT with a presidential graduate fellowship for his doctoral studies, the subsequent years of which were supported by NTU through an overseas scholarship scheme.

Charles has gained some industrial experience working as a structural engineer in his early career related to design and construction of concrete, steel and composite structures. One of the larger projects that he was directly involved includes the One Raffles Link in Singapore – a commercial building with construction costs estimated at S$200 million. In pursuing a switch of role from being a consultant to a client representative, he then worked as a project engineer for Esso Singapore Private Limited, an affiliate of ExxonMobil Corporation, through which he has gained some exposure to the oil and gas industry. Stationed in a refinery, his job responsibilities included contracting, budgeting, planning and control for both civil- and mechanical-related projects.

Charles' decorations include the National Science and Technology Board of Singapore Gold Medal (1999) and the Lee Kuan Yew Gold Medal (1996). Outside of his core academic achievements, he also holds the honor of being a Licentiate of the Trinity College of Music, London (LTCL) in pianoforte, which was conferred back in 1992.

CHAPTER ONE

A PERSISTENT KNOWLEDGE GAP IN CONSTRUCTION

"Whether through more or different education, engineering educators must produce a different product. Depressed salaries, the lack of jobs and the diversification of the workforce now employed to solve traditional civil engineering problems all point to the fact that major change must occur not only in content but also in philosophy."

- John V. Farr (1997)

1.1 Introduction

From the ancient times to the modern era, we, as civil engineers, build our pride on our professional role in building essential living infrastructures. In the course of fulfilling our role, both the academia and practicing world frequently rely on advanced analytical techniques and project management skills in their daily dealings – to the extent that some of these administrative and technical heritages have created a narrow mindset. Many would think that only such skills and knowledge are critical for academic excellence and corporate success. As one of the oldest engineering disciplines, these rigidities have become well entrenched over time. Consequently, it is sometimes difficult to overcome the orthodoxy in the process of catching up with dynamic changes of environmental factors. The increasingly vibrant, competitive nature of businesses in most industries including construction is further amplified by forces of globalization and deregulation, and augmented by new trends of technology to foster competitive positioning. Inevitably, different kinds of knowledge gaps have made their existence in certain areas within our profession.

This is indeed unfortunate, considering the fact that the construction sector represents a significant contribution to a national economy, often in the range of 5% to 15% in terms of the gross domestic product (GDP) (Mawhinney, 2001). Posting an estimated global market size of $3.6 trillion in 1999 (Batchelor, 2000), it also represents the largest industry on a worldwide basis. Judging from these figures, and founding on basic economic arguments for creating positive linkages between industries and nations, it is conspicuous that even a slight improvement in bridging these knowledge gaps can create potentially large benefits to our profession, nations and the society at large.

Among the several areas of knowledge gaps, one important field that has become more relevant to us than before is strategic management at the corporate level, contrasting the majority focus on project and construction site management issues in the civil engineering profession.[1] As an *academic* field, strategic management is relatively young, effectively blooming only since the 1960s (Rumelt, Schendel and Teece, 1994), and

[1] As an additional illustration, another type of knowledge gap is the commonly observed slow pace of adopting new technologies such as the Internet in the industry. Conservatism seems relatively excessive in this old-aged profession.

notably after the works of Chandler (1962) and Ansoff (1965). With in depth studies of four major industrial enterprises – General Motors, Sears, Standard Oil of New Jersey (Exxon) and DuPont, Chandler illustrates how senior management at these companies was involved in the role of strategy formulation that is essentially separated from strategy implementation at the operational level. Thus, following Chandler's parlance:

> Strategy can be defined as the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals. (pp. 15-16)

In retrospect, such classical view of separation between strategy formulation and implementation may not be warranted, at least in the modern era, and in fact it has been subjected to criticisms from other schools of thinking. Discussion of these issues is deferred to the next chapter.

On the other hand, as a field of *practice*, most would agree that the origins of strategic management could be traced back to the concepts and thinking applied in military campaigns in the ancient world.[2] Strategic thinking constantly evolved in the midst of military planning, be it the consolidation and expansion of the Greek Empire in 336 BC, or the art of war masterminded by Sun Tzu in ancient China in the 6th century BC. In short, whatever the alternative rhetoric is, strategic management as we know today is not a typical fad or hype without its merit. Ironically, many powerful rules of thumb and concepts of strategy are subconsciously adopted in our daily management and personal life.

1.2 The Project Management Tradition

Research efforts in fields of strategic management, corporate finance, organizational theories have been achieving breakthroughs and successes with concepts appropriately applied to many industries, such as automobile, telecommunications, and retail – just to name a few. Nonetheless, similar research efforts have been lacking in the construction industry, which still seems to focus largely on management issues at the project level rather than the corporate level. This poses a peculiar picture, given the sheer

[2] See Chinowsky (2000) and Whittington (2001), for example.

size of this industry that is essentially the largest among all. Betts and Ofori (1992) also comment that the general experience in construction is of strategic planning being a low-profile activity that faces significant restrictions at many levels, and the gap between the extent of such planning in construction and other industries is only getting wider.

Chinowsky (2000) further provides some plausible explanations elaborating on such dire outlook in the construction industry. First, an overwhelming number of papers focusing on technical and managerial issues at the project level dominate civil engineering-based literature. Second, academic programs at graduate level are mostly oriented towards technical skills and project management techniques, while leaving out topics related to corporate management and construction organizations. Third, the boom-and-bust cycles during the post-World War II era, rendering unpredictability of industrial trends, have forced firms to be contempt with staying afloat one project at a time. Thus, it is concluded that the impact of these issues has resulted in a close, parallel evolution in the industrial and academic world – forging a so-called "project management tradition".

In principle, such a tradition may not be detrimental after all, provided that an amicable equilibrium is always maintained between the industry and the general environment. However, such equilibrium conditions rarely last, given regular changes ranging from political issues and social reform to advances in technology, communication and economics. Thus, as civil engineers ascend their career ladders reaching senior-level positions, most of them inevitably find that the project management knowledge base developed in their education and past career encounters is not quite compatible with the challenges shaped by such external environmental factors.

Indeed, firms such as Stone & Webster, Washington Group International (WGI) and Philipp Holzmann – all of which experienced severe financial crisis, did not entirely fail due to poor technical and project management skills. Despite its bankruptcy, Stone & Webster's process technologies are still adopted today in many refineries belonging to oil and gas giants such as Shell and British Petroleum. Consequently, technological incompetence was unlikely to be a major cause for Stone & Webster's demise. Likewise, Morrison Knudsen, before its merger with WGI in 1996, had an enviable track record in the U.S. and was unlikely to fail merely because of poor construction management skills.

Lastly, Holzmann's 150-year history makes it unquestionable about their ability to execute construction projects. In each of these cases, crises were partly attributed to wrong strategic policies and choices made at the corporate level.

While leaving the details in subsequent chapters, the causes of these crises are worth mentioning at this point to strengthen the argument of breaking out from the project management tradition. On hindsight, Stone & Webster had diversified too excessively, frequently creating strain to its cash flow and financial management system aggregated at the corporate level. The firm's liquidity crisis was then triggered by huge losses in a couple of international lump sum contracts. WGI, building on its strategy of acquisition for growth, was unable to fully absorb the operations of newly acquired Raytheon Engineers & Constructors (REC), which was effectively double of WGI's size. WGI subsequently found that it could not turn around a couple of large projects that were previously secured by REC. Holzmann, on the other hand, admitted their wrong decision in committing to rental guarantees in their real estate development ventures, which subsequently created huge losses when the domestic real estate market entered into a slump. In 1999, Holzmann was able to avoid bankruptcy when an eleventh-hour rescue package was arranged between the creditors and the shareholders, which was indirectly orchestrated by the German Chancellor Gerhard Schroder. However, the company failed to turn around during the course of restructuring and eventually filed for insolvency on March 21, 2002 when Commerzbank AG, Dresdner Bank AG and HypoVereinsbank AG, three of its biggest creditor banks, rejected a Deutsche Bank AG-led rescue plan. This time round, even during an election year, the government has backed away from intervention.

Apparently, there are many issues beyond the technical and project management regime that determine corporate success and survival. In fact, the last example on Holzmann also aptly illustrates the larger issue of corporate governance that is closely related to external factors such as politics and social environment.

1.3 Motivation of the Research Topic, Objectives and Hypothesis

Armed with the background information presented, this doctoral research is geared towards bridging the gap of strategic management in the construction industry. Inevitably, the topic requires a sound understanding of business and management principles. As a result, the author's research experience has taken full advantage of the openness towards interdisciplinary research and the availability of courses that facilitate cross-learning at MIT. In addition, the scope of research includes the review of operating and financial performance of 24 international construction firms. Concurrently, the study will thus serve as a timely update on the outlook of the industry and firms. As far as the author is aware, a more detailed study at MIT that had a similar nature related to this topic is dated back to a decade ago with Sugimoto's (1990) doctoral thesis.

Specifically, a model for building a better understanding of corporate strategy has to be developed from first principles in this thesis. A direct consequence of such philosophy is the adoption of a broader view of the topic. The resulting model could then serve as a foundation towards detailed studies in more specific areas in the future.

In the search of a concrete methodology, fundamental analysis is used as a means to derive observations related to corporate strategy. Although fundamental analysis is better defined in the context of economics and investment [3], a similar mindset is adopted here in the study of corporate strategy. In essence, this research relies on financial information (such as the income statements and balance sheet) and selected factors (operating, industrial etc.) to provide useful hints towards the extraction of drivers that are pertinent to corporate strategy.

The objectives of the research can thus be summarized into the following:

- To build a conceptual model related to corporate strategy that would help senior managers of construction firms in making strategic management decisions;
- To study how issues beyond the technical and project management regime can dictate the success or failure of a construction firm;

[3] Refer to Downes and Goodman (1998), for example.

- To provide an update and develop a template that summarizes the operating and financial performance of the selected sample of construction firms;
- In general – but most important of all, to promote a general understanding on the importance of strategic management and its potential to augment the technical and project management knowledge already embedded in our profession.

It is believed that the motivation and goals stated previously strongly support the demand of attention devoted to this research area. Peculiar as it might seem, a specific research hypothesis is indeed not obvious (and probably unnecessary) due to the generic nature of this research. The fact that similar research effort has been lacking in this industry implies that a general form, direction, or set of principles that guide the research topic is practically non-existent! Without such general consensus on the *status quo* of strategic management in construction, it is hard to think of a basis to formulate a 'null' hypothesis, and the idea of an alternative hypothesis is even fuzzier.

Nevertheless, in order to stimulate an ongoing interest in the topic, the author would propose the following statements as some kind of hypotheses to put up a challenge to the intellectual world of our profession:

> *That corporate and individual success in construction will go beyond the traditional areas of excellence of civil engineers – project management skills and technical knowledge streams. Business, financial, and marketing issues, just to name a few, are as important, if not more, as the type of engineering skills stated. Moreover, constant reliance and delegation of such management tasks to professionals who are external to the industry, without gradual self-learning and building of competence in these areas, will only act to the detriment of the civil engineering industry in the long term.*

It is hard to prove/disprove objectively the above hypothesis (especially when the stated hypothesis does not possess a quantitative nature that can be explored using a statistical methodology), but the intention is generally a healthy one to our profession. Only through a deeper search for answer(s) leading to the above hypothesis that we can develop an understanding of a vastly unexplored territory in our profession.

Also, it should be clarified that the intention is not to call for civil engineers to abandon their main role or leave their basic training in engineering behind. Neither is it meant to substitute professionals and experts who are hired to manage financial and marketing issues with civil engineers. Rather, the key is to strike a balance and build an understanding of how non-engineering issues can often affect the fate of a company or a project as an entire "package". Given the uniqueness and complexity of construction projects, it is believed that a civil engineer is well suited to make the ultimate decisions, provided that he or she has a clear wisdom of how various issues, engineering and management inclusive, might interact.

1.4 Limitations of the Research

Strategy by itself is a field with a wide scope and constantly experiences fermentation of new theories and ideas. Due to the finite timeframe of a typical doctoral study, there are some inevitable limitations in this research.

The most obvious limitation is initiated by the choice to focus on a broad picture that encompasses as much material as possible from the main field of strategy that is deemed relevant to construction. Hence to certain extent, a more detailed level of study has to be traded off. Given the fact that research related to strategy (within construction) has been either lacking or evolving at random at best, it is deemed that a broader approach is more meaningful to streamline the different schools of thought and past (random) contributions into one coherent philosophy. As will be pointed out repeatedly in subsequent chapters, the conceptual model developed in this thesis possesses a generic nature – with the intention that researchers from different background and origin would still find it useful to develop extensions of their own ideas related to strategy.

Specifically, the conceptual model emphasizes on interactions among various strategic components. While efforts are devoted to provide as many illustrations and examples as possible, the thesis is still limited in terms of studying the interaction between two specific components. On one hand, the author would like to defer such types of detailed studies (in selected areas) to the future. On the other hand, the author naturally

cannot claim to possess in-depth expertise to address detailed interactions in all areas. For example, it is better to leave the interaction between *Information Technology Strategy* and other strategic components of the model to those researchers who have kept themselves up-to-date with the constantly evolving IT trends. Evidently, these researchers would be in a much better position to explore and provide meaningful insights.

Lastly, because the topic (and approach) is relatively new, it will take a longer period of time to collect time series data and observe the behavior, success episodes or failure incidents of construction firms. As such, the thesis is limited in scope to adopt statistical methodologies to build some kind of quantitative models. However, in the author's opinion, some of the statistical methodologies are viable tools to be used to study corporate strategy. Further discussions on this issue will be given in Chapter 7.

1.5 Organization of the Thesis

This section provides an overview of how this thesis is organized.

In the next chapter, a survey and literature review of strategy as a research field in general (most of which, arguably, were developed with industrial contexts other than construction in mind) is presented. In a nutshell, the different schools of theories and thoughts that form the mainstream of strategy research are summarized. In the second part of the chapter, the unique characteristics of the construction industry that post additional challenges to the field of strategy are discussed. Furthermore, past research effort in this area that was conducted by professionals within the civil engineering discipline is mentioned. The last section of the chapter then consolidates these background surveys of literature and research efforts to arrive at an argument for an 'open' model.

Chapter 3 focuses on research methodology, whereby the steps involved are discussed. A key part of the methodology is the construction of a template that facilitates the organization of data extracted from documents related to a company. The five components of the template will be elaborated in detail. Selected parts of these data are then used for the purpose of data analysis in the next part of the chapter. Observations

and findings from the analysis are then presented and discussed. Various trends of operating and financial performance for the chosen sample of firms are also presented in graphical format.

With a thorough theoretical survey in Chapter 2 and a detailed examination of the current state of performance of selected firms in Chapter 3, Chapter 4 embarks on the description of the conceptual model that is the crux of this thesis. Individual components that make up the basic structure of the model are elucidated. The notion of interaction among strategic variables is formally proposed, followed an example that illustrates this notion in the last section of the chapter.

Chapter 5 effectively expands on the basic conceptual model that is built in Chapter 4. To certain extent, it can be said that while Chapter 4 focuses more on the internal side of an organization, Chapter 5 opens up to consider external factors and the interplay between the two. Specifically, the concept of 'boundary' is introduced, together with three possible dimensions of boundary modification and five decision factors that would aid strategists to master the art of managing boundary issues. Again, the notion of interaction is illustrated, except that now the examples include the boundary factor. Chapter 5 thus concludes the theoretical descriptions of the conceptual model.

To enhance the practical use of the conceptual model, it is important to envision how all these are linked back to general strategic management functions that are commonly adopted. It will be shown in Chapter 6 that the conceptual model actually works as a parallel process which, not only augments the role of strategic planning and management functions in the mainstream, but also validates the compatibility of strategies. The second half of Chapter 6 provides a detailed case study by using a renowned U.S. construction firm as the subject to illustrate the use of the conceptual model in a larger strategic planning and management environment.

The last chapter summarizes the main conclusions of the thesis and contributions made by this research. The implications of these findings have also led to three major business imperatives that should be observed by any construction firms. This is then followed by recommendations made on possible future research directions, some of which would address the limitations that cannot be fulfilled by this thesis as mentioned in

Section 1.4. Lastly, the findings from this research study also bear some implications on civil engineering education. Some comments on the academic nature of civil engineering programs are made.

CHAPTER TWO

THE THEORETICAL FOUNDATIONS OF STRATEGY

"The ideal strategy advisor is one who keenly understands the subtleties of the problem at hand and yet can invoke broad, synthetic knowledge, gleaned from other cases, and apply it to the present situation."

- Paul J.H. Schoemaker (2001)

2.1 Setting the Scene

The facts and arguments presented in the first chapter should by now eliminate any doubtful concern of the need to develop a model for strategic management and planning purposes for construction. In order to ensure that the model will contain a solid theoretical construct and a strong logic supporting its propositions, the development of the model must be preceded by a survey of various schools of theories. Although past theories and research effort were mostly structured with other industries and contexts in mind, there remain many core arguments that can be generically applied to construction. Extraction of such core arguments and broad literature review of the strategy landscape stand out as the central themes of this chapter.

In addition, the fundamentals of strategy laid out in this chapter are also heavily relied upon in the study of firms throughout this research. The knowledge base of strategy greatly augments the overall analytical methodology in conjunction with other quantitative methods by adding a qualitative, judgmental facet. Detailed outline of the methodology is given in Chapter Three.

As a matter of fact, strategy is hard. Its intellectual foundations are drawn from various primary disciplines including finance and economics, organizational sociology, political science, and cognitive psychology, all of which are constantly evolving at their own pace (Rumelt *et al.*, 1994). For example, the development of game theory not only expands the frontier of economics, but also contributes to strategic management through its adoption in structuring competitive strategy for oligopolies. In addition, the actors and audience of strategy are diverse, ranging from academicians to managers and consultants concentrating in different industries and sectors.

Naturally, this heterogeneous composition of disciplines and players ensures that consensus can only be sought in a few broadly based directions. Many of these directions also provide conflicting prescriptions for strategy. As in many real-life quandaries then, an optimal, perfect way is arguably non-existent. With eminent writers on strategy frequently cannot even agree on the definition and scope of corporate strategy, it is thus useful as a first step to map out these various schools of strategic thinking along those broadly based directions. As we shall subsequently see, balancing some of these

conflicting phenomena forms the key challenge towards the development of the conceptual model in Chapter Four.

2.2 Mapping the Various Schools of Thoughts in Strategy

Most strategy texts written are predominantly prejudiced towards pre-selected perspectives. Some schools advocate for formal planning processes in strategy formation, focusing on 'hard' topics such as market segmentation and analysis. Other schools of thoughts relinquish the role of these consciously controlled thinking processes and focus on 'softer' issues such as incentives, learning, organizational structure, culture, and both internal and external relational contracts. In other words, the latter group is skeptical about the appropriateness of explicit assessment of strengths and weaknesses of both the market and its players, given the fact that environmental factors are ever changing. The debate between two prominent strategy gurus, Henry Mintzberg (1990, 1991) and Igor Ansoff (1991) on planning versus learning aptly illustrates the point.

Faced with these convoluted arguments and debates in the field, Whittington's (2001) approach is a novel one. By firstly narrowing down to four basic conceptions of strategy – rational, fatalistic, pragmatic, and relativist, Whittington finds that these distinct schools of thoughts can essentially be mapped along two axes: outcomes of strategy and the processes by which it is made. The two combined continuums are as shown in Figure 2-1. The vertical axis examines the degree of variation of strategic intent and outcomes produced. This may represent profit maximization *per se* at one extreme, or accommodation for other complex priorities such as social responsibilities at the other end of the spectrum. The horizontal axis considers the fact of whether such outcomes are derived from deliberate planning, calculation and formulation, or simply as an emerging product of accidents, chance, and social and organizational inertia. The radically different implications on strategy are hence read off from the relative positions along the two axes in the diagram. However, as even Whittington himself notes, the four generic approaches to strategy given in Figure 2-1 occasionally overlap with one another when dealing with certain specific issues. For example, on internationalization, both Classical and Evolutionary perspectives would agree on the logic of efficiency-seeking motives,

although Systemic theorists would provide other explanations along political and cultural dimensions. In other words, while provoking heated debates on some broadest principles, the differences in the four approaches do not necessarily imply mutual exclusiveness when deriving solutions for certain particularities of strategy. This is an important observation since the conceptual model derived later in this thesis has a foundation that spans across at least two of these four quadrants.

The next few sections provide a brief summary for each of these four generic approaches. Following the introduction of each, it is important to identify the strengths and weaknesses of each approach. Ideally, development of any kinds of conceptual models should encompass the strengths of these various approaches while avoiding the pitfalls.

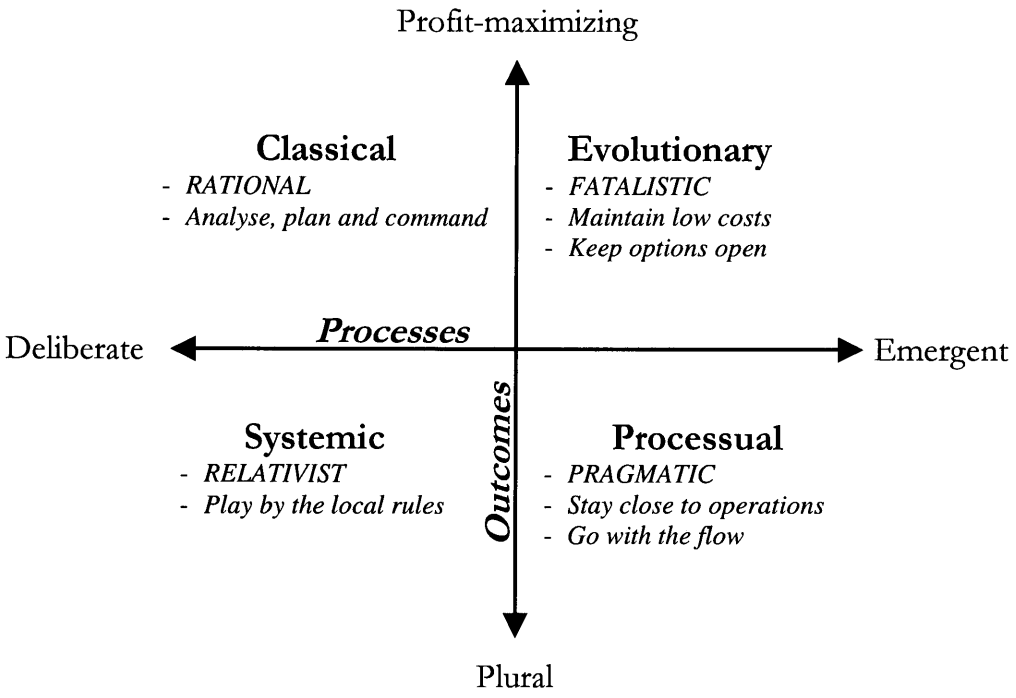


FIGURE 2-1 The Four Generic Approaches of Strategy
[Sources: Whittington (2001)]

2.2.1 THE CLASSICAL APPROACHES

2.2.1.1 Characteristics and Paradigm

The Classicists believe in the superiority of rational planning methods and making objective decisions, which are most evident in mainstream strategy textbooks and dominant in business schools teaching. Among many authors, some of the prominent and influential ones who may be classified under this quadrant include Michael Porter (1980, 1985), Alfred Chandler (1962) and Igor Ansoff (1965). Moreover, an inherent key assumption applied in their models is that profitability is the ultimate and supreme goal of businesses. This assumption has also long been adopted in many microeconomics models. The premise that corporate decision-makers will act as 'rational economic men' (Hollis and Nell, 1975) also forms the philosophical core of Classicists' theories.

Beyond the notion of adopting rational planning approach for profit maximization, Classical theories often imply a top-down planning process and a hierarchical command system. In particular, it signifies the important feature of separation between strategy formulation and implementation. Thus, it is assumed that the determination of long-term goals and strategy falls under the regime of top executives. Once the strategic plan is formed, actual execution is presumed to be carried out smoothly through cascading actions of the middle level and operating core of the organization as dictated by the plan. Rightfully, these characteristics stem from the historical origin of military concepts and early studies of large, diversified corporations. For example, in tracing the link between military and business practice, Bracker (1980) illustrates with Socrates' quote that the duties of a military general and a businessman were equivalent, with both relying on planning wisdom to deploy resources in meeting pre-determined objectives. With a similar theme but in a slightly different context, Alfred Sloan (1963), founding on his experience in General Motors, enunciated the importance of establishing 'policies' (strategy) as a specialization that must be kept independent of the daily distractions owing to policy execution. Incidentally, Sloan's view and General Motors' experience was potentially representative of the characteristics found in other big corporations around that epoch, especially those with similarly diversified businesses under the corporate umbrella.

Another significant corollary of the separation between strategy formulation and implementation is the sequence of strategy determination and design of organizational structure. Since structure is essentially the mechanism through which strategy will be implemented, the Classicists' promotion and limitation of the role of strategy formulation at the top level indirectly implies that 'structure follows strategy' (Chandler, 1962). Thus, whatever the outcome of strategy that has been determined *a priori*, the design of structure is meant to suit and match the plan. Put in another way, structure is a mere enabler rather than one of the core drivers of strategy. Although the maxim has a strong theoretical basis, this straightforward belief has been subjected to severe criticism especially from the Processualists (refer Section 2.2.3). With an equally sound logic concerning the complexity and micro-politics that apparently exist in many of these large, bureaucratic organizations, Processualists argue that strategy is likely to be compromised to suit the administrative heritage and operational inefficiency inherent in the organizational structure. As a matter of fact, structural change to suit new strategy is notoriously hard. In their view, what tools you have would determine what strategic jobs you undertake.

2.2.1.2 Strengths and Weaknesses of Classical Approaches

Still remaining as the mainstream of strategy, the Classical approaches obviously have their merits. First, rational and objective assessment creates a clear-cut and consistent system for decision making, which usually allows *ex post* comparison between projected and actual performance so that the system can be regularly updated and refined. By virtue of its objectivity, the approach also lends itself to auditing so that transparency is preserved during the entire process. Systemic theorists (refer Section 2.2.4) also share this importance of justifying the legitimacy of decisions made especially within the larger institutional environment where public authorities and the capital market constantly scrutinize whether a firm is acting with due diligence. Rational planning, as commonly perceived, is at least one step ahead towards due diligence.

Second, the nature of a rational planning approach creates multiple links with disciplines such as finance and economics that further provide abundant analytical tools

and concepts for decision making. Techniques such as net present value (NPV) analysis, real options and game theory have made substantial contribution towards decision science and risk management, with corporations such as Merck confirming value added in applying these techniques in their corporate management functions (Nichols, 1994).

Obviously, the Classical approaches have their flaws as well. Some of these have been elaborated earlier:

(1) General ignorance of 'softer' issues within the organization, especially of human behavior.

- Such issues have become more important in the modern days when the general social, political and operating environment differs from those days when most mainstream Classical theories were formed.

(2) Naive assumption of strategy implementation to follow strategic plan as laid out in strategy formulation.

- The separation of strategy formulation and execution does not apply in most cases. Many companies have discovered the relevance of a 'bottom-up' approach, thus creating space of concern for operational processes at the floor level within the larger strategic planning exercise.

(3) Since most Classical theories have traditionally relied on studies of larger corporations, these models are found incompatible with the strategy of small, nimble firms especially during the information technology era in the 1990s.

(4) The maxim of 'structure follows strategy' is far from a universal truth. It only wins half the battle given abundant evidence that supports the reverse pattern.

(5) Lastly, schools of analytical and rational planning sometimes place too much emphasis on optimization. In a dynamic environment that strategy constantly face, a truly optimal configuration rarely exists. Even if it does, it will be rapidly rendered obsolete when environmental factors change.

2.2.2 THE EVOLUTIONARY PERSPECTIVES

2.2.2.1 Characteristics and Paradigm

The primary difference between the Classical and Evolutionary perspectives lies with their assumption of top management's ability to plan and act rationally to create superior performance. Evolutionary theorists think that deliberate planning is futile given the fact that the general environment is constantly changing. Their belief is based on natural Darwinism, whereby only the 'fittest' will survive under the hostile environment. Market does its selection of survivors, rather than firms selecting the most profitable market and optimal configuration of operation. Contrasting Porter's (1985) generic strategy of differentiation, any competitive advantage is believed to be rapidly 'competed away'; thus no single unique strategy is sustainable for long. Therefore, a complete free market is assumed, some flourish while others perish, with new entrants constantly evolve to replace old and inflexible players who cannot adapt to new environmental conditions. In essence, Evolutionists push the dictum of "market is efficient" to its extreme level.

Based on the above arguments, coupled with the Evolutionists' view that strategy is both futile and inherently 'expensive', the main implication is that firms should stay at the lowest level of cost in order to survive since revenue is derived from market demand that is uncontrollable by them anyway. Thus, the *only* real comparative advantage is relative efficiency. This indirectly leads to the adoption of myopic short-term actions to undercut those firms that function with 'expensive', long-term strategies.

While it is true that cost control is always a main business imperative and remains as the most commonly quoted action by companies, the study of firm sample in this research confirms that management rarely accepts this as the only critical success factor. At least in the upper league of major construction players, the trend is for managers to constantly look beyond cost control to secure stable growth in market share and earnings.

2.2.2.2 Strengths and Weaknesses of the Evolutionary Perspectives

It is thought that adopting the evolutionary perspectives will bring more disadvantages than benefits in practical sense. First, the adopted view is overly passive

and pessimistic in nature, when it is all left to 'fate' to decide on survivors. Many players in the society should also feel uncomfortable with this seemingly innocuous belief. If cost control remains the one and only business imperative, the value of highly paid executives and managers responsible for crafting future directions of firms and implementing such strategies is directly questioned. In the academic world then, the intellectual value of strategy research that predominantly possesses the classical flavor is substantially tarnished. Further, the usefulness of scientific management and analytical tools in altering the 'fate' in the corporate world is also directly challenged. At least for the sake of looking forward to the future with confidence, the positive belief in success by pursuing an active posture is a noble one to motivate the basic functioning of corporations in a more meaningful way.

Other major flaws of the Evolutionary theories include the inclination to succumb to short-term, myopic actions, and, as it has been mentioned, primarily on cost issues. These actions *per se* are far from justified. It is important to realize that market heterogeneity and complexity do allow segmentation of niche markets. Creation of entry barriers would effectively deter the entrance of new competitors or prolong the replacement process to the extent that may subsequently discourage these new players from remaining in the newly entered market.

That said, a valuable lesson taught by the Evolutionists is the utmost importance of giving due consideration to environmental factors that constantly call for strategy renewal in striving for survival. Although they may not agree with the following consequential argument, all these seem to call for flexibility to be built inside a corporation in order to react to constant environmental changes. It may be true that strategy is inherently 'expensive', but the trick lies on trading the costs for a brighter future.

2.2.3 THE PROCESSUAL APPROACHES

2.2.3.1 Characteristics and Paradigm

Diagonally placed in Figure 2-1, Processual approaches are in direct conflict with most aspects of the Classical theories. Similar to the Evolutionary perspectives, it rejects the hailing of deliberate strategic planning functions. Using a similarly famous phenomenon of 'bounded rationality' in economics, it refutes the notion of 'rational economic men' implicit in Classical approaches. According to the notion of bounded rationality, cognitive limits placed on rational thinking substantially compromise the effectiveness of strategic planning, analysis and projection that rely on such thinking. Unlike the Evolutionists, however, the Processualists are less pessimistic in the sense that "survivors need not be the fittest after all". Market conditions are turbulent and imperfect enough to accommodate even players with only moderate performance. Market forces and efficiency are definitely not as strong as those implied in evolutionary theories.

Consequently, since the elimination forces are believed take effect at a slower pace, Processualists believe that there is room for incremental improvement and learning for corporations. Thus, in direct contrast to Classical theories, the way to succeed is not to analyze the unpredictable and then plan and command. Rather, the key is to stay close to operation and accumulate knowledge about the demanding factors of both internal and external operating environment. In essence, strategy is discovered in action (March, 1976), and a 'bottom-up' approach in shaping strategy is more desirable. The discovery and learning of strategy at the operational level thus forms an inextricable link between strategy formation and implementation, which renders Classicists' recommendation of their separation to be unrealistic.

Most of the above mentioned characteristics promote a sense of inward looking, hence taking the internal coordination and functional mechanisms more seriously than the other three generic approaches. In particular, it recognizes the fact that organization is made up by human beings with diverse individual interests, and intangible elements such as corporate culture and organizational behavior bear a big influence on the ultimate corporate outlook. Furthermore, a direct product of human interaction is the micro-politics of organization as pointed out by Pettigrew (1973). Political bargaining always

stands in the way of seeking and implementing ideal strategic actions. Over time, conservatism starts to set in stone, routines and heuristics get established, and strategic change becomes harder to execute. In fact, for some Processualists, the ability to handle strategic change to suit a new environment forms a critical source of competitive advantage (Pettigrew and Whipp, 1991).

What management can do then, is to adopt an adaptive approach to allow the organization to gradually blend with the environment and create an operating environment for employees that is amenable to learning. For the former, Quinn's (1980) concept of 'logical incrementalism' is widely accepted. For the latter, Senge (1994) has demonstrated ways to unleash the power of learning within organizations. These are also directly linked to the larger field of knowledge management that has attracted a lot of attention these days.

Along a related line, the 'core competency' theory developed by Hamel and Prahalad (1994) that flourished in the 1990s stands to provide the linkage between skills, knowledge and strategy. Emphasizing on fundamentals in leveraging corporate 'resourcefulness' instead of the tangible resource level, Hamel and Prahalad stress the importance of developing core competencies to capture opportunity share rather than market share that remains the focus of product-market positioning and industry structure analysis promoted by the Classicists.

2.2.3.2 Strengths and Weaknesses of Processual Approaches

With abundant research effort by authors such as Henry Mintzberg and the foundation laid by innovative works of the American Carnegie School (which includes Nobel Prize-winner Herbert Simon), the Processual approaches obviously have their intellectual appeal. The most significant contribution is perhaps the addition of a 'human side' to corporate strategy. The Processualissts directly tackle the 'softer' issues that are often delegated to secondary importance in Classical models, and provide cautionary advice and recommendations to handle internal crises. Their theories also tilt the scale of emphasis from creating a machine bureaucracy engaged in cold corporate battle towards

molding a patient, enriching environment that promotes coordination, learning and teamwork within the firm.

The brutal reality of competition, however, reminds us about making sure that firms have to be on their toes. Certain degree of objectivity for corporate control is desired, and firms cannot afford to allow the internal environment to become too nihilistic that would potentially undermine transparency. Matrices and *pro formas* created by Classical theories and tools are still valuable to maintain a feedback loop in monitoring corporate and individual performance. The irony is that firms still need to maintain a certain level of profitability before it can promote that patient, enriching internal environment! Furthermore, formal planning processes can sometimes serve as a means for putting everyone on the same wavelength[4]; in other cases, matrices and *pro formas* can come in handy as objective justifications to remove entrenched political figures within the organization.

2.2.4 THE SYSTEMIC VIEWS

2.2.4.1 Characteristics and Paradigm

In many aspects, the Systemic perspectives have the most outward looking nature in considering the external environment especially dealing with political, regulatory, social and cultural issues. Thus, contrary to the Classical approaches, firms' missions, goals and strategies are not purely owed to economic rationales. As part of the social groups, they are donned with other social responsibilities or even political agendas, as commonly observed for state-owned firms. They are then expected to act in 'socially expected' ways, which sometimes may not be rational when seen through the Classical lens.

[4] See Langley (1988, 1991) and Oakes *et al.* (1998), for example, on the effectiveness of using formal planning processes as a pedagogical tool for 'group therapy' and consensus building.

Unlike the Evolutionists and Processualists, however, Systemic theorists have no holdback towards firms' ability to plan effectively for its future, provided that they include the intimacies of the sociological context in their strategy. So, the rule of thumb is to play by the local rules and follow the norm. Legitimacy becomes the doctrine. An interesting proposition would be to view construction firms' launching of various "e-Initiatives" in the late 1990s as merely following the main troupe. It is reasonable to comment that many did not have a fair idea about how much value can eventually be extracted from such investments, but not pursuing the trend would simply risk being perceived as 'technologically backwards'.

In short, such 'institutionalism' sufficiently explains those aspects of organizational life and strategy that are often taken for granted (Rumelt *et al.*, 1994). It is most helpful in discerning the varying outlook of multinationals from different origins. For example, Wilks (1990) suggests that the Anglo-Saxon cultures of the United States and the United Kingdom are the core influence of individualistic free-enterprise models of strategy. Conversely, the traditional nationalism of the French and German states, and the developmental role of the Japanese ministries, have virtually created closely-knit relationships among their local private and public sectors, with industrial cultures that commonly embed shared agendas and enlist state resources as a natural and important part of strategic management. For construction, this phenomenon is best seen within the industrial environment in Japan, which is used (and still remains to a large extent) to be a closed market, with public spending smoothing cyclical fluctuations in the private construction market.

Another important implication derived from the Systemic view concerns the issue of corporate governance. In Germany, for example, the *Aufsichtsrat*, or supervisory board, must consist of at least 50% from worker representatives. Outside directors elected by shareholders, which is more typical in the United States, make up only the other half (Grinblatt and Titman, 1998). Furthermore, large banks and other financial institutions often become major shareholders and play a central and interventionist role, emphasizing on long-term relationships (Scott, 1997). This poses a big contrast to the diverse shareholding structure in most U.S. companies. For example, Kester (1992) estimated that banks and insurance companies own about 20% of the stock in German firms,

whereas the comparable figure in the United States is only about 5%. Large-block shareholdings then account for roughly 60% of the total shareholdings in Germany, with a figure of 10% in the United States. Likewise, the large cross-holdings and interlocking directorships among Japanese firms are responsible for binding group members together within the now commonly known *keiretsus*.

All these issues affect firms' corporate strategy and outlook to a considerable extent. With the type of corporate governance structure in Japan and Germany, actions taken by firms do not necessarily conform to profit-making motives. Incidentally, most Classical theories were developed in the United States using U.S. firms as study samples! Naturally, other schools of thoughts frequently use examples of non-U.S. companies to attack Classical theories. On the other hand, firms are deemed to survive well as part of the bigger family, which directly contrast the fatalistic feature of Evolutionary perspectives. Lastly, the more outward looking nature of the Systemic views concerning sociological context contrasts with the Processual approaches that focus more on internal mechanisms within the firms.

2.2.4.2 Strengths and Weaknesses of the Systemic Views

The Systemic views hence provide valuable lenses to examine external political, regulatory, social and cultural issues. Consistent with the traditional view of competitive advantage in construction, local network and relationship plays an influential role in a firm's success. The rich vocabulary and complexity of sociological arguments offer a plurality of resources and norms of conduct to explain and legitimize a wide range of business behaviors. Systemic theories are therefore most useful in the study and comparison of multinationals.

Furthermore, Systemic theories are a good starting point to explore the role of public policies and how institutional changes can affect corporate strategy. It reminds us about the all-important and intrinsic linkage between the industrial environment and national economic outlook – a doctrine that is similarly embedded in Porter's diamond model (1990). This is also precisely the reason to demand that the macro view given by Systemic theories must be complemented by more in-depth studies of firms' behavior

given by the Classical and Processual approaches. This, however, does not really amount to a major shortcoming.

2.2.5 SUMMARY AND OTHER SPECIFIC ASPECTS OF STRATEGY

Table 2-1 summarizes the features, strengths and weaknesses of the four generic approaches discussed previously. Although these four approaches would map out the majority of past research efforts and theoretical development in strategy, there are other specific aspects that either do not fit nicely within the framework or span across two or more approaches.

A good example of such aspects is the topic of international management which has also been substantially researched. With trends of globalization and firms attracted by deregulation of market sectors abroad, innovative works by Bartlett and Ghoshal (1998), Prahalad and Doz (1987), and George Yip (1992) have added a new dimension to the field of strategy. Due to the complexity of the issues in international management, these authors inevitably arrive at tools and matrices that contain classical favors, while drawing on other Systemic theories to explain peculiar phenomena related to cultural and social issues. In addition, they also emphasize on the challenge that destabilizes the internal structure and corporate culture when handling cross-border issues, which naturally falls under the regime of the Processual school of thoughts. Essentially, the search for solutions in this area demands intellectual support from all these different schools of thoughts. From the lengthy discussion of these schools of thoughts, there are apparently both overlapping and conflicting concepts among them, which is what makes international management particularly hard to tackle in the field of strategy.

Generic Approaches	Characteristics	Strengths	Weaknesses
CLASSICAL	• Rational and analytical • Planning oriented • Economic rationale • Separation between strategy formation and implementation • Structure follows strategy	• Objective assessment and methodology straightforward to apply • Long-term concern conforms to corporate mission and overcome short-term, myopic views • Analytical tools and theories are abundant especially from allied disciplines such as finance and economics	• Ignorance of 'soft' issues and internal mechanisms within firms • Naïve separation of strategy formation and implementation • Models generally do not apply to small organizations especially during the Internet era
EVOLUTIONARY	• Darwinian • Passive • Cost control oriented	• Enunciates the brutality of competitive and environmental forces which demands for constant strategy renewal	• Overly passive, indirectly challenging the intellectual foundation of academic theories and managerial functions • Succumb to short-term view • Ignorance of market complexity and heterogeneity
PROCESSUAL	• Emphasis on corporate culture, human nature, micro-politics and organizational behavior • Strategy formation and implementation inextricably linked • Structure determines strategy	• Add a 'human' side to strategy • Tackle 'soft' issues that are largely ignored by Classical theorists • Enunciates the importance of internal mechanisms within firms	• Lack of control, transparency and objective measures to compare effectiveness of strategy adopted
SYSTEMIC	• Concern of external environment including political, regulatory, social and cultural issues • Behavior of firms explained by historical heritage and in a sociological context	• Add the all-important external environmental factors to corporate strategy • Provide intellectual linkages to explore the impact of public policies • Provide plausible explanations on the impact of firms' origins	• Primarily adopting a macro view point, relegating the importance of inter-company competition in some industrial environment • Needs to be complemented by studies of firms' behavior especially for cross-border competition

TABLE 2-1 Summary of Characteristics, Strengths and Weaknesses of Four Generic Approaches

As mentioned in Section 2.1, there are constantly concurrent developments within allied disciplines such as finance and economics that extend into strategic management. Ward (1993), for example, removes the restrictive assumptions that create the gap between actual financial strategy and the real commercial world and demonstrates how issues such as the organic stages of development, mergers and acquisitions, capital raising, restructuring and privatization stand in the middle of both disciplines. Often times, the solutions and models recommended by these authors possess characteristics that are derived from at least one generic approach in Figure 2-1. A possible explanation for this is that these authors do not come from the mainstream of strategic management and hence are not preoccupied by the biased viewpoint of a particular school of thoughts. Interestingly, this should be perceived as a positive outcome indeed.

2.3 Construction – Not a Typical Industry

Strategic decisions must also consider tactical concern. Theory ultimately delivers its value through application in the practical field. Thus far, extensive sources of theories have been introduced but the specific industrial context has been left out. This is done intentionally because the field of strategy by itself is full of convoluted arguments as we have seen. As civil engineers we surely would also appreciate the fact that the construction industry is filled with numerous specificity and not typical at all. Some of these unique factors, which deserve special attentions in applying any kind of strategic concepts that have been reviewed, are presented in this section.

2.3.1 An Overview of Characteristics that Affect Strategy

In general, the construction industry has low barriers to entry, creating a high degree of fragmentation. To paint a rough picture of this highly competitive and fragmented nature of the industry, consider the U.S. market whereby about $700 billion of construction is put into place on an annual basis (Flanagan, 1998). The two largest players, Bechtel and Fluor Daniel, each has a stake of only around 1% of the domestic market volume as of 1998. In the international market, the top 225 international

contractors, ranked by the *Engineering News Record*, secured a revenue level of $116.4 billion in 1998. Yet, Bechtel and Fluor Daniel each accounted for only $6 billion (5.2%) or $5.3 billion (4.6%) of this pie (*Engineering News Record*, 1999), let alone the total global construction volume. All these facts point towards a vastly different picture compared to some manufacturing industries such as automobile or home appliances, whereby top players retain relatively large market shares. In those industries, strategic movement of a few dominant players might be sufficient to affect the rules of competition. Likewise, the numerous competitors in construction, including some who are indeed not profit-driven, has heightened the rivalry intensity within the industry. Price is also far from being the only determining success factor (Macomber, 1999). To make things worse, the exit costs in construction is generally high due to existing contractual obligations, risky nature of projects and other specific investments that bear limited transfer value.

Even under the waves of globalization and deregulation, construction largely remains as a local business and domestic networks are always valuable. This somewhat creates a multi-domestic setting, following Porter's (1998) parlance, although his definition that competition only takes place on a country-by-country basis with little or no linkage does not apply in entirety for construction. Since activities of production are mostly conducted onsite, there are also limited economies of scale and a weakened learning effect when considering all projects executed in different locations.

Concerning specific operating issues, human capital remains as a key asset, especially within the service sectors of construction. Obviously, there is also a heavy reliance on labor for the physical construction process, although automated construction methods are constantly pioneered by mostly the Japanese contractors. Imperfect communication and coordination among parties also gives rise to misunderstanding and a consequential litigious nature of the business. Dispute resolution methods has been an important area to explore both in practice and research. Insurance and various types of bonds (bid, payment, and surety) serve as important tools of the trade for risk sharing, transfer and avoidance.

Next, consider the simplified value system shown in Figure 2-2 that is typical for most sectors of the industry. Except for upstream activities of suppliers which are product-based, it is observed that other activities within the value system are primarily process-oriented. The differences between a product- and a process-based industry can be crucial in terms of the nuances in operations, marketing, technology, 'product' design and value added. This is the reason why models such as Porter's value chain, the development of which is implicitly referenced to mostly other industries, do not fit perfectly with construction. For example, although "inbound" and "outbound logistics" have clear meanings for the value chain of a manufacturing company, they do not have similarly clear-cut equivalents for an engineering design company or even a contractor.[5]

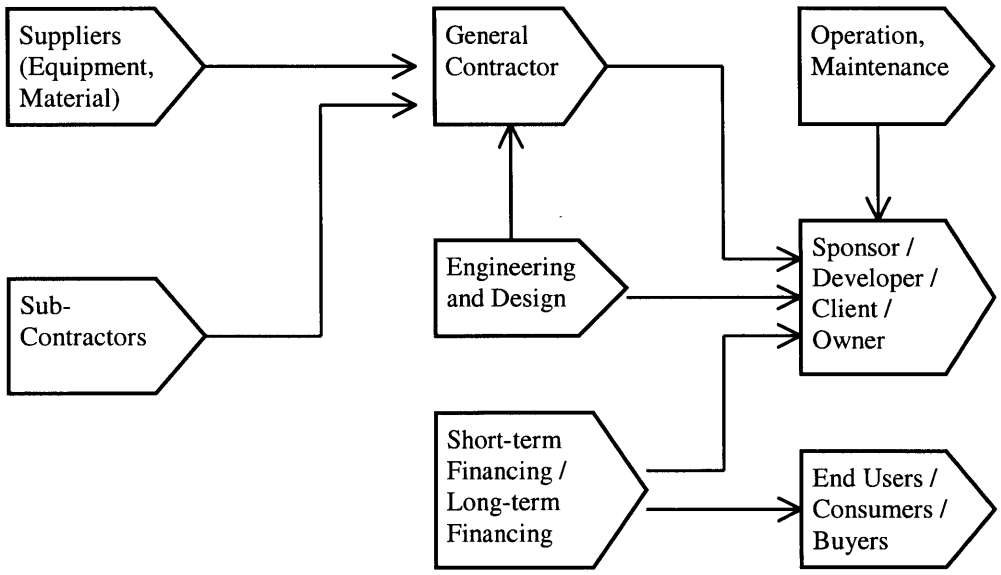


FIGURE 2-2 Simplified Value System for Typical Sectors in Construction

[5] In his opinion, John D. Macomber, the former CEO of George B.H. Macomber Company – a Boston-based contractor, would substitute "Sales; Estimating; Purchasing; Project Management; and Close-out" for Porter's primary activities in the value chain model.

Lastly, contractual conditions and delivery methods critically govern the rules of the game, at least at the project level. The merits of different project delivery methods – *Design-Bid-Build (DBB), Design-Build (DB), Design-Build-Operate (DBO),* and *Build-Operate-Transfer (BOT),* are constantly debated and lobbied by their respective supporters. Developed mainly from the public sector's perspective, Miller's (1995) quadrant framework represents a novel approach in mapping out these delivery methods along the two axes of "Integration of Delivery" and "Source of Finance". By providing abundant evidence in the historical success of the U.S. government in the *simultaneous use* of different delivery methods to suit the varying needs in managing a collection of projects, Miller (2000) effectively refutes these futile debates over the merit of each kind. More importantly, he also adds a strategic dimension to the role of delivery methods in public procurement. Miller's insight thus creates a crucial linkage for meeting public sector's needs by utilizing private sector's resources and expertise. Cheah *et al.* (2001) illustrates the mechanics of such principles using three project portfolios in major urban redevelopment settings. They concluded that the way public sectors structure the procurement process would drive firm rivalries and affect firm strategy. This external factor is an important addition to the planning agenda of corporate strategy.

2.3.2 PAST LITERATURES IN CIVIL ENGINEERING RELATED TO STRATEGY

Although the knowledge gap of strategic management still sustains until today, some interests in exploring issues of strategy in construction did exist in the past. In the United Kingdom, the 'Ashridge Studies' (Lea *et al.*, 1974; Sadler *et al.*, 1974; Lansley *et al.*, 1979) was a significant effort in studying corporate management issues in the 1970s. Later, Hillebrandt and Cannon (1989) edited opinions on varying topics such as business strategy, diversification and product differentiation, most of which using U.K.-based players as the subjects of study. Male and Stocks (1991) likewise synthesized a wide range of articles covering competitive advantage, economics, organizational behavior, culture and sociology contributed by a number of civil engineering professionals including themselves. Interestingly, though developed in the U.S., Porter's models had created more ripples in the construction research environment of the U.K. at that time.

All these culminated in the disagreement between Betts and Ofori (1992, 1993) and Fellows (1993) on the relevance of Porter's models to both supply- and demand-side analysis. In view of the embryonic development of understanding of such principles in construction during that period, such debate really represents nothing more than a healthy intellectual exchange to move our industry a step forward.

Likewise, Hasegewa (1988) documented the business strategies of leading Japanese contractors such as Shimizu and identified factors that contributed to the success of these players in the 1980s. It was suggested that the success was largely attributed to the attention that these players had given to business strategy as opposed to the lukewarm reception of similar concepts in other regions.

Strangely, although scholars in the U.S. are the ones who develop most mainstream studies of strategy, their principles have not attracted great attention from their construction fellows despite the proximity. Possible explanations include greater fragmentation in the U.S. (thus without superior strategy, survival might still be possible within the local market), larger national market volume (thus strategy to venture overseas is perceived as less necessary), and of course, the traditional emphasis by academicians in the U.S. on the more technical aspects of research. In fact, Chinowsky's (2000) recent publication represents perhaps only the first text ever written by a construction professional in the U.S. that focuses entirely on strategic corporate management.

2.4 The Call for an Open Model

The diverse meta-theories of strategy presented in Section 2.2 naturally calls for a certain degree of integration. In the earlier period, both Allison (1971) and Murray (1978) arrived at the conclusion that some combination of paradigms among classical models, incremental models and individual management style models (the latter two being Processual in nature) is required. Ruefli and Sarrazin (1981) even went further to develop a strategic control model that incorporates elements from these different generic approaches. More recently, Schoemaker (2001) again confirms that integration of theories, though elusive, is nonetheless necessary to avoid reinventing the wheel every

time a new situation arises. In his opinion, the field of strategy is well beyond the classification stage, and the emphasis should now be devoted towards deeper integration instead of continuing expansion of knowledge base in a pluralistic fashion.

In short, it is reasonable to conclude that a lack of integration will only result in a slow, incremental, and never-ending search for solutions by industrial professionals such as those in construction. However, what Schoemaker and others had probably left out, or at least did not explicitly mention, is the variation of industrial contexts from one to another, which could indeed be substantial. Integration should thus be sought independently at the juncture of strategy and distinctive industries. It is believed that this is a valid case for the construction industry due to its uniqueness as explained in Section 2.3.

The task at hand is thus the hardest among all – to develop a coherent model of strategy that integrates all relevant but diverse theoretical content that is also applicable to the industrial context of construction. This goal is depicted in Figure 2-3. The diversified nature of theories coupled with the specificity of the industrial context can only be reconciled *via* an 'open' conceptual model (as opposed to a 'closed-form' solution) that would flexibly incorporate all these components. This is the core challenge of this research. The next chapter explains the approach towards developing this conceptual model.

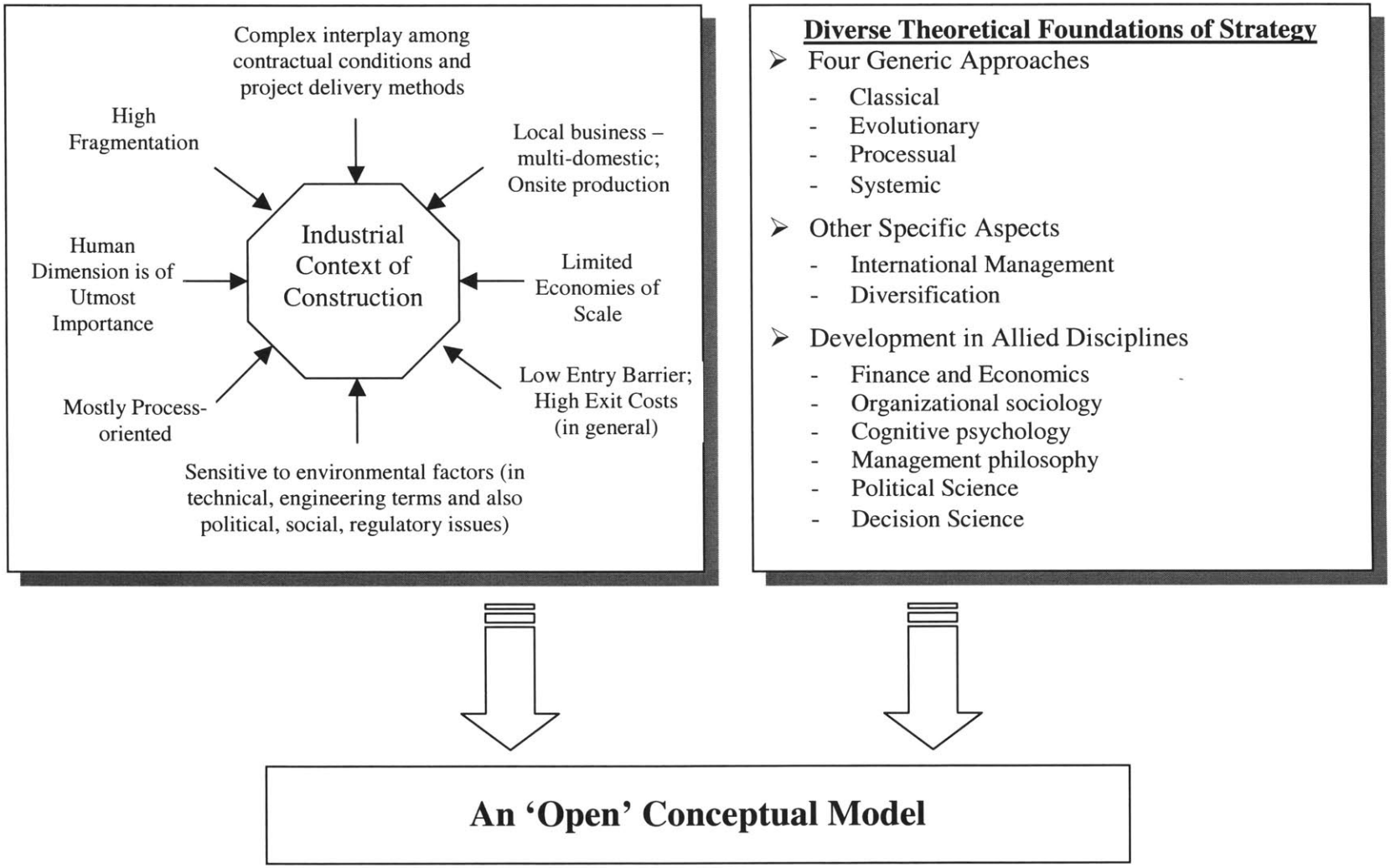


FIGURE 2-3 Toward an 'Open' Conceptual Model

CHAPTER THREE

RESEARCH METHODOLOGY AND DATA ANALYSIS

"Earnings are distorted by accounting conventions that make it hard to compare values from one to the next. But compare one must, if one has any hope of applying rationality....."

- P. Fuhrman (1988)

3.1 Overview of Research Methodology

The overall methodology adopted in this doctoral research can be broadly divided into two tasks:

(1) Fundamental analysis of the firm sample

- This includes data collection and analysis of financial statements of companies. However, contrasting its common use in stock market analysis to forecast companies' future stock price movements, the scope of fundamental analysis is limited to the consideration of past records of assets, earnings, sales, product, management and markets *without* any future projections of these indicators. The data is analyzed to provide indications of recent success or failure of the companies. This part is the core emphasis of this chapter.

(2) Development of a conceptual model for corporate strategy as called for in Figure 2-3

- Together with the theoretical foundations of strategy reviewed in Chapter 2, observations from the fundamental analysis of Part (1) are used as a guide to develop a conceptual model for corporate strategy. The emanated framework is presented in Chapter Four.

Figure 3-1 summarizes this overall research methodology.

It is important to recognize that the development process of this model is an incremental one. Moreover, as components of the model start to form, the development process itself becomes iterative since the knowledge base of the model is useful for extracting more qualitative observations from the data. For example, from the analytical findings of fundamental analysis, the gist of the structures, forms and actions that international construction firms have adopted to improve their competitiveness would seem to stand out. This creates an iterative loop as shown on the left in Figure 3-1.

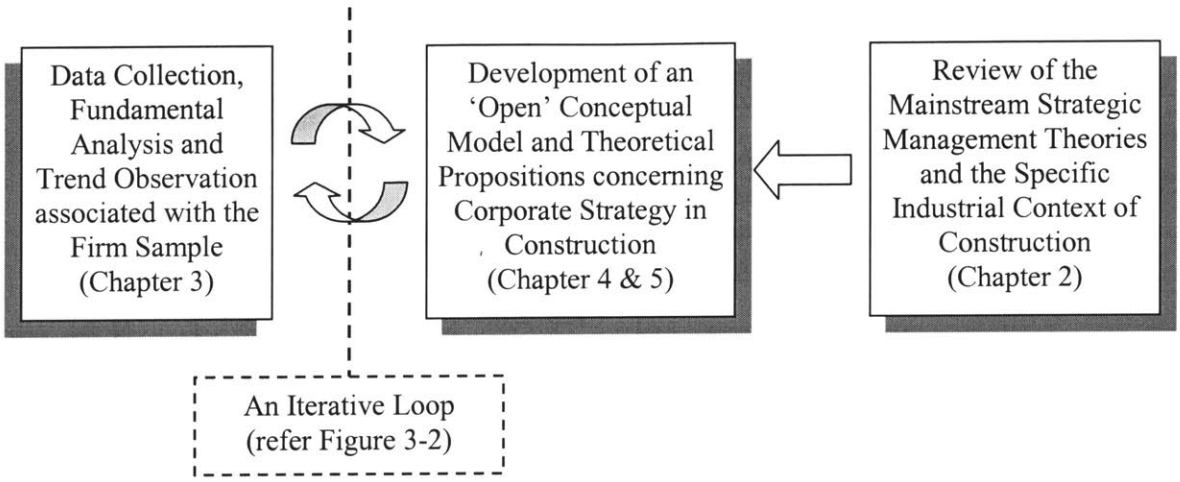


FIGURE 3-1 The Overall Research Methodology

Actual details of the study approach embedded in this iterative loop can be roughly broken down into four steps:

(I) Building selected trends that depict the financial and operating performance of the firms;

(II) Identifying significant trends and "out-of-the-pack" performers;

(III) Extracting strategic issues and characteristic information that underlie the findings in Step (II) and expressing them in the parlance of the conceptual model;

(IV) Deriving observations and conclusions, and refining the conceptual model wherever necessary.

These steps are depicted schematically in Figure 3-2. In summary, it is believed that the challenge of filling the gap between diverse strategic management theories and traditional construction management practice can only be handled *via* incremental refinement of the conceptual model and augmentation with some new theoretical propositions. In this way, not only that the methodology is logically sound, it is also supported by practical evidence from the outcome of data analysis.

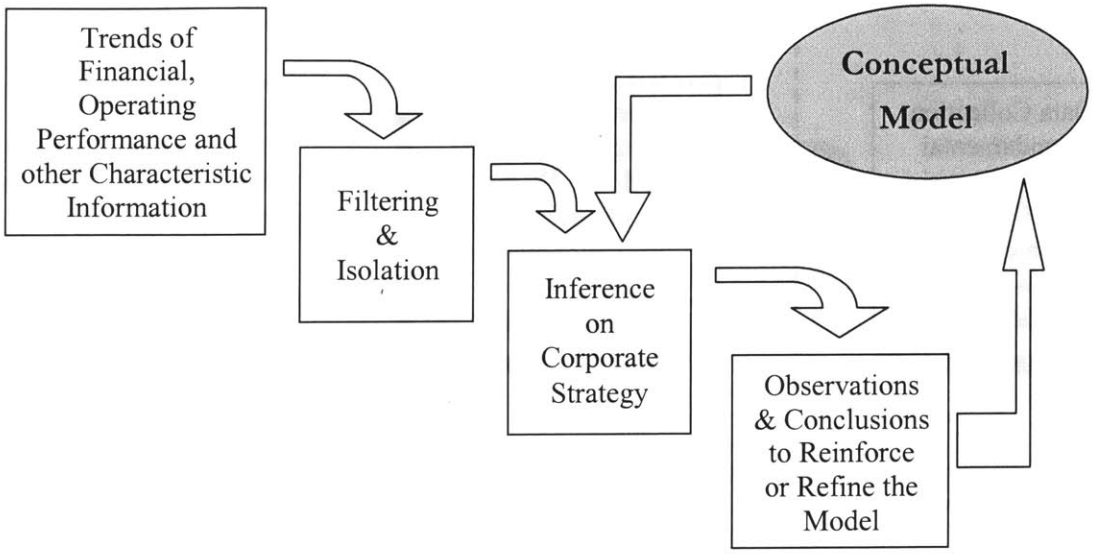


FIGURE 3-2 Detailed Study Approach Embedded in the Iterative Loop

3.2 Firm Selection and Data Collection

3.2.1 FIRM SAMPLE

A total of 24 firms have been selected as the sample for this study. This consists of 8 firms from each of the following regions: Europe; the United States; and Japan. The selection criteria of specific firms can be described as follows:

(1) The firms must be publicly listed.

- This serves as the most important criterion due to the priority given to data availability, transparency of firm's policies (which is better associated with publicly listed firms than privately owned firms), and wide coverage by the media, professional journals, and electronic "infomediaries". Information availability obviously has a large impact in a research study of this nature.

(2) Focus is only given to large, international contractors.

- The reasoning behind this selection criterion is the characteristics of the competitive arena within which these players operate. Interesting issues such as internationalization and diversification are frequently encountered. Moreover, these players are normally engaged in integrated project delivery

methods that include engineering and design services, thus providing a more complete picture of the competitive nature of various segments of construction.

- The *Engineering News Record*'s Top 225 International Contractors ranking (*ENR*, 1999, 2000a, 2001a) is used as a guide for the selection process. In this ranking format, companies are ranked according to their international construction revenue in the previous year. As many as 22 firms from the sample secured a place among the top 50 in the year 2000 ranking (based on international construction revenue in 1999).

(3) Sub-categorization of specific market and firm characteristics.

- The third criterion provides further screening to facilitate a more uniform comparison of strategy between firms. For example, in the process of selecting the U.S. sample, it is realized that a majority of the firms are very active in the power and energy sectors. Therefore, to provide a more meaningful comparison of strategy among these firms, Stone & Webster (currently a subsidiary of the Shaw Group) has been included in the sample even though it was not ranked within the Top 50 in *ENR*'s ranking. In fact, such uniformity of the U.S. sample has formed the basis of numerous theoretical propositions that are discussed in Chapter 5.

- Other signposts that are adopted include *ENR*'s Top 25 or 50 International Contractors ranking in separate major industrial sectors (such as Power, Petroleum, Industrial Process etc.), firm characteristics (such as diversified conglomerates versus specialty firms), and special events (such as bankruptcy). In short, the third criterion also calls for qualitative judgment in consideration of possible comparison of certain strategic issues.

Table 3-1 lists out the selected firms, their geographical origins and corresponding *ENR* rankings for the past three years.

FIRM	GEOGRAPHICAL ORIGIN	*ENR's* TOP 225 INTERNATIONAL CONTRACTORS RANKING, Note (a)		
		1999	2000	2001
Kvaerner PLC Group	Norway	–	2	–
Skanska AB	Sweden	4	3	2
Bouygues S.A.	France	3	4	5
Halliburton/Kellogg Brown & Root	U.S.	5	5	7
Fluor Corp.	U.S.	2	6	10
Vinci (SGE)	France	8	9	4
Groupe GTM	France	7	11	Note (b)
TECHNIP Group	France	15	13	11
Foster Wheeler Corp.	U.S.	12	14	15
Philipp Holzmann AG	Germany	10	15	8
AMEC PLC	U.K.	13	16	12
JGC Corp.	Japan	14	18	23
Raytheon Engineers & Constructors	U.S.	35	23	Note (c)
Kajima Corp.	Japan	21	27	18
Toyo Engineering Corp.	Japan	19	28	39
McDermott Int'l. Inc.	U.S.	28	33	38
Obayashi Corp.	Japan	18	35	30
Chiyoda Corp.	Japan	16	37	58
Kumagai Gumi Co. Ltd.	Japan	44	39	165
Nishimatsu Construction Co. Ltd.	Japan	20	42	62
Penta-Ocean Construction Co. Ltd.	Japan	32	43	43
Jacobs	U.S.	50	57	48
Stone & Webster	U.S.	53	77	Note (d)
Morrison Knudsen Corp.	U.S.	82	78	Note (c)

Notes:

(a) The 1999, 2000 and 2001 *ENR*'s Ranking are based on international construction revenues of the firms in 1998, 1999 and 2000 respectively.

(b) Groupe GTM has merged with Vinci in year 2000.

(c) Both Morrison Knudsen Corp. and Raytheon Engineers & Constructors were acquired by Washington Group International, Inc (WGI). WGI was ranked 32 in the year 2001 ranking.

(d) Stone & Webster was acquired by the Shaw Group after filing for bankruptcy in the year 2000. The Shaw Group was ranked 80 in the year 2001 ranking.

Table 3-1 List of Firms Selected as Data Sample

3.2.2 SOURCES OF DATA

The primary data used to conduct fundamental analysis is extracted from the annual reports of these 24 firms. Data is collected over a 4-year period from 1997 to 2000 for most companies. There are however several exceptions due to special events such as mergers and acquisitions and bankruptcy filing during the period. Thus, for firms such as Groupe GTM, Stone & Webster, Morrison Knudsen/Washington Group International, and Raytheon Engineers and Constructions, data from annual reports is limited to a 3-year period. Other than annual reports, companies' Internet home pages also provide valuable information and occasionally linkages to their internal technical publications.

There are also other sources of information that are supposed to be unbiased. These include the 10-K Statements filed by the U.S. companies with the Securities and Exchange Commission (SEC), press releases, and articles from publications such as the *ENR* and coverage reports by electronic "infomediaries" such as www.Hoovers.com.

3.3 Data Analysis

3.3.1 THE ANALYTICAL TEMPLATE

An analytical template is constructed to organize all data extracted from the annual reports and other sources of information in a systematic fashion. Broadly, the template is divided into five components: Background Information; Market Segmentation Matrix; Operating and Financial Performance; Observations on Strategy; and Issues dealing with Opportunity and Threat. Some components of the template are formed on specific theoretical basis. Examples of these include the organizational structure and market segmentation matrix. Appendix A shows a sample of the complete template that has been constructed for Skanska. Appendix B, then, provides a complete set of data collected for the remaining 23 firms for components of Background Information; Market Segmentation Matrix; and Operating and Financial Performance. The last two components are omitted since the findings identified in those sections have been consolidated with the discussion of the proposed conceptual model in Chapter Four and Five.

A brief description of each component is given below.

3.3.1.1 Background Information

This section includes the ownership structure; trends of number of employees, shareholders and shares outstanding; organizational structure; and other general information such as year founded and whether there has been a change in the firm's CEO or Chairman during the period of study.

The ownership structure provides a sense of corporate governance. On the other hand, the trends of number of employees and shares outstanding, coupled with any changes in top executives, may signal that a particular firm is in distress.

In a broad sense, information regarding the organizational structure is arranged into three parts: Technical Infrastructure; Operating Core; and Support Operations. This adopted format is inspired by Mintzberg's (1979) work on the structuring of organization. Thus, the components here resemble three of the five basic parts of his organizational model (the other two being "Strategic Apex" and "Middle Line"). However, the definitions and meanings of Technical Infrastructure and Support Operations differ slightly from Mintzberg's "Technostructure" and "Support Staff".

The Technical Infrastructure mainly consists of divisions and groups that deal with technology development and formulate strategy for existing and new market ventures. An obvious candidate would be the R&D Department and the Strategic Planning Division. The Operating Core is the main production network of the firm. The structure of the Operating Core is often designed and organized along one of these three dimensions: Market (or Business Areas, which can either be product- or process-oriented); Geography; or Functions (such as material procurement and engineering design). Lastly, the Support Operations consist of the finance division, legal counsels and other administrative divisions.[6]

[6] The classification adopted here for "Support Operations" follows the traditional mindset. It is later proposed that finance should not be viewed as a mere supporting operation but as a key component of overall corporate strategy.

Obviously, numerous details would exist within a firm's organizational structure. Only information that bears significance to the overall corporate strategy will be listed in the template of the firms.

3.3.1.2 Market Segmentation Matrix

The Market Segmentation Matrix is intended to map out the primary activities of a firm so as to paint a picture of its area of focus or extent of diversification. Although formulation of the matrix follows closely the method that is recommended by Porter (1985), his definitions of "Buyers Type" and "Product Type" for the two axes are not followed strictly. Instead, the market is segmented by various industrial sectors (the horizontal axis) and activities along a value system (the vertical axis). This format is deemed more suitable for the construction business. For example, residential projects differ vastly in terms of characteristics from infrastructure projects, while new ventures that go beyond the conventional realm of construction can be classified under "Diversification". On the other hand, the vertical axis would dictate whether a firm has integrated into upstream/downstream activities beyond the conventional AEC provisions.

This mapping exercise therefore constructs a general outlook of a firm's generic strategies (Porter, 1985) – ranging from a focus, differentiated strategy to a broad, diversified strategy.

3.3.1.3 Operating and Financial Performance

This section compiles all the numerical data to keep track of a firm's operating performance and financing structure. It contains the yearly trends of various operating and financial data and the associated ratio analysis. In addition, subjected to data availability, revenue, backlog and new orders are presented in terms of percentages as determined by different geographical regions and business areas. This will provide better insights concerning the sources of superior/inferior operating performance for the company.

There are other technical issues and debates related to the methodology used in analyzing financial and operating performance data. These details are discussed under Section 3.3.2.

3.3.1.4 Observations on Strategy

Observations on strategy in general and any critical success factors (CSFs) for specific business areas are noted in this section. The theoretical foundations of strategy as described in Chapter 2 are notably useful in this section by adding a qualitative dimension to the analysis. As mentioned previously, observations are also expressed in the context of the conceptual framework of Chapter 4 that is developed incrementally during the course of research.

3.3.1.5 Issues on Opportunity and Threat

This last section represents more of a 'catch-all' area that encompasses issues that are not covered by other sections. However, attention is also devoted to the identification of imminent opportunities and threats that the firm is facing. At the very least, this would include an environmental scan in an attempt to understand the dynamics of the operating environment of the firm (Macomber, 1991). Specific topics that bear significant influence on corporate strategy can then become the focal point going from here.

The most commonly encountered example is none other than the growing importance of environmental issues (in a technical sense).[7] This includes environmental preservation, waste elimination (both at source and the recycling of material), energy preservation, and other environmental engineering systems and services at large. In terms of social awareness and offering of service provisions, all these issues are closely related to the construction business. They can take on either direction in becoming opportunities or threats, depending on a firm's strategy and policy.

[7] The term 'environmental issues' can sometimes be referring to: (i) general factors in political, social, cultural and industrial contexts; or (ii) topics that are more technical in nature relating to environmental engineering. To avoid such confusion, phrases such as "technical sense" or equivalent are used to distinguish the latter.

3.3.2 BUILDING TRENDS OF OPERATING AND FINANCIAL PERFORMANCE

3.3.2.1 Monitoring Data Comparability and Classifying Interpretation Tasks

While most sections of the analytical template are relatively straightforward in their meanings and functions, the section on Operating and Financial Performance Data deserves further elaboration. The methodology of trend building and reliance on annual reports is constantly under attack. In particular, it is becoming a common belief that corporate managers frequently manipulate financial reports to hide losses and to present an incorrectly favorable picture to external investors. Given past cases of scandals and class-action lawsuits, there is some truth behind such arguments. However, it is also believed that this picture is incomplete and information extracted from the annual reports should still be granted with some merit.

Firstly, annual reports is one of the most objective sources of information available simply because it follows standardized rules for reporting purposes such as the Generally Accepted Accounting Principles (GAAP). Furthermore, regulatory bodies such as the SEC and FASB in the U.S. constantly scrutinize firms to ensure their conformity to the standards set. Cases of infringement and acts of violation are investigated, and penalties are brought up against unscrupulous corporations to ensure that rules are strictly enforced. Moreover, new regulations and practices are designed to uphold and improve transparency in financial reporting and patch up any loopholes. By the same token, third-party auditors are governed by the ethical conduct and regulations of their own profession. Given all these mechanisms, cases of scandals should be treated as isolated cases rather than the norm.

It is thus fair to comment that there is limited room for manipulating reported elements as allowed by regulations and the scrutiny of regulatory bodies and auditors. Even if certain 'resources' such as hidden reserves could exist, these are typically not non-exhaustive and eventually firms will come to the point whereby they have to confront with previously accrued losses and liabilities (Pratt, 2000).

With a reasonable level of confidence established with the source of data, it is more of a matter of how to use it wisely. For analytical purposes, it is useful to relate the

tasks of interpretation to different levels of details, which can be classified as the following:

(1) Eyeballing the general outlook;

(2) Studying the time-series pattern of individual firms;

(3) Making cross-comparison of firms from the same region or with similar reporting practices;

(4) Making cross-comparison of firms from different regions.

The first task gives a sense of the general operating conditions, such as the order of magnitude and the cyclical nature or idiosyncrasies (if any) of the trends. It thus has the least concern with differing accounting practices and "gimmicks".

In contrast, the second task provides more specific hints on the sample of firms. It keeps track of how firms perform individually over a period of time rather than viewing the firm sample as a whole. In this way, recent performance record of a specific firm could be linked to its specific strategy adopted for a particular market.

The third task becomes even more useful in terms of extracting issues underlying the trends that are related to *differing* corporate strategy and outlook of the firms. In this task, compatibility in comparison measures becomes essential, and it is important to study in more details to ensure that similar reporting practices are adopted.

The final task is notably the most challenging one. All nations have different histories, economics, cultures, and political and regulatory systems. Therefore, firms from different regions usually adopt different financial reporting practices. However, harmonization of world accounting standards is continually propelled by profound economic forces of international trade and capital movement and lobbied by the International Accounting Standards Committee (IASC) (Haskins *et al.*, 2000). The linkage between the European Union and the IASC further holds the promise that the two most active and influential players in the harmonization movement will create widely acceptable standards (IASC, 1996). By virtue of such forces, some parts of the financial statements in different countries indeed follow a more standardized structure even though

the overall statement is still influenced by the regional contexts.[8] The key is to distinguish the varying degree of discrepancies among the hundreds of figures reported in an annual report. Some indicators and ratios are more compatible for cross-comparison purposes as compared to the others. For example, it is reasonable to assume that a cross-comparison of *Total Asset Turnover* [Revenue/Average Total Assets] has less concern of incompatibility, contrasting a cross-comparison of the *Return-on-Equity* [Net Income/Average Shareholders' Equity]. This is because there are likely to be more distortions of the *Net Income* reported as compared to *Revenue*.

Ultimately, most caveats mentioned in financial and accounting literatures are meant for the purpose of security valuation. It should be reminded that the goal of this research is to study the corporate strategy of the firms. Indicators obtained from financial and operating performance data are simply used as pointers and signposts. Consequently, the level of accuracy required is of secondary importance as compared to that in security pricing.

3.3.2.2 Segmenting Financial Statements

When coupled with an understanding of the financial reporting contexts (discussed next in Section 3.4), the task classification given in the previous section provides a strong intellectual basis to derive observations from the data collected from the annual reports. Discrepancies among differing financial reporting practices can be filtered out through a prudent selection of trends and cross-comparison measures. Essentially, one can "segment" the balance sheet and income statement into categories that comply with different degrees of compatibility required by the interpretation tasks.

For example, an analyst may be overly concerned about two firms adopting different revenue recognition practices. In this case, the data may not be used for the third and fourth tasks of comparing those two firms directly, but this should not subdue its usefulness to track the individual performance of the two firms in the second task. On the

[8] A good example is related to revenue recognition policies. Many Japanese and European construction firms in the sample have recently switched from the "completed contract" method to the "percentage-of-completed work" method, which is more commonly adopted internationally especially in the U.S.

other hand, other ratios are more 'generic' and are not tainted by different revenue recognition practices, hence allowing cross-comparison between these two firms for this matter. These include most *Liquidity Ratios* (such as the *Cash Ratio* and *Quick Ratio*).

The same is true for segmenting the income statement from the top line to the bottom. For example, refer to Figure 3-3, which shows some common components of the income statement in a simplified form. It is clear that there are many items to go through prior to arriving at the bottom line of *Net Income*. Put in another way, there is less room to distort *Gross Profit* as compared to *Operating Income*, and the same argument holds when comparing *Operating Income* to *Net Income*. *Extraordinary Items*, for example, is a popular ground for manipulating figures since they are both unusual and infrequent. Gains/losses due to disposal of a business segment, for instance, is partly derived from subjective market assessment.

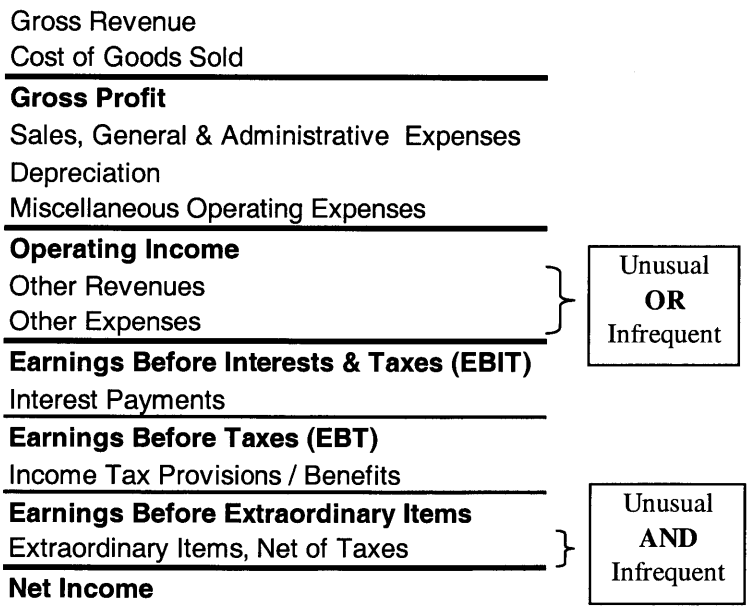


FIGURE 3-3 Anatomy of the Income Statement – Typical Components

The implication of this is that for cases in which cross-comparison of *Net Profit Margin* [Net Income/Revenue] and *Return-on-Equity* (*ROE*) is a concern – perhaps due to suspected manipulation of *Other Revenues/Expenses* or *Extraordinary Items*, a similar concern may not be warranted for similar comparison of the *Gross Profit Margin* [Gross Profit/Revenue] or *Operating Profit Margin* [Operating Income/Revenue]. This is because both *Other Revenues/Expenses* and *Extraordinary Items* are recorded after *Operating Income* has been calculated, thus any the manipulation of these items do not necessarily imply similar distortions of the upper figures.

An example would further clarify this concept of segmentation. Company laws in Japan and Germany impose looser criteria for companies to establish contingency reserves. In contrast, criteria of the U.S. GAAP are much more stringent. Thus, it is relatively easier for companies in Japan and Germany to smooth earnings as compared to their U.S. counterparts. During a bad year, transfer from the reserve account is typically reported under the account rubric Other Income. As such, the *Net Profit Margin* and *ROE* of Japanese and German firms may not be compared to that of the U.S. firms, but one should not immediately draw a similar conclusion for the comparability of the *Gross Profit Margin* and *Operating Profit Margin*.

3.3.3 Establishing Other Indicators

The financial ratios: *Leverage ratios*, *Profitability ratios*, and *Liquidity ratios*, established under the "Operating and Financial Performance Data" section of the template are very typical of most ratio analysis elaborated by finance texts such as Brealey and Myers (1996). In the template, however, other indicators are established to keep track of issues that are not so commonly monitored by conventional ratio analysis. These include the $(Revenue)_t$-to-$(Backlog)_{t-1}$ ratio; the *R&D Expenses*-to-*Sales* ratio; the *Cash Flow Profile* subsection; and the *Expected Volatility* subsection.

The logic behind these indicators is explained in Appendix C. In general, they provide useful information on strategy, financial and operating performance of the firm. Not all categories of these indicators are available for each company, and such establishment is limited by data availability.

3.4 The Context of Financial Reporting

In any kind of financial analysis, it is important to understand the context within which financial reports are made. This is especially important in this research, considering the fact that the data sample has an international dimension, which inevitably creates some disparities in the forms and meanings of the figures presented. As such, developing an appreciation of these contextual issues would tremendously help to 'calibrate' the findings extracted from the reports. More importantly, it adds a qualitative judgment to comparison analysis. For example, due to the unique contextual issues that affect customary financial reporting practices in Japan (to be discussed later), one should not be too alarmed to find that the *Return-on-Equity* of a Japanese construction firm is way below that of a U.S. competitor – even though both are achieving the same level of profitability.

The current section focuses on the important characteristics of different contextual issues of financial reporting, which have profoundly affected the "language of business". It effectively complements the previous section on Data Analysis which is more methodological in nature.

3.4.1 ACCOUNTING AND ENVIRONMENTAL FACTORS

Common to a widely held opinion, Adhikari and Tondkar (1992) comment that "accounting reporting and disclosure standards and practices do not develop in a vacuum but reflect the particular environment in which they are developed". Haskins *et al.* (2000) further posit that this includes the cultural, legal, political and business environment. More specifically, the following contextual factors are relevant: a country's dominant culture; system of taxation (this being a resultant of political and legal influences); role of capital markets; and business-government relations.

In associating a country's dominant culture to its nation-specific form of financial reporting practice, Haskins *et al.* find that Hofstede's (1991) definitions of cultural "dimensions" are especially insightful. These dimensions encompass: power distance; individualism; long-term orientation; and uncertainty avoidance. In a broad sense,

societies with high scores of power distance, uncertainty avoidance, and long-term orientation and a low score of individualism signify more conservatism and uniformity in their financial reporting approach, fewer financial disclosures, more emphasis on thrift, perseverance toward steady results and willingness to subordinate oneself to a long term goal and collective purpose. Obviously, candidates that potentially fall under this category include Japan and South Korea, which are in direct contrast with the other extreme of the U.S. and the U.K.

Under legal environment, the most significant consideration is the relationship between financial reporting system and tax law. Unlike in the U.S. and the U.K. whereby companies are allowed to prepare separate set of books for financial statements and tax returns, Japanese, German and even Swedish firms have to record their expenses in financial statements for these figures to be qualified for deductions in their tax returns. This usually results in an understatement of profitability as compared to their U.S. and U.K. counterparts. Further, since tax law is formulated by national legislative bodies in response to varying political and economic agendas, the general political environment also bear an indirect influence on the eventual outcome of financial reporting practices.

The state of capital markets in a nation plays an influential role between the general business environment and the corresponding financial reporting practices. If firms primarily secure their source of capitals from the open stock and bond markets (as in the U.S.), it is only natural to put more weight on financial disclosure so that investors would not view these firms as risky and impose a 'premium' on the securities issued. Conversely, in countries like Japan and Germany, banks play a prominent role as both lenders and investors. Since internal corporate information can be obtained more easily, external reporting is more of a formality and tax consideration. As such, disclosure is more likely to be de-emphasized. Furthermore, this form of corporate governance structure allows firms to adopt a longer term mindset in the pursuit of market share and growth instead of short-term profitability and margin which is given a heavier emphasis in the U.S. and the U.K.

3.4.2 ANALYTICAL CONSIDERATIONS FOR THE FIRM SAMPLE

As shown in Table 3-1, the sample in this research is composed of firms originating from Japan, the U.S., the U.K., Germany, France, Sweden and Norway. The environmental factors described above obviously have a varying impact on financial ratios calculated for the firms. In the process of roughly gauging the relative similarities and differences among the countries, main observations, conclusions and the associated impact on the financial ratios can be summarized.

3.4.2.1 Net Profit Margin and Return-on-Equity

For this type of indicators, Japan and the U.S. stand at two extremes. A survey of the Japanese cultural and business environment gives rise to the following characteristics:

(1) Public duty, not individual rights, stands as the highest value.

(2) Group membership being a dominant factor and business relationships are expected to proceed on the basis of mutual trust. Interlocking ties, such as those that exist in *keiretsus* under the aegis of a major bank or a large trading company, minimize principal-agent problem and information asymmetry between debt-holders, shareholders and managers.

These characteristics portend that hostile takeovers are unusual, and thus managers are able to focus on long-term objectives rather than short-term profitability. Coupled with hefty corporate taxes, firms only have a strong incentive to keep reported earnings down. Furthermore, propelled by the cultural elements of mutual trust and group harmony, legal reserves and contingency accounts are permitted, which provide avenues to smooth income between good and bad times. On average then, both *Net Profit Margin* and *Return-on-Equity* for Japanese firms would be lower than that of the U.S. firms.

As in Japan, book and tax income in Germany and Sweden are required to be substantially the same. This linkage between fiscal and financial reporting has thus reinforced the similar conservatism in earnings measure. The use of 'hidden' and untaxed reserves is also a common practice in Germany and Sweden. As such, the *Net Profit Margin* and *Return-on-Equity* of firms that have their legal domicile in Germany and

Sweden are also expected to be lower. Similar indicators of firms from other countries in the sample are perceived to be more in line with the U.S. practice. In both the U.K. and France, for example, discretionary reserves are generally not permitted except for liabilities and losses that can be reasonably estimated.

3.4.2.2 Leverage Ratios

With the unique role that banks play in the corporate world, Japanese firms have a higher propensity to finance capital needs *via* debt. In addition, these debts are carried at face value rather than present value – the practice adopted in the U.S. The combination of these factors tends to cause Japanese companies to appear to be less solvent than their U.S. counterparts.

Though caused by a different factor, the solvency ratios of German firms arrive at a similar outcome. In this case, equity is often understated due to permission by the German tax law to adopt excess depreciation (up to three times the straight-line rate). Furthermore, goodwill write-off is more liberally done and amortized over a shorter period compared to standard practice in the U.S. All these have the effects of understating shareholders' equity, thereby lowering total assets while increasing the various *Leverage Ratios* (e.g., *Total Debt Ratio*, *Long-term Debt Ratio* and *Non-current Liabilities Ratio* – all these having debt values in the numerator).

On the other hand, although British firms similarly apply a relatively heavy hand in writing off acquisition-related goodwill (with the use of the charge-to-equity method in the past before being replaced by a short amortization period), this effect is offset by other factors. These other factors include the revaluation of assets above historical cost (not permitted by the U.S. GAAP except for certain current assets) along with the parallel creation of an equity revaluation reserve, which cause a systematic upward bias in total assets and shareholders' equity of British firms. It is thus assumed that the opposing effects neutralize each other and the *Leverage Ratios* of British firms are more in line with that of the U.S. firms.

Lastly, all debt is also commonly valued at face value in France. Thus the *Leverage Ratios* of French firms could be slightly overstated, but the difference is not

perceived as substantial due to closer resemblance in environmental factors. For example, French companies are allowed to separate tax and financial reporting considerations, thus shareholders' equity is not understated to the extent of that of German and Japanese firms.

3.4.2.3 Summary

An understanding of the contextual issues and their impact on financial reporting practices obviously enhances the quality of the findings from data analysis. Especially for firms that lie in the middle of the extreme between the U.S. and Japan or Germany (notably France and Norway), it can be concluded from their financial statements and associated footnotes that many aspects in their reporting practices do not differ substantially from the U.S. and U.K. GAAP. This observation is largely attributed to the fact that the sample consists of major international construction firms (recall that they rank within the Top 50 in *ENR*'s ranking) which place a heavy emphasis on attracting businesses and capital from the global marketplace. Naturally, confusing potential investors and customers with hazy financial nuances is the last thing that they desire.

3.5 Observations and Findings

Using the quantitative data gathered from the Operating and Financial Performance component of the analytical template, and relying on the different tasks as classified on page 62, a series of charts can be built for comparison purposes. Interpretation of these graphs is done in conjunction with the qualitative observations gathered from the other parts of the template and the understanding of accounting contextual issues that has been explained at length.

Most of the graphs are built by using the average values of the chosen indicator determined over the study period (3 to 5 years). The data of some firms and periods have to be omitted because only a stable average is desired. This is important to ensure a closer representation of the long-run equilibrium. For example, a substantially negative *ROE* during a year of restructuring is omitted in the calculation of the average value.

3.5.1 COMPARISON OF OPERATING AND FINANCIAL PERFORMANCE

3.5.1.1 Gross, Operating and Net Profit Margins

Figure 3-4 compares the Gross Profit Margin (GPM), Operating Profit Margin (OPM) and Net Profit Margin (NPM) of the firms. Firms from the same region are clustered together along the horizontal axis. On average:

GPM (European firms) > GPM (U.S. firms) > GPM (Japanese firms)

Furthermore, except for the Japanese firms, there are large disparities of GPM within each region. However, the trend disappears when it comes to both the OPM and NPM. In those cases, firms with the highest GPM do not necessarily end up with higher values of OPM or NPM.

Figure 3-5 plots the difference between the GPM and OPM for the firms, which is arranged in a descending order. From basic definitions of the GPM and OPM, it is thought that the difference would provide a proxy for the fixed and overhead costs incurred by firms. Again, the largest difference is associated with most European firms.

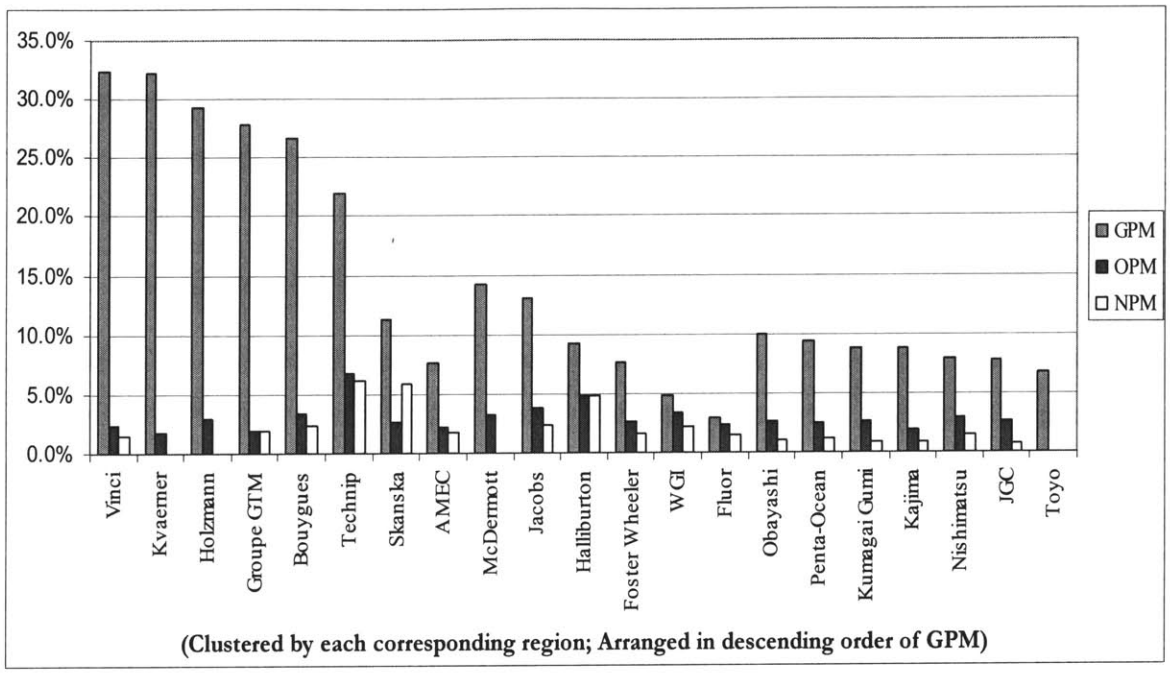


Figure 3-4 Gross, Operating and Net Profit Margins of Firms

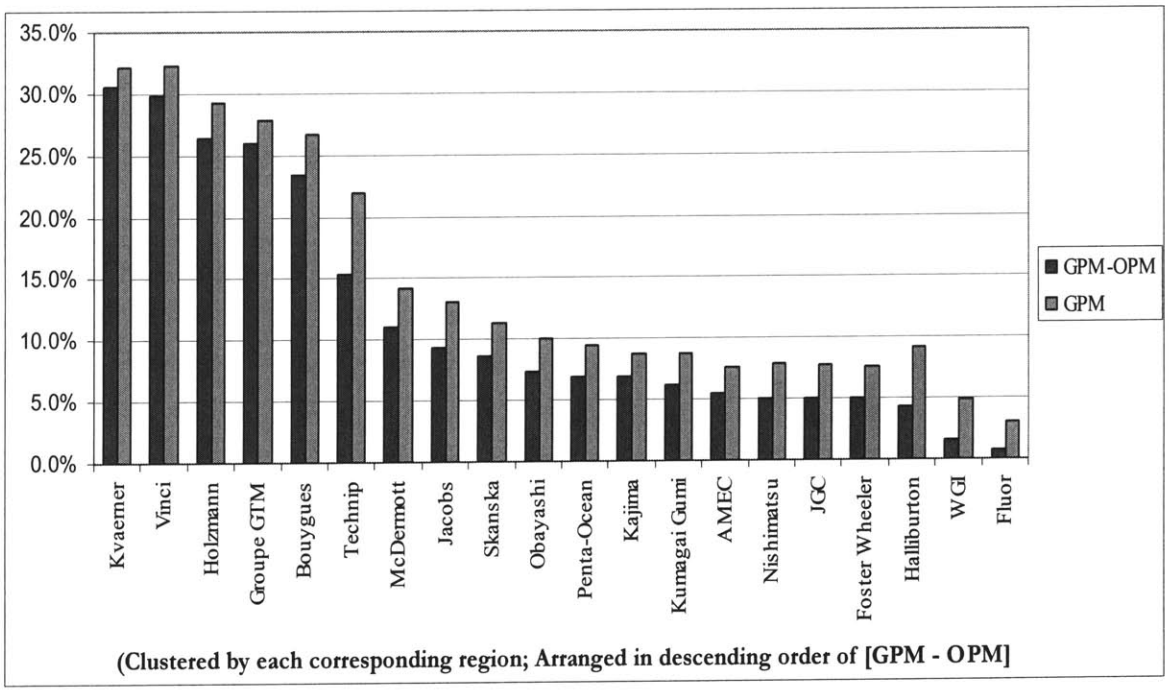


FIGURE 3-5 Differences between GPM and OPM - Proxy for Overhead Costs

These observations give rise to following possible conclusions:

(a) In general, costs associated with wages, social benefits and workers' compensations are notoriously high in some European countries. Thus, high GPM is correspondingly offset by higher costs of these items, thereby arriving at an equally low OPM.

(b) The difference could also be partially due to the financial reporting practices adopted by some European firms. Apparently, some components of the labor and overhead costs could be reported "below the line", whereas they would have been lumped with the associated *Cost of Goods Sold* (*COGS*) according to the U.S. GAAP or in other countries. Nonetheless, it is unlikely that such effect will totally account for the large differences observed in Figure 3-4 and 3-5.

(c) The fact that higher GPM does not ensure higher OPM or NPM signals that material and overhead cost control itself is far from being a complete strategy. This directly challenges the aggressive cost cutting measures that some managers have adopted, most of which have ended up ineffective or even destructive to the firm.

3.5.1.2 The "Profit Margin – Volume/Growth" Tradeoff

By definition, *Return-on-Assets* is the product of *Net Profit Margin* (*NPM*) and *Total Asset Turnover* (*TAT*). Neoclassical economic theory posits that firms constantly face competitive and capacity constraints in order to achieve a high *ROA*. To certain extent, these two constraints are reflected by *NPM* and *TAT* respectively (Haskins *et al.*, 2000). Competitive constraint ensures that firms in industries whose products are undifferentiated or close to commodity like in nature face an upper limit on the profit margin that they can achieve. To them, it may be wiser to pursue a higher turnover of the assets. Conversely, some industrial sectors are handicapped by various capacity constraints – either due to supply (high fixed costs and limited production capacity) or demand (consumer and market size) factors. In this case, since a large turnover is harder to attain, it is better to target for a high profit margin. Others may also associate the above

dichotomy with 'the appropriate' business strategy – cost leadership for the former, and product differentiated for the latter, although it should be noted that this matching relationship only holds in a loose sense.

Plainly put, it is perhaps more useful to interpret from the angle of a tradeoff between profit margin and volume/growth. By plotting *NPM* against *TAT*, Figure 3-6 tests whether such phenomenon exists for the firm sample. Two modifications, however, have been made to produce this graph. Firstly, to increase the number of data points, eight additional firms have been included. Details of the Operating and Finance Performance data for these eight firms are compiled in Appendix D. Secondly, the *NPM* of Japanese firms have been adjusted upwards by three-fold. This is to compensate for the knowingly understatement of profitability by these firms (as explained in Section 3.4). It has been reported that the average *ROE* for Japanese publicly listed companies consistently runs approximately 300% less than for U.S. companies (Haskins *et al.*, 2000). The adjustment will make the figures more comparable and the plot more meaningful.

From Figure 3-6, two main observations can be made. First, there are a number of firms that cluster around the region between 1% ~ 3.5% (for *NPM*) and 0.5 ~ 1.3 (for *TAT*). Apparently, these firms are struggling with the commonly known characteristics of the construction industry. Effectively, high fragmentation and intensive rivalry among firms forge a low margin, low turnover (volume) business environment surrounding these firms. For others who manage to break off from this vortex, the "profit margin – volume/growth" tradeoff is illustrated by the negative slope of the trend line. In fact, ignoring the data of the Japanese firms (thus eliminating potential distortion due to the second modification outlined above), the correlation between *NPM* and *TAT* has been determined as –0.23. Table 3-2 provides the actual figures adopted for the plot and analysis.

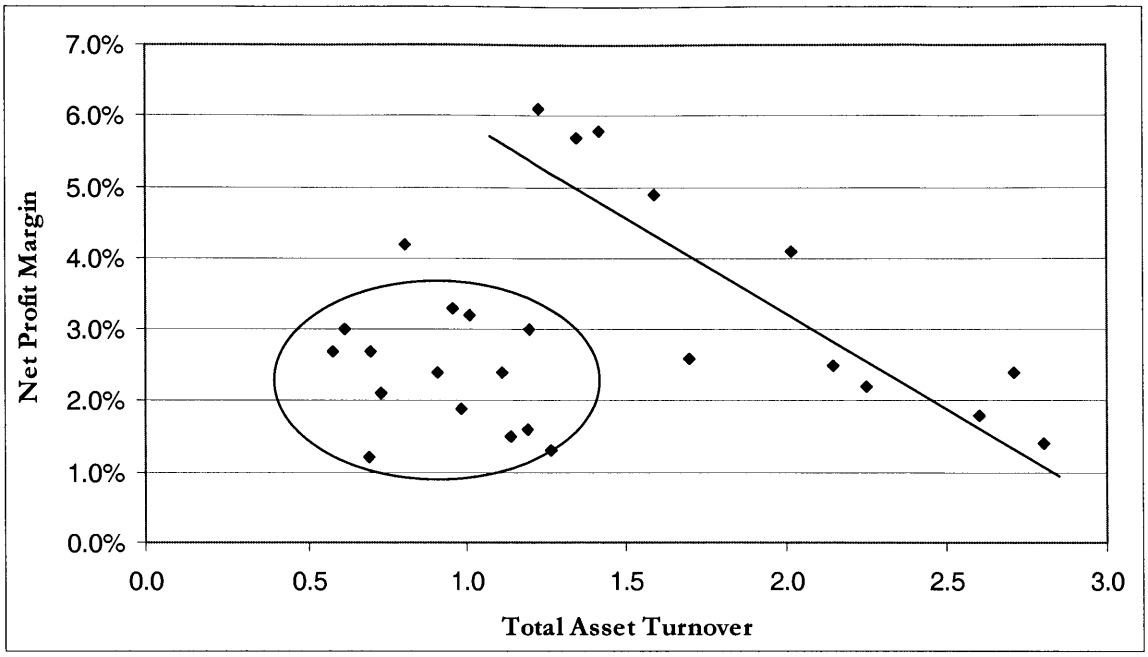


Figure 3-6 The "Profit Margin – Volume/Growth" Tradeoff

The two observations naturally lead to the following conclusions:

(a) Even though the selected firms in this sample represent a reputable bunch based on *ENR*'s ranking, some still struggle to escape from the typical low margin, low turnover feature of the construction industry.

(b) Achieving both high margin and high turnover is tough. Firms usually face a tradeoff between the two, and it is important to invest their resources wisely corresponding with a chosen strategy. For example, they can choose to pursue a focus, differentiated strategy that would lead to a high profit margin; they can alternatively choose to pursue an aggressive, high growth strategy to capture higher volume and market share (although this does not necessarily imply the pursuit of cost leadership strategy that some might have claimed).

FIRMS	Average Net Profit Margin	Average Total Asset Turnover
Technip	6.1%	1.23
Skanska	5.8%	1.42
Centex	5.7%	1.35
Halliburton	4.9%	1.59
Granite	4.1%	2.02
Hochtief	3.2%	1.01
NCC	3.0%	1.20
Stone & Webster	2.6%	1.70
Perini	2.5%	2.15
Jacobs	2.4%	2.71
Bouygues	2.4%	1.11
WGI	2.2%	2.25
Groupe GTM	1.9%	0.98
AMEC	1.8%	2.60
Foster Wheeler	1.6%	1.19
Vinci	1.5%	1.14
Fluor	1.4%	2.80
Bilfinger+Berger	1.3%	1.27
Correlation Coefficient:	**- 0.23**	
Nishimatsu	1.4% (4.2%)	0.80
Penta-Ocean	1.1% (3.3%)	0.95
Obayashi	1.0% (3.0%)	0.61
Kajima	0.9% (2.7%)	0.70
Kumagai Gumi	0.9% (2.7%)	0.58
JGC	0.8% (2.4%)	0.91
Shimizu	0.7% (2.1%)	0.73
Taisei	0.4% (1.2%)	0.69

Notes:

1) The correlation coefficient is determined without considering the data for the Japanese firms

2) For the Japanese sample, numbers in brackets are 3x the originally determined average, following the second modification described in the body text. The inflated numbers are used in the plot in Figure 3-6.

TABLE 3-2 Data Used in the *NPM - TAT* Plot and Determination of Correlation Coefficient

3.5.1.3 Return-on-Asset and -Equity

Figure 3-7 plots the *ROA* and *ROE* of the firms, arranging in a descending order of *ROA* within each region. Because these firms either experienced huge losses or incurred substantial restructuring charges in some years, the figures for Chiyoda, Toyo, Kumagai Gumi, Philipp Holzmann, Kvaerner, Raytheon E&C and McDermott are very unstable and have been excluded in the comparison analysis.

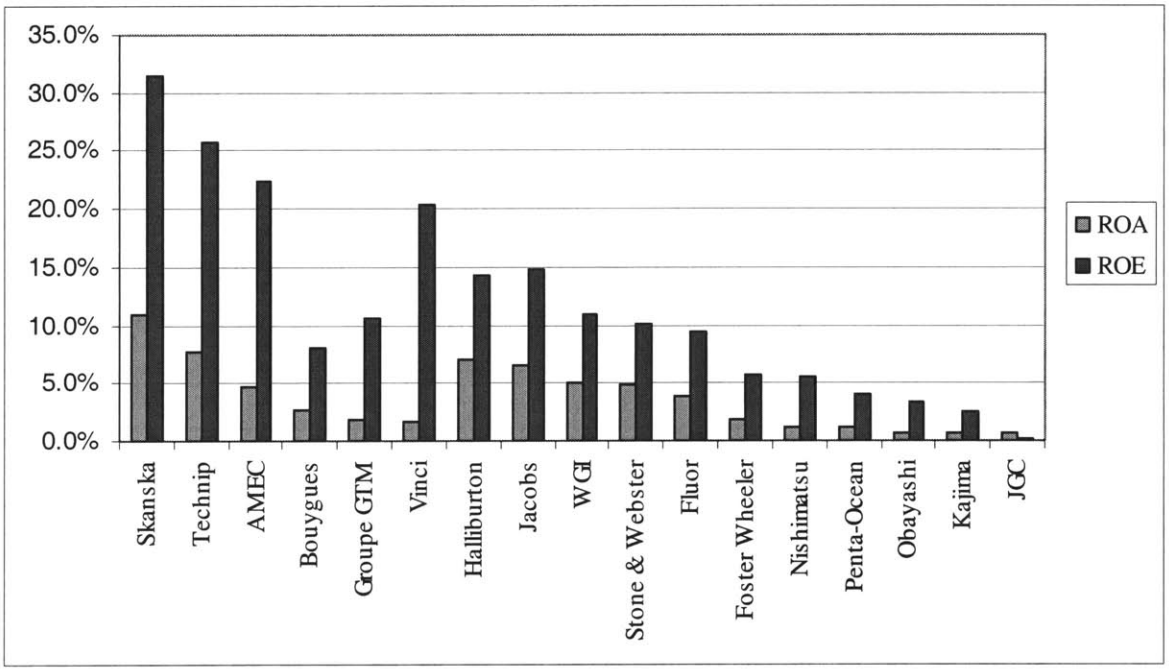


FIGURE 3-7 Return-on-Assets and -Equity of Firms

On average, the *ROA* and *ROE* of Japanese firms are lower than those of their U.S. and European counterparts. However, this should not come as a surprise due to their propensity to understate profitability. Likewise, although relative comparison between the *ROA* of the U.S. and European firms is largely inconclusive, it should be noted that the order of *ROE* does not follow that of the *ROA*. In other words, firms with a low *ROA* may end up with a high *ROE* in relative comparison. This is due to the leverage effect, and apparently the policies on capital structure adopted by firms are quite diverse. For example, the high value of *ROE* of Vinci is partly due to a highly leveraged capital structure that the firm has adopted. In fact, it can be observed from Figure 3-11 that Vinci has the highest level of *Total Debt* and *Non-current Liabilities* after Philipp Holzmann

among the European sample (the latter is known to have experienced financial hardship during the period of study).

3.5.1.4 Other Operating and Financial Indicators

Other operating indicators that have been chosen include the $(Revenue)_t$-to-$(Backlog)_{t-1}$ ratio; the *Capital Intensity* [Non-current Assets/Total Assets] ratio; and the *Average Collection Period.* Along with the others, the definitions and purposes of these indicators are explained in Appendix C. Figure 3-8 to 3-10 present these indicators correspondingly.

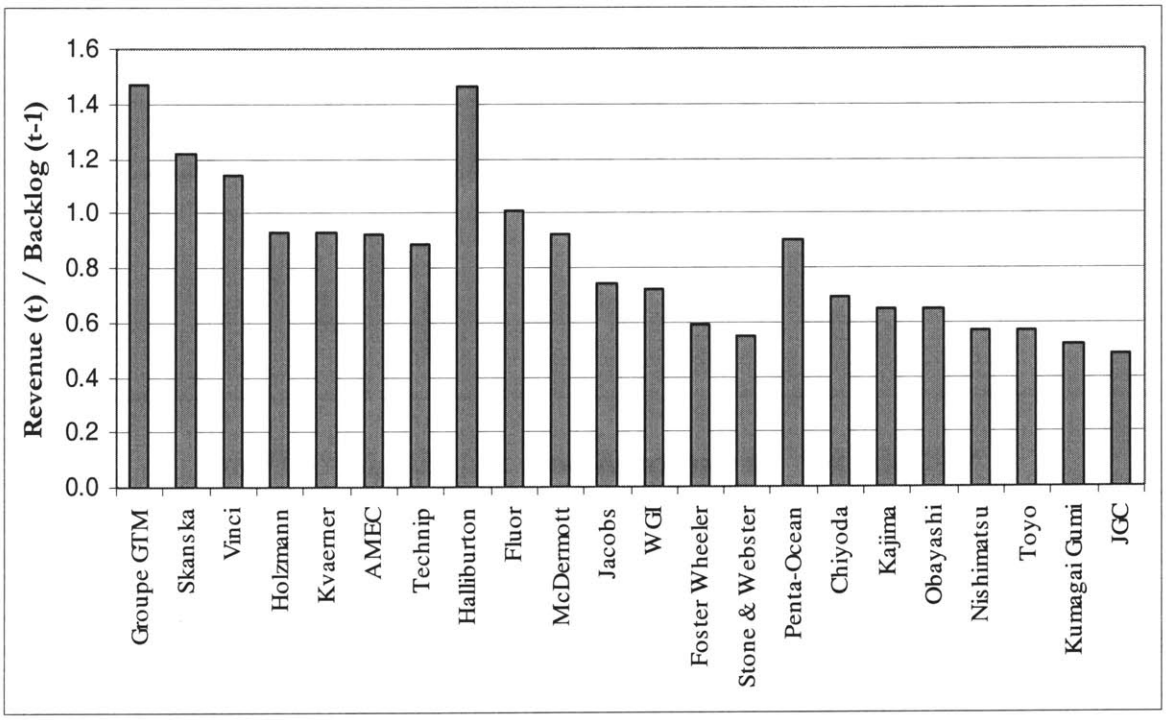


FIGURE 3-8 The Conversion Ratio: [Revenue(t)/Backlog(t-1)]

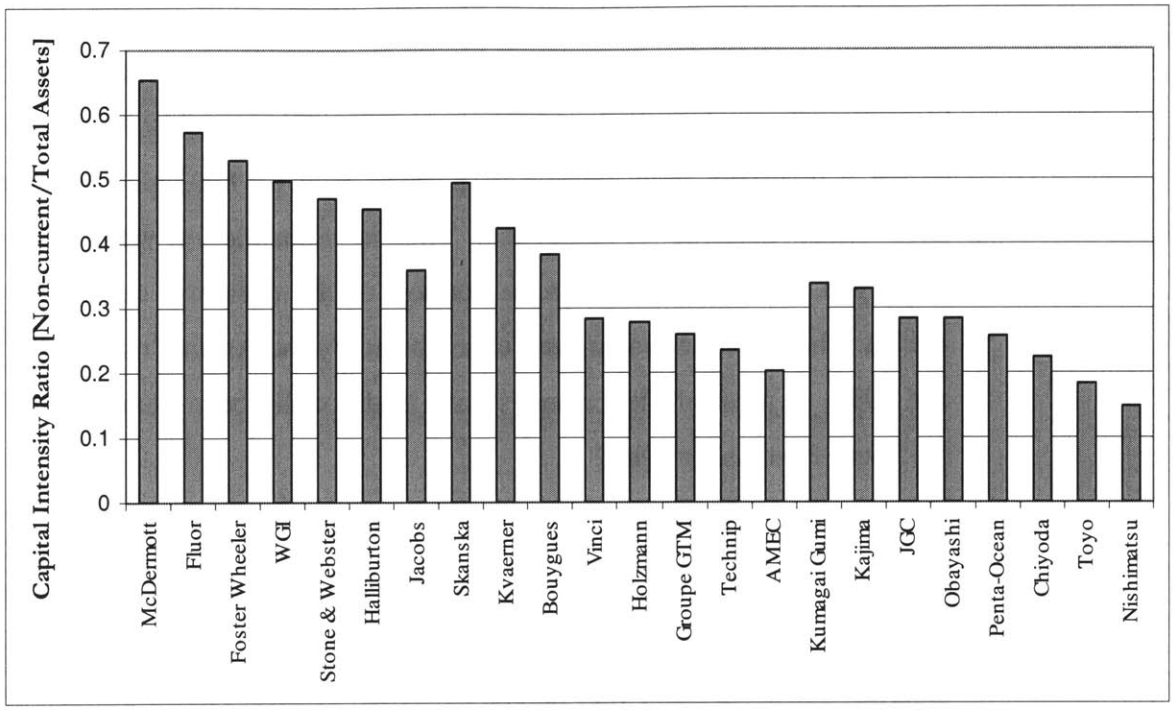


FIGURE 3-9 Capital Intensity Ratio of Firms

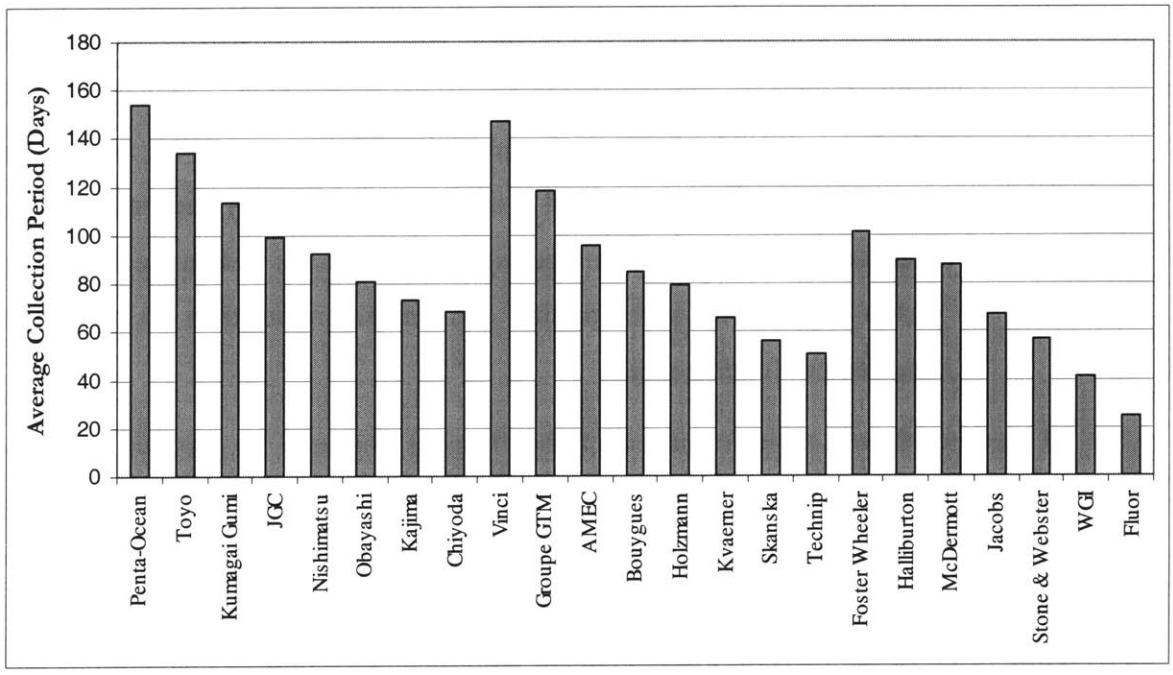


FIGURE 3-10 Average Collection Period of Firms

A few conclusions can be made from these figures:

(a) On average, the $(Revenue)_t$-to-$(Backlog)_{t-1}$ ratio of the Japanese firms are lower than those of the U.S. and European firms. One possible explanation is that a relatively large portion of projects won by the Japanese firms were either deferred or cancelled. This is plausible in view of the prolonged recession and stagnant outlook of the domestic construction market. The situation was indeed exacerbated by the Asian Crisis in 1997 and 1998, as most of these players have traditionally been quite active in the South East Asia market.

(b) On average, American firms are more capital intensive than the European sample, which in turn is more capital intensive than the Japanese firms. Within each region, however, the choice of operating leverage adopted by individual firms is again very diverse.

(c) Although the *Average Collection Period* of individual firms takes on a wide range, on average the Japanese firms have higher collection period as compared to the European sample. The American firms also seem to fare better in collecting their receivables. Although it is hard to prove, it is suspected that the relatively high collection period of the Japanese firms is linked to their business and cultural environment. With ubiquitous business group formations and a culture of dealing by mutual trust and understanding, collection of receivables is perhaps determined more by 'mutual adjustment' to the parties' convenience rather than textbook-style management fundamentals.

Likewise, financial performance of the firms is captured by various debt and liquidity ratios. In Figure 3-11, firms within each region are arranged in a descending order of the *Total Debt Ratio*, with their corresponding *Non-current Liabilities Ratio* and *Long-term Debt Ratio* being shown alongside. In Figure 3-12, *all* firms are arranged in a descending order of the *Current Ratio*, coupled with the corresponding *Quick Ratio*. In a glimpse, it is noted that Kumagai Gumi, Chiyoda and Philipp Holzmann have high level

of debts (either in terms of total, non-current and/or long-term); Kumagai Gumi and Chiyoda incidentally maintain the lowest liquidity ratios.

In fact, by using the data of all firms, Table 3-3 demonstrates that high debt ratios are usually associated with low liquidity ratios. A closer look at the relative value of these figures further proves their validity. For example, the more negative correlation coefficients of *Total Debt* with *Liquidity Ratios*, as compared to those of *Non-current Liabilities*, imply that *Current Liabilities* are more influential in liquidity management. This is especially true given the fact that some items under *Non-current Liabilities* (such as *Deferred Tax Liabilities*) have no impact on immediate cash flow.

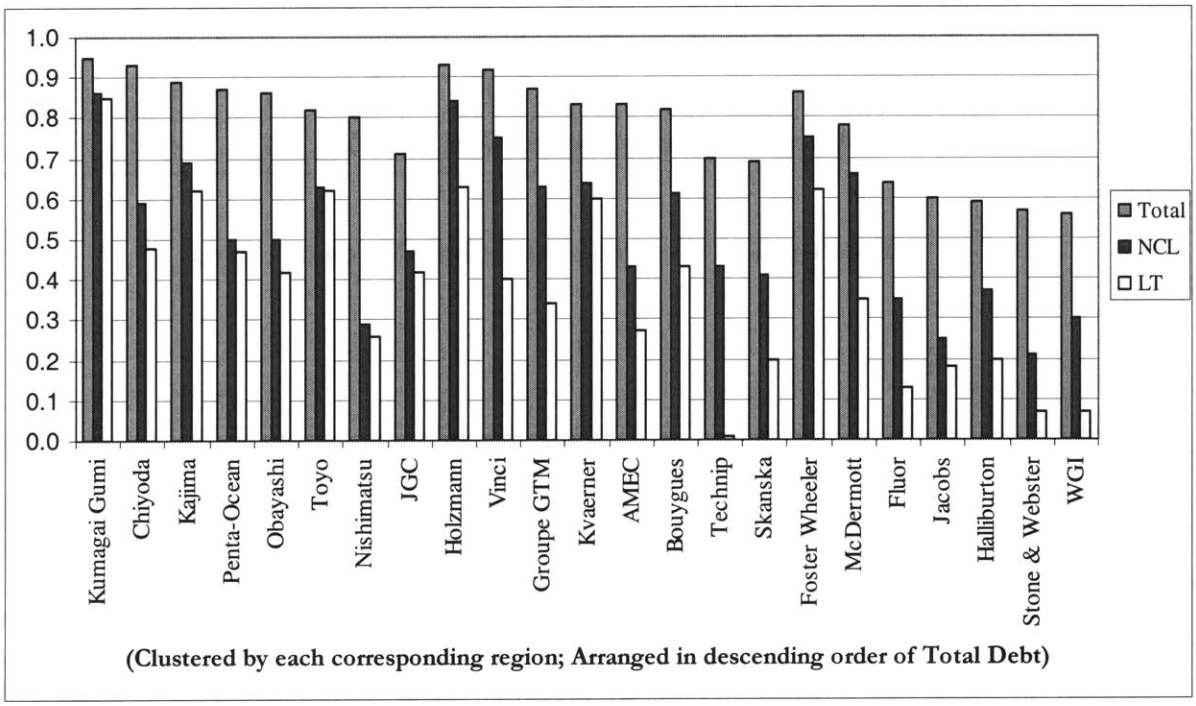


FIGURE 3-11 Total Debt, Non-current Liabilities, and Long-term Debt Ratios

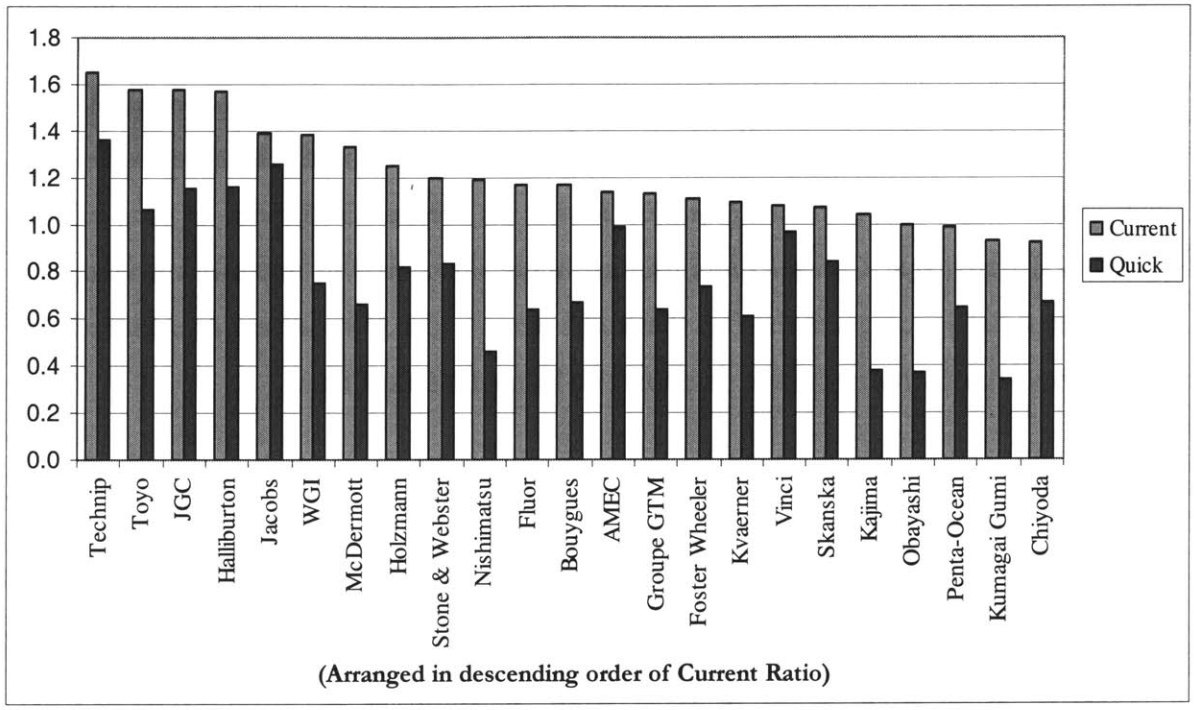


FIGURE 3-12 Current and Quick Ratios of Firms

	Total Debt Ratio	Non-current Liabilities Ratio	Long-term Debt Ratio
Current Ratio	- 0.59	- 0.34	- 0.42
Quick Ratio	- 0.49	- 0.34	- 0.47

TABLE 3-3 Correlation Coefficients among Leverage and Liquidity Ratios

3.5.1.5 The Bottom Line

Although some conclusions drawn from previous observations of the charts have provided insights towards the general outlook of the firm sample, the primary purpose is to use the charts to identify the "out-of-the-pack" performers, consistent with Step (II) of the study approach presented on page 53. In addition, these charts are also useful in providing hints about the collective forces contributing to the failure of other firms. The isolation process is the focus of the next section.

3.5.2 THE ISOLATION PROCESS

It is useful to categorize firms by considering whether they have 'outperformed' or 'underperformed' their peers, or simply bear a moderate outlook during the study period. This is particularly helpful in drawing inferences on corporate strategy, so that factors contributing to success or failure (whether temporary or permanent) are at least consistent with their relative performance during the period. That said, the categorization process should not be resolved to strict statistical measures. Firstly, while cross-comparison can be augmented with qualitative knowledge built into the study, techniques such as running regressions require far greater accuracy of the figures. Secondly, the appropriateness of such techniques is questionable given the many broad, "soft" issues captured under the veil of corporate strategy.

The method adopted here follows these rules of thumbs:

(a) Firms that have 'outperformed' are judged by their relative ranking within each region in four profitability measures: ROA, ROE, NPM and OPM. This is as shown in Table 3-4. Objectively, it is fair to conclude that those which are ranked 1st or 2nd in three or more categories are deemed to have outperformed the others.

(b) The identification process of 'underperformance' is much more comprehensive. Not only that the charts presented in Figure 3-4 to 3-12 are used to identify potential problems that these firms are struggling to

overcome, but their case is also confirmed by reviewing other qualitative information. This is discussed in more details below.

(c) The remaining firms that have not been classified under either category in the above are simply assigned to be having a moderate outlook during the period.

	Regional Size Ranking based on Total Assets	Regional Ranking based on Profitability Measures				
		Return on Assets	Return on Equity	Net Profit Margin	Operating Profit Margin	Rating
Halliburton	1	1	2	1	1	O
Fluor	2	5	5	6	6	M
Foster Wheeler	3	6	6	5	5	M
McDermott	4	N/R	N/R	N/R	4	M
Jacobs	5	2	1	3	2	O
Raytheon E&C	6	N/R	N/R	N/R	N/R	M
WGI	7	3	3	4	3	U
Stone & Webster	8	4	4	2	N/R	U
Bouygues	1	4	6	4	2	M
Vinci	2	6	4	7	5	M
Skanska	3	1	1	2	4	O
Groupe GTM	4	5	5	5	7	M
Kvaerner	5	N/R	N/R	N/R	N/R	U
Holzmann	6	N/R	N/R	N/R	3	U
AMEC	7	3	3	6	6	M
Technip	8	2	2	1	1	O
Kajima	1	4	4	4	6	M
Obayashi	2	3	3	3	2	M
Kumagai Gumi	3	N/R	N/R	N/R	4	U
Nishimatsu	4	1	1	1	1	O
Penta-Ocean	5	2	2	2	5	O
JGC	6	5	5	5	3	M
Toyo	7	N/R	N/R	N/R	N/R	U
Chiyoda	8	N/R	N/R	N/R	N/R	U

Notes:
N/R = Not Rated, due to: (1) Excessive fluctuation in study measures; or (2) Data unavailability
O = Outperformed the others in the sample; U = Underperformed; M = Moderate performance

TABLE 3-4 A First Look at Relative Performance of Firms

3.5.2.1 Preliminary Evidence of Underperformance

A total of seven firms have been classified as "underperformed" relative to their peers for the period of study: Toyo, Chiyoda, Kumagai Gumi, Kvaerner, Philipp Holzmann, WGI and Stone & Webster. The preliminary evidence of such underperformance can often be obtained from the "Background Information" component of the analytical template. The usefulness of the background information should never be underestimated. Frequently, practical hints are embedded under seemingly trivial information such as resignation/firing of top executives, trends of dividend payout and number of employees. Some of this information is summarized in Table 3-5.

From the table, six out of the seven underperforming firms have experienced a concurrent change in leaders and elimination of dividend payout during the period (except Stone & Webster, which, although did not cut dividend, nonetheless brought in a new CEO in 1996 in the hope of a turnaround). These are strong signs of distress. Furthermore, substantial reductions in the number of employees are observed for the Japanese and European underperforming firms.

In contrast, three "outperformers" – Technip, Skanska, and Jacobs actually enlarged their human capital base by more than 50% during the period. Both Technip and Skanska in fact increase their dividend payout; Jacobs, on the other hand, has chosen a zero payout ratio to retain all its earnings for its internal growth (this policy, for example, is similar to that of companies pursuing high growth such as Microsoft).

3.5.2.2 Factors Contributing to Underperformance

As a starting point, some of the potential problems can be linked to miserable operating and performance based on the data presented in Figure 3-4 to 3-12. This is summarized in Table 3-6.

Detailed examination of data summarized in the analytical template corresponding to each of these seven firms further discloses other strong evidence for their underperformance. A brief description of these issues is given for each company below.

Company	Year Founded	Changed leader during term? (If yes, in what year?) (a)	% Change in No. of Employees during Term	Yearly Trend of Dividend per Share (in local currency)
Chiyoda	1948	Yes (1999)	-32.2%	0, 0, 0, 0
Kumagai	1898	Yes (1998)	-17.6%	3, 0, 0, 0
Toyo	1961	Yes (1999)	-26.9%	6, 6, 0, 0
JGC	1928	No	-20.4%	10, 5, 0, 3
Nishimatsu	1937	No	-14.1%	12, 10, 10, 10
Penta	1896	No	-25.7%	7.5, 7.5, 0, 0
Kajima	1840	No	N/A	9, 9, 7, 7
Obayashi	1892	No	-6.3%	8, 8, 8, 8
WGI	1911	Yes (1998)	N/A	0, 0, 0
Stone & Webster	1889	Yes (1996)	N/A	0.6, 0.6, 0.6
McDermott	1924	Yes (1996, 2000)	-52.0%	0.6, 0.2, 0.2, 0.2
Halliburton/KBR	N/A	Yes (2000) (b)	-8.8%	0.5, 0.5, 0.5, 0.5
Foster Wheeler	1892	No	-8.3%	0.84, 0.84, 0.54, 0.24
Jacobs	1947	No	96.4%	0, 0, 0, 0, 0
Fluor	--	No	-22.4%	0.76, 0.8, 0.8, 1.0
Kvaerner	1853	Yes (1998, 2001)	-49.1%	7, 0, 0, 0
Holzmann	1849	Yes (1999)	-40.6%	0, 0, 0, 0
Skanska	1887	No	70.2%	11, 12, 16, 13.5
Bouygues	1952	No	12.5%	3.89, 3.89, 3.89, 0.54
Vinci	1910	No	78.9% (d)	0.61, 1.40, 1.60, 1.65
Groupe GTM	1891	No	1.4%	1.3, 1.5, 2.35
AMEC	1848	No	13.6%	5, 6.25, 7.5, 8.5
Technip	1958 (c)	Yes (1999) (b)	53.1%	2.21, 2.45, 3.0, 3.3

Note:
(a) Year of change as inferred from annual report. Since fiscal year in Japan ends in March, the actual change might have occurred in the previous calendar year. "Leader" refers to Chief Executive Office (CEO), Chairman or President of the corporation.

(b) Change of leader in these case are not likely to be related to underperformance of the corporation. In the case of Halliburton, Dick Cheney resigned to run for vice president of the U.S. In the case of Technip, it is due to the retirement of Chairman cum CEO.

(c) Year incorporated.

(d) Figure includes change due to merger with GTM in year 2000.

TABLE 3-5 Selected Background Information of Firms

	Operational Performance			Financial Performance	
	Profitability	Revenue Conversion	Collection Period	Leverage	Liquidity
Toyo Engineering	Low	Low	High	O.K.	O.K.
Chiyoda	Low	O.K.	O.K.	High Total Debt	Low
Kumagai Gumi	O.K.	Low	High	High	Very Low
Kvaerner	O.K.	O.K.	O.K.	High Long-term Debt	O.K.
Philipp Holzmann	O.K.	O.K.	O.K.	High	Low
Stone & Webster	O.K.	Low	O.K.	O.K.	O.K.
WGI	O.K.	O.K.	O.K.	O.K.	O.K.

TABLE 3-6 Comparison of Operating and Financial Performance of Underperforming Firms

Toyo Engineering Corporation

Toyo has suffered large liquidation losses for its financial subsidiary (TEC International) in 1998 and operational losses in 1999. Signs of trouble are possibly verified by the fact that financial institutions and foreign investors reduced their shareholdings (as a percentage of total equity of the firm) from 34% in fiscal year 1997 to 11.4% in 2000; these institutional investors are more informed than individual investors in general.

Other specific business factors include Toyo's lack of diversification. On average, the firm has more than 80% of its revenue related to hydrocarbon processing industries (HPI). HPI are known for their cyclical nature moving with global outlook of the energy and oil & gas market. Incidentally, a downturn in large-scale plant investment in the petroleum and petrochemical sector was experienced during that period. The late 1990s also witnessed some transformation in the upstream, with major oil & gas companies consolidating with numerous mergers and acquisitions. Pending for such restructuring, many projects have been put on hold.

Geographically, Toyo also had more than 60% of its backlog tied up in South East Asia, South West Asia and Africa. The market outlook in South East Asia was especially bleak during the Asian Crisis.

Chiyoda

Net cash flow from operations (CFFO) has been consistently running negative during fiscal years 1997 to 2000. Financial distress in Chiyoda culminated in capital infusion by Kellogg Brown & Root (KBR) in 1999. Concurrently, a representative from KBR has been elected as an executive vice-president. Number of shares outstanding increased from 195 million to 248 million in that year. All these are clear signs of trouble.

In its annual report, Chiyoda claimed to have suffered from similar factors given by Toyo related to the market outlook of HPI.

Kumagai Gumi

Running with huge debt level, Kumagai Gumi was calling on its creditors to write off some of its debt at the turn of the century. Together, Chiyoda and Kumagai Gumi probably have the worst liquidity problem in the entire firm sample. Unlike Chiyoda, however, Kumagai Gumi does not compete in HPI. It is also less internationalized, with more than 90% of its revenue tied to the domestic construction market, 30% of which involving works from the public sector. Essentially competing head-to-head with firms larger than its size such as Kajima and Obayashi in the domestic market, Kumagai Gumi consistently ran a negative corporate financing gap during the period. In other words, it had been relying substantially on external capital to finance its ongoing operations and investment needs. Given the lack of financial slack on its balance sheet, it is no surprise to observe a distressed pattern for the firm.

Kvaerner

During the months of October and November 2001, Kvaerner was wrestling with its two largest shareholders in securing a rescue package to save itself from bankruptcy. Apparently, the two largest shareholders, Aker Maritime and Yukos Oil, had come out with different financial restructuring plans. In fact, there had been a year-long stand-off between Aker and Kvaerner when Aker initially planned to force through a merger of the oil & gas operations in the two companies (*Financial Times*, 2001a,b, c). Such corporate governance problem and restructuring opportunity (from Aker's point of view) remotely echo the wave of hostile takeovers in the U.S. in the 1980's. Basically, Aker is no different from the corporate raiders at that time which would seek to break up a conglomerate such as Kvaerner and extract value from more profitable pieces of operations.

In short, the cause of Kvaerner's problem could simply be due to excessive diversification. This is best manifested by the fact that it has the highest difference between GPM and OPM (see Figure 3-5), which implies significant inefficiencies within the conglomerate. A study of its structure also reveals a number of overlapping activities housed within related market segments. When Kvaerner started to divest loss-making

operations such as shipbuilding and operations in the pulp and paper industry, it realized that the exit costs are high and economically unjustifiable. The time coincided with a broad market downturn, and assets have to be sold off at deeply discounted prices, not to mention the difficulty of finding a credible buyer in the first place. To make things worse, the divestment process called for lengthy negotiations, due diligence process, follow-up and settlement completion, all of which adding tremendous strain on the management.

Philipp Holzmann

Throughout the study period, both net cash flow from operations and corporate financing gap of Philipp Holzmann ran into negative figures. In November 1999, Holzmann's problematic financial situation came to light when it also ended up with a negative equity value for the fiscal year. At that time, the Group was able to escape bankruptcy through internal financial restructuring when German Chancellor Gerhard Schroder intervened and orchestrated discussions among key members from the Builders' Union (IG BAU), the Central Works Council of Philipp Holzmann, and the major lending banks. A subordinated, equity capital-replacing loan from the state-owned Reconstruction Loan Corporation amounting to DM 150 million was also offered (Philipp Holzmann *Annual Report*, 1999). Any hope of recovery, however, was curtailed when the firm continued to record losses and finally became insolvent in March 2002.

To certain extent, Holzmann's cause of problem could be traced back to the mid-1990's when the domestic construction market in Germany slowed down. It was only till 1997 – still with 62% of its revenue derived from the local market, that Holzmann started to develop its U.S. operations to hasten geographical diversification. As of 2000, revenue from the U.S. even exceeded that from Germany, making up 52% of its total revenue.

Similar to Kvaerner, Holzmann has high overhead costs, as illustrated by a total of 40 branches within Germany itself and some 600 affiliated companies at home and abroad by the end of 1999. It also experienced high exit costs to close down certain operations, but this is largely due to tough negotiations entered to renegotiate layoff or employment terms during the time of crisis. Redundancy-related exceptional charges are often incurred in cushioning the social impact of job losses.

An important lesson learnt from Holzmann's crisis is the significance of corporate culture. In its Year 1999 Annual Report, Holzmann claimed that its worst financial crisis in the 150-year history was due to:

(a) Initial insistence on volume growth at any price, which led to an emphasis on major projects.

(b) As part of a series of moves to define itself as a project developer in such major projects, it has chosen to take on rental guarantees and provide preliminary financing.

(c) Eventually, the company was not prepared to take on such new business roles and high level of economic risk when its historical culture and success was founded on entrepreneurial spirit and technical realization of construction projects.

Washington Group International (WGI) and Stone & Webster

Similar to Philipp Holzmann, these two U.S. companies also ended up with bankruptcy filing under Chapter 11. Paradoxically, both of them do not show significant problems in operating and financial metrics in Table 3-6 (in fact, WGI achieved admirable profitability as shown in Table 3-4). Causes that triggered the bankruptcy of these two companies are somehow unique, although it is also observed that both have diversified extensively (e.g., WGI into mining operations; Stone & Webster into refrigeration services and warehousing).

Stone & Webster ran into a substantial cash flow problem starting from 1998 when cost overrun was recorded for a few international lump sum contracts. The change from 1997 to 1998 was sharp: net cash flow from operations drop from $83.2 million to negative $72.5 million a year later; corporate financing gap went from $34.3 million to negative $126.7 million. Defensive effort was finally pierced when construction delays at a gas-fired power plant in Rhode Island forced it to take a $27.5 million charge in 2000.

On the other hand, WGI's case was triggered after pursuing some aggressive moves in acquisitions. In fiscal year 1999 alone, net cash flow from investment ran

deeply negative into $148.7 million, with $132 million out of this number being spent on business acquisitions. In 2000, WGI consummated the acquisition of Raytheon Engineers & Constructors, which eventually proved to be too large a deal to digest. The details of this event are explained in the discussion of boundary issues in Chapter 5.

3.5.2.3 Prediction of Corporate Bankruptcy – the Altman's Z-Model

Armed with the previous identification of firms that have apparently failed or underperformed relative to the others, it is interesting to explore whether there are tools that would have raised the red flag prior to such debacles. As one of the common methods used in the prediction of corporate bankruptcy, Edward Altman's Z-model (1968) can be conveniently applied simply because most of the factors inherent in his model (except for market value of equity) can be extracted from financial reports.

Without going into details about the derivation of the Altman's Z-model, below is a summary of the essential components of the model:

Ratio used to Predict Bankruptcy	Notations	Weighting Attached to Each Ratio
Working Capital / Total Assets	$\mathbf{X_1}$	0.012
Retained Earnings / Total Assets	$\mathbf{X_2}$	0.014
Earnings Before Interest & Taxes (EBIT) / *Total Assets*	$\mathbf{X_3}$	0.033
Market Value Equity / Book Value of Total Debt	$\mathbf{X_4}$	0.006
Sales / Total Assets	$\mathbf{X_5}$	0.999

Overall Index, $\mathbf{Z} = 0.012\ \mathbf{X_1} + 0.014\ \mathbf{X_2} + 0.033\ \mathbf{X_3} + 0.006\ \mathbf{X_4} + 0.999\ \mathbf{X_5}$

Note: In using the above formula, $\mathbf{X_1}$ through $\mathbf{X_4}$ should be expressed as absolute percentages, while $\mathbf{X_5}$ should be expressed as a ratio.

TABLE 3-7 Basic Components of the Altman's Z-Model

In his original study to derive this model, Altman found that a minimum value of 1.81 for the Z-score is required for safety. However, it should be mentioned that there exists a "zone of ignorance" for Z-scores between 1.81 and 2.67 in his study, where misclassifications of corporate bankruptcy category can occur.[9]

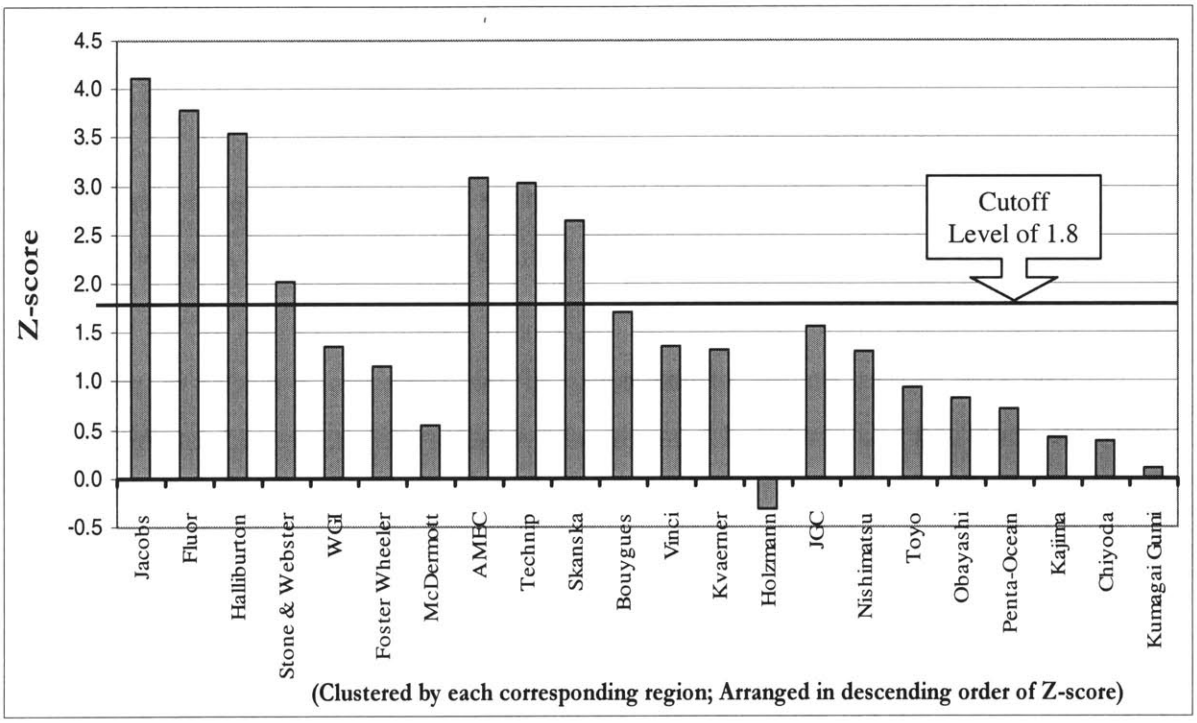


FIGURE 3-13 Prediction of Bankruptcy for Firms using the Altman's Z-model

By applying the model to the sample firms in this research, the above graph summarizes the Z-score calculated for each firm.[10] If the cutoff value of 1.8 is strictly applied to the above, some interesting observations can be made:

- The "outperformers" in the U.S. and European regions (i.e. Halliburton; Jacobs; Skanska; and Technip) have such high level of Z-scores that would

[9] It should be mentioned at this point that "corporate bankruptcy" as implied by Altman's Z-model should be referred to both technical insolvency (e.g. inability to meet cash obligation) and bankruptcy in the formalistic, legal terms. This is analogous to the meaning of "failure" throughout this chapter. This interpretation is further supported by the "classification chart" that will be presented in a moment.

[10] Z-scores for GTM and RE&C have not been computed for obvious reasons: the former has merged with SGE/Vinci, whereas the latter is a subsidiary of a larger corporation.

undoubtedly imply a remote possibility of a bankruptcy problem.

- All Japanese firms in the sample have Z-scores that are below 1.8, thus posing an obviously flawed conclusion that *all* these firms are facing potential corporate bankruptcy.
- Only five out of the seven "underperformers" previously identified (i.e. WGI, Kvaerner, Philipp Holzmann, Chiyoda, and Kumagai Gumi) are picked up by the Z-model as facing potential bankruptcy danger.
- The model has, on the other hand, picked up some "moderate performers" (such as Vinci and Bouygues) that actually did not show any signs of potential dismal failure.

The conclusions on the effectiveness of the Altman's Z-model in predicting corporate bankruptcy, as gathered from the above observations, are at best mixed. The model has done a good job in isolating the "outperformers" from bankruptcy possibility, but nonetheless does poorly in picturing the status of Japanese firms. Some plausible explanations can be given to clarify on this second point.

After going so far in this chapter in setting the scene for financial analysis and addressing accounting issues, the low Z-scores of the Japanese firms are obviously explained by their propensity to report low profitability (which affects $\mathbf{X_3}$ and possibly $\mathbf{X_2}$ in the long run) and relatively high level of "leverage" (which affects $\mathbf{X_4}$). Furthermore, Altman originally developed the parameters and weightings of the model using only U.S. firms. Cross application of this model to foreign firms is obviously questionable, let alone using a similar (and subjective) cutoff mark! Even if an analyst believes that the fundamental relationship between bankruptcy and the associated factors remain unchanged and transferable, the cutoff mark that signals a financial distress for Japanese firm should be a lower value than 1.8.[11]

As for the third and fourth points, an initial explanation that can be given to defend the Z-model is that no statistical model is perfect and some misclassifications

[11] Given that two of the "big five" in Japan, namely, Kajima and Obayashi, do not seem to fare well in terms of Z-score, an assumption of similarity in fundamental relationship in Japan should be challenged.

should be expected. In order to explore this statement further, the results are arranged in a classification chart or "accuracy-matrix" similar to the format presented in Altman's original paper. In effect, the results are arranged in two different tables: one by interpreting "bankruptcy" strictly as a legalistic process; the other being interpreted as equivalent to "failure" as defined for the case of the seven firms identified in this chapter. Due to their low (and probably unreliable) Z-scores, the eight Japanese firms have been left out.

		Predicted Category "Formalistic" Bankruptcy (using 1.8 as cutoff mark)	
		Bankrupt	Not Bankrupt
Actual Category	Bankrupt	1	1
	Not Bankrupt	6	6

(a) Results Classified according to Actual Bankruptcy in the Formalistic, Legal sense

		Predicted Category Failure / Underperformance (using 1.8 as cutoff mark)	
		Failed	Not Failed
Actual Category	Failed	3	1
	Not Failed	4	6

(b) Results Classified according to Failure (Broader Interpretation of "Bankruptcy")

		Predicted Category	
		Bankrupt	Not Bankrupt
Actual Category	Bankrupt	Right Conclusion	Type I Error
	Not Bankrupt	Type II Error	Right Conclusion

(c) Statistical Implications

FIGURE 3-14 Accuracy-matrices for Results of Z-model

Figure 3-14(a) seems to imply that the predictive power of the Z-model is not very impressive, with 50% of the firms being misclassified. However, when the interpretation of "bankruptcy" is broadened to include both technical insolvency and other potential indications of failure consistent the earlier definition in this chapter (which affects "actual category" in Figure 3-14(b)), the predictive power has improved to 64%. Thus, this supports the view that the Z-model is more suited for signaling signs of financial distress rather than predicting whether a firm would ultimately seek protection under the Bankruptcy Act. This is especially true for governance structure that would allow influential debt or equity holders to bailout a company and avoid formalistic bankruptcy – although the company could very well be experiencing financial distress or technical insolvency.

As far as misclassification is concerned, the Z-model seems to err more on Type II error (i.e. accepting the null hypothesis – "this firm is bankrupt", when it is actually false) rather than Type I error. This implies that an analyst is more likely to make a wrong conclusion when the computed Z-score is low (hence inferring that a firm has failed) as compared to the situation when the computed Z-score is high.

Obviously, a more concrete conclusion can only be arrived with a larger sample size (given the fact that only 14 data points are available in this case).

3.5.2.4 "Beta" as a Proxy for Risk

The notion of "beta" long forms the cornerstone of the Capital Asset Pricing Model (CAPM) (Sharpe, 1964; Lintner, 1965; Mossin, 1966), which serves as a proxy for "systematic" risk, or simply, how capital (equity and debt) and operating assets are correlated to the market risk. For the firm sample, it is thought that firms that have failed or under-performed might have been exposed to a more risky operating environment and would be indicated by a higher value of asset beta (although as will be seen, the riskiness of an equity holder's position is a separate matter).

Firms ranked by Equity Beta	Equity β	Firms ranked by asset beta	Unlevered β
Kvaerner	1.479	Halliburton	0.48
Bouygues	1.387	Technip	0.25
Halliburton	1.161	Bouygues	0.25
Holzmann	1.115	Kvaerner	0.25
Toyo	1.110	JGC	0.20
Chiyoda	1.036	Toyo	0.20
Kumagai Gumi	0.977	McDermott	0.19
McDermott	0.862	Jacobs	0.17
AMEC	0.852	AMEC	0.14
Penta-Ocean	0.838	Skanska	0.13
Obayashi	0.828	Nishimatsu	0.12
Technip	0.824	Obayashi	0.12
Kajima	0.770	Penta-Ocean	0.11
Vinci	0.719	Foster Wheeler	0.09
JGC	0.702	Holzmann	0.08
Foster Wheeler	0.665	Kajima	0.08
Nishimatsu	0.597	Chiyoda	0.07
Skanska	0.434	Vinci	0.06
Jacobs	0.429	Kumagai Gumi	0.05

TABLE 3-8 Equity and Asset (Unlevered) Betas of Firms

Table 3-8 has been produced to examine if this hypothesis is valid.[12] The five firms shaded in gray are those that have been previously identified as "under-performers". On the left-hand side of the table, these "under-performers" appear to cluster around a higher level of equity beta. Thus, preliminary evidence seems to support the hypothesis if risk assessment concerns only the equity holder. After controlling for different capital structures by unlevering (assuming that beta for debt is approximately zero – an assumption that is commonly used in such procedure), the ranking of these firms becomes dispersed. Apparently, the high level of equity risk is due to high leverage rather than riskiness of the operating assets themselves.

[12] Due to different events, beta values for Stone & Webster, WGI, Fluor, Raytheon E&C and GTM are either not meaningful or unavailable. The first two firms have filed for bankruptcy; Fluor's equity has been trading as "new" shares after the spin-off of AT Massey; beta for RE&C as a subsidiary of a larger corporation is hard to assess; while GTM has long merged with SGE/Vinci. Inclusion of data for these firms are only meaningful when beta values before these events occurred are obtainable.

Lastly, by definition, beta only relates to market risk. Total risk (which includes idiosyncratic risk specific to a firm) is more meaningful for analytical purposes of strategy. As will be mentioned in Chapter Five, the expected volatility of equity option of a firm can be used as an indication of the riskiness of assets or firm operations, although this parameter would still be distorted by the effect of leverage.

3.5.3 Major Conclusions and Impact on the Derivation of Conceptual Model

From the discussions of factors contributing to underperformance, apparently there is no single trend of failures that can be determined. In short, firms fail for different reasons. One might have performed tremendously well in some categories of indicators, but fail simply because it has overlooked one or two other critical factors. WGI, for example, has been making relatively good profit margin and adopting a conservative capital structure; yet it still could not escape the fate of seeking Chapter 11 bankruptcy protection.

Likewise, in the process of building the conceptual model as elaborated in the next two chapters, factors that contribute to the success of good performers are diverse, and there is no single company that places itself at the top in all measures. Based on the outlook presented from Figure 3-4 to 3-12 and other data given in Appendix B for all firms, one can easily verified that successful companies do not consistently provide a near-perfect performance outlook at all times.

Simply put, there is more than a single formula towards success. This argument can be examined by looking at the frequently debated issue of focus versus diversification. In Table 3-9, based on the activities of each firm as mapped out in the Market Segmentation Matrix component of the template, firms are classified into three categories as defined in the table. It is immediately obvious that there are underperformers in all categories, and outperformers are not constrained to only one category as well (although it should be observed that the "most diversified" category still does not seem to be favorable to outperformers)! A second example can be given on size. Referring back to Table 3-4, the six outperformers identified in this table come from

different range of total asset values. This refutes certain rhetorical statements such as "big is beautiful" or "the small and nimble speeds past inflexible behemoths".

Focus and/or Differentiated		**Broader Target**		**Most Diversified**	
Single vertical market;		Multiple vertical markets;		Multiple vertical markets,	
Limited OR multiple roles in a single value system		Limited role in most of the value systems		Multiple roles in most of the value systems	
Firm	**Rating**	**Firm**	**Rating**	**Firm**	**Rating**
Halliburton	O	Jacobs	O	Bouygues	M
Technip	O	Penta-Ocean	O	Vinci	M
McDermott	M	Nishimatsu	O	Groupe GTM	M
Foster Wheeler	M	AMEC	M	Fluor	M
Toyo	U	Kajima	M	Stone & Webster	U
		Obayashi	M	WGI	U
		Kumagai Gumi	U	Kvaerner	U
		Holzmann	U		
~~Chiyoda~~	→	Chiyoda	U		
		Skanska	O	← ~~Skanska~~	
		Raytheon	M	← ~~Raytheon~~	
		~~JGC~~	→	JGC	M

Note:

1) It is noticed that Chiyoda, Skanska, Raytheon and JGC has moved from one category to another around the study period. For example, Raytheon Engineers & Constructors (RE&C) originally joined others (Raytheon Systems, Raytheon Commercial Electronics and Raytheon Aircraft) as part of the larger Raytheon Company - hence developing a fully diversified profile. Subsequent to its sale to WGI, RE&C alone became isolated as a conventional engineering and construction firm under the "Broader Target" category.

2) Diversification can generally be pursued along a few dimensions - industrial market segments; geographical regions; and types/nature of clients served. The definition of the third category in the table - "Most Diversified", refers only to the dimension along industrial market segments. Firms fall under this category may experience different degrees of diversification along the other two dimensions.

TABLE 3-9 Classification of Firms consistent with Market Segmentation Matrices

All the evidence, observations and conclusions determined in this chapter thus link back to the earlier call for a "open, generic" conceptual model. This can be succinctly described by two major points:

(1) Firms, especially in the construction business, have to consistently check on the downside risks of ALL measures – operational, financial, business, environmental factors and others. It might take only one or two critical factors to initiate a crisis.

(2) On the other hand, there are numerous routes towards success. Critical success factors can be derived from all areas of financial, operational, technological, human-related, and others. This argument essentially makes up the form of the conceptual model in Chapter Four.

CHAPTER FOUR

Re-conceptualizing Strategy, and Linking it All Together

"While there are no generally successful strategies, there are some general principles of strategic planning that can improve performance."

- Sharon M. Oster (1999)

4.1 Introduction – Toward a Generic Model

This chapter and the next formally outlines the components and propositions of the conceptual model. Given the diversity of firm characteristics, causes of success and failure, and continuous debate in the various schools of theories, an optimal solution and methodology arguably does not exist. As there are few absolutes then, a format akin to that of a contingency model is adopted, rather than falsifying a step-by-step approach towards successful corporate strategy. In other words, the use of the model is situational, depending on specific internal issues and external factors faced by corporate executives at a particular point in time. In view of this objective, the model should be generic enough to be useful in differing circumstances, yet sufficiently specific to identify critical issues and principles to react to dynamically competitive forces.

The starting point of the basic model realizes that any discussions of corporate strategy should always go parallel with the mechanisms within an organization, as depicted in Figure 4-1. Within corporate strategy and organization, there are distinctive components anchoring each of the two areas and driving the interaction between them. These individual components will be explored in sequence.

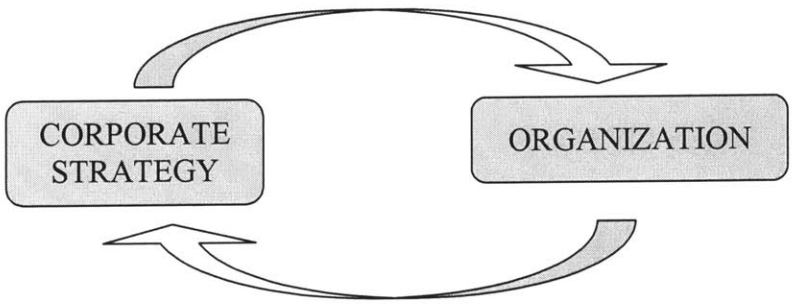


FIGURE 4-1 Two-way Flow between Corporate Strategy and Organization

4.2 Inside Corporate Strategy – The Seven Strategic Fields

To keep the model open and flexible, the corporate strategy main stream has been decomposed into seven 'strategic fields' as shown below [13]:

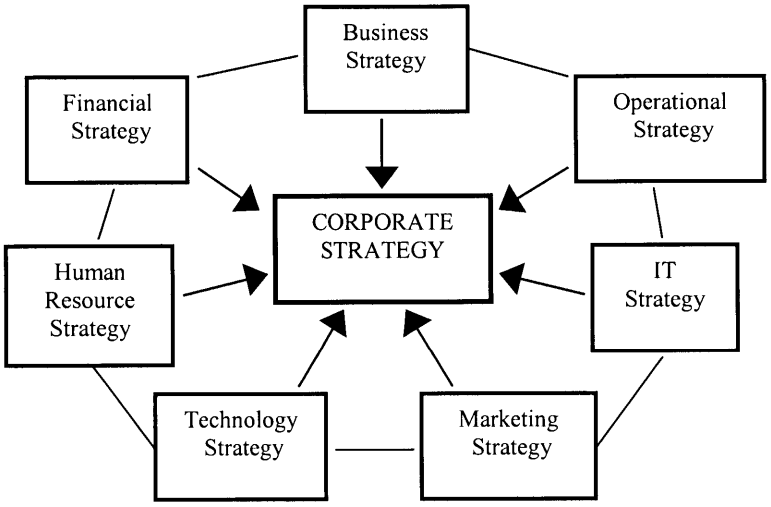


FIGURE 4-2 Seven Strategic Fields of Corporate Strategy

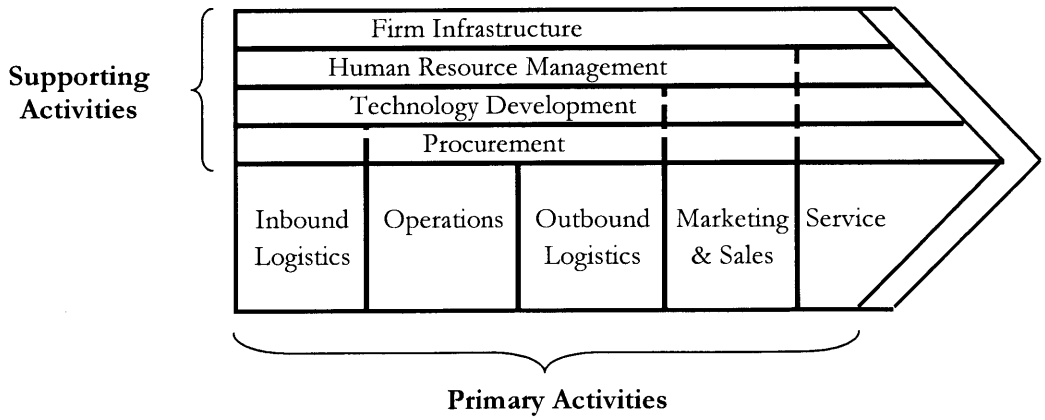


FIGURE 4-3 Porter's Generic Value Chain Model
[Sources: Porter (1985)]

[13] Throughout the thesis, the seven fields are italicized to distinguish their roles in *this* conceptual model from their meanings in a more general context.

At first sight, it may appear that the concept bears some similarities to those value activities presented in Porter's (1985) value chain concept, hereby reproduced in Figure 4-3. For example, the two supporting activities of "Human Resource Management" and "Technology Development" in Figure 4-3 might seem to resemble the *Human Resource Strategy* and *Technology Strategy* fields in Figure 4-2. Yet, the crucial difference lies on the perception of the scope of the strategic fields. Ever since the value chain concept was developed in the 1980's, individual strategic fields as defined in Figure 4-2 have grown to capture new levels of importance. In effect, all of them rightly claim to be separate, major components within the realm of corporate strategy. Instead of merely serving as value activities and drawing attention on the identification of cost and unique drivers, the strategic fields have practically evolved into broad disciplines that dictate separate strategic planning and execution consideration.[14] The key then becomes how to integrate these fields effectively to arrive at an overall coherent corporate strategy.

For example, technology development is far from being just a "supporting activity" as in Figure 4-3. In the 1990's, numerous small, nimble firms evolved that mainly concentrated in selling technological products or technical knowledge and strove without putting heavy investment in the physical distribution process of the products. These firms rightly reverse the definition of "primary" and "supporting" functions from their perspectives. In short, comparing with Figure 4-3, the proposed concept in Figure 4-2 leaves the question open to individual firms as for the determination of the relative importance of these strategic fields.

Whereas many of these strategic fields are broad disciplines with a wide scope of activities, some are more closely linked to corporate strategy than the others. Therefore, contingent upon the outlook of a particular firm, an advertising campaign may be less related to corporate strategy. For others that perceive it as part of brand management and reputation building process (such as being a new entrant in a new market), these activities are far from being routine. A brief description of the common issues that are pertinent to each strategic field is given to provide a more concrete picture of its scope.

[14] A good piece of evidence is that most business schools nowadays offer separate courses (especially for inner-depth studies) for each of these fields after a general treatment of strategic management in an introductory subject.

4.2.1 BUSINESS STRATEGY

The distinction between "business" and "corporate" strategy is often made. Frequently, business strategy is referred as strategies adopted to ensure successful ventures of individual *business units*, whereas corporate strategy concerns the operations of the entire firm. This distinction is obviously consistent with the model, as *Business Strategy* remains as only one of the seven core fields of the overall structure.

As perhaps the most popular field among researchers and theorists, *Business Strategy* formally deals with the development of competitive advantages and core competencies. In particular, Porter's (1980, 1985) techniques such as the determination of unique and cost drivers; the "Five Forces" model; and market segmentation matrix are still proven to be some of the most useful tools in formulating *Business Strategy*. Other theorists choose to forget about rhetorics and instead resolve to addressing simple (yet subtle) fundamental questions such as "what market are we in?" and "what values are we creating for our customers?".[15]

In short, *Business Strategy* is traditionally the primary area of concern. It focuses on the products and services that the firm could offer, should offer or is targeting to offer.

4.2.2 FINANCIAL STRATEGY

No business ventures can operate without consideration of financial issues. There are two fundamental aspects in *Financial Strategy*: investment decisions and financing decisions.

On investment decisions, firms are confronted with the challenges of capital budgeting and financial resource allocation. In order to make better decisions of investments, managers have to select the appropriate tools for project analysis and evaluation, which include the Net Present Value (NPV) method, decision tree analysis, portfolio planning and the real option approach. The main principles behind these tools

---

[15] The oftentimes related question of "how are we going to deliver these created values" is more specifically concerned with process. This is classified under *Operational Strategy* in the conceptual model.

are mostly built on the understanding of relationship between risk and return.

Financing decisions are concerned with issues of capital structure. Firms have to understand the relative pros and cons of using various kinds of debt and equity instruments in raising capital and the corporate governance structure associated with these financing decisions. For example, simple capital structures usually reduce restructuring costs. Complex structures with a combination of secured private debt and numerous subordinated public debt issues have been found to be strong impediments to out-of-court negotiations and settlements (Asquith *et al.*, 1994). Arguably, in Philipp Holzmann's first escape from bankruptcy in 1999 (see Chapter 3), having a relatively small number of primary stakeholders might have facilitated a smoother negotiation process (*albeit* it should not be forgotten that in this case a substantial extent of political influence was also present).

Modern corporate financial theories on investments and capital structure have also been revolutionized by an increased understanding of issues concerning real options, financial distress, managerial agency problem and risk management. In providing the detailed mechanics within these areas, Grinblatt and Titman (1998) also showed how these could impact corporate strategy as a whole.

In the context of construction industry, conventional contractual elements such as surety bonds and insurance policies are closely related to *Financial Strategy*. For example, strong balance sheet is one of the primary necessities to continually secure surety bonds for ongoing project procurements. Reliance on insurance for risk transfer is also intrinsically linked to risk management policies of a firm.

Lastly, some major construction firms have gone beyond the use of *Financial Strategy* as a mere internal tool. In effect, these firms offer their knowledge and network relationships in this area as additional services to clients in terms of structuring innovative financial packages.

4.2.3 OPERATIONAL STRATEGY

Operational Strategy is primarily concerned with execution and implementation – how firms manage their operational processes to convert different inputs into the final products or services sold to their customers or clients. These activities might include the inbound and outbound logistics, procurement functions, production and manufacturing processes for physical products and other procedures for services. For contractors, these activities are analogous to most project management functions such as material procurement, physical construction of the structure, and the management of labor and machinery. Likewise, service firms utilize their expertise and knowledge to assist clients in achieving their needs and goals, such as performing planning, design and engineering functions.

As mentioned at the beginning of this thesis, research efforts in civil engineering traditionally focus on mostly pure technical areas (as in engineering design and analysis) or management issues at the project level. Therefore, going by the scope definition of strategic fields in this conceptual model, most of the knowledge developed by conventional research efforts is directly related to *Operational Strategy*. However, it is important to realize that common issues addressed by civil engineers often go beyond the boundary of *Operational Strategy*. For example, project execution onsite calls for a basic control of quality, costs and time. However, quality, costs and time can be profoundly affected by technological factors, which are in fact related to the kind of *Technology Strategy* that the firm has all along been adopting. Project costs also bear an impact on cash flow at the corporate level, the sufficiency of which is again related to a specific *Financial Strategy* pursued. In addition, the choice of project delivery methods not only has an impact on physical executions, but also greatly influenced by both *Business* and *Technology Strategies*. Many cases illustrated by Miller (2002) strongly reflect these characteristics.

Obviously, the conceptual model embraces the fact that there are at least six other core fields to consider for corporate strategy to create more chances of success. The model is thus consistent with the basic hypothesis of this thesis.

4.2.4 TECHNOLOGY STRATEGY

Tatum (1988) effectively suggests five possible technology-based strategies for construction firms: borrowing and applying technology from other industries; using technology for efficiency gains; specializing in construction technology R&D; creating an organization structure that demands better technical solutions; and using technology for forward and backward technical integration. All said, choices made on the *type* of technology development, and the *means* through which the development is being carried out, still remain as the most basic questions in *Technology Strategy*. Besides, it is also useful to examine three other important issues that are commonly encountered.

The first typical question in *Technology Strategy* that has withstood the test of age is the notion of "pioneer versus follower". Not surprisingly, whether one should be at the 'bleeding edge' of the technology wave as a first mover is *always* a tough decision to make. This is especially true when the trend of technology is shaped by uncertain environmental factors. In the case of technology development in power generation, for example, there is still no clear winner among the various technologies corresponding to the different kind of fuel sources – coal, natural gas, hydropower, nuclear power, non-conventional renewable energies (wind, solar, tidal) and others. When environmental, economic, technical and political factors are to be considered collectively, each of these stands a chance to emerge as the eventual winner(s).

In the old days, many firms managed to establish operational advantage by achieving economies of scale through vertical integration. Nonetheless, it is not clear if scale and integration will still provide advantage in terms of technology development in these days. For example, Chesbrough and Teece (1996) define innovations as either autonomous or systemic, each of which will determine the appropriate alternative between outsourcing and internalized technology development. Thus, if technological innovation for a particular process or product has to be driven by integrating functions along a value chain, it is more inclined to be systemic and scale and integration may provide distinctive advantage. The converse, however, is also true.

Third, firms also have to assess the relative importance between basic and applied research in order to allocate resources accordingly. This importance is well illustrated by

the structure of Kajima Corporation, which houses most of its R&D efforts in two different groups – the Technical Research Institute (TRI) and the Advanced Technology Departments that are directly related to different market divisions (refer to Kajima's data set in Appendix B). While the latter group is more oriented towards developing applications in each respective market, the former group focuses more on basic research.[16]

It is evident that the answers to most of the questions above are contingent upon corporate strategy as a whole.

4.2.5 INFORMATION TECHNOLOGY (IT) STRATEGY

In the conceptual model, *IT Strategy* is separated from *Technology Strategy*. Specifically, *IT Strategy* focuses mainly on the use of technology to leverage information to a firm's advantage rather than other types of technology development in general in *Technology Strategy*. This distinction is justified by the fact that information technology has grown into an important market sector and research area by itself since mid-1990s.

Similar to the other fields that get increasing in scope, it is necessary to trim down the "bells and whistles" of IT in the conceptual model. Basically, emphasis is directed towards building a stronger appreciation of how IT can provide an impact on corporate strategy rather than muddling in the technological aspects *per se*. To achieve this, it is firstly essential to grasp a sense of the current state and the role of IT within the construction industry. Appendix E provides a brief overview and discussion on this.

To establish the linkage between IT and corporate strategy, Ross and Rockart's (1999) "IT Infrastructure Pyramid" model is very insightful (Figure 4-4). The model basically suggests that the upper level components are built upon the lower ones, with corporate strategy being the cornerstone of all the others. In Ross and Rockart's opinion, IT-related components (Systems, IT Infrastructure and IT Architecture) should be utilized as an "enabler" to connect the corporate strategy of a firm with its operational processes.

---

[16] This piece of information is gathered from an interview with Koji Kato, an engineer from the Civil Engineering Design Division of Kajima Corporation. Mr. Kato's contribution is gratefully acknowledged.

From the viewpoint of the conceptual model as proposed in this thesis then, *IT Strategy* is a critical field that closely interacts with *Operational Strategy* to shape up part of the overall corporate strategy of the firm.

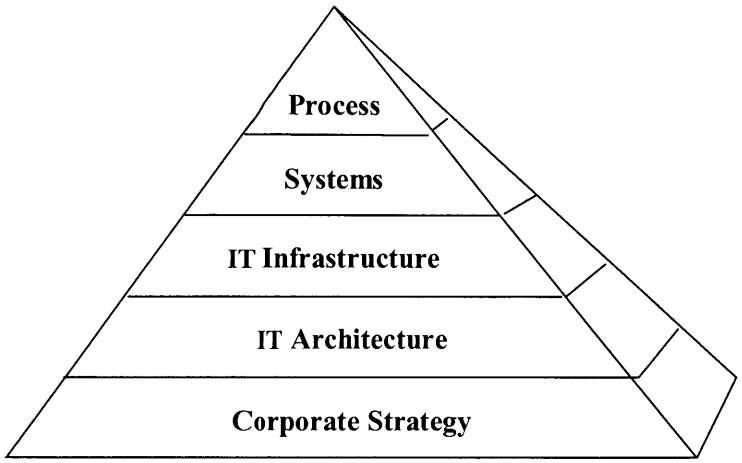


FIGURE 4-4 The IT Infrastructure Pyramid

Incidentally, an "enabler" should not be confused with a "driver" of corporate strategy. From the overview given in Appendix E, it is clear that the current trend of IT investments and implementations within the construction industry appears to follow very fuzzy goals. Too often, participants from the industry (at least during the initial era) investing in IT have forgotten their original identity as firms that provide construction services, thereby putting their core competitive advantages at stake. In most cases, these investments are lacking in terms of establishing linkages between processes and corporate strategy in the long run. True enough, anything that is preceded by an "E-" had stimulated capital infusion especially from venture capitalists during the late 1990's. However, since the 'crash' of technology stocks in May 2001, those days are over. Rationality, once again, has come back to reign.

Similar to the arguments in *Technology Strategy*, the question of outsourcing versus internalization is dependent upon how *IT Strategy* can be managed to link processes with corporate strategy and should be assessed on a case-by-case basis. Since individual firm strategy is (and should be) unique, it is often difficult to manage the development process in collaboration with external parties. Likewise, although

purchasing "off-the-shelf" platforms and systems available in the market would turn out to be a less costly and risky option, these might be found to be too generic in nature if the intention is to utilize IT to support long-term competitive advantages.

4.2.6 HUMAN RESOURCE (HR) STRATEGY

This is a field that constantly encounters 'soft' issues. It should not be confused with the usual strategy of manpower deployment among different sites or resource allocation for different work tasks of a project – these issues are more related to *Operational Strategy*. In essence, *HR Strategy* is more concerned about aspects of managing the organization's human assets. This often turns out to be a daunting task, which requires due consideration of internal and external issues. These issues include, but are not limited to:

(i) Personnel management (e.g., training programs; job rotation among functions and regions);

(ii) Industrial relations (e.g. employment law; union-management relationship; negotiation tactics and strategy);

(iii) Incentives and compensation policies and systems;

(iv) Restructuring concerns (e.g. downsizing)

Simply put, the goal of *HR Strategy* is to have an effective system for obtaining (recruiting), training, mobilizing, and managing the organization's human assets to systematically carry out business operations and new ventures.

4.2.7 MARKETING STRATEGY

As the terminology implies, *Marketing Strategy* requires one to look at the entire marketing mix in light of the strategy of a firm. To certain extent, the conventional "Four P's" concept of Product, Price, Place and Promotion in marketing management is still relevant in every sense, though the change in environment (especially technology and the Internet) has redefined the boundary and meaning of each of these components. With a

tremendous overlap with *Business Strategy*, this field is especially important in designing products that create value and *also* signaling the value of the product or services offered by the firm in order to demand a premium. As Porter (1985) would aptly comment, differentiation is meaningless unless customers are able to perceive the value added in the product to suit their unique needs. To achieve all these, firms need to identify both needs (demand) and resources (supply factors) and choose the most efficient selling formats.

In short, among many others, some common corporate involvement in *Marketing Strategy* includes: umbrella branding and reputation building; logistics issues (thus supply chain management can be perceived as an overlap between *Operational* and *Marketing Strategies*); cross-selling (by using shared sales forces) versus focused promotion strategy; and gathering information about customer needs.

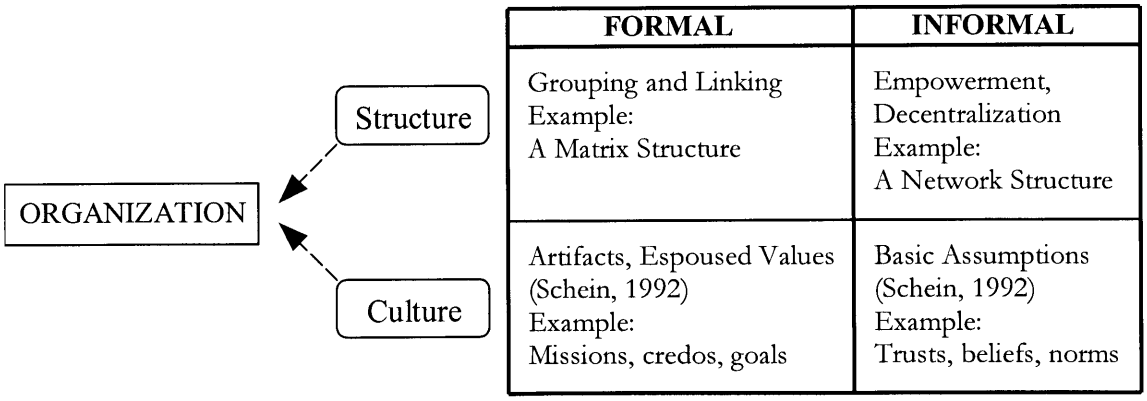
4.3 The Internal Mechanisms of Organization

Similar to the fields of strategy, there are several components that are critical to the functioning of an organization. The few aspects that receive the most attention are organizational structure, corporate culture, organizational development and transformation. All these belong to (or are at least closely related to) the study of organizational behavior, an applied behavioral science that is built upon contributions from disciplines such as psychology, sociology, anthropology and political science (Robbins, 1998). By tracing the roots, it is evident that corporate strategy has some overlapping foundations with the study of organization. As mentioned at the beginning of this chapter, corporate strategy *always* goes parallel with the internal mechanisms of organization – both form the heart and soul of a corporation.

For the purpose of the conceptual model, the internal mechanisms of an organization are confined to only two fundamental and complementary components: organizational structure and corporate culture. Unlike organizational development and transformation, these two mechanisms are the most basic and quintessential mechanisms for an organization to function. In contrast, issues on organizational development and transformation focus more on the element of change over a particular time horizon, rather

than the day-to-day functioning of the organization. Furthermore, change is usually initiated by external environmental forces, and these issues are more appropriately perceived as emerging from firm boundary modification (discussed in Chapter Five). Therefore, organizational development and transformation are more contingent in nature, as opposed to being the basic mechanisms of a firm.

While it may seem intuitive that structure is the formal mechanism of governance and culture is the informal opposite, in reality these two can exist separately in both formal and informal ways. Some examples are given in Figure 4-5 to illustrate how structure and culture can exist in both formal and informal ways. It is also necessary at this point to mention the perceived difference between *HR Strategy* and the two internal mechanisms of organization. Despite the intrinsic links that exist among them, the unit of analysis in *HR Strategy* is mainly the individuals, whereas structure and culture are basically elements capturing group level and organization systems level dynamics.[17] That said, since the behavior of individuals and groups are profoundly affected by the corporate environment that is housing them, it is sometimes difficult to draw an exact line. Conceptually though, the more variables one can identify, the more flexibility and options one would have for strategy formulation.



	FORMAL	INFORMAL
Structure	Grouping and Linking Example: A Matrix Structure	Empowerment, Decentralization Example: A Network Structure
Culture	Artifacts, Espoused Values (Schein, 1992) Example: Missions, credos, goals	Basic Assumptions (Schein, 1992) Example: Trusts, beliefs, norms

FIGURE 4-5 Internal Mechanisms of Organization

[17] Readers can refer to Figure 1-8 in Robbins (1998) for a concrete diagrammatic representation.

4.3.1 FIRM STRUCTURE

Designing and structuring an organization is a complex task. Frameworks on structure as proposed by past researchers are useful in formalizing tasks, grouping members into effective teams, and linking these various processes and teams to produce the final output of a firm. The gaps that exist within the system of formal authority in an organizational structure are often filled by the system of informal and social communication flow.

Structural Configuration	Prime Coordinating Mechanism	Key Part of Organization	Type of Decentralization
Simple Structure	Direct supervision	Strategic apex	Vertical and horizontal centralization
Machine Bureaucracy	Standardization of work processes	Technostructure	Limited horizontal decentralization
Professional Bureaucracy	Standardization of skills	Operating core	Vertical and horizontal decentralization
Divisionalized Form	Standardization of outputs	Middle line	Limited vertical decentralization
Adhocracy	Mutual adjustment	Support staff	Selective decentralization

TABLE 4-1 Mintzberg's Configuration Hypothesis
[Source: Mintzberg (1979)]

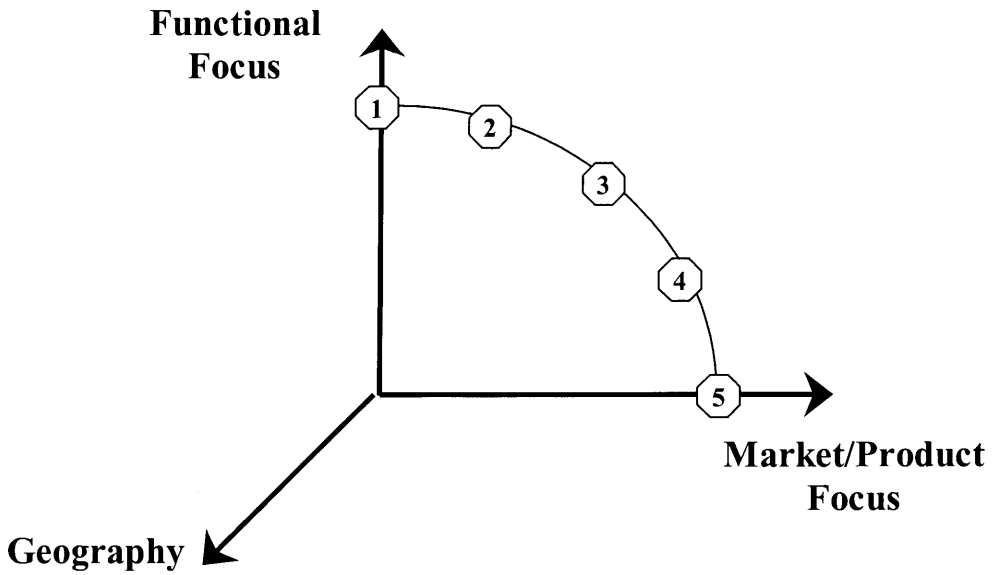
In his "configuration hypothesis", Mintzberg (1979) postulated that effective organizations have to achieve an internal consistency among their design parameters, hence developing a logical configuration of these parameters as presented in Table 4-1. Essentially, Mintzberg proposed that firms exist in one of the forms of structural configurations and adopt the matching primary coordinating mechanism. Firms also choose ways to delegate (or aggregate) decision making authority to some levels, resulting in the distribution (or concentration) of power within certain parts of an organization. Mintzberg's framework is a useful starting point to understand the interplay

between formal and informal structure. As an illustration, one might interpret that "machine bureaucracy" is based more heavily on a formal structure, while the "adhocracy" relies more on an informal structure to accomplish an activity.

However, it is fair to say that large multinational firms in these days need not necessarily fit themselves neatly into all the 'fives' presented above. The informal communication flow that drives an "adhocracy" configuration, for example, might play an important, complementary part even within a "machine bureaucracy" that adopts a strict functional structure. In other words, it is essential for firms that have adopted a primary configuration to look beyond and learn about the coordinating mechanisms that have driven the other configurations into effect. By adopting this mindset, firms would be able to strike a balance between both formal and informal structure and leverage on the relative advantages of both.

Ultimately, it is important to realize that a chosen structure is simply a means to achieve the ends of producing something that is valuable to the customers. The structure hence serves as a bridge to deliver the value created in the first place by adopting some prescribed *Business Strategy*. In the course of settling on a chosen structure to deliver these values, firms typically face various tradeoffs that many researchers have brought out. Figure 4-6 illustrates these tradeoffs by showing a continuum of structures that a firm can adopt, depending on its propensity towards functional focus or market/product focus. For multinational firms, the complexity adds on with a third dimension of geography in the process of developing an organizational structure.

In the firm sample, all of these three forms of structure commonly appear as either the primary or secondary setting. Incidentally, some firms also pursue a fourth dimension of client (not shown in Figure 4-6) nowadays, particularly those that have key accounts or repeated business from a few major clients. The presence and significance of these structural forms is discussed next.



LEGEND : (Definitions of 2, 3, and 4 are drawn from Wheelwright and Clark (1992))

1	**Functional silos**, each with clear defined disciplines such as engineering, marketing, financial planning etc.
2	**"Lightweight" team structure** with liaisons "volunteered" from each functional department to coordinate the workflow in delivering a specific product or executing a certain project.
3	**"Heavyweight" team / matrix structure** with project managers or process owners who have the authority to draw resources from each of the functional departments or coordinate with the functional heads to deliver a specific product or execute a certain project.
4	**Autonomous or "Tiger" team** with individuals from the different functional departments formally assigned and dedicated to accomplish a specific project that is usually temporary in nature.
5	**Process-based setting or Product teams**, which, unlike the "tiger" team, is more permanent in nature and emphasizes on the delivery process of a particular product. Thus whereas the functional silos leverage the vertical depth of functional expertise, the process-based setting counts on a seamless horizontal flow of making the product. The product teams have a cross-functional mix, and many have argued that this is more amenable to product innovation.

FIGURE 4-6 The Dilemma of Structural Configuration

4.3.1.1 Outlook of Structure for the Firm Sample

Table 4-2(a) to 4-2(c) (on page 121 through 123) summarize the information related to structure that is gathered from the analytical template of the firms. Since information is mostly available at the corporate level, the focus is limited to the aggregate setting, although it is conjectured that microstructures would exist within these larger settings.

For half of the firms, a single primary structural form can be observed. This is specified explicitly in the tables. Occasionally, a 'special' division, adopting a setting other than the primary one, also exists (as in the case of Foster Wheeler). Such divisions are marked by the symbol '✓'. For the other half of the firms (especially the Japanese firms), a multidimensional or hybrid alignment is more prominent. All dimensions are perceived as being given more or less equal weighting, and thus all of them are denoted by the symbol '✓'. Further clarification is given under the "Comments" column.

The outlook given in Table 4-2(a) to 4-2(c) is interesting. Firstly, the earlier comment on the fourth dimension centering upon client can be observed in firms such as Fluor, McDermott and WGI, which have indeed set up separate divisions to handle projects associated with specific clients. Such clients include the Department of Energy (DOE) and the Department of Defense (DOD), for which Fluor Corporation has set up its Government Services Operating Company; McDermott with its Babcock & Wilcox Government Group; and WGI with its Morrison Knudsen and Westinghouse Government Services companies. In general, the operations of divisions dedicated to serve specific clients can range from the provision of liaison interface to fully functional capabilities in seeing through the project from inception till completion.

In broad terms, it also seems that firms from each region tend to adopt a particular dominant form of structure. All the U.S. firms in the sample are prone to adopt market/product divisions as their primary setting. On the other hand, the Japanese firms seem to have inclination towards a multidimensional or hybrid setting. The outlook for the European firms is probably mixed, although market/product focus is slightly more prominent.

Intuitively, this outlook could be shaped by a complex interaction of various systemic factors (historical, cultural etc.) consistent with the Systemic school of thoughts (recall Chapter 2). The following comments are nonetheless plausible explanations:

(1) The fact that the U.S. has a larger domestic market means that venturing overseas is an option rather than a must. Foreign subsidiaries are probably viewed as appendages, and companies are more inclined to set up structure that centers upon market and products.

(2) Although many European firms have far smaller domestic markets as compared to the U.S., the regional effect of the European Union market has probably influenced the adoption of the market/product setting as the primary structural setting.

(3) Two exceptions nonetheless stand out among the European firm sample – Philipp Holzmann and Skanska, both of which seem to place a heavy emphasis on geographical setting as the first layer. A more detailed study reveals some specific reasons. For Philipp Holzmann, the firm would have liked to separate the U.S. operations from the domestic ones, since the market outlook in these two countries differs vastly in the past few years. The fact that Philipp Holzmann was able to grow its U.S. businesses despite a slump in the German market is mostly owed to the natural isolation effect of the geographical setting. On the other hand, a geographical setting is also amenable to Skanska's acquisition strategy and venture into new markets. Effectively, it implies "grab it first, integrate later".

(4) The settlement on a hybrid structure could be due to a constant pull of the three different dimensions. On the functional side, the Japanese firms spend the most percentage of their revenues on research and development as compared to the U.S. and European counterparts. This naturally sets up a functional setting to isolate the department. Emphasis on technical knowledge at large has also allocated much power to functional managers that erect invisible walls among the 'silos'. On geography, many Japanese

contractors have ventured into the South East Asia more than three decades ago. The current slump in the domestic market can only reinforce the importance and autonomy of overseas operations. Lastly, with a scale of operation that is essentially the largest among all construction firms, these firms have traditionally operated in different markets, serving their role as part of the *keiretsu* family. The improved time-to-market and product focus given by product divisions are certainly attractive features. In short, most Japanese seek to balance the need in these three dimensions in their organizational structure.

Just as there is no optimal configuration among the strategic fields, a perfect organizational structure is illusive. Some contemporary practitioners praise product teams for their great responsiveness to market condition and customers' needs. It is also true that the structure of product teams (or at the aggregate level, a division with multiple product teams within a single market segment) lends itself to profit & loss (P&L) performance evaluation and accountability – something that is harder to achieve with a functional setting. On the other hand, bureaucracy embedded within a functional hierarchical structure does serve its purpose of increasing control over specific resources (especially technical secrecy), and a functional setting is more amenable to the development of technical expertise within a specific discipline.

Similarly, having peripheral geographical units poses both advantages and disadvantages. In terms of benefits, geographical units are relatively easier to be disposed or downsized when market turns sour. Exiting from a certain geographical market is potentially less chronic, less painful and even less costly than pulling out from a market segment altogether. Furthermore, it is also easier to consolidate a few geographical operations into one, as opposed to integrating product and functional divisions. Conversely, the disadvantage of a geographical setting obviously lies in its failure to pool knowledge and expertise under one roof in order to create innovative solutions for complex problems.

Thus, depending on the context of corporate strategy, it is hard to conclude which structural form is more superior. The study and categorization of structural forms adopted

by firms in the sample confirms the point that a single prominent, ideal structure probably does not exist. Firms have adopted different forms of structure commensurate with their corporate strategy.

	Market/Product	Geographical	Functional	Comments
Fluor	Primary			Client setting exists for to serve DOE, DOD, Procter & Gamble.
Stone & Webster	Primary			
Raytheon Company	Primary			
Foster Wheeler	Primary		✓	Functional setting exists separately for the Global Project Finance Group
McDermott	Primary			Client setting exists for to serve DOE, U.S. Naval Reactors Program.
Halliburton	Primary			
Washington Group	Primary			Client setting exists for serve DOE, DOD.
Jacobs				Information available is not conclusive.

TABLE 4-2(a) Structural Forms adopted by U.S. Firm Sample

	Market / Product	Geographical	Functional	Comments
Kajima	✓	✓	✓	- Market segments focusing on Building Engineering; Civil Engineering; Environmental Engineering; Maintenance Services. - Geographical divisions also exist: Kajima USA Inc.; Kajima Europe B.V.; Kajima Overseas Asia Pte. Ltd.; International Division that oversees the Middle East and Africa market; and of course the centralized headquarters in Japan for domestic market. - Functional setting retained for R&D; Engineering Design bases.
Obayashi	✓		✓	- Market segments focusing on Building Construction; Civil Engineering; Nuclear Facilities. - Functional setting retained for Arch. &Eng. Design; Technology.
JGC	✓	✓	Primary	- Primary functional setting for Project Systems; Engineering; Procurement; Sales and Project Management. - Market (Hydrocarbon; General Industries) and geographical substructure mostly housed under these functional departments.
Penta-Ocean	✓	✓	✓	More like a network of functional divisions operating under the umbrella of two main markets: Civil Engineering and Architectural (see template of Penta-Ocean). International divisions exist for some functions.
Kumagai Gumi	✓		✓	
Chiyoda	Primary			
Nishimatsu				Information is not conclusive.
Toyo Engineering				Information is not conclusive.

TABLE 4-2(b) Structural Forms adopted by Japanese Firm Sample

	Market/Product	Geographical	Functional	Comments
Groupe GTM	Primary			
Vinci	Primary			
Philipp Holzmann	✓	Primary		- Geographical setting adopted for domestic market (Regional Divisions: North, East, South, West, Central) as well as to distinguish overseas operations (PH USA Inc.; European businesses conducted by subsidiaries in each country; PH International Ltd. conduct all the others) - Market setting for more specialized sectors (prefabricated structures and structural steel; transportation systems and materials; infrastructure project development; facilities management.
Technip	Primary			
AMEC	Primary			
Bouygues	Primary			
Skanska	✓	Primary		Except for project development, real estate, facilities management and telecom networks, the operations of various civil engineering market sectors (residential, commercial, roadworks, underground construction etc.) are housed under three primary geographical divisions: Sweden, Europe, USA.
Kvaerner	Primary			

TABLE 4-2(c) Structural Forms adopted by European Firm Sample

4.3.2 CORPORATE CULTURE

Whereas structure is important in defining the individual responsibilities within the process of workflow, a congruent culture will ensure that these responsibilities are carried out with minimum resistance by individuals. More importantly, strong culture dictates the way that things should be done and creates expectations shared by group members, which are not outlined explicitly by a formal structure. In an attempt to clarify what "culture" really means, O'Reilly (1989) views culture as social control systems and normative order. The social control systems represent the common agreements that exist among people about what constitutes appropriate attitude and behavior, and the norms set the socially created standards that help the interpretation and evaluation of events governed by such control systems.

On top of the daily beliefs or norms held by individuals at all levels of the organization, top management in particular is ordained to build the vision that shapes the direction of the firm. Thus the corporate culture, starting from this higher level, is often guided by the mission and philosophy of the firm, and addresses the question of why the firm exists in the first place. This is true especially when the founding member of a firm still exerts tremendous influence on the culture. In many ways, the actions of top management highly dictate the fortune of keeping the original culture alive through policies on succession of top executives (e.g. promoted from within versus "injecting new blood" from external) and setting themselves as role models.

On the relationship between culture and strategy, an interesting question that naturally evolves out of the conventional wisdom is whether strong organizational culture is *always* a functionally positive phenomenon. Obviously, the now abundant research findings on organization transformation and change have shed new light on this question. Despite the many positive enhancements that a strong culture can bear on strategy formulation and implementation, there are at least three liability aspects of a strong culture: (1) barrier to change; (2) barrier to diversity; and (3) barrier to mergers and acquisitions (Robbins, 1998). These could lead to negative outcomes such as groupthink in strategy formulation and rigid response in reacting to a changing external environment. Therefore, although imposing changes in corporate culture is notoriously difficult,

chronic and full of resistance within the organization, sometimes such changes are necessary for long-run benefit and survival. Some firms even went further to create crises in order to stimulate cultural change in their organization (Dumaine, 1993).

4.4 Zooming Out to the Big Picture

At this point, the primary building blocks of corporate strategy and organization have been laid out. A strategist would hope to make the best decision in choosing a proper configuration of these building blocks that would enable his or her firm to compete successfully. Nonetheless, although firms stand as the relevant units of analysis, they do not compete in isolation. During the course of strategy formulation, the strategist will soon find that in order to define input variables, evaluate alternative configurations and arrive at a final execution plan, he or she has to define the boundary of the firm subjected to the dynamic forces imposed by the larger industrial and external environment. This is depicted in Figure 4-7.

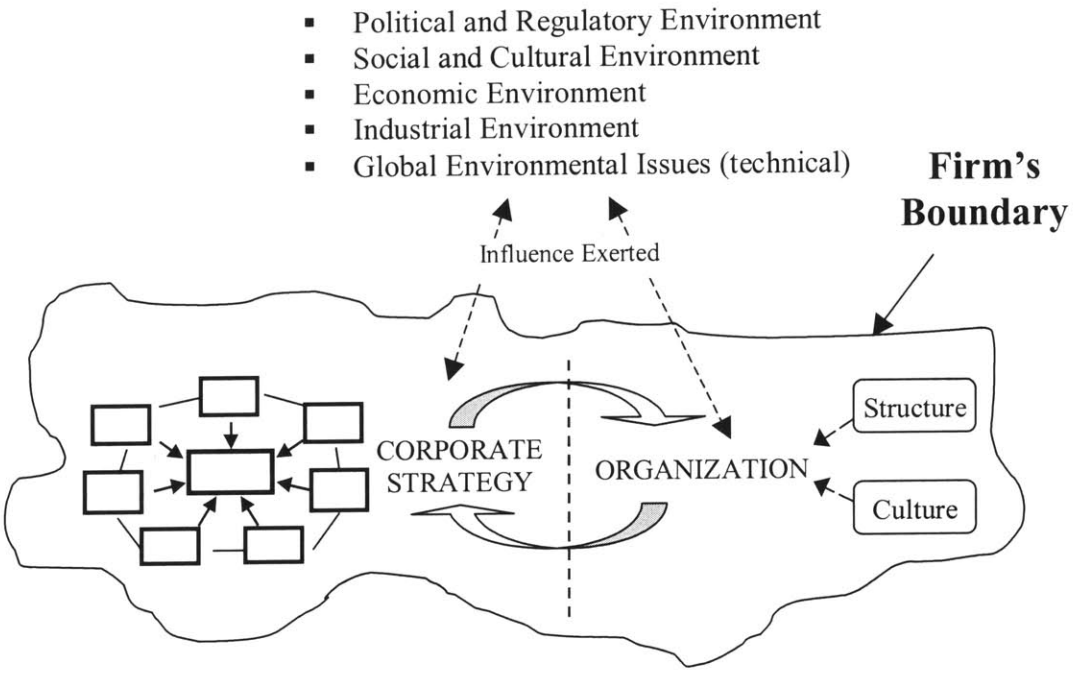


Figure 4-7 The Big Picture of the External Environment, Corporate Strategy and Organization

While the broad definitions of political, social and economical environment are generally clear, one should distinguish the differences between external cultural environment and internal corporate culture. The external cultural environment, together with political and social environment, is taken as *a priori* and is usually beyond the firm's ability to change. On the other hand, internal corporate culture can be cultivated and aligned with the kind of environment that a leader envisions his/her organization should have. As such, corporate culture should not be taken easily as a predefined condition.

Lastly, the industrial environment is closely related to *Business Strategy* as discussed previously. In fact, Porter's "Five Forces" model is a good starting point to paint the picture for the industry or market segment chosen.

Highly influenced by these external environmental factors, decisions made to define boundary conditions are contingent upon concurrent analysis of corporate strategy with due consideration of the internal mechanisms of organization. Also, the wavy line shown in Figure 4-7 represents the irregularity of firm boundary to be defined. It implies that the extent to which a firm chooses to enlarge or shrink its boundary will correspondingly alter the amount of influence exerted by these environmental factors. Among others, some important factors to be considered in determining the boundary condition of firms are as follows:

- Types/number of industries and market segments to compete (e.g. diversification vs. focus)
- Types/number of roles to engage along the value system in the industry or market segment (e.g. forward and backward integration)
- Mode of expansion (e.g. full integration, acquisition, merger, joint venture or alliance)
- Geographical expansion (e.g. local, regional or global)

Thus, firms that choose to confine their boundaries to a local, focus, single niche market, for example, will have less concern about the global economic and political conditions.

Due its large implication on corporate strategy, an entire chapter is devoted to further discussion of these boundary issues, thus representing a key branch of the conceptual model.

4.5 Implications of the Conceptual Model

4.5.1 Strategic Fields, Structure and Culture are Variables

The external environmental factors shown in Figure 4-7 are not static but instead becoming increasingly tumultuous and dynamic in the modern days. Ironically, as a usual way of life, firms often have to treat these factors as given and find ways to maneuver around obstacles. This indirectly causes the breakdown of closed-form models, as they are based on fixed or slow-to-change boundary conditions, which in turn result in a rigid way of strategic planning.

The findings of the previous chapter also underpin the above statement. In view of the fact that firms fail or succeed due to different factors, the development of an open, generic conceptual model is necessary, which has been illustrated in this chapter. As a corollary to the model then, it is important to treat the seven strategic fields and the two internal mechanisms of organization as variable building blocks of corporate strategy. Effectively, these variables create the 'fluidity' of the firm boundary that is shown in Figure 4-7. "Variables" often imply built-in flexibility and dynamism, and this is essential to counteract with tumultuous and ever changing external environmental pressure.

The second corollary drawn from the model is that firms have to continually reassess their corporate strategy and organizational configuration against the external environmental factors in the light of this open concept. In other words, they have to ensure a proper fit among corporate strategy, organization and the external environment. While a frequent change in strategy and organization will be disruptive, performing such a check in a regular manner will enable a firm to have great foresight to plan before a crisis dawns.

To evaluate the sound logic of these two corollaries, consider the scenario below extracted from another industry (adapted from the *Harvard Business School Case* #9-399-102). The scenario appropriately demonstrates the need to treat structure and culture as variables.

In the consumer electronics industry, both Philips and Matsushita had been experiencing tremendous difficulty to strike the right balance between global integration and local responsiveness. Historically, Philips was one of the first firms to globalize. With its expansion abroad, individual "national organizations" were established on a geographical basis. Due to trade protectionism and the event of World War II, communication between the headquarters and the national organizations was hindered. Over time, national organizations had gained ground and power, with headquarters having minimal control over them. Effectively, Philips has evolved into a highly decentralized structure, and was thus strong in local responsiveness but weak in global integration. As a result of this structural development, corporate culture was also embodied with an autonomous mindset. Individual groups and divisions, each having their own agenda, did not border to perceive the world market as a whole for cross-border collaboration within the corporation.

The story for Matsushita is more or less the opposite. Matsushita was a latecomer at globalization. It had a much larger home market than Philips, and one that grew very rapidly in the postwar period. Thus traditionally, personnel, technology, material, and capital was mostly localized and derived from domestic resources. Production was dispersed only to certain closed markets abroad. Effectively, Matsushita had developed a highly centralized structure, and was strong in global integration but weak in local responsiveness in individual geographical markets overseas. On the part of culture, the overseas operations were over-reliant on Japan for both production and innovations.

For firms like Philips and Matsushita that have a long history, conventional settings of structure and culture "inherited" from the old days frequently develop into an 'administrative heritage' (Bartlett and Ghoshal, 1998). It took Philips 30 years (and many changes in CEOs) to "tilt the matrix" from national organizations towards global product divisions, and it took Matsushita several years to begin to shift real power and autonomy

to the foreign subsidiaries so that they would act more responsively towards the local markets. Ironically, their administrative heritage, which had once served as core *competency* that contributed towards the firms' past success, became core *rigidity* when market situations and operating environment called for a change.

Evidence as such demonstrates that changing the structure and culture is a daunting task. More importantly, the evidence also points out that taking no challenge to change could be more disastrous in the long run. This constitutes the reason why both Philips and Matsushita, despite the painful transformation process, insisted on the move in order to rejuvenate their competitive strengths in the new market environment. Strategic fields, structure and culture should not be taken as fixed conditions simply because they are hard to change or determine. All of them serve as essential levers that drive corporate strategy. When a firm grows along the evolutionary path, operating environment typically changes and past strategy, structure and culture are rendered inappropriate. Incidentally, this is also one explanation for the increasing attention being placed on the area of organizational transformation.

4.5.2 INTERACTION AMONG VARIABLES

In his description of the value activities in the value chain, Porter (1985) placed significant emphasis on identifying the linkages among these value activities:

> *Linkages are relationships between the way one value activity is performed and the cost or performance of another. Linkages can lead to competitive advantages in two ways: optimization and coordination.*

The concept on linkages is a noble one, though the context of linkages that exists here among the strategic fields, structure and culture is slightly different from that that exists among value activities. While optimization of value activities may be feasible, the interaction among the strategic fields and the internal mechanisms is more fluid, thus an optimal configuration may not exist. Although optimization is a separate matter, examination of these linkages remains the key towards a successful corporate strategy with the following proposition:

Stated formally, strategic actions that are derived from the interactions between two or more strategic fields are more powerful in shaping a sustainable and successful corporate strategy than those that are confined, both in terms of origination and impact, within only one single field.

These can be referred to as the "higher order" effects, just as a differential equation will capture more dynamic effect by incorporating higher order derivatives and more independent variables to provide a better picture in solving an engineering problem.

The concept of treating those seven strategic fields and the two internal mechanisms as dynamic, interdependent variables is fundamentally important.

From previous discussion of individual strategic fields, it is obvious that the strategic fields have overlaps among one another functionally. In many manufacturing sectors, the distribution function has much to do with *Marketing Strategy* as well as *Operational Strategy*. That said, *overlaps* are fundamentally different from *interactions*, which form the gist of the proposed model. Overlap effectively implies duplication. On the other hand, interaction represents more of a phenomenal function that derives a meaningful output, which in this case is the overall corporate strategy. [18]

4.5.2.1 An Example of Interaction among IT, Financial, Operational Strategies and Organizational Structure

This example serves to illustrate how the study of interaction between two or more strategic fields can provide valuable insights towards constructing corporate strategy as a whole. It also illustrates the linkages between corporate strategy and organization, and demonstrates the importance of maintaining consistency among the various components. The four components used for illustration (three strategic fields and one internal mechanism) are arranged under Figure 4-8.

---

[18] Those with a mathematical bend may find the following analogy illustrative:

Overlap between A and B:	$(A \cap B)$
Interaction as a function of A & B to derive C:	$C = f(A,B)$

Characteristics of Information	Operational Control	Management Control	Strategic Planning
Source	Largely internal	→	External
Scope	Well defined, narrow	→	Very wide
Level of Aggregation	Detailed	→	Aggregate
Time Horizon	Historical	→	Future
Currency	Highly current	→	Quite old
Required Accuracy	High	→	Low
Frequency of Use	Very frequent	→	Infrequent
Relevant Partsof the Organizational Structure (Definitions following Mintzberg, 1979)	Operating Core (Site engineers, supervisors)	Middle Line (Regional Managers, Project Managers)	Strategic Apex (Senior Mgmt, Functional V.P.s, Regional Managers)
Relevant Types of Investment Evaluation and Resource Allocation Methods	Linear Programming, Optimization	Decision tree	Real option Portfolio aggregation

FIGURE 4-8 Interaction among *Financial, IT, Operational Strategies* and Organizational Structure

The top half of Figure 4-8 summarizes some general observations about the categories of management activities and the characteristics of information that management requires for decision-making purposes. The three categories of management activities – operational control, management control and strategic planning, have largely differing nature and follow separate procedures. The configuration adopted might be derived from a specific *Operational Strategy* of the firm. On the other hand, the characteristics of information basically falls under the regime of *IT Strategy*, since managers have to decide on the type of data to collect, the way to build the database system, the way to classify these data, and the type of information to rely on as relevant input for decision-making purposes (Gorry and Scott Morton, 1971).

Likewise, the bottom half of the diagram shows some common analytical and quantitative methods that managers use for resource allocation and investment evaluation, thus this is related to *Financial Strategy* (recall that the scope of *Financial Strategy* can be broadly classified into investment decisions and financing decisions). What seems striking is the way that the characteristics of information fit with the nature of the input factors required in these analytical models. Take the real option approach for example, which is matched with the various characteristics of information under the "Strategic Planning" column (i.e. external source, very wide scope, aggregated level, predicting on future trends, and low requirement of accuracy). Also assume that the real option approach is applied to evaluate a toll road project.

Given this scenario, one can treat the fluctuation of traffic volume over time to be analogous to the 'volatility' parameter of the underlying asset in the real option model. It is a well-known fact that quantifying 'volatility' with a high accuracy is a difficult task, and this is especially true in a toll road project for traffic volume forecast. Nonetheless, if the matching characteristics of information as suggested by Gorry and Scott Morton is plausible, then the level of data accuracy for applying the real option approach (in this case for the purpose of strategic planning) does not necessarily have to be high!

This makes intuitive sense for the following reasons. First, strategic planning, unlike operational control, deals with an extremely uncertain external environment. If things are going to change tremendously, the accuracy of data from the past is less of a concern but the use of an appropriate evaluation model is critical. Second, as time goes by, some of these uncertainties or volatility will unfold and estimates can be refined on an ongoing basis. In the case of strategic planning, this refinement process is feasible and acceptable since the task at hand is dealing with a very wide scope of issues that would provide sufficient room to maneuver and adjust over the long term.

On the other hand, historical data on operational performance is often available from operational controlling functions. Examples of such kind of data include the number of man-hours required for concreting, for bricklaying and machine hours utilized for a particular work task. The characteristics of such data fit nicely with the use of

methodologies such as linear programming and system optimization, which are powerful resource allocation tools derived from the field of operational research.

Lastly, the middle horizontal portion of the picture presents the relevant parts of the organizational structure that are likely to use the corresponding categories of information and investment evaluation or resource allocation tools. Again, the matching makes intuitive sense, as verified by the type of personnel from each group and the nature of day-to-day decisions that they make.

In short, there is a fit among *IT, Financial, Operational Strategies* and organizational structure. By adopting the mindset that is embedded in the conceptual framework, the powerful interactions among these building blocks of corporate strategy can be captured in a more explicit manner.

CHAPTER FIVE

Boundary – the Alchemy behind a Simple Definition

"Every piece of business strategy acquires its true significance only against the background of that process and within the situation created by it."

- Joseph A. Schumpeter (1976)

5.1 Introduction

The past few decades had witnessed the production of a plethora of articles and literatures written on globalization, diversification, integration and topics of similar nature. The common denominator among these issues is none other than the boundary of a firm. Boundary is ubiquitous. It is a simple word to start with, but often a difficult concept to manage pragmatically.

Being such a powerful concept, a separate discussion is warranted for issues related to firm boundary. This chapter thus extends the conceptual model by presenting and categorizing principles dealing with boundary issues. These principles are supported and drawn from the study of the U.S. firm sample. Primarily active in the power and energy sector, these firms also compete in the engineering and construction industry in one way or another. The industry value system thus serves as a good starting point to analyze the actions of the different parties when reacting to boundary changes.

Since each firm occupies a different space within the value system, each of them deals differently with the boundary issues confronted. These differences provide great insights and facilitate the comparison of the strategic intentions behind the chosen postures. While some actions initiated by these firms are legitimate, others are grown merely out of unjustified desire to build larger empires.

The derived principles are found to complement the basic conceptual model that is proposed in the previous chapter. The chapter finally closes with a demonstration of the intimate relationship between corporate strategy, organization, boundary and the environment, thus completing the theory and intuition behind Figure 4-7.

5.1.1 Definition of Firm Boundary

In the context of the model depicted in Figure 4-7, firm boundary is defined as the interface between those activities that a firm directly manages and the external environment that it typically has no direct control. Arguably, it is difficult to draw an exact line to divide the subsets that lie within or beyond the firm boundary. In most cases, the situation is further complicated by the subtle difference between direct *control* and

indirect *influence* that a firm can sometimes exert on external environmental conditions. For example, although a firm has no direct control over government policies, it can exert influence by joining factions that lobby for an outcome in line with the interests of a firm (Lowi, 1979). In other cases, a firm might have so much bargaining power over its allies that it effectively controls most decisions made within those firms.

In short, firm's boundary is a fluid concept. For the purpose of this research, the following point is made to minimize the disparities among different views – the ultimate "shape" of a firm boundary has to be defined in a way that will be consistent and meaningful for strategic planning and management purposes. Take the previous example of the firm that has a lot of bargaining power over its allies. In this case, if management is confident that they can persuade (or even dictate) their allies to move in the direction demanded by a new strategy, these allies should logically fall within the firm boundary for strategic planning purposes.

5.2 Why Boundary Aspects are Important

In any exercise that deals with strategy, boundary aspects cannot be ignored due to three major reasons.

First, although a firm may choose to optimize its performance to suit a current set of operating conditions, the environment at large is dynamic in nature. Hence, boundary conditions are not fixed forever, and changes over time would render a previously determined strategy irrelevant or questionable. A formula for success today typically does not guarantee similar invincibility in the coming future.

Second, even when the operating environment remains largely stagnant at one point, the competitive landscape may still be changing as a result of some improvements made by a firm's competitor. When market reacts to such improvements and demand starts shifting away from the complacent firm, boundary will in turn change to an unfavorable fashion against the firm concerned, thereby calling for a renewed strategy to reinstate its competitiveness. The morale is simple: the wave of competition will push those who remain stagnant backwards.

The third reason stems from a natural phenomenon. As firms develop, they encounter stages of evolution and revolution (Greiner, 1998). During such stages of growth and crisis, firms would have to constantly reassess the appropriateness of previous corporate strategy and practices in view of the new boundary that will be encountered as a condition to grow. Thus, contrary to the preceding first and second factors concerning changes that are caused by the external environment, here the need to assess boundary issues is initiated by the internal growth of the firm.

To illustrate the changing nature of boundary and its importance, consider the operations of marine construction services of McDermott, which primarily functions in upstream exploration and production activities in the oil and gas industry. The level of activity in exploration and production depends on the amount of capital expenditures that clients – mainly the oil and gas companies, spend in a particular year. These expenditures in turn are influenced by the selling price of oil and gas along with the cost of production and delivery, the terms and conditions of offshore leases, the discovery rates of new reserves offshore and the ability of the oil and gas industry to raise capital in the financial market. Adding to these uncertainties are the local and international political and economic conditions, with various extent of governmental influence. A slight change in any one of the many factors may be amplified along the line, creating both temporary and permanent changes to the boundary of McDermott's marine construction services.

5.3 The Different Perspectives on Boundary

It is interesting to note that at least four main disciplines – economics, finance, law and strategy, view the very same issue of firm boundary from different angles. These views, however, are not mutually exclusive. In fact, each stream adds valuable substance to the knowledge field that contains boundary.

In economics, the issue of firm boundary can be traced back to 1937 when Ronald Coase, in his famous article entitled "The Nature of the Firm", first posed what initially seemed to be an innocuous question: "Why do firms exist?" It sparked off a quiet revolution in economic theory, and for decades economists have formulated theories that

centered on the issue of transaction costs of using pricing mechanism in the general market. Not surprising, research efforts naturally evolved to those related issues of vertical integration, strategic alliances and business groups such as the *keiretsu* in Japan. The central tenet lies on the fundamental choice between internalizing certain functions within the firm and purchasing required goods and services from the general market at some level of transaction costs. The transaction cost approach has also been applied by Williamson (1975, 1979) and Eccles (1981) to support the theoretical existence of the 'quasi-firm' and subcontracting practices in the construction industry.

Due to the tremendous amount of hostile takeovers, leveraged buyouts (LBO) and management buyouts (MBO) in the 1980s, mergers and acquisitions have become a major topic of interest within the finance profession. Valuation of targeted companies, bidding and defensive strategies are the main areas of focus. Since the focus is mainly placed on 'deal making' and actions are mostly represented by numbers and currencies, it is not immediately obvious that these are very much related to boundary issues as well. For example, valuation techniques often call for a forecast of the cash flow generated by the target or the combined entity. Forecasting these cash flows is very much an issue of boundary assessment especially when synergy or operational efficiencies is sought.

Liabilities and taxation are two areas that are commonly covered in business law. When a sole proprietor seeks to shelter his or her personal assets from the potential claims of lawsuits arising from the normal course of business, he or she can choose to form a separate legal entity by incorporating the business. Obviously, the entrepreneur now faces double taxation at both corporate and personal level. Limited liability and taxation therefore forms the fundamental tradeoff that sometimes lies in the way of boundary expansion. For example, a firm that expands its boundary into new markets may want to seek for legal separation between the new operation and the original company. Such decisions are often relevant to the construction industry when claims filed on lawsuits are common. Babcock and Wilcox, a subsidiary of McDermott, Inc. that is active in the power industry, filed for bankruptcy on February 22, 2000 due to extensive

asbestosis claims. The legal undertakings, nonetheless, did not directly affect other operations of McDermott such as marine construction services.[19]

Last, but not least, is the study of boundary from the perspective of strategy. The discussion of boundary issues in this chapter mainly falls into this category. From the strategic standpoint, boundary modification is usually initiated with intentions that include an increase in market share (either in existing or new markets) or enhanced market power of a firm. These issues are examined in detail in the remaining sections.

5.4 Three Dimensions of Boundary Modification

There are three primary dimensions along which firms can modify their existing boundary: geographical expansion; expansion in the market segments served; and skill and knowledge enhancement.

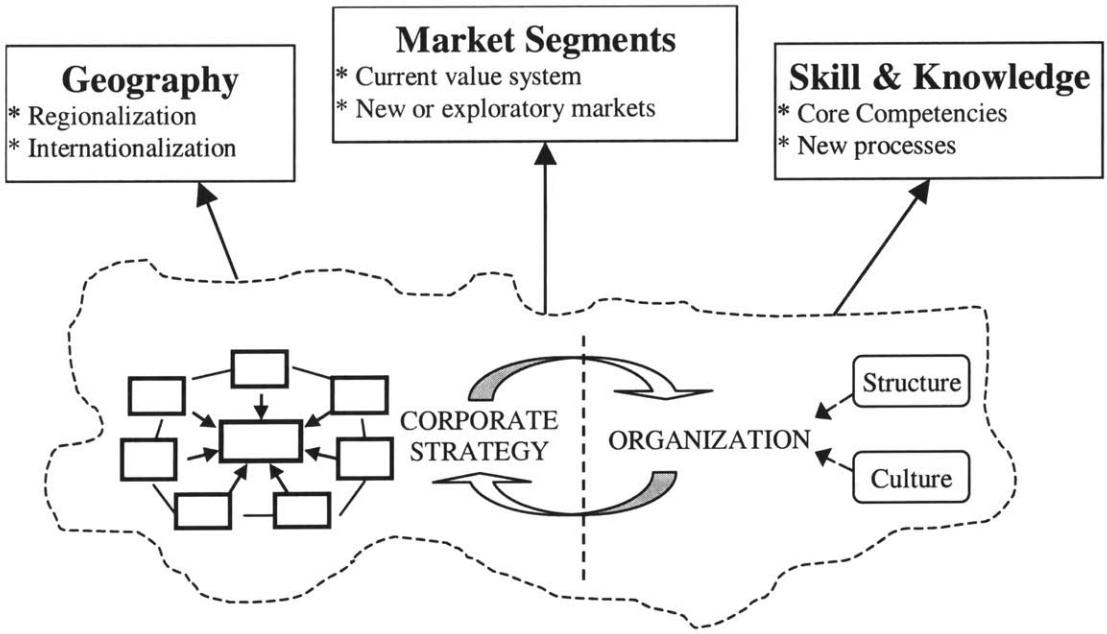


FIGURE 5-1 Three Dimensions of Boundary Modification

[19] In this case though, the parent company may still be affected due to its exposure as a guarantor of outstanding letters of credit and other indemnification obligations. Furthermore, firms are also subjected to other types of indirect costs of financial distress (Brealey and Myers, 1996).

5.4.1 GEOGRAPHY

When a firm expands its operation into other regions within a nation or the international market, it is said to be pursuing the geographical dimension of boundary modification. In general, the motivation of such pursuits can be classified into two main categories, namely, the market-seeking motive and the resource-seeking motive.

When the intention is that of market-seeking, the firm attempts to capture additional sales volume by utilizing its current expertise and resources to execute projects in the new regions. Unlike other product-oriented industries (such as consumer goods), which can typically achieve some economies of scale with a higher utilization level of the existing plant, most construction firms are not equipped with such advantages. Largely attributed to the business nature, construction firms have limited ground to exploit operating leverage and generally possess a lower ratio of fixed-to-total assets. Furthermore, construction projects are localized in nature and do not come in the form of a continuous stream that allows for production optimization.

The resource-seeking motive has been a common strategy for centuries. Firms that originate from a nation with high labor and material costs often seek to transfer some of their operations to locations that are endowed with comparative advantages in these input factors or other natural resources. However, for the same reasons stated that dampen the benefits of the market-seeking motive, even cheaper resources found are usually difficult to be transferred to a localized project site in a cost-effective manner.

Consequently, compared to most other industries, the geographical dimension of expansion brings a relatively higher level of risk to the construction business. A practical example is given by Stone & Webster's liquidity crisis (and subsequent bankruptcy) that was initiated by losses suffered in a few international projects (*Stone & Webster Annual Report*, 1998). However, if a firm could potentially capture benefits that would be more than adequate to compensate for the initial risk of geographical expansion, it might become justifiable for the firm to take the risk. By utilizing its international presence and building relationships with many suppliers, for example, Foster Wheeler subsequently gains preferential access to worldwide procurement sources, thereby allowing it to obtain optimum conditions of price and delivery (Foster Wheeler Annual Report, 1997). With

such a network in place, the risk of further geographical expansion would also be minimized. Thus, what initially seemed to be a threat was turned into a competitive advantage that others find it hard to imitate.

5.4.2 MARKET SEGMENTS

Expansion in targeted market segments by the firm is conventionally classified as either horizontal diversification or vertical integration.[20] Unfortunately, this classification is not sufficiently precise for the purpose of formulating strategy. In the past few decades, the outlook of industrial dynamics has evolved into a new setting which renders terms such as "diversification" and "integration" potentially misleading. For example, firms can be innovative in ways to transfer their original expertise in one market to a new market – an act that would be classified as "diversification" in a conventional sense, but by no means as "disconnected" as it is sometimes perceived to be. Similarly, the meaning of "integration" becomes blurred when alternative ties like business groups and strategic alliances are ubiquitous these days to virtually integrate their operations along a value system.

Due to the vagueness of the terminology, a more meaningful way to consider boundary modification along the market segment dimension is by adopting Porter's (1985) value system concept. Focus should be placed on the roles that are currently being occupied within the value system of the industry served. By mapping out those activities that firms currently engage in the value system, the boundary forces confronting the firms become more explicit, which provides a huge advantage in studying boundary modification. Alternatively, in the process of transferring expertise to another industry, firms can immediately examine the variation in boundary forces by comparing the two different value systems and analyzing the bargaining power of downstream and upstream players from the new market segments.

---

[20] Boundary modification along the dimension of market segments should not be confused with the "market-seeking" motive that has been discussed previously under geographical expansion. The former involves expansion into segments that are not currently served within a value system or ventures in new markets altogether. The latter merely pursues geographical expansion while staying within the same segments.

In short, the following classification of market segment expansion provides far more intuition:

- Engaging in additional roles within an existing value system by venturing upstream/downstream;
- Exploring new market segments or value systems in which the firm currently does not play a role.

5.4.3 SKILL AND KNOWLEDGE ENHANCEMENT

This last dimension of boundary modification may seem a little abstract at first, but nonetheless becomes increasingly distinctive in the field of corporate strategy. The prominence of the core competency theory by Hamel and Prahalad (1994) augments the importance of this dimension. It entails acquisition of new functional or management skills and knowledge that would add value to existing activities of a firm. This can be achieved either through direct acquisition of another firm, external contracting, or internal accumulation of the desired skills.

A good illustration comes from the study of Halliburton. The company executes many acquisitions and alliance formation that are geared towards knowledge expansion as opposed to market expansion. These include:

- A multi-year agreement with BP Amoco to standardize its drilling, reservoir engineering, geology and geophysics applications;
- Joint forces with SAP Germany to develop a seamless interface that integrates oil and gas production operations, allocation and accounting processes;
- Acquisition of Economic Analysis Systems – the developer of TERAS® which is an industry-leading software for economic analysis, portfolio planning and risk management.

In all cases above, Halliburton extends its skill and knowledge boundary by tapping the intellectual capacity of the counter-parties. Obviously, the mode adopted will

bear different impact on integrating such skill and knowledge with other activities of the firm.

Another example of boundary modification along this dimension is manifested by the birth of the Information Technology era. When IT suddenly erupted into a seemingly quintessential function for firms' operations in the 1990s, firms sought different routes to extend their boundary in order to ride on this new wave of knowledge revolution. In one scenario, Bechtel Group, Inc. made an equity investment in Cephren (now known as Citadon after a merger with Bidcom) as a "non-controlling shareholder". Presumably, the intention is to keep itself abreast on the current technological trend and observes any best practices before implementing a larger strategic move to 'internalize' IT into its business processes. In another contrasting scenario, Halliburton adopts a more tightly-knitted IT strategy through its Landmark division by developing a new technology that extends integration across the entire enterprise. In both cases, the firm boundaries are modified accordingly when their competitive power changes with the new knowledge acquired via direct and indirect pursuits.

5.5 Decision Factors for Boundary Modification

Obviously, the three dimensions of boundary modification are not mutually exclusive. Certain strategic plans may include concurrent modification of firm's boundary along two or three dimensions. In most cases, the extent of boundary modification is determined by five key decision factors:

(a) Clients and customers;

(b) Diversification – core competencies tradeoff, and resource allocation;

(c) Risk profile of business and project portfolios;

(d) Mode of boundary modification;

(e) Options inherent in boundary modification actions.

The purpose of examining these key factors is to decide upon:

- Whether firms should be aggressive in modifying its boundary (the active posture) or simply react to boundary changes initiated by the external environment (the passive posture)
- Why firms should engage in the more risky active posture in certain cases
- In the case of an active posture, which dimension(s) should a firm pursues for boundary modification

In this section, the relevant issues associated with each key factor are described and illustrated with findings that are gathered from the study of the U.S. firm sample.

5.5.1 CLIENTS AND CUSTOMERS

5.5.1.1 From Executing One-Off Projects to Building Long-term Relationships

Pricing or bidding policies sometimes differ depending on the likelihood that the client served would become a repeated customer. For one-off projects, in which a firm is typically dealing with the client for the first time, firms may bid at a higher margin to compensate for the risks associated with the unfamiliar client (such as credit risk, coordination issues, special procedures required by the client). On the other hand, if the firm is more concerned with the long-term to build a relationship with the client so as to secure other benefits, it may be willing to sacrifice current profit margin in order to increase the chances of attracting repeated business from the client.

Other than pricing policies, however, there are important boundary issues to consider in order to ensure repeated business and success in building a long-term relationship with their clients. One consistent finding among the sampled firms is the attempt to set an irreplaceable presence in the client's value chain, and this may take different forms depending on individual firms.

In the case of Fluor Corp., the company has a separate operating company known as PACE, which exclusively provides engineering, procurement and construction (EPC) services to Procter & Gamble (Fluor Corporation Annual Report, 1997). The alliance is

obviously a strategic one from P&G's perspective, since it would enable P&G to utilize Fluor's broad geographic scope and readily expand its production to serve new markets. P&G can therefore meet increased global demand for its product in a shorter time span. With PACE 's operations currently working in seven countries, this initiative has surely demonstrated its scale and has modified Fluor's boundary in terms of operating structure. In fact, using the parlance that is introduced in the previous section, Fluor has effectively extended its boundary along the market segment dimension by melding its services into the global expansion program of P&G. It is hard to imagine if such an action could have been derived from the traditional thinking of vertical integration (a partial integration at best in this case), but it is not difficult to conclude that the power of boundary modification in this case lies on the change in business dynamics that has created a win-win situation for both parties. In exchange for the benefits that the arrangement has given to P&G, Fluor gets repeated business and reduces the fluctuation of its revenue. In fact, Fluor Corporation as a whole is reported to have 80% of its business coming from repeated customers.

Similarly, Foster Wheeler typically maintains long-term relationship with blue-chip firms, with half of its work being accounted for by only 20 worldwide clients. It locks in long-term relationship by tailoring process technology to suit the individual operating condition of the client's plant. In essence, Foster Wheeler has a foot at the door when clients plan their regular upgrades since the company would have known the technology best. Lastly, Jacobs' management has attributed the successful growth and expansion of the company to their unique business model – a relationship-based approach with approximately 70% of their work derived from long-term partnerships and alliances.

Obviously, the merit of adopting such a strategy is open to debate. Some might suggest that too much concentration of businesses with few clients would expose a firm to the volatility dictated by business cycles that are experienced by its clients. This may cause problem to construction firms that typically do not have as much resources as the blue-chip firm to tide over the troughs of those cycles. Here, the main point is nonetheless clear: firms modify their boundary to set a presence in their clients' value chains, and they rely on some core competencies to achieve the goal.

5.5.1.2 Changing Industry Nature or Characteristics of Clients

Occasionally, firms have to reassess their boundaries because the nature or characteristics of their customers have changed. In the deregulated power industry, for example, construction firms are now building plants for independent power producers (IPPs) rather than previously regulated utilities. These merchant plant owners are much more demanding especially in terms of speed and operating efficiency, and firms have to reassess their boundary to acquire new operating skills or marketing channels to target the new clients.

5.5.1.3 Changing Structure of Clients

Client-service provider interface typically varies in different industries or market segments. In some value systems, a change in the client's organizational structure could initiate a corresponding (and appropriate) change in the service provider's firm boundary. For example, Foster Wheeler has reported that many of its clients have reorganized their structures along business lines instead of geographical regions (Foster Wheeler Annual Report, 1999). This partly negates the competitive advantage that Foster Wheeler possesses through geographical diversity. Understandably, if Foster Wheeler provides a new client interface by changing its own structure, the dimension of boundary modification along geography would not have the same level of importance as before.

5.5.1.4 Public versus Private Sectors

As with the changing industry nature of private clients, boundary issues can be substantially different when dealing with public contracts. As a starting point, the contracting environment and conditions are more regulated, and they differ greatly from one sovereignty to another, thus complicating matters in international expansion. Second, opportunities to offer an integrated package of services by pursuing market expansion along a value system may be minimized in certain cases. For example, by statute in most American states and for the federal government, segmented Design-Bid-Build has been made the prominent project delivery method for design and construction of public infrastructure (Miller, 2000). Thirdly, issues such as security and safety become more

sensitive (and easily politicized), which call for an extra effort to develop skill and knowledge enhancement in these areas. All these factors would affect boundary that might have remained as status quo if not for the public contracting environment.

These are only a few examples that demonstrate the need to reevaluate corporate strategy and boundary when competing for contracts in the public sector.

5.5.2 Resource Allocation Tradeoffs: Diversification versus Core Competencies

The world of corporate strategy is filled with fundamental tradeoffs. Making a wise choice among various tradeoffs is often a challenging task that may have a profound impact on the final outcome. The tradeoff between diversification and development of core competencies (assuming that firm's resources are limited – usually a reasonable one), is among one of the most important considerations.[21]

Diversification obviously represents an act of boundary modification. Advocates of diversification often quote the main advantage as hedging one's risk by "putting all eggs in different baskets." Similar to the two (out of three) dimensions of boundary modification as discussed previously, diversification can take either the form of geography or market segment. It is important to note that both forms are subtly different and have different risk hedging functions.

Take Foster Wheeler as an example. In a normal year, the company has project operations in 30 countries over 6 continents. It also maintains manufacturing facilities in the U.S., Finland, Spain, Poland and China, which handles offsite prefabrication of some modular components of a plant. Effectively, the project and manufacturing operations are geographically diversified. Foster Wheeler is hedging the company as a whole against a regional economic downturn such as the Asian Crisis in 1997. Although revenue decline is inevitable in the case of a regional downturn, the company can obviously survive better than others that concentrate their entire businesses in that region. However, Foster

[21] Professor Massood Samii's insight on this issue is gratefully acknowledged.

Wheeler is not very diversified along the dimension of market segments. A bad year for the energy and power sectors would drive down Foster Wheeler's profits substantially.

Working against the desire to diversify is the need to develop core competencies in certain markets. As defined by Hamel and Prahalad (1994), core competence is "a bundle of skills and technologies that enables a company to provide a particular benefit to customers." Undoubtedly, for the case of construction whereby projects are deeply rooted with locational factors, gaining a superior understanding of the operating environment in a region can also lead to the development of core competencies. In any case, since core competence represents a sum of learning across individual skill sets and organizational units, the cultivation of core competence requires time and resources.

When time, resources and managerial attention are too much devoted to diversification, the development of core competencies is often overlooked. Conversely, over-concentration in one area exposes the company to substantial risk. Instead of taking sides on any one of the two tradeoff factors, it is better to suggest that the ultimate choice depends on the level of resources (in terms of time, finance and human capital) that a company poses.

As depicted in Figure 5-2, a company should go through the thinking process of mapping its current position on the figure by evaluating its business portfolio and assessing the level of core competence that it needs to develop in each business area. If a company is solely concentrated in only one narrow market segment, this position will plot on the horizontal axis. At the other extreme, a pure holding company structure that invests in multiple business segments, but has no expertise to operate directly in any of these segments, will plot along the vertical axis. Most companies would fall in between lying within the quadrant. The exact position will be determined by the choice of resource allocation – whether the firm prefers to allocate more resources towards developing core competencies or diversifying its operations. When a firm wants to extend its boundary by pushing out its "resource frontier" towards the northeast direction, it would require additional level of financial and human resources.

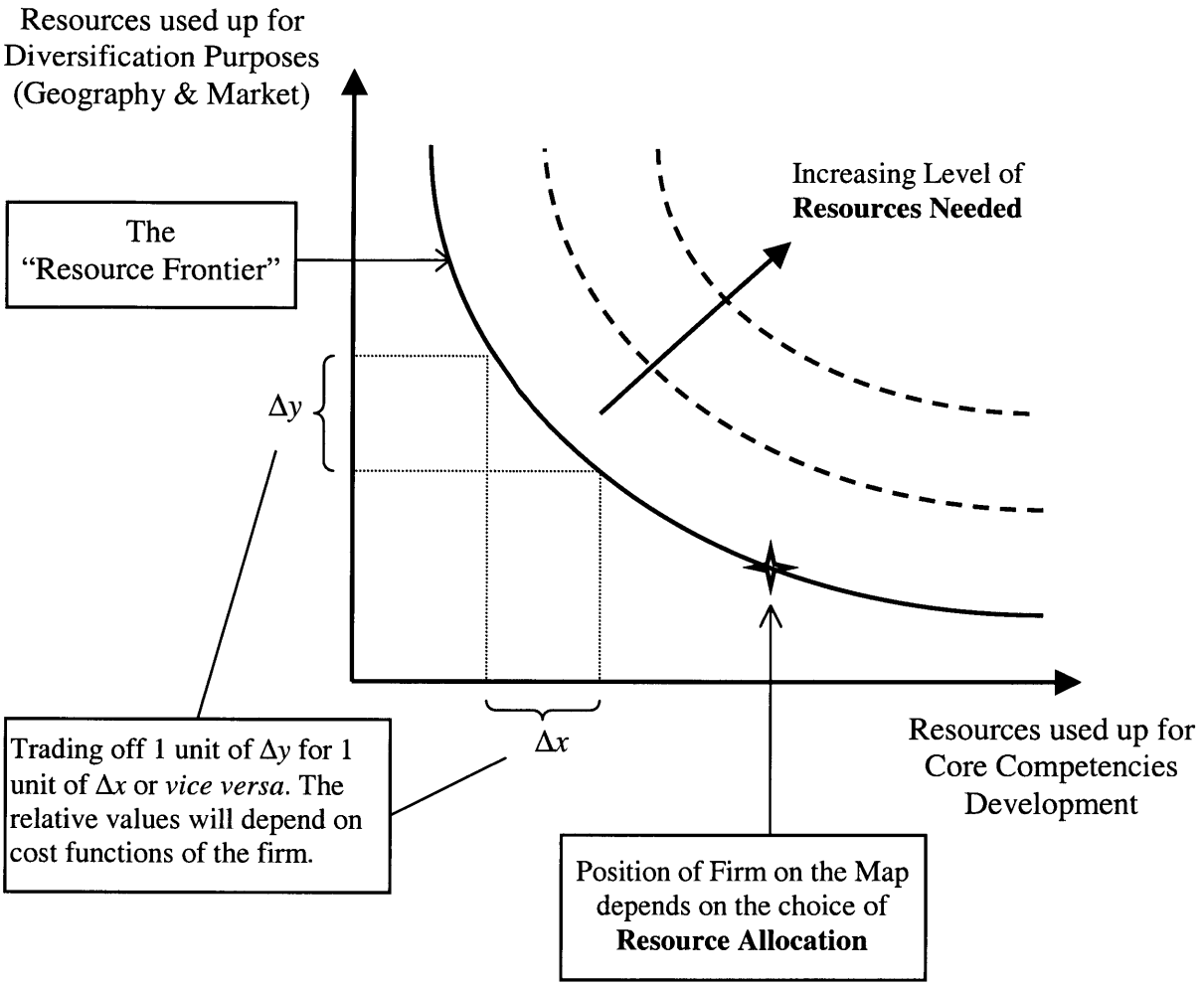


FIGURE 5-2 Typical Tradeoff between Resources used for Diversification and Core Competencies Development Purposes

Conceivably, the exact level of "resource frontier" is hard to quantify. However, some judgment can be made with the aid of a few pointers. Incidentally, these pointers are linked to two of the strategic fields that the author has defined in the previous paper.

First, if a proper *Human Resources* (*HR*) *Strategy* were in place, the firm would be able to develop a proper training program to fully capitalize on its human capital and maximize the extension of the frontier. Second, with proper incentive measures – a tool that is also part of the *HR Strategy*, a firm can motivate its staff to further expand its frontier beyond its current limit. Hamel and Prahalad (1994) describe this as the "stretch" of strategy, which they argue that resourcefulness, not resource level, is a more important

factor for getting to the future. Third, the *Financial Strategy* of a firm would be flawed without proper financial evaluations such as analyzing the trend of its liquidity and debt ratios to keep track of the level of financial resources used to push out the frontier. Thus, when signs of excessive strain on human resources start to surface and key financial ratios start heading into the red zone, it becomes apparent that the firm should push the boundary out no more.

A good illustration of the relevance of this decision factor for boundary modification comes from the decision that Foster Wheeler has to make on technology development. The choice of technology is highly contingent upon the prediction of the type of fuel that utility plants would use to generate energy in the near future. On one hand, there is increasing pressure worldwide calling for more stringent environmental standards and advocating for cleaner fuel sources such as the natural gas or LNG. On the other hand, economic fundamentals might dictate the final choice of the fuel source. A recent analysis of power generation economics by Resource Data International, Inc. reveals that coal-fired generation will be very competitive if the average annual price of natural gas settles above $4/mmBtu (Kern, 2001).

Ideally, Foster Wheeler would have liked to develop its technology and expertise in all processes utilizing these different kinds of fuel sources so that it remains competitive regardless of the type that would eventually dominate. However, in order to pursue this diversification strategy, Foster Wheeler would have to dispense tremendous resources since each fuel technology and process is unique. Instead, Foster Wheeler devotes most of its resources towards developing clean-coal energy products and processes that compete directly with competitors who construct utility plants that generate power using the natural gas. It is not clear if Foster Wheeler has made the right choice, but it certainly shows that the company would rather not lose focus by specializing in too many kinds of technology.

Finally, the "resource frontier" in Figure 5-2 need not always follow a one-way expansion. The frontier may shrink when market situation calls restructuring and downsizing actions. In year 2000, Fluor Corporation spun off one of its major subsidiaries, A.T. Massey, in the coal mining business, effectively shrinking the firm's

boundary. Such decisions are sometimes initiated by a renewed direction of the *Financial Strategy*, but in other occasions they represent strategic actions to change the risk profile of the firm's boundary – the third decision factor that will be discussed next.

5.5.3 Risk Profile of Business and Project Portfolios

Diversification typically modifies the risk profile of a firm's business portfolio. Assuming that the market efficiency theory holds, a reasonable proxy for the risk profile of the firm as a whole is given by the expected volatility that is assumed in evaluating the stock option of the firms.[22] These values of volatility can be obtained from market analysts' reports or annual reports of the firms. Figure 5-3 plots the values of expected volatility of equity of the firms that are sampled in this study.

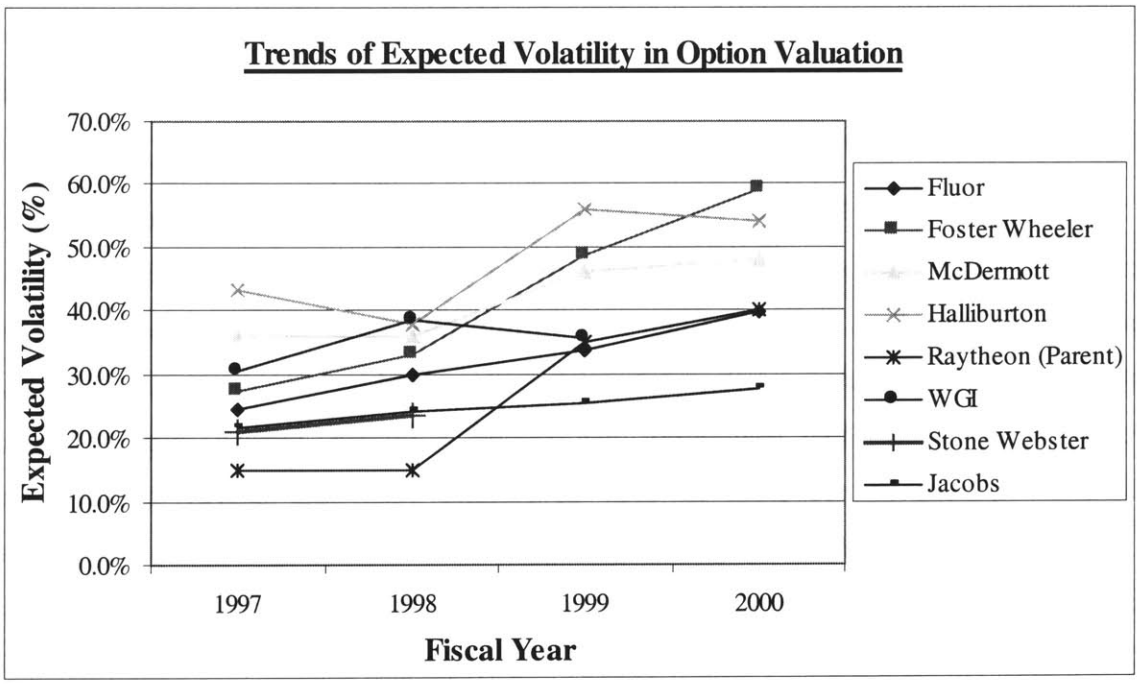


FIGURE 5-3 Trends of Expected Volatility of the U.S. Firm Sample

[22] In principal, this is really the volatility of the equity and not the assets/firm as a whole (which would be lower after "unleveraging"). However, just like maximizing shareholder value has always been a core mission of firms, the objective of minimizing either type of volatility (equity or assets) stays the same in strategic planning. Hence, in the main text, no explicit distinction is made between the two.

In general, the values given in Figure 5-3 are consistent with the profile of the business portfolios of the firms. Starting from the lower end, Raytheon was well diversified with its core business in defense systems, commercial electronics, aircraft manufacturing and the RE&C arm in construction back in 1997. With a large part of its businesses associated with the defense sector (which is known to have low correlation with the market in general) and about 20% of revenues derived from construction (which highly fluctuates with the market economy), the low correlation between the components of its portfolio has resulted in a low volatility of 15%. Then, after having a bad year in 1999, Raytheon consolidated some of its functions and subsequently sold RE&C to the Washington Group International in 2000. The narrowing in targeted market segments is reflected by a steep increase in volatility to 35% ~ 40%.

Similarly, Stone & Webster, with businesses in a broad range of sectors ranging from power and process to software design and refrigeration, have the second lowest volatility values. Being active in the engineering and construction activities multiple industrial markets, Jacobs Engineering followed closely with the third lowest volatility values as indications of its diversified profile. Not surprisingly, those that reside at the upper end are focus, differentiated players like Halliburton, Foster Wheeler and McDermott whose main activities remain concentrated in the energy and power sectors.

The above discussion obviously supports the fundamental tradeoff that was previously brought out: focus, differentiated players face the challenge of managing business cycle fluctuation of the market that they concentrate in; diversified players, though have lesser fluctuation as a whole, face the risk of losing focus on any particular vertical market and imposing too much stress on firm resources. In fact, the last stated reason was widely stated as a factor that initiated the demise of Stone & Webster (which was briefly discussed in Chapter 3). All said, the real intention here is to illustrate that firms should evaluate the risk that it is absorbing (or reducing) *as a whole* before committing to such acts of boundary modification. Specifically, the assessment of risk has to be made in the light of changes imposed on the *overall* risk profile of the business portfolio – and not just isolated risk changes produced by the action alone.

In making such assessment, the intuition behind the portfolio theory (Markowitz, 1952) adopted from the world of finance provides some good insight. The goal of the theory is to develop an efficient frontier between expected return and risk. In mathematical form:

Let x_p , x_n represent the approximate portions of the level of activities that the firm would engage in the present and new segments respectively (using indicators such as asset investments or revenues as proxies);

σ_p represent the volatility of the present business portfolio;

σ_n represent the volatility of the newly targeted business segment;

and $\text{cov}(r_p,r_n)$ represent the covariance between the average returns of the present portfolio and the new segment;

then the resultant volatility, σ_{total} , is given by:

$$\sigma_{total} = \sqrt{x_p{}^2\sigma_p{}^2 + x_n{}^2\sigma_n{}^2 + 2x_p x_n \,\text{cov}(r_p,r_n)}$$

The parameter σ_n can be obtained from market analysts' reports or annual reports of representative firms that compete in the newly targeted business segment. The parameter $\text{cov}(r_p,r_n)$ can also be estimated from past returns of the firm and those of the representative firms in the new segment. As a matter of fact, so long as the present business portfolio and the new business segment is not perfectly correlated, the new risk profile after boundary modification will surely be improved (which forms the cornerstone of diversification).

Since our goal is to compare the options facing the firms, the above method can be used to assess the different risk profiles of the various options. These can then be plotted on the same graph together with the projected returns of the combined new ventures as shown in Figure 5-4. The better options would be the ones that provide a higher return and/or less risk for the new business portfolio – those that are lying close to the so-called "efficient frontier". Yet, unlike in the case of applying the theory to a

financial portfolio with many possible choices of securities, the efficient frontier in this case is probably not observable given the limited options that a firm typically faces during the process of boundary modification. Nonetheless, one could still rely on the principle to eliminate bad choices. As shown in the figure below, although we cannot immediately deduce whether option 1 or 2 is more superior, we can safely conclude that option 3 is obviously inferior to both option 1 & 2.

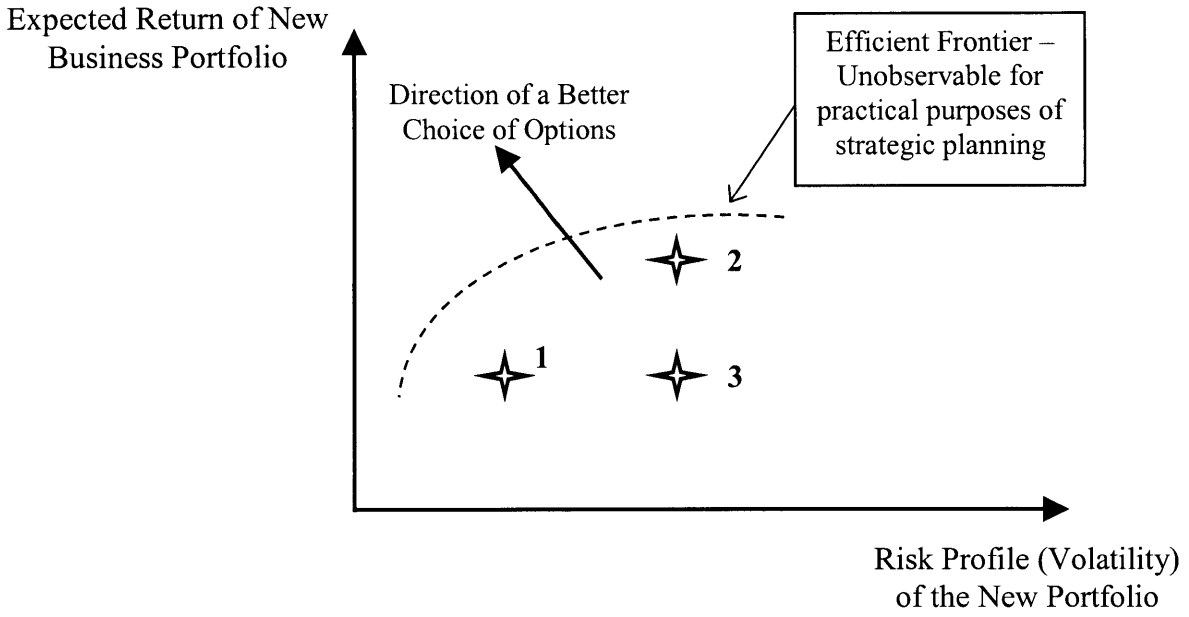


FIGURE 5-4 Choice of Boundary Modification Option using Portfolio Theory

Other than new business ventures (defined as entry into a new value system), the concept can also be applied to activities along a currently served value system. AMECO, Fluor Corporation's subsidiary in the equipment retailing business, has expanded into the complementary after-market parts and services businesses. Since the revenue of the after-market businesses is more stable than that of equipment retailing, this strategy lowers the volatility of the combined risk profile of AMECO.

Lastly, besides assessing the risk profile of the *business* portfolio, construction firms also have to worry about the risk profile of the *projects* that they are handling. For example, the working capital requirement at any point in time varies considerably with the mix, stage of completion (e.g. the conventional S-curve representation of cumulative

cost) and commercial terms stated in the contract for different projects in the portfolio. Resource allocation of manpower and equipment is commonly addressed in most conventional textbooks of project management. By the same token, management has to realize that financial requirements of each project are aggregated at the firm level as a whole. Certain mix of projects may concurrently demand financial resources that are beyond the limit of the firm, thus causing financial distress. It may then be better off not to take on some of those projects in the first place. This is especially true for an overseas project where more uncertainties are present and the risk profile of a project would have a large impact on the risk profile of the firm as a whole.

5.5.4 MODE OF BOUNDARY MODIFICATION

The importance of the type of modes used by firms to modify their boundaries effectively speaks for itself. Hundreds of books and articles have been written on mergers and acquisitions (M&A), joint ventures, strategic alliances and licensing issues. The intention here is to elaborate only on specific issues that would affect the decision making process when dealing with boundary modification.

Beyond the hype that has been stirred up by all these buzzwords, most have overlooked the fact that it is indeed the three dimensions of boundary modification that begets the various chosen modes. In other words, whether firms choose to engage in M&A activities or form joint ventures, they do so for the purpose of geographical and market access or even to acquire new skills and knowledge. Unfortunately, too often management gets too immersed in the detailed activities of the mode and loses sight of the more important transfer of value that would help to push the corporation forward as a whole in the long term.[23]

As a decision factor, firms choose different modes because they expect that values are created differently from M&A, JV and alliances. In fact, a firm may also pursue two or three different modes at the same time in the process of boundary modification. To

[23] Hamel, Doz and Prahalad (1989) emphasize this point in illustrating the differences of learning mindset between western companies and Japanese firms in strategic alliances.

strengthen its position within the pharmaceutical sector, Fluor acquired Marshall Contractors in 1996, thus adding construction management strength and expertise in the sector, and allowing it to capitalize on Marshall's client relationships in the market. To penetrate the Japanese market (in terms of serving Japanese multinational companies), it worked with Hitachi and JGC to serve these multinationals on global projects. Lastly, Fluor also formed strategic client alliances with Eli Lilly, Amgen and Genentech to design and deliver world-class manufacturing activities for these clients (Fluor Corporation Annual Report, 1997). The challenge is to reconcile the value derived differently from these various modes to enhance its strategic position in the sector.

5.5.4.1 Joint Ventures (JV) and Strategic Alliances

With the exception of some issues on contractual and financial arrangement, the dynamics behind JVs and alliances are mostly similar. Unlike M&A, the firm does not have complete ownership and control in these two modes. As such, the main concern in choosing these two modes is how much value (in terms of learning, intellectual property, profits etc.) can be extracted from the JVs and alliances and redirected back to the corporation.

This value is often maximized when the JV effort or alliance has a long-term nature. In such cases, it can incorporate a long-term strategy, which combines the core competencies and expertise of all partners. This might lead to a product or services that may not be feasibly developed with a single firm's effort. For example, under a non-exclusive agreement, McDermott's B&W Power Generation Group, together with equipment suppliers General Electric and Westinghouse, formed an integrated team to upgrade the complete steam and power cycle for the clients. Over a longer period, each partner also has more opportunities to learn from one another. For the same reasons, the collaboration effort may also be improved if it represents a worldwide effort as it fully utilizes the partners' network and exploits both economies of scale and scope.

Stone & Webster pursued just such kind of strategy in the area of joint venture. In 1997, the firm launched a joint venture with Fluor Daniel to combine its proprietary ethylene technology and EPC resources with Fluor Daniel's worldwide execution

capability. The JV represented a worldwide effort, and this seems logical since their targeted clients are global companies anyway. To Stone & Webster, Fluor Daniel's role resembles a special marketing and executing channel to promote its technology. In the process, the company had the chance to learn about the best way to market this technology to global clients. The JV also represents a virtual extension of its firm boundary along the value system by borrowing market share from the downstream partner as a leverage to jack up the effort of technology development.

As mentioned earlier, the incomplete ownership and control in these two modes causes potential problem on the level of commitment to be made and the value to be recouped by each party. This is especially true when firms view this only as one (of the many others) alternative for boundary modification and resources could be channeled to other modes. An interesting rule of thumb as proposed by Judy C. Lewent, the Chief Financial Officer of Merck & Co., Inc., is that JV should be a 50-50 arrangement to minimize asymmetrical value- and profit-sharing[24] (or, in the case of alliance, an equal commitment of resources and profit-sharing). Arguably, it is easier to delineate financial commitment, but more difficult to assess the level of complementary expertise that is contributed to the venture. Nevertheless, the point emphasized by Lewent is that parties should expect equal value of going in and coming out of the venture. In such cases, less energy is wasted on unworthy disputes and more efforts are concentrated on the common interest and strategic pursuit of the venture.

Though impossible to test the rule quantitatively, some evidence from the firm sample does support this argument. Among the three larger JVs of Halliburton, two of them are 50-50 split ownership, while the third is slightly short with 49% ownership. Incidentally, the two 50-50 jointly-owned operations have been very profitable with net income of $341 million and $316 million in 1997 and 1998 respectively, and interest in the third venture was sold in 1999. It is also noted that both the 50-50 JVs are poised to enhance Halliburton's core competencies in offering integrated energy services to its clients. The first JV, European Marine Contractors, is part of Halliburton's Energy

[24] "The Real B2B: Contracts, Acquisitions and Joint Ventures," a lecture on Strategy and Organization by Judy C. Lewent on April 2nd, 2001 at the Sloan School of Management, M.I.T.

Services Group and specializes in engineering, procurement and construction of marine pipelines. The second JV, Bredero-Shaw, specializes in pipe coating. Apparently, Halliburton is leveraging external resources to complement its internal operation that may turn out to be a transition route to achieve a more permanent new boundary.

5.5.4.2 Mergers and Acquistions (M&A)

Most mergers and acquisitions fall apart or fail to realize the "integration value" that the deal is supposed to deliver. If anything, M&A actions in the construction industry can only be more risky. The nature of the construction business has especially made M&A much more complicated to evaluate the potential benefits and liabilities in the deal. There are at least six reasons that the author can identify to support such a claim:

(a) There are usually some projects in progress during the time of the deal. Hence, regardless of whichever party agrees to take the responsibility to complete those projects, the uncertainty in future revenues or subsequent deviation of costs from initial estimation would potentially trigger a lawsuit – often blaming on the course of "insufficient disclosure" *a priori.*

(b) In construction, the seller sometimes retain certain liabilities associated with the initial securing of projects such as letter of credits, performance bonds, parent company guarantees and other support agreements at the time of sale. In the case of non-performance of the contract by the acquirer, the beneficiaries of such guarantees and support agreements would still seek resource from the seller. In short, there is a prolonged period even after the completion of the deal that the seller has to be "on guard".

(c) Pending change orders in some projects complicate the transition process and add uncertainties to projected profits from uncompleted projects.

(d) It is also difficult for the acquirer to judge its own effectiveness and competence to handle projects that are passed on through the deal. For example, a project may initially be projected as profitable precisely because it suits the expertise of the seller. The same project, nonetheless, might impose too much strain on the

acquirer who may not have similar resources or expertise to achieve the same level of profit margin.

(e) The engineering and construction business is essentially a service business as compared to asset-intensive production business like manufacturing. Consequently, the costs, risks or even benefits are harder to estimate – starting right from the analysis of the balance sheet! There are simply too many intangibles (such as human assets that forms a major part of the business) and potential liabilities (including unforeseeable lawsuits like in cases of asbestosis claims) that get buried under the numbers.

(f) Acquirers commonly use their stocks to secure, in part or in whole, an M&A transaction. Typical construction firms, however, are known to have low price-earning (P/E) ratios in the capital market. This makes the common channel relatively expensive, while on the other hand construction firms are not known to be cash-rich as well.

In short, M&A are high-risk transactions for construction firms. Most of the problems listed above exist due to the long-term and litigious nature of construction projects. It results in a high exit cost for companies who want to quit the business.

A recent example of an unsuccessful M&A transaction is the acquisition of Raytheon Engineers & Constructors by the Washington Group International, Inc. (WGI). As of the date when this chapter is written, issues remain unresolved and pending in the litigation process. Meanwhile, WGI had filed for bankruptcy under Chapter 11 on May 14, 2001. Before that, the company had walked off two huge Massachusetts power projects that it acquired from Raytheon Corporation – the completion of which would have required an additional funding of $380 million but ended with a projected loss (according to WGI) of $54 million (*Engineering News Record*, 2001b). Obviously, Raytheon Company, as the guarantor, was exposed to potential liability to complete the two projects. These projects (among several others) were projected to be profitable before the transaction. Again, it is hard to tell whether the decrease in margin – all the way down to the red mark – is due to the incompetence of WGI or inflated profits as reported by Raytheon during the transaction (which is what WGI claims).

Raytheon Company alleged that WGI's bankruptcy was mainly caused by the acquisition of a company that was effectively double of its size. As of 1999, WGI's total assets were reported to be $1,196 million (WGI Annual Report, 1999), whereas the identifiable assets of RE&C were $1,521 million (Raytheon Corp. Annual Report, 1999). As a rule of thumb, many analysts believe that any acquisition that exceeds 30% ~ 35% of the market capitalization of the acquirer would be 'difficult to digest', not to mention the possibility of extracting 'integration benefits' that was sought after in the transaction. Putting aside all these convoluted arguments, one conclusion is clear – pace is another big factor. WGI initially merged with Morrison Knudsen in 1996, and it then increased its assets by 50% through the acquisition of Westinghouse Government Services in 1999. With the acquisition of RE&C in 2000, this represents at least a 300% increase in size within a five-year time frame! Yet most companies require years to integrate a new company into its existing operation.

There are other examples in the sample that firms learn about hidden costs of M&A in a hard way. In 1998, McDermott, Inc. had to write off a $262.9 million charge for goodwill associated with its previous acquisition of Offshore Pipeline, Inc., which the management concluded no longer had value. Subsequently, the acquisition of minority interest in its subsidiary J. Ray McDermott in 1999 had resulted in an increase in goodwill of $333.2 million, which might again set a prelude for another write-off if the price paid for the stock repurchase subsequently turn out to be unjustifiably high. It is important to note that these charges have the same order of magnitude as the operating income (reported as $355.5 million in Mar-98 and $217.4 million in Mar-99), and will impose a large toll before arriving at the net income level. In other words, it represents a huge cost to the shareholders.

Even Halliburton, which had prior experience in making various strategic acquisitions, had to incur a $980 million charge related to the merger with Dresser Industries, Inc. (Halliburton Annual Report, 1998). Out of this total, $509 million were asset-related charges including impairments and write-offs of intangible assets. In the process of aligning the strategy between the two firms, some of the assets of Dresser would not be utilized for their originally intended usage, therefore lowering projected cash flows and resulting in impairment charges.

To summarize, M&A is tough especially for construction firms that may not have sufficient financial resources to absorb some of the inevitable charges associated with the transaction, even though value can be extracted in the long-run. Often times, original product lines have to be de-emphasized especially during the period of "rationalization" of the acquired assets. Ultimately, the cost incurred (especially additional goodwill) has to be justified by means of strategic assessment (for the long-term value) and financial evaluation (for the price paid and the level of financial resources to absorb the "shock" of various charges). Meanwhile, Halliburton has decided to divest its Dresser Equipment Group in the year 2000, possibly due to non-realization of the real asset value and a move to recoup some of the losses in the impairment charge incurred. For other companies without the level of resources similar to Halliburton's, such acquisition and divestment cycle could possibly cause a crunch in financial liquidity that may end up with a Chapter 11 filing.

5.5.5 OPTIONS INHERENT IN BOUNDARY MODIFICATION

The fifth and final decision factor is the exploitation of options that may be inherent in certain boundary modification actions. In most of Michael Porter's work during the 1980s, the focus is on capturing market share. Some critics have since commented that Porter's model is 'static' in nature. From Hamel and Prahalad's (1994) viewpoint, market-based competition – the main focus of Porter's model – only represents the final stage in competing for the future when new opportunities become matured and the industry structure settles into an equilibrium. The key point of success, they argued, lies on the competition for *opportunity* share and intellectual leadership – by developing industry foresight and crafting strategic architecture during the first stage of the competition.[25]

In the context of boundary modification, pursuing opportunity share can be interpreted as making initial investments in areas that will potentially evolve into a whole new expansion of the firm's boundary. In the boundary model of this thesis, however, the

[25] In between these 1st and 3rd stages, Hamel and Prahalad (1994) had defined Stage 2 as the competition to shape and foreshorten the migration paths between today's and tomorrow's markets and industry structure.

vocabulary of opportunity share need not be limited to intellectual leadership or core competence development – which is only one out of three dimensions of boundary modification. Opportunity shares also exist along the other two dimensions.

For example, the execution of a project in a country that is new to the firm can potentially be viewed as a smaller-scale investment for further expansion into the new market.[26] Effectively, the firm is trying to capture an opportunity share to set a permanent foothold in the new market – just like most firms trying to achieve in China and India. The mindset adopted here also differs from mere geographical expansion on a regional or worldwide basis, which may be more temporary in nature by simply executing "one-off" projects in those countries. In many cases, the difference is reflected by the organizational structure adopted in the host country, which sets the primary difference between a subsidiary, a representative office and a project office (in a descending order of permanence).

From another point of view, pursuing a smaller-scale investment along those dimensions may make more sense because of the risk of a large-scale boundary modification. Thus, before executing a cross-border merger or acquisition that is notoriously risky, it may be preferable to gain prior exposure to the operating conditions of the foreign country through a joint venture or alliance of a similar nature (both of which usually involve a lesser extent of commitment).

Conceptually, this decision factor is analogous to identifying real options that are inherent in some projects (such as oil exploration and plant expansion), except that here it is being applied at the corporate level. Thus, the strategy adopted in the above example of a project in a new geographical region can be modeled as a sequential investment and a compound option (see Dixit and Pindyck, 1994, for example).

[26] The project is "smaller-scale" only in a relative sense – when compared to the scale of operation in the future state with a more permanent presence. The absolute size of the project itself could be large.

5.6 Strategy, Organization, Boundary and Environment in Perspective

Since boundary lies at the intersection of strategy, organization and the external environment (refer again to Figure 4.7), its modification cannot be isolated from these components. In fact, these components drive the changes in boundary, as suggested in Section 5.2. Upon addressing how boundary can be modified (the three dimensions) and what determines the extent of modification (the five decision factors), it is appropriate at this stage to step out and put things in perspective in order to elicit the rationale of boundary modification within the larger context of corporate strategy.

There are obviously infinite ways that boundary could interact with the seven strategic fields and the two internal mechanisms of organization (as defined in the previous paper). Hence, it is not practical to provide a comprehensive list of these interactions. Nonetheless, since such interactions really are the crux of the entire model, two strategic fields – *Business* and *Operational Strategy*, and an internal mechanism – *Structure*, are chosen in this section to illustrate how their interactions with boundary can bear practical implications for corporate strategic planning purposes.

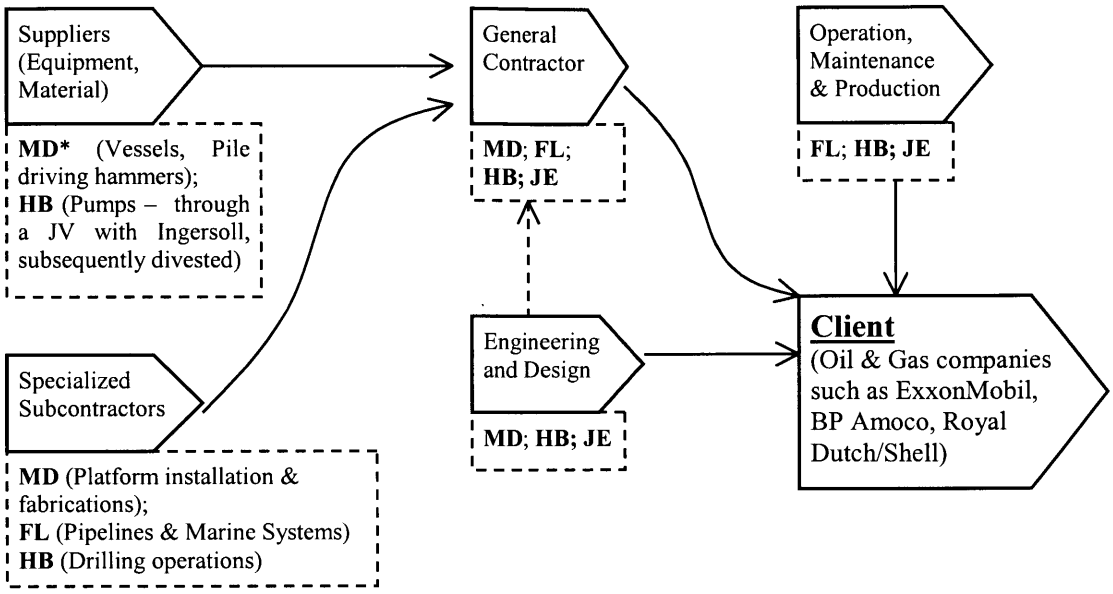
5.6.1 Business Strategy and Boundary

Industry structure analysis commonly forms the first level of business strategy assessment. Since its inception in the 1980s, the value system concept (Porter, 1985) has proven to be useful in laying out the connections among the different players within a particular sector or industry. The tool is hereby used to map out three value systems to facilitate the discussion of the interaction between business strategy and boundary. These are shown in Figure 5-5(a), 5-5(b) and 5-5(c), respectively, for the simplified versions of the following value systems:

(1) Upstream operations in the oil and gas sector, which includes exploration and production;

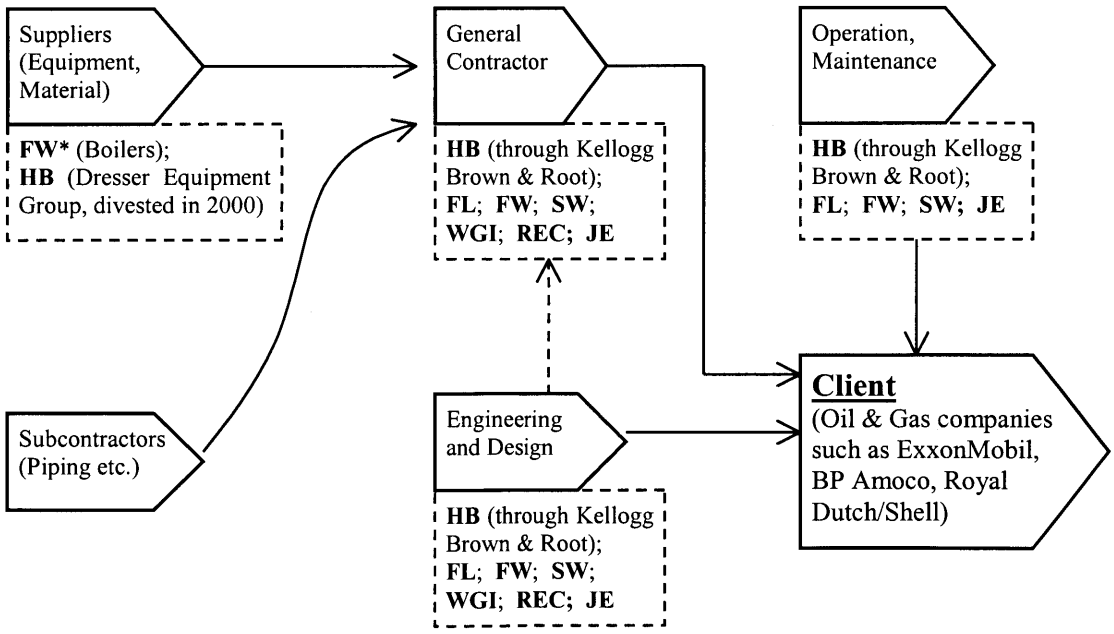
(2) Downstream activities in the oil and gas sector, primarily refining operations;

(3) Upstream activities in the power sector, primarily in power generation.



* Refer to the next page for legend

FIGURE 5-5(a) A Simplified Value System of Upstream Operations in the Oil & Gas Sector



* Refer to the next page for legend

FIGURE 5-5(b) A Simplified Value System of Downstream Activities in the Oil & Gas Sector (Primarily Refining Operations)

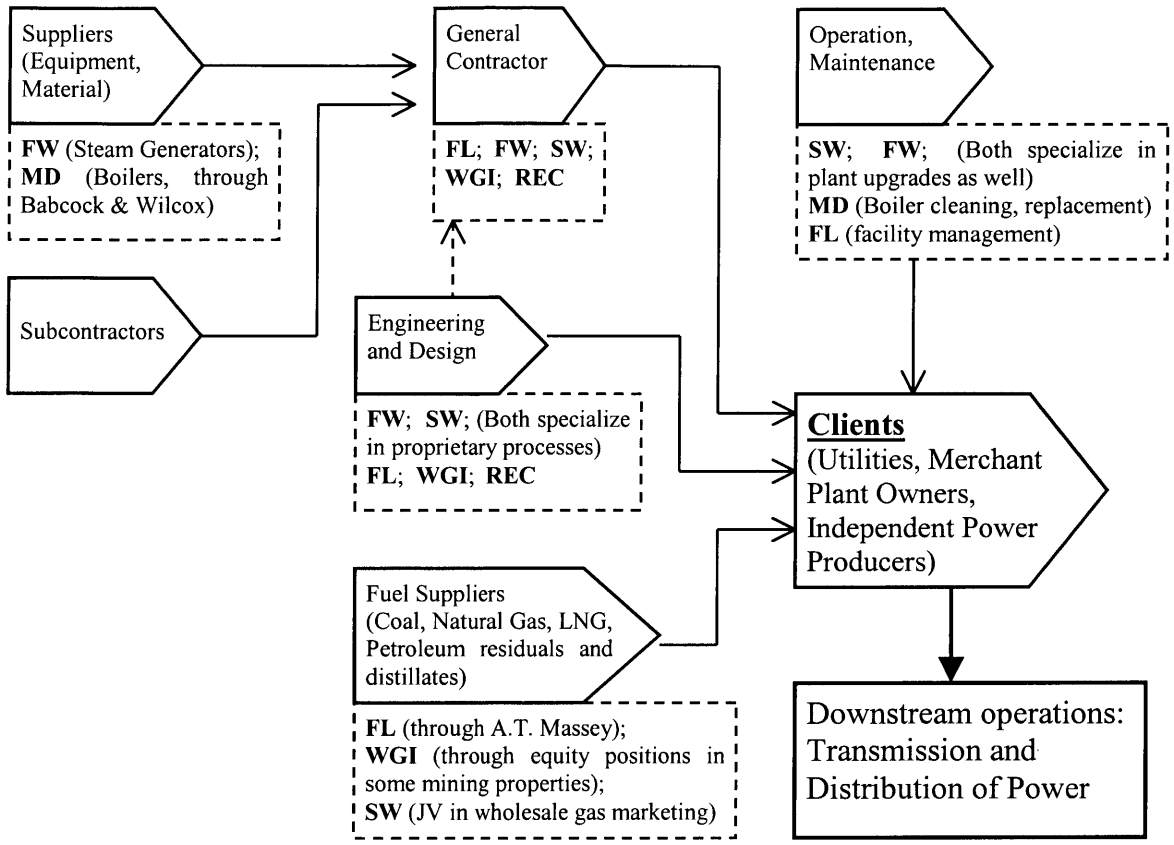


FIGURE 5-5(c) A Simplified Value System of Upstream Activities in the Power Sector (Primarily Power Generation)

Legend for Figures 5-5(a), 5-5(b) & 5-5(c)

MD	-	McDermott
HB	-	Halliburton
FL	-	Fluor
FW	-	Foster Wheeler
SW	-	Stone & Webster
WGI	-	Washington Group International
REC	-	Raytheon Engineers & Constructors
JE	-	Jacobs Engineering Group

Notes:

1) Kellogg Brown & Root is Halliburton's EPC subsidiary in the downstream petroleum and other industrial process sectors;
2) Babcock & Wilcox is McDermott's subsidiary in the power generation business. The subsidiary has filed for Chapter 11 bankruptcy in year 2000.
3) A.T. Massey is Fluor's subsidiary in coal mining and production. It has been spun off in year 2000.

The dashed-boxes placed alongside each value chain list out those firms in the sample that have a considerable amount of business activities in the areas concerned. All firms take on at least a "box" along a particular value system; and when it enlarges its boundary to include two or more, it is traditionally said to have "vertically integrated" some upstream/downstream activities. An interesting proposition is that when a firm takes on more and more of these "boxes", it naturally meets a 'virtual' limit to expand – when it takes on all the value activities in the value system. This boundary limit is said to be 'virtual' precisely because of the way that a typical value system is being drawn or defined. The concept itself is not flawed, but most overlook the fact that one value system connects to another. A client or end user defined in one value system may mark the end of that value system, but it may become a supplier or upstream party in *another* value system. In fact, one can view Figure 5-5(a), 5-5(b) and 5-5(c) as one large, interconnected value system.

The implication of this proposition is an important one. Firms that can envision the flow of products and services from one value system to another can become more efficient, at least in terms of filtering and processing critical information, when it operates (either directly or through other modes) in multi-linked value systems. The concept is analogous to the idea of 'arbitrage' when investors attempt to profit by exploiting the slightest price discrepancies of financial instruments in two different countries. Here, it is more of a case of exploiting information that gets bounded within a single value system in order to 'optimize' the strategy of operating across two value systems.

Halliburton, for example, is practically ubiquitous in the Figure 5-5(a) and 5-5(b). Incidentally, both value systems have the same type of clients – large multinational oil and gas companies. By enlarging its boundary to encompass two intimately linked value systems, Halliburton is obviously better positioned to respond to the needs of those clients and address eminent changes in the environment. Furthermore, it can exploit "missing" linkages between the upstream and downstream value system of the oil and gas sector. For example, after exploration and production upstream, crude oil has to be transported to refineries and Halliburton could choose to expand into transportation and storage facilities, a function which does not naturally appear in either value system. It is

easy to miss out such important linkages that fall in between two interconnected value systems when they are being drawn separately.

Other players such as Fluor and Foster Wheeler also have their boundaries covering separate value systems. The caveat is that ubiquitous positioning alone does not necessarily count for an effective business strategy. Those activities have to be meaningfully connected. McDermott, for example, have operations in both Figure 5-5(a) and Figure 5-5(c), but those operations are too remotely linked to one another. Whatever events that have happened in upstream oil & gas exploration may not have an immediate effect on McDermott's operation in the power generation sector. As such, those operations of McDermott do not provide the full advantage of functional optimization or informational efficiency, thus resembling more of the usual course of market diversification.

5.6.2 Operational Strategy and Boundary

Project delivery Project delivery and contractual methods are two main pillars of the construction business. Parties are brought together in different ways: from the issue of tender offer calling for competitive bids; to pre-selection followed by subsequent negotiation.

When a project is completed, the relationship between contracting parties usually comes to an end – at least until the next one starts. In certain cases when two parties contract with each other more and more often (e.g. sole-source procurement from a familiar subcontractor in a subcontracting network as described in Eccles' (1981) notion of the "quasi-firm"), the transacting parties may make specific investments (both tangible and intangible) to enhance their individual operations for the repeated business dealings. Indirectly, such specific investments create ties between the two parties and inflexibility for each to deal with a third party – thereby foregoing exogenous market mechanisms. Provided that the relationship does not turn sour, a possibility of contractual hold-up can be created (Klein, 1988).

To minimize potential disruption to the operational conditions of either firm (so that each can concentrate on other corporate strategic issues at large), one of them may seek to acquire the other. Due to the absence of legally constructed constraints upon completion of the acquisition, there would be a decreased possibility of contractual hold-up. More importantly, corporate planning becomes more flexible as a whole and it liberates the field of *Operational Strategy* of the firm. This is particularly important given the basic argument of the conceptual model in favor of openness and versatility: each strategic field has to function effectively as variables to cope with the dynamism of the external environment.

Since construction is largely a fragmented business, however, contractual hold-up is generally not a large and common problem in our industry. On the other hand, it is noted that such phenomenon exists quite frequently in the study of the U.S. firm sample in this chapter (and the common denominator among the firms being that each has some activities in the power and energy sectors). One possible reason is that specific investments are more necessary and commonplace in the power, oil and gas sectors, since processes are technologically sophisticated and unique. The same generality might not be true for the residential and commercial building sectors. Finally, at the upstream of the value system where businesses are less fragmented (e.g. some specialized construction materials may be supplied by only a few large vendors), the example given on the interaction between *Operational Strategy* and boundary could also become more relevant.

5.6.3 STRUCTURE AND BOUNDARY

Just as the type of modes adopted (acquisitions, alliances etc.) represents a critical decision factor to determine an *external* structure when boundary is modified, boundary changes may similarly demand for a corresponding alteration of the *internal* structure. In recent days, firms providing services to large multinationals commonly set up some variations of global account management organization to present a single interface to these global customers (Galbraith, 2000). In most cases, the account management setting is necessary to increase the responsiveness and consistency to meet clients' needs. In

some cases, the account manager is even given the authority to overwrite the decisions of the project manager and other functional managers if conflict arises.[27]

Another fashionable trend that is evident in the sample is the emphasis on maintaining autonomous business divisions that can be readily integrated to provide a bundled package or solution to the client, while each capitalizing on external growth opportunities independently. The design is a direct response to maintain a fluid firm boundary. This type of structure can be found in Fluor and Foster Wheeler. Figure 5-6 shows the organizational structure of Fluor Corporation in year 2000, arranged in a format that is partly conformed to Mintzberg's (1979) model. Effectively, services provided by the strategic business units (SBU) of Fluor Global Services and Fluor Signature Services can be bundled with the operations of Fluor Daniel to provide integrated packages, but each of them has separate profit-and-loss accountability and can be readily spun off.

Technostructure	Operating Core	Support Functions
Fluor Leadership Institute	**SBE Fluor Daniel** - Focus purely on EPC opportunities SBU Energy & Chemical SBU Manufacturing & Life Sciences SBU Mining SBU Infrastructure **SBE Fluor Global Services** - Integrated portfolio of services capitalizing on opportunities outside the traditional EPC value chain SBU American Equipment Company SBU Fluor Federal Services SBU Telecommunications SBU Operations & Maintenance SBU Asset Management Services SBU Property Services **SBE A.T. Massey Coal (Spun-off in 2000)**	**SBE Fluor Signature Services (FSS)** - Provide business and administrative support to Fluor operating units and external clients - Organized into individual lines of businesses in areas of finance, IT, safety, HR, office services and performance solutions
SBE: Strategic Business Enterprise	**SBU:** Strategic Business Unit	

FIGURE 5-6 Organizational Structure of Fluor Corporation in Year 2000

[27] From the interview with Dr. Uwe Kruger, Head of Corporate Development, Hochtief AG, Germany.

The above-mentioned structure may look ideal, but one should be aware that as a company divisionalizes and fractures into smaller business units, competencies in turn become fragmented and weakened (Hamel and Prahalad, 1994), especially when innovative solutions demand for cross-functional effort or business cooperation. Such compromise in core competence development consequently lessens the ability to spearhead future boundary modification.

5.6.4 FACING CHALLENGES POSED BY EXTERNAL ENVIRONMENT

At the beginning of this chapter, the concept of boundary is defined in such a way that the external environment is typically beyond the direct control of a firm. In fact, most case studies drawn from the firm sample confirm that this is often the case. Expanding on the example of the choice of technology development faced by Foster Wheeler, recent changes in environmental factors have put even more immense pressure demanding for boundary modification with a new *Technology Strategy*. In Europe, new stringent fuel standards have been set by the European Commission. In response, Foster Wheeler has been focusing on the new market of refinery modifications and facility upgrades with advanced technology to accommodate the new regulations. Similarly, as a major supplier to the U.S. Naval Reactors Program of nuclear fuel and reactor components, McDermott is exposed to unique boundary issues related to environmental factors that are mostly beyond its control including political issues, since the demand of its products and services is related to defense budget and military spending.

In view of the increasingly turbulent nature of environmental factors, some have questioned the usefulness of strategic planning functions when something that is planned today might not be applicable tomorrow. Instead, they adopt the view that strategy should be derived externally by *solely* reacting to changes in environmental factors. This is much like the philosophy embraced by the Evolutionary school of thoughts (refer Chapter 2). Although there is some basis behind such argument, passively reacting to external changes will guarantee, at best, average performance in the industry. The study of firms in this research demonstrates that firms do actively modify their boundaries in

expectation to better exploit opportunity and market shares even though the future environment is highly unpredictable.

To reconcile the disparity, it is worthy to note that any rational economic decisions have to consider the equations on both sides of supply and demand. The entire planning exercise should resemble an iterative loop – by examining external environmental factors while assessing internal capabilities and determining what should be improved. Boundary, then, serves as the pivoting point of the loop to put together a coherent strategy. Management has to assess the fit between the internal variables (corporate strategic fields and organizational mechanisms) and the external environment, and redefine boundary when incompatibility exists. The modification dimensions and decision factors identified in this chapter will provide better insights to achieve this.

Through the numerous examples given and the repeated emphasis on the important characteristics of the conceptual model, it should now be clear that the model really gathers selected viewpoints from the various schools of thoughts in Figure 2-1. The next chapter will look at how the model can fit into general strategic management functions.

CHAPTER SIX

Model Application in the Context of Strategic Management

"In many ways, strategy has been discredited over the past several years. Consulting companies that once focused on strategy are now turning to operational issues. Strategic planning departments are being disbanded. The view that "strategy is the easy part, implementation is the hard part" goes unchallenged in many quarters. Most strategic planning is strategic in name only, ritualistic and formulaic, seldom deeply creative. No wonder strategy has lost much of its credibility. But make no mistake – strategy is hard work. Creating a compelling view of tomorrow's opportunities and moving preemptively to secure the future are tasks for neither dilettantes nor the merely intellectually curious."

- Gary Hamel and C.K. Prahalad (1994)

6.1 Linking the Conceptual Model to Strategic Management

The publication of "From Strategic Planning to Strategic Management" edited by Ansoff *et al.* (1976) came to clarify the subtle difference between the strategic planning process and the broader scope encompassed by strategic management. Since then, people have come to accept the notion that strategic management is really more of an ongoing commitment beyond the planning process itself. Grünig and Kühn (2001) define the three subsystems of strategic management as being strategic planning; implementation of strategies; and strategic control. In essence, this broader view ensures the understanding that realization of strategies is as important as the planning process.

Grünig and Kühn also point out that the three subsystems basically form a larger, single process. Building on this standpoint, a prototype of this process is developed in this section. This prototype serves as a basis to demonstrate how the conceptual model is related to the general strategic management functions. It will be seen that the conceptual model truly augments the analytical power of strategic planning with due consideration of its linkages with the two other subsystems (implementation and control). To provide a more concrete picture, the second half of the chapter closes with a case illustration using the U.S. company Stone & Webster.

6.1.1 The Conceptual Model as a Parallel Process

The application of the conceptual model can be construed as a process that runs parallel to the mainstream of typical strategic management functions. This is depicted in Figure 6-1, whereby the subsystems of strategic management are further broken down into roughly five stages.

The parallelism between the two processes is explained by the fact that most input required for assessing the interactions among variables in the conceptual model (i.e., the seven strategic fields and two organizational mechanisms) comes from the usual strategic management functions. As will be explained later in detail, each part of the strategic management functions is principally related to one or more components of the conceptual model. Essentially, the conceptual model takes these inputs to check and validate the

compatibility of strategies derived from the mainstream. Consequently, potential conflicts arising from incompatibility of strategies are identified more effectively. Moreover, new insights dealing with interaction and higher order differentiation effects can be created, thus serving as a feedback to the mainstream.

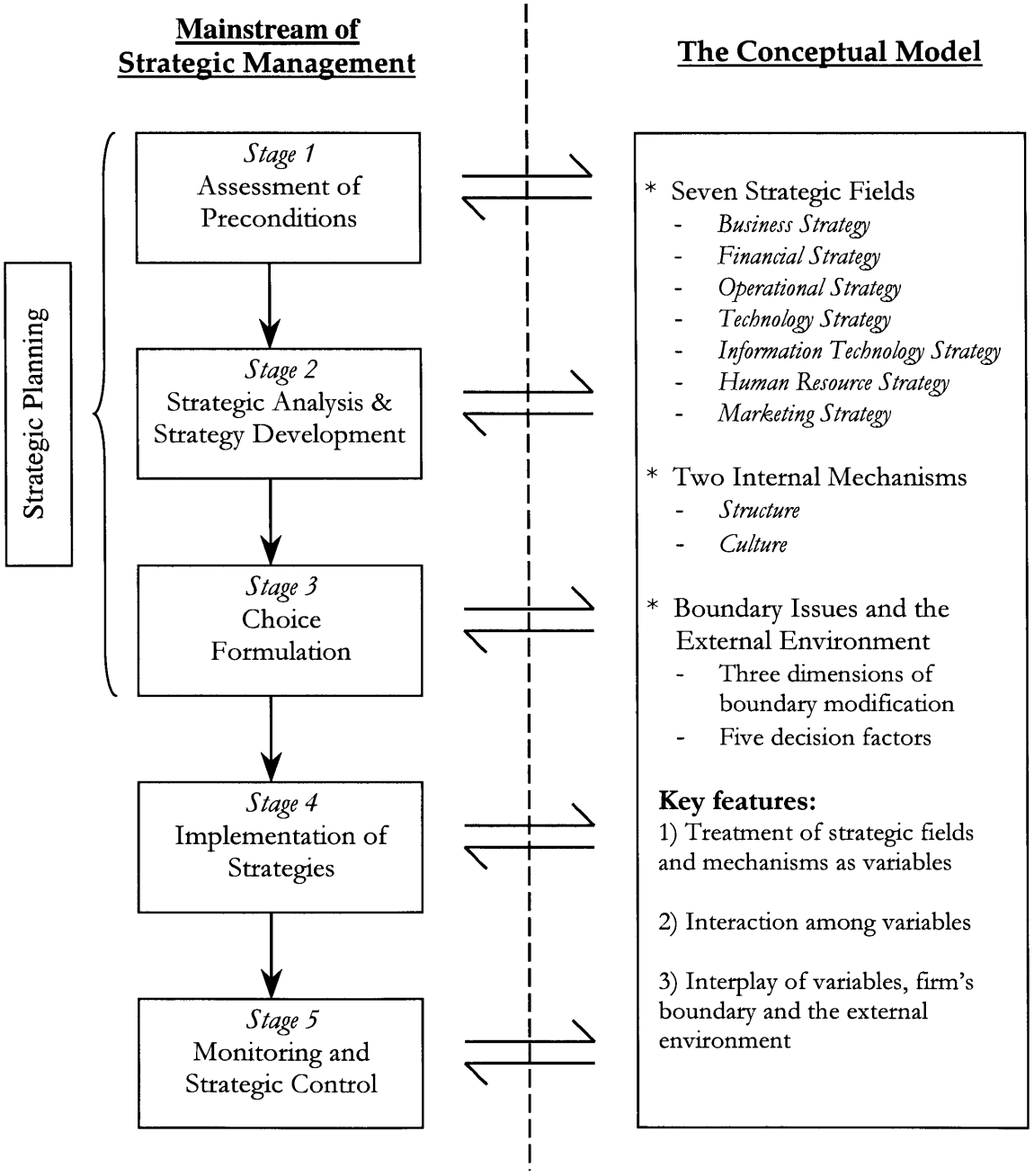


FIGURE 6-1 Parallelism between the Conceptual Model and the Mainstream of Strategic Management in General

6.1.2 ASSESSMENT OF PRECONDITIONS

Stage 1 of the strategic management functions basically consists of three steps as shown in Figure 6-2.[28] In general, there is no particular order in conducting these three steps and the sequence is immaterial. Also listed are components of the conceptual model that are principally related to the steps concerned.[29] In other words, during the process of going through the steps in the mainstream, the strategist should also interpret the problem at hand from the standpoint of the conceptual model and note down any pertinent issues related to those components of the model. By following this methodology, issues and data aggregated will allow concurrent analysis using the conceptual model. Lastly, comments on the dominant stream of theory that is deemed inherent in each step are also given, following the four different schools of thought elaborated in Chapter 2.

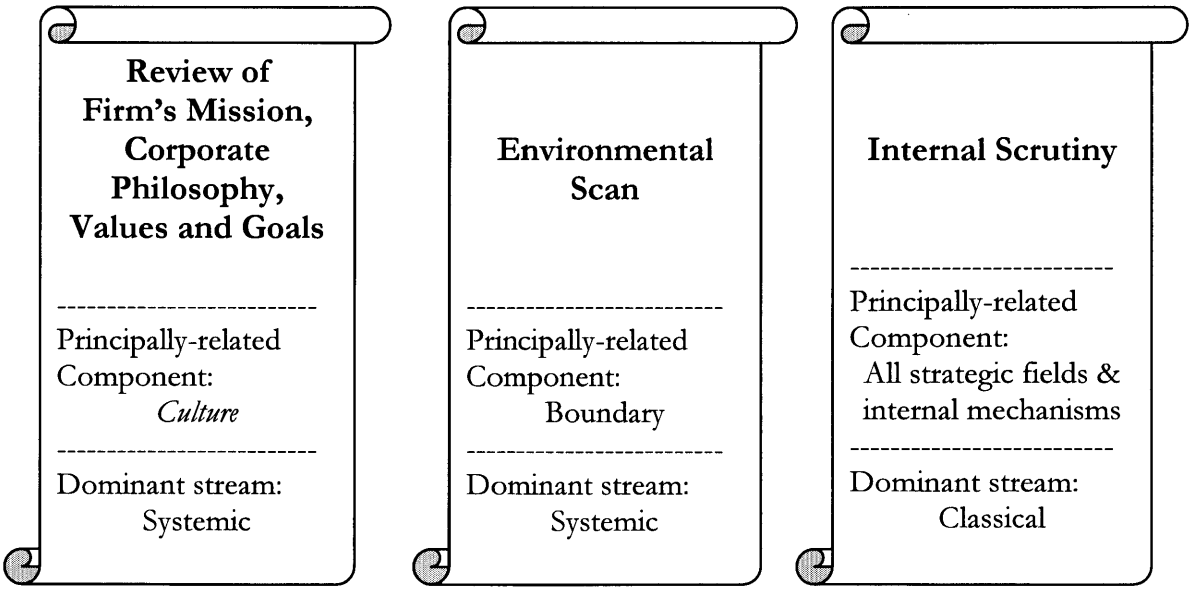


FIGURE 6-2 Three Steps for Assessing Preconditions

[28] This viewpoint is inspired by Macomber (1991). The meaning of steps outlined in Stage 1 closely resembles the first three steps in his article.

[29] These components are said to be "principally" related because they are the most obvious in the respective contexts. This does not imply that other components of the conceptual model would not be present.

Firstly, the step of reviewing firm's mission, corporate philosophy, values and goals is generally self-explanatory. Chinowsky (2000) in particular devotes an entire chapter of his book to this area. Given the broad understanding of the role of the reviewing process, this will not be elaborated any further.

The goal of environmental scan is to gather the latest information on the external environmental factors so that it could be subsequently used for strategic analysis purposes. This includes assessing the outlook of political, social, economic, regulatory, environmental (in technical areas related to engineering) and industrial factors in general. The assessment of industrial factors should also be done with consideration of the firm's current market position and market offers (Grünig and Kühn, 2001).

Throughout the years, many researchers and practitioners have developed their own tools to guide the environmental scanning process. Some of the specific tools and concepts include the Porter's (1990) diamond model and Hamel and Prahalad's (1994) notion of capturing opportunity share. More generally, the industry life cycle model is highly relevant to assessing the industrial outlook; and obviously the enormous range of models developed in the field of macroeconomics is well versed for scanning the broader environment.

Moving on, the step of internal scrutiny, as the name implies, is inward looking. Among the main concerns are the assessment of firm's current competitive strength (which is intrinsically linked to earlier assessment of market position and market offers); internal resource analysis (both quality and abundance); and the mapping of current business and project portfolios along the dimensions of market share, potential growth and risks. In addition, as a direct link to *Information Technology Strategy*, the strategist should also examine and compare the firm's enterprise resource planning (ERP) and decision support systems to the current trend and state-of-the-art. The effectiveness of current systems – in terms of fulfilling business needs, can thus be judged and compared with other alternatives available in the market.

As with environmental scan, guiding tools and concepts abound. Those that are more commonly known are listed below:

- SWOT analysis

- Boston Consulting Group (BCG) portfolio matrix
- Industry attractiveness-competitive strength portfolio method developed by the McKinsey company
- Hamel & Prahalad's (1994) notion of identifying core competencies
- Black & Boal's (1994) method for identifying rare and sustainable resources
- Typical tools of fundamental analysis such as financial ratio analysis
- Altman's (1968) Z-model for the prediction of corporate bankruptcy (see also Langford *et al.*, 1993)

The above list is far from being exhaustive and the strategist can choose other tools that would suit his/her needs.

6.1.3 STRATEGIC ANALYSIS AND STRATEGY DEVELOPMENT

Strategic analysis and strategy development have always been the prime area of research and discussion, with a plethora of well-known tools and concepts available for application in this stage. In general, it is useful to think that strategic analysis and strategy development are really performed at four different levels within the organization:

(1) Corporate level

(2) Business units level

(3) Functional units level

(4) Project level

At the corporate level, the focus is mainly on issues of managing the company's businesses as a whole. Some of these would include resource allocation for various business units, development of an overall marketing image and the overall direction towards a selected generic strategy (Porter, 1980). A diversified conglomerate or an industrial group, for example, is always concerned with the disposition of unprofitable business units and/or new foray into attractive business areas.

The strategy of individual business units appears below the corporate level. Here the focus is more narrowed down to the specific contexts of industries that the units are competing within. Also included are functions such as capital budgeting and making formal appropriation request for each project proposal to be submitted for planning and approval at the corporate level (Brealey and Myers, 1996).

Strategic analysis and strategy development can also be performed at the level of functional units. This is true especially for firms that are technologically driven and have separate functional units set up for R&D. For example, many large Japanese construction firms such as Obayashi and Kajima have separate functional divisions focusing on technology development and basic research. With special expertise and knowledge housed within these units, functional specialists in these units would have a 'better feel' about future direction of where the current trend (of technology, for example) is heading. As such, they would possess some unique insights in terms of shaping the strategy and defining future role of their functions within the larger corporation.

Lastly, core operations of a construction firm can never be divorced from the notion of projects, just like "atoms constitute molecules", so to speak. Contractual issues, project delivery methods and site management functions have always been playing a central role in the civil engineering tradition. In many ways, choices ranging from contractual and delivery methods to equipment and construction technology utilized at site can often be associated with a way of strategic thinking. For example, a large part of Jacobs Engineering Group's success is attributed to its business model – a relationship-based approach, which is more amenable to negotiating contractual terms rather than engaging in the usual price-based competition.

Logically, it is quite obvious that the analysis performed at one level could hardly be isolated from the other in entirety. For example, it has been said that technical specialists housed within the functional units are highly competent in dictating the strategy and future role of their functions. For such strategy to be meaningful, it has to be consistent with other developments at the corporate and business unit levels. "Rocket science" would not add much value to the firm if this were only marginally related to the

firm's business and overall strategy. Similarly, strategy development at the corporate level sometimes has to take due consideration of the intricacy at the project level.

All these sound utterly familiar – in some ways the analysis at different levels are linked through the interaction effect of the conceptual model. Table 6-1 provides further clarification by associating each level with the principally related components of the conceptual model. As mentioned earlier, thanks to the prime interests directed towards strategic analysis and strategy development, strategists nowadays are blessed with the availability of many guiding tools and concepts in this area (although the misery would be to determine exactly just which ones are more suitable!). Again, some of the commonly known ones are listed alongside in the table.

Level of Analysis	**Principally Related Components within the Conceptual Model**	**Guiding Tools & Concepts**
Corporate	*Business Strategy* ; *Financial Strategy* ; *Marketing Strategy* ; *Human Resource Strategy* ; *Structure* ; *Culture* ; Boundary	* The framework of parenting advantage (Goold *et al.*, 1994) * Business Portfolio Management and the "Dialogue Process" (Allen, 2000) * Industry and market segmentation; Five forces model; Value chain analysis (Porter, 1985) * International dimension of management - Location-specific Advantages (LSAs) and Firm-specific Advantages (FSAs) - Mobility of competitive advantages - Local responsiveness versus global integration (Prahalad and Doz, 1987) - Globalization drivers (Yip, 1992) * Project delivery methods - The Quadrant Framework (Miller, 1995) - The CHOICES©™ Model (Miller and Evje, 1999)
Business Units	*Business Strategy* ; *Financial Strategy* ; *Marketing Strategy*	
Functional Units	*Information Technology Strategy* ; *Technology Strategy*	
Project	*Operational Strategy*	

TABLE 6-1 A Primer on Strategic Analysis and Strategy Development

6.1.4 BRIEF COMMENTS ON CHOICE FORMULATION, STRATEGY IMPLEMENTATION AND STRATEGIC CONTROL

The foci of Stage 3, 4 and 5 basically go beyond the scope of this thesis, hence will not be elaborated extensively here. Rather, a few comments will be made for aspects that are related to Stage 1 & 2 and the conceptual model.

It is always possible that Stage 2 (strategic analysis and strategy development) would generate a few alternatives upon which decisions are to be made. The ultimate choice could depend on, among others: the "objective function" of the firm; generic strategy followed by the firm; degree of risk aversion of the decision maker; sustainability of the strategy to be followed etc.

Regardless, some scenario analysis should be performed to project the most optimistic and worst case scenarios before the final decision is made. Also, choices should be considered in conjunction with the adoption of an offensive versus a defensive posture for the planning horizon. An interesting point then comes from the realization that each strategic field of the conceptual model could take on either posture in different periods. For example, with a given level of resources, an aggressive CEO might choose to take on an offensive posture for the firm even when recession dooms (leaving out the issue whether such a decision is wise). This might lead to the devotion of more resources to promote the firm's presence following an aggressive *Marketing Strategy*. Concurrently, the *IT Strategy* may call for an expansion in its management information system to provide a seamless integration of information flow between the new venture and existing business operations. Conversely, a defensive posture might be preferred. This might then lead to trimming manpower and restructuring, among the other choices determined under *Operational Strategy*.

In general, implementation of strategies and control concerns at least the following issues:

- Resource allocation
- Delegations of authority and job tasks
- Communication of strategy and program to all levels

- Direct implementation versus indirect "nurturing", support and adjustment
- Criterion of monitoring
- Control systems (Anthony *et al.*, 1989)

Again, each of these aspects is related to different components of the conceptual framework: resource allocation would be in line with *Financial Strategy*; delegation of authority has to be consistent with *Structure* and *Culture*; success of communication can probably be ensured with a sound *HR* and *IT Strategies* in place. Likewise, many aspects of implementation, monitoring and control are linked to *Operational Strategy*.

Consequently, it can be said that a forward-looking mentality is developed even when analysis and planning are performed prior to Stage 4 and 5 – all because of the linkages between the functions in these stages and the components in the conceptual model. This supports the notion that the conceptual model is really a parallel process that augments strategic management functions in the mainstream.

6.2 Case Illustration – Stone & Webster

This section demonstrates the practical application of the planning process outlined in the last section in conjunction with the conceptual model developed in this thesis. The firm chosen for illustration purposes is Stone & Webster, a technologically prestigious firm that was established since 1889. As we have seen in Chapter 3, Stone & Webster unfortunately suffered from a financial crisis and filed for Chapter 11 bankruptcy in May 2000. The assets of the firm were subsequently purchased by the Shaw Group, a supplier of fabricated piping systems, at a bankruptcy auction. Stone & Webster currently remains as a subsidiary of the Group.

For case illustration purposes, it is presumed that the planning process is applied in the early 1999, as the last annual report available was released for the year 1998. Only the key points are summarized for each part of the process. The goal is to exemplify how the conceptual model can expand the wisdom of a conventional strategic planning process in terms of building higher order strategic actions and giving warning signals for

incompatibility of strategies. Obviously, the task is simplified by the benefit of hindsight on how the events surrounding Stone & Webster had actually evolved.

6.2.1 REVIEW OF FIRM'S MISSION, CORPORATE PHILOSOPHY AND VALUES

Simply stated, Stone & Webster's mission is to deliver superior returns to shareholders, provide best-in-class full service to clients, and foster a challenging environment for employees to achieve career satisfaction and professional achievement (*Stone & Webster Annual Report*, 1998). In terms of goal setting, the firm strives to become a leader in market share, revenue and technology.

The above-stated mission and philosophy might sound plain and routine, but if one truly believes in the value stated, diversification into territories that are unrelated to the core competencies of the firm (principally the engineering-construction services in the energy and process industries) are in conflict with some of these mission statements. For example, it is difficult, if not impossible, to provide "best-in-class" services in the many fields that Stone & Webster was last involved in back in 1999. Here, mission, corporate philosophy and values provide the first sense of direction towards which the firm should be moving.

6.2.2 ENVIRONMENTAL SCAN

Here the attention is given primarily to environmental factors within which Stone & Webster's core businesses lie – the power and energy sectors.

First of all, deregulation within the power sector had promoted competition to a global level. Whereas opportunities in emerging economies abounded, Stone & Webster also soon found that competition in the domestic U.S. market had also become more intense due to the inflow of competitors both from foreign countries and other sectors that had vertically integrated. Increased privatization in the power sector adds to the turmoil, and the nature of client is changing. Independent power producers, for example, often have a different set of priorities as compared to a traditional utility company. The evolving structure of the *demand conditions* can be analyzed from the standpoint of

Porter's "diamond" (1990) and how it interacts with the other components of the "diamond".

The downstream was particularly fraught with waves of utility mergers and restructuring. The U.S. utilities industry, for example, is rapidly dismantling its vertically integrated power monopolies and replacing them with horizontal monopolies based on new specializations and the larger markets that can be served by them (Flowers, 1998). With the changing landscape at the downstream, it was clear that Stone & Webster had to reassess the various aspects of services that it was capable of providing, including technology, geographical coverage, time-to-market, costs, project packaging and delivery methods. As a practical example, it might at first seem that coal-fired electrical generation was the cheapest in the U.S. New techniques of gas-fired generation combined with dramatically increasing world supplies of natural gas, however, dictated that gas-fired generation might set the sustainable price of electricity in the near future. Thus the linkage between pricing and technology had become more intimate that ever before, with clients (the utilities) looking for the most innovative package.

Regulatory amendments concerning environmental issues (generally towards the direction of increasingly stringent and tighter control) are also altering the business landscape of Stone & Webster's clients in the energy and process industries. As Moavenzadeh (1994) points out, the tighter regulations on one hand have indirectly shifted the onus to construction contractors. On the other hand, all these issues have created a large environmental marketplace, with new demand calling for the design and engineering of "cleaner" processes; manufacturing of emission-control equipment; remediation of hazardous sites; decommissioning and decontaminating nuclear power plants; and upgrading and revamping of facilities, refineries and petrochemical plants. This setting fits nicely with Hamel and Prahalad's (1994) argument of capturing "opportunity share" that could be transformed into market share in the future. Thus, it is important to assess whether resources should be devoted to develop competencies in this area.

The overriding pros and cons from the economic, environmental, political and technological perspectives have produced a convoluted scenario as to which energy

source is the most desirable. With core businesses closely related to these areas, it is clear that Stone & Webster was faced with a complicated picture in terms of developing strategies dealing with each different type of energy sources and markets, so much so that the associated environmental issues can either turn into an added burden or new opportunity.

With more than 50% revenues derived from the foreign market, the global outlook in general is also a main concern. By early 1999, Asia was yet to stabilize the reminiscent effects of the financial crisis that the region suffered in 1997. Even the outlook in the Middle East was uncertain, and Stone & Webster had earlier recorded losses associated with contracts in Taiwan, Africa and the Middle East, while the construction of a large ethylene and olefins complex in Indonesia was then suspended indefinitely. Thus, to add to the earlier domestic picture, the international marketplace was very volatile. Fixed contractual obligations such as lump sum contracts was definitely not an attractive contractual mechanism.

6.2.3 INTERNAL SCRUTINY

Most of the information related to internal scrutiny is in fact summarized in the data set for Stone & Webster (refer Appendix B). The discussion is hereby focused on just two main areas: financial performance; and the basis of competitiveness.

Financial Performance

In general, the ratios given under the "Operating and Financial Performance" component of the analytical template can be classified into four types: liquidity ratios; activity or efficiency ratios; leverage ratios; and profitability ratios (Brealey and Myers, 1996). The 3-year time series of these ratios presented in the template can often be compared to the industrial averages published by sources such as Dun & Bradstreet. Table 6-2 on the next page presents a few selected industrial averages for year 1997 and 1998 obtained from Dun & Bradstreet. However, due to lack of further information regarding the basis of which these averages were determined (which could be quite

different from the assumptions given in Appendix C, for example), these figures should be only used as a rough guide to gather preliminary evidence.

The decreasing trend of Stone & Webster's liquidity ratios is obvious. Further, the ratios are way below the industrial averages in 1997 and 1998. These ratios provide hints towards potential cash flow problems. Further examination of the cause of problem might possibly trace back to cost overruns and suspensions of international lump sum contracts for which losses were recorded in the annual report.

	Industrial Averages (Dun & Bradstreet)		**Stone & Webster (from Appendix B)**	
	1997	**1998**	**1997**	**1998**
Liquidity Ratios:				
Current Ratio	1.7	1.6	1.38	0.83
Quick Ratio	1.3	1.2	0.97	0.68
Activity/Efficiency Ratios:				
Average Collection Period (days)	48.2	41.3	49.9	66.7
Total Asset Turnover	1.9	3.4	1.85	1.59
Leverage Ratio:				
Total Debt-to-Assets	0.53	0.33	0.53	0.65
Profitability Ratios:				
Return-on-Assets	5.7%	N.A.	4.8%	-5.9%
Return-on-Equity	13.1%	8.1%	10.1%	-15.5%
Net Profit Margin	3.5%	2.7%	2.6%	-3.7%

TABLE 6-2 Comparison of Financial Ratios of Stone & Webster with Industrial Averages

As for efficiency ratios, Stone & Webster seems to take longer to collect its receivables relative to the average. This was especially true in 1998, and presumably some of its clients were also facing some squeeze financially. This would definitely have spillover effect to cash flow problem. On top of that, the firm had substantially underutilized its assets to generate a sufficient volume of business in 1998, the sudden increase (from 1997) in Dun and Bradstreet's figures also seemed unusually high.

The total debt of Stone & Webster increased substantially in 1998. Nonetheless, in view of the marginal increase and low level of non-current liabilities, a large part of the increase in total debt was probably attributed to short-term borrowing used to tide over liquidity issue. Lastly, the profitability ratios of the firm had been fluctuating and not faring particularly well.

One can also examine the difference between *Gross Profit Margin* and *Operating Profit Margin* of Stone & Webster to get a sense of its overhead costs relatively to other U.S. counterparts (note that Stone & Webster's figures have not been included in Figure 3-5 earlier due to the unstable figures posted over the 3-year period – see Appendix B). Assuming that the figures in 1997 is a good proxy for its average operating performance, the difference between *GPM* and *OPM* is 5.2%. This is higher than the other four U.S. companies presented in Figure 3-5 (Foster Wheeler, Halliburton, Washington Group Int'l. and Fluor).

Basis of Competitiveness

Internal scrutiny of competitive strength overlaps substantially with strategic analysis in Stage 2 of the process (refer Figure 6-1). It is nonetheless worthwhile to briefly review the origin of competitive strength – Hamel & Prahalad's (1994) notion of core competencies of Stone & Webster prior to a more detailed analysis in the next stage.

It is fair to state that Stone & Webster's strong reputation is built upon its expertise in providing design and construction services in the power and process industries. In particular, it employs proprietary process technology to provide cost-effective solutions for petrochemical, refining and gas processing applications. Its Ultra-Selective Conversion (USC) cracking and Advanced Recovery System (ARS) have existed for decades and still stand as effective technologies serving the world's olefin market (for example, these can be traced back to Stone & Webster's Annual Report in 1967). It is no doubt that technological innovation remains as Stone & Webster's core competency.

Categories/Sectors	Stone & Webster's ranking among	
	DESIGN FIRMS	CONTRACTORS
Power	1	12
Petroleum / Process	19	>25
Nuclear Power*	2	-
Nuclear Waste*	-	9
Hazardous Waste*	>25	15
Industrial Processes – Chemical Plants	16	>25

*Note: Ranking of these 3 sectors is based on domestic level (i.e. only U.S. Contractors); others on international level.

TABLE 6-3 Indication of Stone & Webster's Competitiveness based on *ENR's* Ranking in 1998

Evidence supporting Stone & Webster's excellence in the power and process industries can be summed up in the *ENR*'s ranking for firms competing in these sectors based on revenue recorded in 1998. Table 6-3 summarizes the findings. In most categories, Stone & Webster was ranked among the top 25.

Over the years, however, the firm has diversified into other areas, both within and beyond the value systems of the power, process and industrial sectors. As of 1998, the overall portfolio includes businesses in the environmental, infrastructure (rail, rapid transit, highway, airport, bridge projects), software (with applications in aerospace, automotive and telecommunications) and logistics markets (cold storage, food handling and distribution). Within the value systems of its core businesses, it has also integrated forward to provide management consulting services in the gas, power and water industries. Whether such a diversified portfolio adds to its competitive strength is not immediately obvious, but the analysis in the next stage provides a partial answer.

6.2.4 STRATEGIC ANALYSIS

A good starting of strategic analysis is the industry and market segmentation matrix. In the case of Stone & Webster, the segmentation matrix given in the template does not present the entire picture since the firm is involved in many sectors within the

"Industrial" category. As such, Figure 6-3 provides a more detailed breakdown of the matrix.

From Figure 6-3, one can immediately conclude that Stone & Webster is more diversified than it seemed from the segmentation matrix presented in the template. In view of the size of the firm as compared to other similarly diversified engineering firm such as Fluor Corporation (which incidentally has total assets of more than five times of that of Stone & Webster), it is an irony that the firm might have diversified too excessively given its current capacity. Thus, the first critical question that should be posed for future strategy development is the necessity to move from a *broad target, differentiation* type of generic strategy (Porter, 1980) to a *narrow target, differentiation* strategy.

BUYER TYPE

PRODUCT VARIETY	Power	Process	Automotive	Tele-communications	Industrial (Others)*	Environmental / Water & Sanitation	Transportation	Aerospace
Design / Engineering	■	■	■	■		■	■	
Management Consultant	■	■				■		
General Contractor / Construction Management	■	■	■	■		■	■	
Full Service / EPC	■	■	■	■				
Software & Artificial Intelligence			■	■				■
Refrigerated Services					■			
Operation & Maintenance	■	■						

LEGEND:

■ Segments currently served by Stone & Webster's Business Portfolio

FIGURE 6-3 Market Segmentation Matrix of Stone & Webster with Subcategories

The "Five Forces" model (Porter, 1980) can subsequently be applied to analyze the attractiveness of each of the segments within the matrix. For illustration purposes, the focus here is placed on the core business sectors – power and process. It is also thought that the "five forces" faced by Stone & Webster in these two sectors do not differ by much, hence the "five forces" diagram and the associated discussion would be applicable to both sectors.

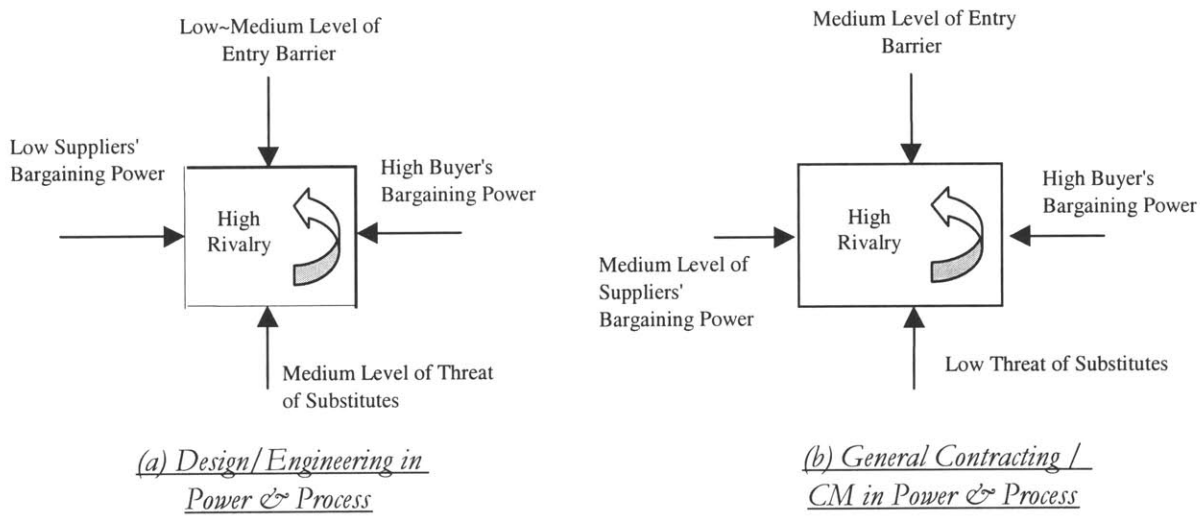


FIGURE 6-4 "Five Forces" of Two Different Segments in the Power & Process Sectors

The reasoning behind Figure 6-4 goes as follows:

- A design firm typically requires less capital investment since the value of service is added through knowledge and expertise as compared to that of a general contractor who has a higher level of fixed assets. In that sense, the entry barrier of a designer is lower. On the other hand, knowledge and expertise in proprietary technology will raise the entry barrier of the design/engineering sector. In general, however, the entry barrier for these two segments is conceivably lower in these days with deregulation and reform of the industry that have created alternative channels (such as pooling of resources, acquisitions by vertically integrated players) that might not be feasible in the old days.

- A designer typically requires only computers, software and office commodities to perform his/her work (a very competitive supply market), as compared to a contractor who has to negotiate good terms with equipment suppliers and more specialized subcontractors in constructing a plant. Hence, the latter typically faces higher supplier's bargaining power. For procurement of commodities such as piping, the contractor would face a lower supplier's bargaining power.

- The threat of substitutes for both segments again differs slightly. Sophisticated clients – large multinational oil companies such as ExxonMobil, Royal Dutch/Shell and BP Amoco all have strong in-house design capability. For relatively routine upgrading and revamping of processes, external designers might not be needed. On the other hand, it is hard to imagine a substitute for plant construction or modification other than procuring the services of an external contractor directly.

- According to the environmental scan discussed previously, consolidation of buyers downstream could only heightened the buyer's bargaining power.

- Lastly, the rivalry among players competing in these segments is typically intense.

One can also carry out value chain analysis for each division of Stone & Webster. As an example, Figure 6-5 lists out some key drivers of the value chain of Nordic Refrigerated Services – a subsidiary of Stone & Webster in cold storage and frozen food handling business.

The analytical process can also be furthered by using other tools and models listed in Table 6-1. The reassessment of international management and strategy is particularly important, given Stone & Webster's recorded losses in Africa, Taiwan and the Middle East. Contracts abroad should be sought more selectively since *Account Receivables* have been piling up while the *Average Collection Period* is increasing. The decision factors of boundary modification discussed in Chapter 5 will be useful in examining whether some businesses (in the aspects of clients and geographical operations) should be eliminated to conserve liquidity. Again, this type of assessment interacts with the strategic fields.

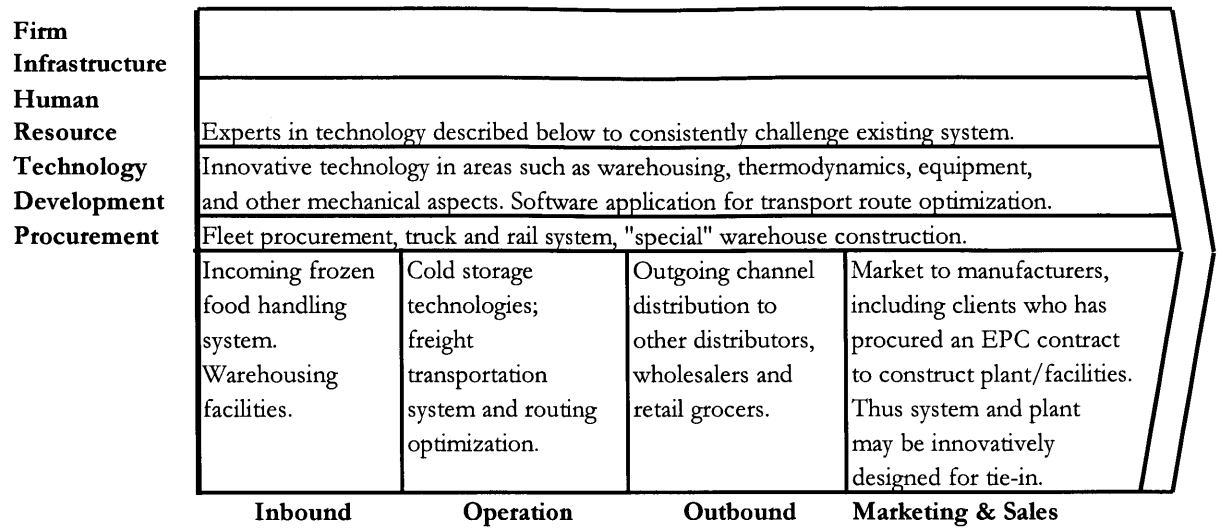


FIGURE 6-5 Key Value Activities for Nordic Refrigerated Services, Inc.

6.2.5 APPLYING THE OPEN CONCEPTUAL MODEL IN STRATEGY DEVELOPMENT

Subsequent stages in the strategic management process – strategy development, strategic choice formulation, implementation and control can be routinely determined. Much of the details in these stages are contingent upon a thorough understanding of the firm assets, employee profiles and operational procedures. As such data is usually hard to obtain, making wild assumptions about these details simply for the sake of proceeding with those stages of management process is apparently too far of a stretch. Instead, the focus of this last section is devoted to demonstrating how the parallel process of checking compatibility and validating strategy by using the open conceptual model in this thesis can tremendously augment the wisdom in strategy development.

The main theme of the conceptual model is to treat each strategic field as a variable and examine the interaction among them. Interestingly, brainstorming critical unique and cost drivers within the value chain can become an intuitive exercise if one follows the philosophy of variables interaction within the conceptual model. This phenomenon can be illustrated by examining the three value chains given in Figure 6-6, 6-7 and 6-8.

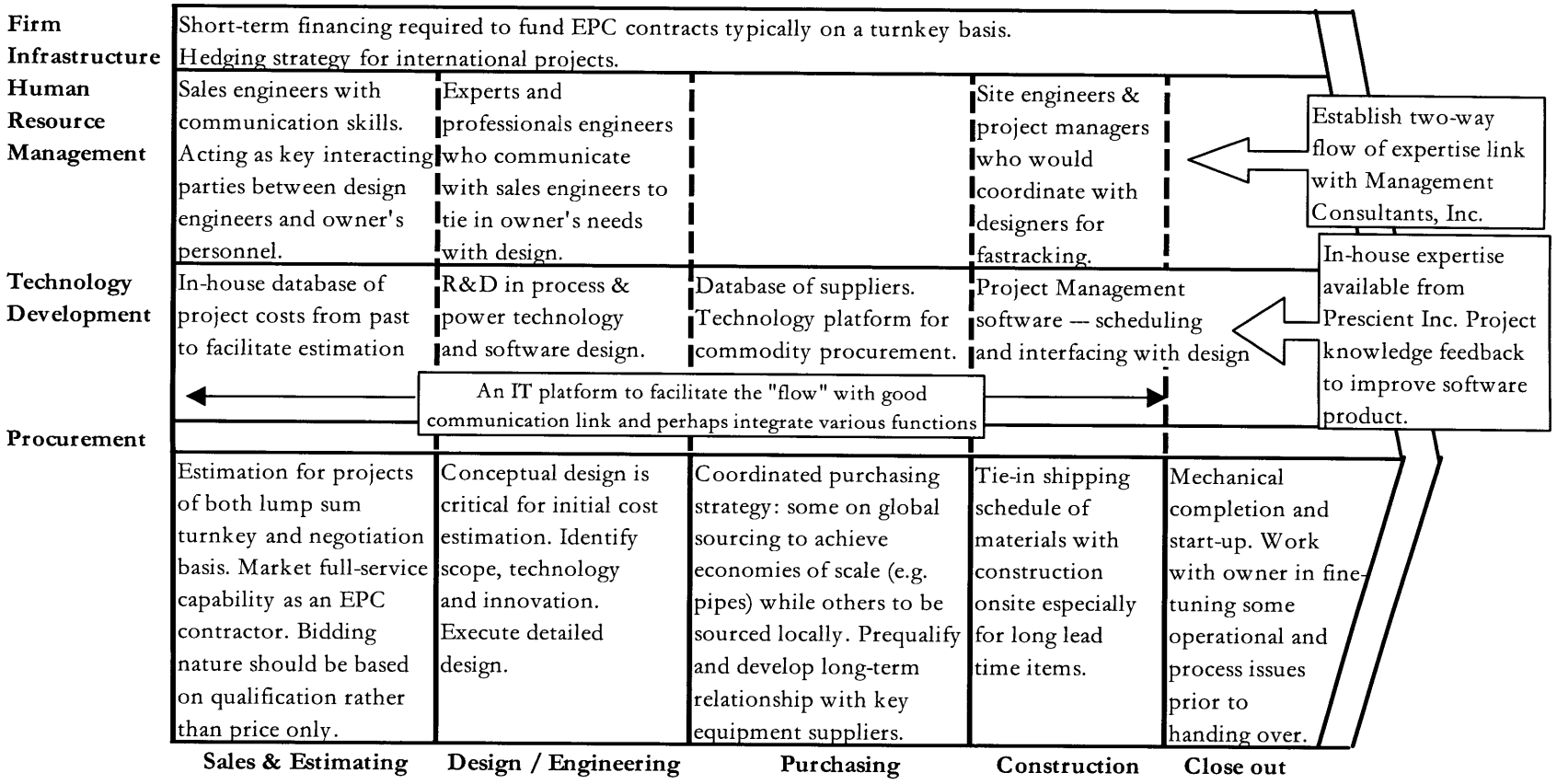


FIGURE 6-6 Some Key Drivers and Value Activities to serve the Power & Process Sectors

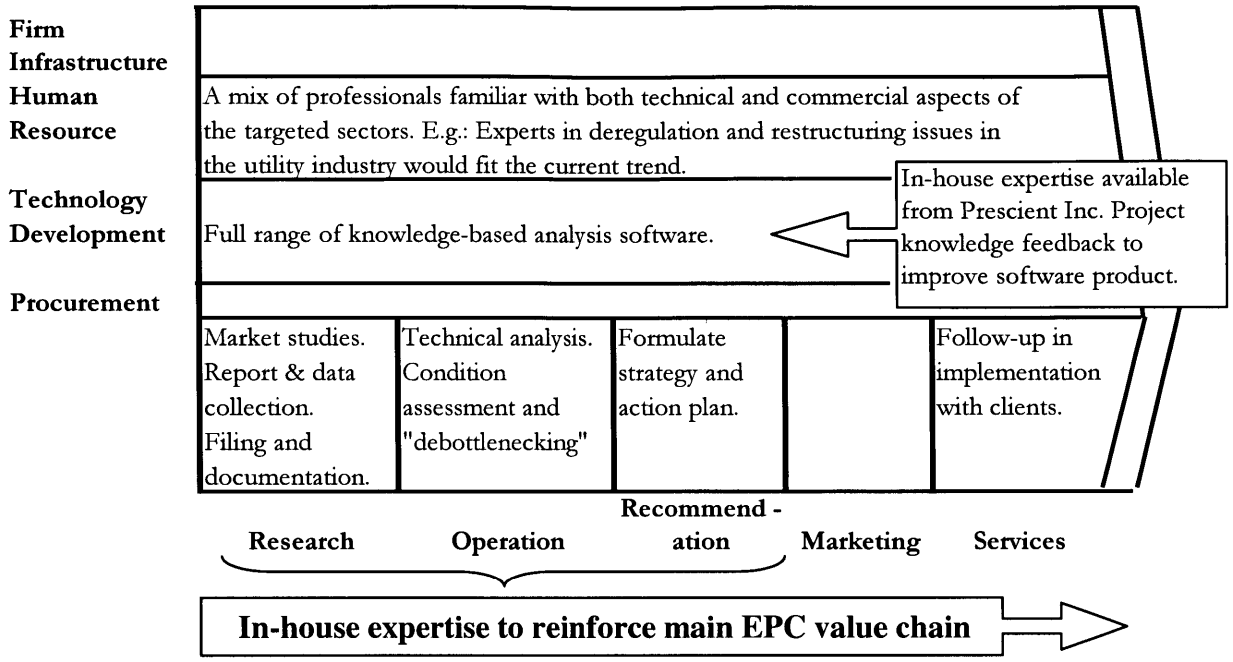


FIGURE 6-7 Key Drivers & Value Activities of S&W Management Consultant

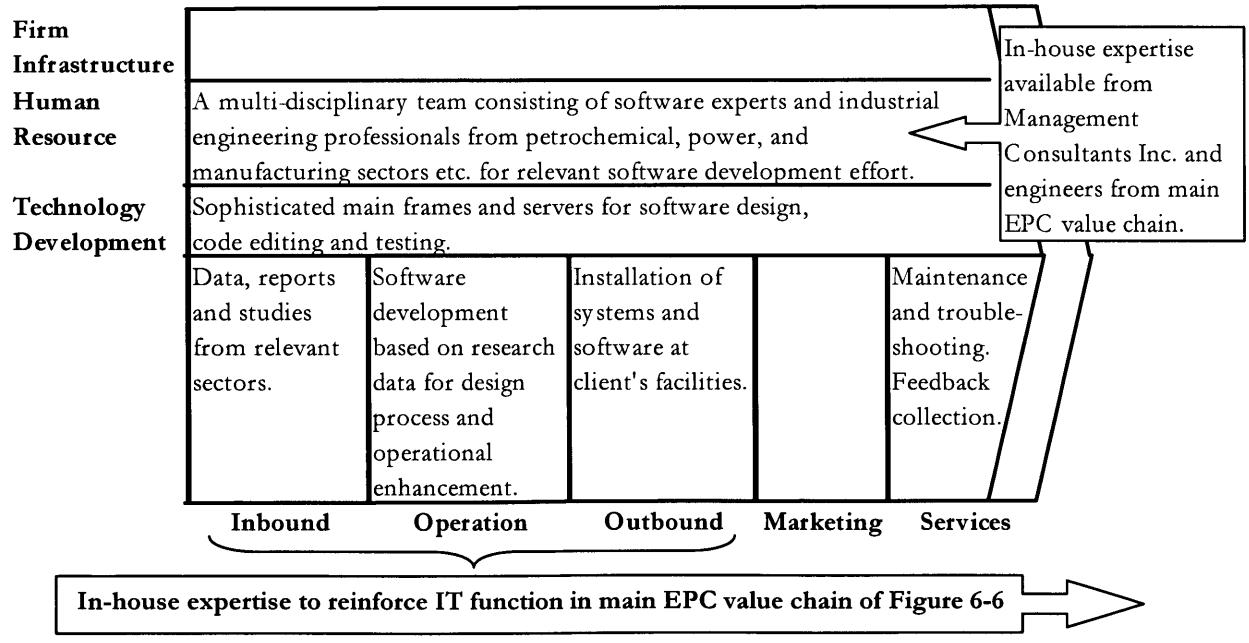
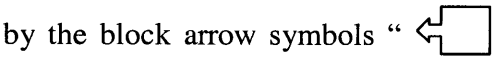


FIGURE 6-8 Key Drivers & Value Activities of Prescient Technologies

Firstly, Figure 6-6 lists out some of the key drivers required to excel in the power and process value chains. In addition, Figure 6-7 and 6-8 also show the value chains of two other divisions – Stone & Webster Management Consultants, Inc. and Prescient Technologies, Inc. Of the key drivers listed in these diagrams, many are formulated through the thinking process of identifying interactions. Some examples are as follows:

- A proper hedging strategy for international projects should be assessed considering the interaction between *Business* and *Financial Strategies.*
- It is evident that the factors for recruitment and training of human resources described are structured by considering the interaction between *HR, Marketing* and *Operational Strategies.*
- By nature, the component of "Technology Development" in the value chain model would have some relationship with *Technology* and *IT Strategies* of the conceptual model. Most of the drivers are derived by identifying the interactions between these two strategic fields and primarily with *Operational Strategy.* A good example is the development of a technology platform for materials procurement, something that has been achieved with great success by JGC, for example.
- Most important of all, some two-way linkages exist among the three value chains as represented by the block arrow symbols "  ". For example, Prescient Technologies specializes in developing engineering software for reducing cycle times and improving product quality for manufacturing companies. Nonetheless, the operating nature of certain industries served currently (especially aerospace) demands diversion from what Stone & Webster probably knows best – the energy and petrochemical processes. As such, one valuable option to consider is to divert the software development skills from the current focus towards reinforcing the role of IT in the EPC value chain of Figure 6-6 as indicated by the block arrow. Effectively, this is a decision that should made in considering the interaction among *IT, Operational, Financial* and *Business Strategies* (the last two are relevant because it involves a decision to allocate resources away from/towards applications in selected industries).

To conclude the discussion of the use of the value chain model in conjunction with the conceptual model, it should now be clear that interactions among *Business*, *Operational*, *Technology*, *IT* and *HR Strategies* are helpful in identifying key drivers and linkages among the value chains. As an EPC contractor equipped with additional expertise in management consulting and knowledge-based software development, Stone & Webster has a great potential to move up the "value curve" (Bartlett and Ghoshal, 2000) even within the same industry. This will transform the "five forces" into its favor, provided that it can streamline these extra components into seamless, value-added activities. This strategy is valuable considering the fact that there are signs of clients within the power and process industries favoring integrated delivery packages which incorporate innovative solutions that cannot be otherwise created through a segmented process. The factors mentioned in this section will lead to a more coherent strategy and implementation plan.

6.2.6 Other Insights and Applications of the Conceptual Model in General

More Interaction between *Business* and *Financial Strategies* and Boundary

From Internal Scrutiny, it is obvious that strengthening the balance sheet and liquidity position would be a primary focus within the *Financial Strategy*. In addition, the outlook of market segmentation matrix, relatively high overhead costs (refer page 187) and the reexamination of generic strategy (refer page 189) all point towards a major conclusion in the *Business Strategy*: the firm might have diversified too excessively.

The interaction between the two converges to a central issue: *Business Strategy* will not be sustainable with the current situation of financial strength. It is thus critical for Stone & Webster to review its business portfolio and divest some non-core businesses and assets in order to raise cash, conserve liquidity, and even potentially lower the overhead costs. In that sense, *Business* and *Financial Strategies* have to be assessed hand-in-hand in determining the right businesses to divest.

Even with just a brief analysis conducted previously, there are strong hints that the infrastructure business, the refrigerated services business, selected portions of the

industrial and software businesses not directly related to the energy and process sectors, are potential candidates for divestiture. This is simply because these candidates do not leverage on the core competencies of Stone & Webster (refer back to Internal Scrutiny, for example). The key drivers for Nordic Refrigerated Services in Figure 6-5, for example, require an investment mindset, skills and technology development that are vastly different from those inherent in the value chain of divisions serving the power and process industries (shown in Figure 6-6). Based on the key conclusion of interaction – one of which is to conserve financial resources, it is not advisable to stretch resources too thin in developing the drivers in too many types of value chains.

Note that this is also a boundary issue, in the sense that it deals with the risk-return profile of business portfolio. The third decision factor of boundary modification – risk-return profile of business portfolio, could thus provide more information on how divestment of one particular business unit would affect the outlook of the entire portfolio. The approach outlined in Section 5.5.3 is hereby applied with the (assumed) divestment of Nordic Refrigerated Services to illustrate the point.

The first step of the approach requires collection of information on "close comparables" that have similar business characteristics of Nordic. In the absence of a perfect "clone" in refrigerated services that is publicly listed, the following companies from the logistics sector (the business nature of which provides a reasonable proxy for Nordic) are selected to retrieve relevant information as compiled in the table below:

"Close Comps"	β_E (Equity)	Debt-Equity Ratio	Volatility	β_A (Asset) $\cong \beta_E$ x E/(D+E) (assuming that $\beta_D \cong 0$)
Hub Group	0.74	0.92	40%	0.39
Offshore Logistics	0.72	0.61	40%	0.45
Vitran Corp.	0.76	1.01	-	0.38
Average:	-	-	40%	0.41

Source: Annual reports of selected companies; and the website: http://finance.yahoo.com .

TABLE 6-4 Selected Data on "Close Comparables" of Nordic Refrigerated Services

The second step entails the determination of values of input variables in the formula given in Section 5.5.3. It should be noted in the case of divestment, the formula is applied indirectly to "back-out" the expected return and volatility of the remaining portfolio. For further clarification, the notations in Section 5.5.3 indeed carry different meanings in this case:

x_p	represents the approximate portion of the level of activities that the firm would engage in the remaining segments (to be determined);
x_n	represents the approximate portion of the level of activities that the firm engages in the segment to be divested (Nordic);
σ_p	represents the volatility of the remaining business portfolio after the divestiture of the said segment[30];
σ_n	represents the volatility of the segment to be divested;
$cov(r_p,r_n)$	represents the covariance between the average returns of the remaining portfolio and the segment to be divested;
r_p	represents the expected return of the remaining segments (to be determined);
r_n	represents the expected return of the segment to be divested;
r_{total}	represents the expected return of the current business portfolio;
σ_{total}	represents the volatility of return of the current business portfolio

From the 1998 Annual Report of Stone & Webster, the book value of total assets is given as $834,682 thousands, whereas the identifiable assets of its cold storage segment amount to $124,301 thousands. Therefore, it can be estimated that:

$$x_n = \frac{124,301}{834,682} \cong 0.15$$

Also, in Table 6-4, σ_n has been estimated from the data of "close comparables" to be 40%.

[30] As mentioned in Footnote No. 22 in Chapter 5, for practical purposes it is easier to estimate the volatility of the equity due to readily available information on the stock price. The volatility measure referred here is actually the volatility of equity invested in the related business segment rather than the volatility of operating assets. The implication on strategy remains unchanged though.

The determination of $cov(r_p,r_n)$ in the case of divestment is more tricky, since theoretically it would require historical values of r_p (and r_n) which is indeed not available (given the fact that the returns of the remaining portfolio are yet to be observed)! It is nonetheless possible to estimate indirectly the covariance between the two returns from their "betas", which represent their individual correlation with the market return. The procedure will go as follows:

(1) β_n (for the segment to be divested) estimated to be 0.41 in Table 6-4;

(2) β of Stone & Webster's equity, according to Multex Investor® at http://yahoo.marketguide.com, is 0.22. Given that the total debt ratio is 0.65 (refer to template of Stone & Webster), β_{total} is thus $0.22x(1-0.65) \cong 0.08$;

(3) Since $\beta_{total} = x_p\beta_p + x_n\beta_n$,

⇨ $0.08 = (0.85 \times \beta_p) + (0.15 \times 0.41)$

⇨ β_p (of the remaining portfolio after divestment) = 0.02

(4) It can be proven mathematically that the following relationship holds[31]:

$$cov(r_p,r_n) = \beta_p \times \beta_n \times [\text{variance(market return)}]$$

The volatility of market return (with the S&P 500 index as a proxy, for example) is widely perceived to be about 20% ~ 25%. Assuming this to be 20%,

$$cov(r_p,r_n) = 0.02 \times 0.41 \times (0.2)^2 \cong 3.28 \times 10^{-4}$$

[31] From CAPM, $r_p = (1-\beta_p)r_f + \beta_p r_m$; and $r_n = (1-\beta_n)r_f + \beta_n r_m$. Applying Theorem A on page 131 of Rice (1995) will lead to the stated results. Nonetheless, due to empirical weakness of CAPM (specifically, β as the sole factor in a linear model will provide only limited explanation for the variation in the dependent variable – the expected return), this equation only gives an approximate result for the covariance.

Equipped with these intermediate calculations, the Capital Assets Pricing Model (CAPM) (Sharpe, 1964; Lintner, 1965; Mossin, 1966) can be used to estimate the expected returns. The risk-free at the end of 1998 was about 4.5% and the market risk premium ($r_m - r_f$) is assumed to be 8%.[32]

$$r_p = r_f + \beta_p \, x \, (8\%) = 4.5\% + 0.02 x 8\% \cong 4.7\%$$

$$r_n = r_f + \beta_n \, x \, (8\%) = 4.5\% + 0.41 x 8\% \cong 7.8\%$$

$$r_{total} = r_f + \beta_{total} \, x \, (8\%) = 4.5\% + 0.08 x 8\% \cong 5.1\%$$

Lastly, using the data from the template that gives an approximate value of σ_{total} = 23.7% in 1998, and thus the volatility of the remaining portfolio after divestment can be calculated from the following equation:

$$\sigma^2_{total} = x_p{}^2 \sigma_p{}^2 + x_n{}^2 \sigma_n{}^2 + 2 x_p x_n \, cov(r_p, r_n)$$

$$0.237^2 = (0.85^2 \text{ x } \sigma_p{}^2) + (0.15^2 \text{ x } 0.40^2) + (2 \text{ x } 0.85 \text{ x } 0.15 \text{ x } 3.28 \text{ x } 10^{-4})$$

$$\Rightarrow \quad \sigma_p \quad \cong \quad 27.0\%$$

The calculated values of the expected return and volatility of remaining business portfolio (if Nordic were to be divested) can thus be compared with those parameters of the existing portfolio by constructing a diagram that is similar to Figure 5-4 – hereby produced in Figure 6-9 using the figures obtained in the Nordic example.

[32] Estimation of risk-free rate is based on the 3-month treasury constant maturity rate obtained from the interest rate data of the Federal Reserve Bank of St. Louis.

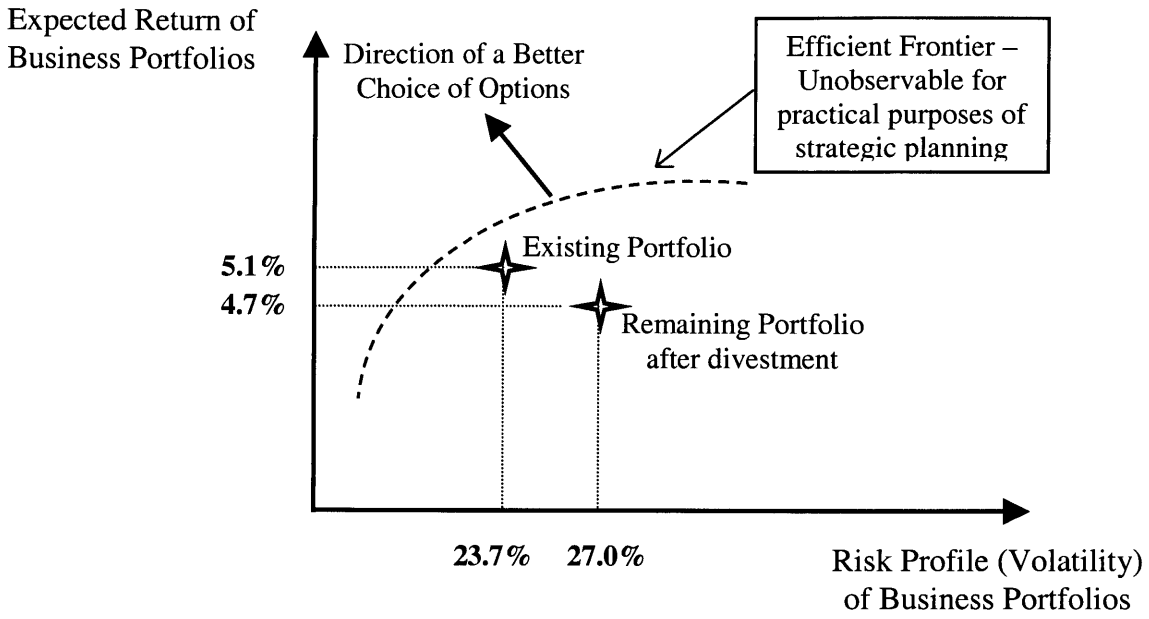


Figure 6-9 Change of Risk-return Profile due to Divestment

It can be seen that if Nordic Refrigerated Services were to be divested, the risk-return profile of the business portfolio actually becomes worse (since the position migrates towards the southeast direction which implies larger risk but lower return)! This should not come as a surprise due to two facts:

(1) Nordic **is** in fact a profitable business unit, posing an operating margin of 24.7% and 31.5% in 1998 and 1997 respectively (*Stone & Webster Annual Report*, 1998). With the average operating margin of businesses as a whole below these figures, the divestment of Nordic will obviously pull down the average.

(2) The extremely low correlation between Nordic and the remaining business portfolio implies that Nordic is in fact a good hedge for diversification purposes. It thus follows that its disposition will lead to an increase in volatility.

With the findings from this example (which in general going against the divestment of Nordic) contrasting the earlier argument in strategic analysis, should the

decision be reversed then? Probably not, particularly if the following counter-arguments are taken into consideration:

(1) Assessment of risk-return profile only represents one of the many other decision factors and strategic considerations. Including such factor to make a more rational judgment does not necessarily imply that it should overrule the other factors.

(2) Overall, Nordic only represents a minor part of the entire operations (15% in terms of asset value). As such, strategic analysis on core operations and competencies that focus on the larger part of the remaining business portfolio should be given a much heavier weight towards the ultimate decision.

(3) Following the previous point, in view of the financial squeeze, craving of liquidity and importance of cash in such a period of crisis, the fact that Nordic can probably demand a good price (due to its profitable track record) would only make it a more ideal candidate for divestment to save the other core operations!

In any case, the point here is simply to illustrate a case of interaction between *Business Strategy*, *Financial Strategy* and Boundary and how a decision factor discussed in Chapter 5 can be pulled in to enhance (and challenge) the analysis and planning procedure.

More Interaction between *IT*, *Marketing*, *Operational Strategies* and Boundary

A key component of *IT Strategy* (which also appears in the value chain diagrams previously) is to develop software and platform that will facilitate efficient information flow among different operations within the firm. If such coordination can be extended into the client's organization (which has become a common form in corporate travel businesses), the technology established can effectively become a major marketing channel. Operationally, the workflow among the owner's personnel, sales engineer,

design engineer, and even the construction manager that is based on a related set of information can be coordinated more efficiently.

When such a product exists, the boundary question of 'mode' cannot be overlooked in extending the use of the product. Much like the issue faced by FreeMarkets OnLine, Inc. for delivering its bidding software (*Harvard Business School Case* #598-109), the firm has to consider how to market the new product:

(i) Either opening up the usage on a project-by project basis to clients who concurrently has design/construction work with Stone & Webster;

(ii) Or licensing to an external third party and charging a fee.

Interaction between *Business, HR Strategies* and *Culture*

All the strategy development so far seem to point towards a *narrower target, differentiated* type of generic strategy and focusing particularly on the power and process industries related to energy (e.g. petrochemical and refining). This advice is deemed reasonable considering the cultural dimension of Stone & Webster. The basis of core competencies originally evolved as a focus differentiator with proprietary technology. Presumably, the type of employees that had driven Stone & Webster to its past success was functional specialists with high technical competence. There exists a strong cultural influence reinforcing the aspects of human, knowledge and process.

On the other hand, it is true that environmental conditions have changed since the old days (such as those prominent in 1967), calling for a deeper appreciation of client's business needs in the downstream. This change is depicted in Figure 6-10, whereby employees now have to possess interdisciplinary skills to augment their technical skill in order to achieve strong delivery of solutions for the clients. Even then, it can be said that the type of interdisciplinary skills desired are still related to the *same* industrial contexts and not fundamentally different. In other words, in-depth knowledge about the vertical markets remains important.

In contrast, managing a portfolio in *various* industrial sectors such as the one that Stone & Webster held in 1998 would demand skills that are far more diverse than simply

augmenting technical fundamentals with business and management capabilities. Therefore, when pursuing skill development that is way too diverse from the technical origin, cultural compatibility might become a critical question when current managers come from a background that is acquainted with the old process of working and thinking. Adding on to these miseries is the dwindling level of resources that the firm currently faces, which potentially limit the use of a broader *HR Strategy* to attract talents and experts to manage the different areas of businesses. Again, the conclusion to shrink the territory would avoid some of these problems.

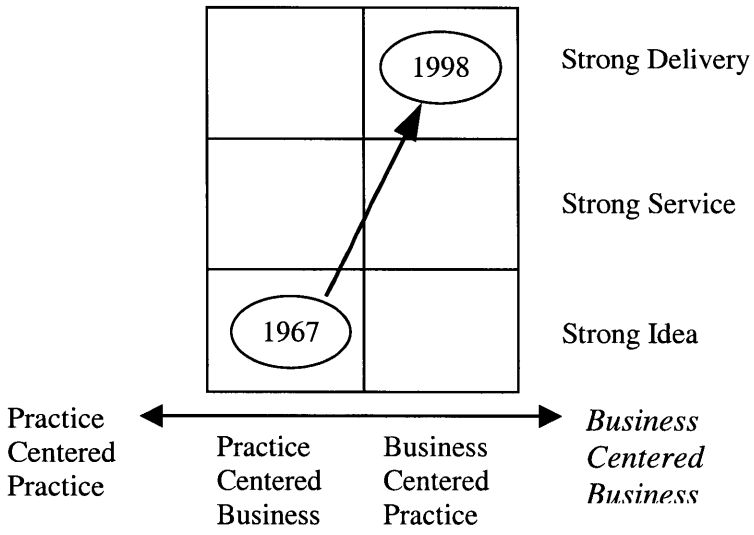


FIGURE 6-10 Skill Types Valued by Changing Business Environment over Time

CHAPTER SEVEN

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

"As engineering becomes increasingly central to the shaping of society, it is ever more important that engineers become introspective. Rather than merely revel in our technical successes, we should intensify our efforts to explore, define, and improve the philosophical foundations of our profession."

- Samuel C. Florman (1987)

"You won't be given any answers, but from what you have here and your own experience, you should finish by thinking differently... **[and]** *emerge with your own coherent philosophy of strategy, something that will be a resource and guide in all the unforeseeable, non-standard events and opportunities that may make up your managerial life."*

- Richard Whittington (2001)

7.1 Conclusions and Implications

7.1.1 Challenges and Response in General

From the study of firms in this research, it is apparent that the corporate world in the construction industry constantly faces challenges – not only the new ones that evolve due to constant change in environment, but also old obstacles that would not go away.

Firstly, many of the conventional civil engineering services are getting more and more standardized and "commoditized". For example, design and construction of high-rise building, that demanded much knowledge and innovations to conquer a few decades ago, no longer command a high degree of competitive advantage when an increasing number of firms can equally get the job done in one way or another.

Fragmentation of the industry persists, and entry barrier continues to lower in conventional design and construction marketplaces. This is especially true when the roles concerned are the typical ones that are sandwiched in the middle of the value system. Referring back to Figure 2-2, for example, most general contractors and designers would fall under this category. At the downstream, clients typically possess more bargaining power since more services have become commoditized and substitutions abound. Pressure continues to exert, not only in terms of pricing, but also of speed and knowledge. 'Total solutions', not services, are sought for. Similarly, it is hard for typical designers and contractors to inquire better terms from the upstream. Suppliers, notably those with proprietary products, are more insulated from the downstream pressure and better protected by their resemblance to the manufacturing sector. They do not yield much to pricing pressure since profit margin is more stable, in relative terms, as compared to their counterparts in the middle of the value system. Most important of all, economies of scale are often achievable – something that designers and contractors usually do not enjoy due to the nature of construction projects. Furthermore, let's not forget the perennial professional liabilities that designers and contractors are exposed to, creating a curiously high risk-to-*potential* reward ratio.

Is it time to give up, or strive along but accept the notion purported by the Evolutionary perspectives (recall Chapter 2)? Is further research and innovation in the technical aspects of engineering the *only* way to exit from this viscous cycle? Would

improvements in management aspects at the project level naturally alleviate these problems? Shouldn't majority of these problems be confronted at the *corporate* level or in combination instead? Regardless of whether one would classify construction as a "perfectly competitive" market or a "contestable" market, it is evident that economic forces have played their part. To improve long-term economic return then, construction players have to embrace a larger part beyond their conventional roles.

Although it is too excessive to assert that strategy matters the most, it is certainly legitimate to state that one can only ignore strategy at its peril. In many ways, the conceptual model developed in this thesis helps to renew our thinking. By including an all-rounded definition of strategy, construction professionals effectively follow a broader philosophy of thinking about new service provisions, carving out new territories that are worthwhile to explore and develop value-added components. Not all is gloom though, as the importance of IT, technology and finance have obviously received more attention in our industry in the past decade or so. A similar picture, however, cannot be concluded for the effects of marketing management that are often taken lightly, while the design of human resource policies is commonly viewed as just another routine undertaking.

7.1.2 SPECIFIC CONCLUSIONS FROM THIS THESIS

From the literature review given in Chapter 2, the evolvement of strategy as a field has shown that it has received considerable attention mostly from other industries and its popularity has sustained for a few decades. So if this were really management school rhetoric, it would have died down long ago. Due to its complicated procurement systems (delivery methods and contractual issues) and production (construction) process, it would appear that civil engineering professionals are better suited to venture into the study of strategy for their own industry.[33]

[33] Most strategy researchers in general do not seem to show too much interest in the construction industry. The author offers at least two reasons behind this: (1) High growth industries such as biotechnology, the internet and telecommunication has stirred up so much publicity that researching these industries would derive a better 'return'; (2) Construction poses many complex and unique issues that cannot be easily studied without a thorough understanding of and experience in the industry.

If one remains skeptical about the importance of strategy, the study of operational and financial performance of some of the largest international construction firms in Chapter 3 provides more facts to support the argument. In essence, it is observed that there is more than one route towards success, but many pitfalls to evade. The urgency however comes from the fact that many are still frustrated by the confrontation with a low margin, low volume profile (see Figure 3-6). A detailed study of individual firms, many examples of which have been presented in this thesis, reveals that the cause of problem can originate from different nature – just to quote a few examples:

- strong ties with public works that cannot be severed even when the domestic economic has turned south (primarily factors related to the Systemic school of thought);
- poor business and financial planning, e.g., diversification strategy that is not commensurate with the level of resources (primarily factors related to the Classical school of thought);
- incompatibility of strategy and failure to extract synergy through a coordinated workflow in many M&A transactions (primarily factors related to the Processual school of thought).

Evading such pitfalls, and developing various routes towards success, need not be segregated into two separate tasks in strategy formulation. Some main conclusions derived from Chapter 4 to 6 would shed some light to such concerns:

- A dynamic model is required to deal with dynamic changes. By definition, the structure of the model captures dynamism by identifying fundamental *variables* (the seven strategic fields and two internal mechanisms) and emphasizing the 'fluidity' of firm's boundary;
- The notion of interaction among variables is by default dynamic. In the process of searching for interaction effects, not only that a higher-order competitive advantage can be designed, compatibility of strategy is also indirectly ensured. In this way, developing success factors and evading pitfalls are handled concurrently;

- From an "input-output" standpoint, the application of conceptual model stands as a process that runs parallel to the common strategic management functions – by taking the issues faced in mainstream as inputs, and feeding back conclusions from the model (on interactions and compatibility checks) as outputs to aid further planning and analysis in the mainstream.

7.1.3 THREE BUSINESS IMPERATIVES

The conclusions discussed in the previous sections further channel the attention to the confirmation of three business imperatives: profit margin; volume; and risk.

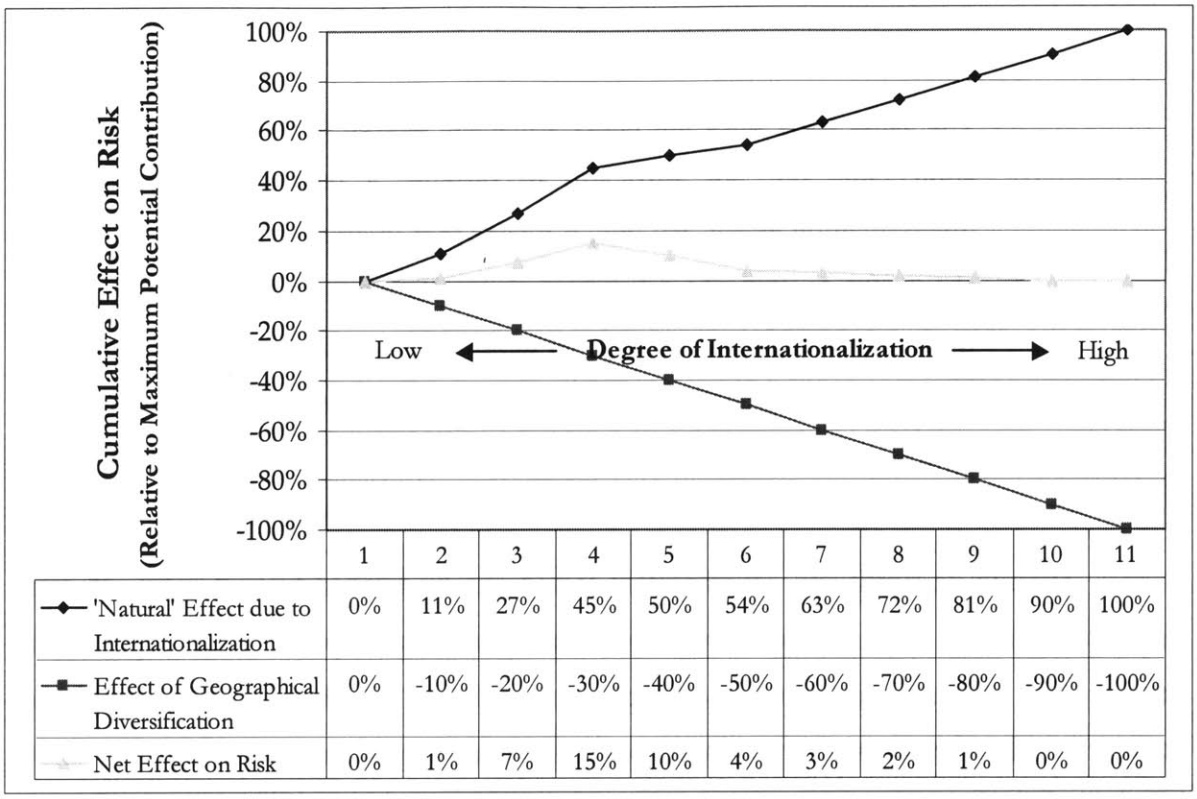
Achieving high profit margin and capturing large market share (volume) have long been the two main business imperatives. One might remember, however, the lessons learned in Figure 3.6 – that there is often a tradeoff between the two. It is often difficult to move diagonally across from a low-margin, low-volume status towards a high-margin, high volume outlook directly. When resources are constrained, firms simply have to settle with one of these two imperatives (at least initially) before an over-aggressive strategy backfires.

The story however does not merely end with the potential tradeoff between profit margin and volume. The study of boundary issues in Chapter 5 reveals that a third imperative – managing risk and volatility of businesses, cannot be ignored. Although risk management has now become a main topic of research within the industry, one should not limit his/her perception of risk management only to the project level. Construction professionals, especially senior managers who handle corporate issues, should also get acquainted with managing other risk such as financial liquidity and risks associated with new business ventures through different modes. Due to the negative skewness of profitability in construction, competitive margins earned in ten projects may not be sufficient to cover up losses arising out of even one bad mistake. For new initiatives such as mergers and acquisitions, skewness further increases when such actions are pursued at a fast pace without prior experience.

A main concern for risks comes from a firm's venture into the international marketplace. On one hand, the level of risks increases naturally by virtue of the act of internationalization itself – either imposed by the firm's unfamiliarity with host country environment, or due to its exposure to a *larger* set of uncertain factors such as the contractual structure (e.g. a lump sum contract denominated in an inconvertible, foreign currency). On the other hand, geographical diversification effect would help to lower the overall risk level of the firm's businesses and/or projects. The combined effect of the two leads to numerous feasible outcomes, one of which is described next. The example, though abstract, serves to illustrate how risk management can sometimes create an unexpected result on strategy determination.

Imagine for the moment that the cumulative contribution to risk due to each effect can be expressed as a relative percentage of their respective maximum levels. When a firm internationalizes, it is assumed that the marginal diversification effect due to increasing geographical operations is constant, thus the cumulative effect on risk would decrease by following a linear fashion (see Figure 7-1). On the other hand, when a firm ventures overseas, it is reasonable to assume that its risk profile increases sharply at first (due to inexperience in setting up and managing foreign operations). Thereafter, the firm would be able to shrug off similar challenges when it gains experience and knowledge about foreign operations and host market conditions. Therefore, due to the skewness effect faced by the firm when it first internationalizes, the *rate* of contribution to risk would exceed that of the diversification effect at first, before it dies off and matches that of the latter. This scenario is depicted by an initially higher slope of the cumulative effect on risk arising naturally due to internationalization, which becomes flatter when the degree of internationalization increases.

When viewed in aggregate, the net effect is an interesting one. Following the conditions imposed in this example, there exists a hurdle (represented by the hump in the picture) that a firm has to cross when it expands its operation overseas.



	1	2	3	4	5	6	7	8	9	10	11
'Natural' Effect due to Internationalization	0%	11%	27%	45%	50%	54%	63%	72%	81%	90%	100%
Effect of Geographical Diversification	0%	-10%	-20%	-30%	-40%	-50%	-60%	-70%	-80%	-90%	-100%
Net Effect on Risk	0%	1%	7%	15%	10%	4%	3%	2%	1%	0%	0%

Figure 7-1 A Risk Hurdle in Internationalization

Effectively, the above example has been constructed with the following propositions in mind:

- The low end of internationalization is practically exemplified by players who primarily concentrate on the local market. These players convert local knowledge and network to their full advantage, although they would suffer from their ties to the cyclicality of the local economy. To a large extent, the two opposite effects cancel each other; thus the combined risk level would generally be low.
- Similarly, at the high end, with a large international network, the geographical diversification effect is substantial. The threat posed by the volatility of individual markets – resembling a form of idiosyncratic risks, make up a larger percentage of the total risk of the global operations

which can be diversified away. Again, it is perceived that the combined risk level would generally be low.

- The same story does not apply when the degree of internationalization is appreciable but not sufficient to provide a meaningful geographical diversification effect. By this, it means that international works contribute about 10% to 25% of total volume, typically when an established domestic firm ventures into overseas in an appreciable scale. Within this range, the risk level increases at a sharp rate due to the skewness effect – whereby a firm is potentially exposed to a large cash drain and/or huge loss, while not enough volume to average out these potential losses.

Despite its simplicity, an important lesson can be learned from this hypothetical example: when a firm ventures into the international marketplace, it is important to ensure that sufficient amount of resources are available to ride over the 'hump' and counteract the skewness effect. Alternatively, the pace should be slowed down to allow for more learning about the foreign environment, and lowering risk to an absorbable level commensurate with limited resources.

In summary, it goes without saying that the need to understand and manage risk wisely deserves to form the third business imperative.

Finally, it should be cautioned that the context of business imperatives cannot be isolated from the Systemic theorists' view of environment. For example, a profit-seeking motive is not *always* an objective of top priority. This is especially true in an environment that views social responsibility (for example, maintaining a stable level of job provisions) as a major role of a firm. Hence, the relative importance among business imperatives should be judged in accordance with the different contexts.

7.2 Recommendations on Future Research Directions

In a way, recommendations given on future research directions are meant to overcome the limitations of this doctoral research as discussed in Section 1.4.

7.2.1 IN-DEPTH STUDIES OF INTERACTIONS AMONG SPECIFIC COMPONENTS

First of all, it has been mentioned that this research adopts a broad view aiming to absorb the many schools of theories on strategy. A natural outcome would be to sacrifice on more specific studies of detailed interactions between any two or more strategic components. It is hoped that the model presented in this thesis would help civil engineering researchers to:

(1) Think about expanding their traditional role by incorporating knowledge from the other strategic fields (IT, marketing, finance, etc.) more formally based on the notion of interactions among strategic fields;

(2) Change their philosophy of thinking about how their works can bear an impact on corporate strategy in construction instead of constraining them to become isolated studies.

Although the conceptual model in this thesis captures the philosophy, it is the author's honest belief that specific interactions can only be meaningful determined by the *collective* efforts of experts in each of these fields. It is hard to imagine anyone could have specialized in all the components in the model in order to study the interaction among these variables at an in-depth level. Specialists should pick those few strategic components (e.g. *IT* and *Business Strategies*) that they are most familiar with and study the interaction effects. In addition, the author also adopts the viewpoint that civil engineers should take the lead role in becoming such "specialists" and "experts" because of their familiarity and appreciation of the unique characteristics of the construction industry.

With a reasonable exposure to the area of finance, the author, for example, has spotted the following potential ground for developing future research:

(1) A deeper understanding of how the use of credit derivatives can benefit the construction business transactions and its impact on developing *Business Strategy* (e.g., choice of projects, clients, suppliers).

- Credit derivative usage has been growing dramatically, with the notional size of the market being predicted to reach $1.6 trillion by 2002 according to The

British Bankers' Association. Significant credit exposures often accrue in Design-Build-Finance-Operate (DBFO) (or Build-Operate-Transfer) projects with a take-or-pay commitment made by a certain party. With many construction firms taking up equity stakes as sponsors for such type of projects, they would have a need to understand how effective use of credit derivatives can help to lower their risk exposure and weigh this against the additional costs.

(2) A deeper understanding of the nature of derivative instruments in general that would help to minimize the fluctuation in revenues from some of the projects.

- While the previous point deals with credit risks, the use of derivative instruments is now very common to reduce a party's exposure to market risks, especially those associated with the revenues of projects. Again, this is more relevant for those firms that expand their involvement beyond the completion of construction – by taking up equity stakes in the operation of DBFO projects such as toll roads or power plants. Derivatives on energy products, for example, are now commonly available in the over-the-counter (OTC) market, which can be used to hedge revenue risk in the electricity production of power plant if such risk cannot be addressed explicitly in the power purchase agreement.

- An example is adopted from another industry to illustrate the idea. A car tire manufacturer, who has just borrowed a significant amount of debt for plant expansion on a floating-rate basis, is subjected to a tremendous amount of risk in the event of an increase in interest rate. This is because an increase in interest rate typically reduces demand on new cars, which in turn reduces the sale of tires to car manufacturers. This reduction in revenue could not have come at a worse time when debt obligation increases as well. To prevent too much exposure to a potential liquidity crisis, there are at least two ways to hedge the revenue risk – in this case due to an increase in interest rate: (1) by entering into a "pay fixed, receive floating" swap arrangement; (2) by shorting

interest rate futures (e.g. treasury bond futures and eurodollar futures) that would increase in value when interest rate increases. In this way, it is hoped that the gain in the derivative instruments held would offset the loss in revenues of the physical operations of the business.[34]

It should be mentioned that these derivative instruments can be very complex, and in some cases the exact execution strategy should be consulted with financial experts. That said, it remains the client's (in this case the construction firm) responsibility to express its needs so that the cheapest or most effective instruments can be selected – again leading to the necessity to understand at the basic level how these instruments work. Disasters arising from misuse of derivatives abound, often leading to the misconception that the use of derivatives is either ineffective or "evil". However, past disasters were mostly due to inadequate understanding of how a derivative position might affect the firm's financial position as a whole or, in some cases, using the instruments for *speculation* rather than hedging purposes. While many industries have started to learn and appreciate how these instruments could benefit risk management, again we do not see a similar interest in the construction industry to possibly take advantage of one of the most significant financial innovations for the past few decades.

While the above illustration focuses on the interaction between *Business* and *Financial Strategies*, it is hoped that similar insights can be derived as new research agendas in other areas that would benefit the construction industry.

7.2.2 SPATIAL BEHAVIOR OF FIRMS AND STRATEGIC COMPONENTS

The template constructed in this research provides a setting to organize and collect data over time. By building up a database over time, there is more factual information available to analyze how operating and financial factors might change, thereby providing a dynamic view on strategy. Moreover, only with an adequate amount of data points that powerful statistical methodology can be applied to better identify and

[34] Due to "basis risk", gain and losses from the two sides of the hedging strategy might not match perfectly. In effect, the real gain is simply to minimize the fluctuation or volatility of revenues.

understand factors that might bear profound implications on strategy.

For example, econometric models are commonly used to determine the relationship between a dependent variable (say, the operating profit margin) and a set of explanatory/independent variables (which could either be straightforward numerical variables such as the debt ratio or a dummy variable that attempts to mimic differences in the organizational structure). There are also associated methodologies that systematically eliminate those independent variables that are deemed insignificant (at least statistically) in affecting the dependent variable. As can be imagined, the use of such tools would expand our horizon in understanding corporate strategy in construction.

Similarly, hypothesis testing is applied commonly in some technical fields of civil engineering (e.g. in transportation – for assessing the effectiveness of a road hump in reducing the average speed of motor vehicles). In many occasions, such tools can be transferred and applied to the study of corporate strategy by civil engineering professionals.

7.3 Another Case for Education Reform?

By nature, the conceptual model substantiates the needs for understanding interdisciplinary topics. With the current outlook of the academic program and research environment as described in Chapter 1, it is evident that this outlook is not quite in sync with the dynamic requirement of the real business world. Even at the graduate level of studies, most academic programs and research still focus on technical and project management issues, both of which, though remain as core competencies required in civil engineering, are far from making up the entire business and project delivery processes.

How about the financing issues for projects or the company as a whole – at the very least, have we understood well enough what an optimum capital structure might be like? How about marketing your skills and knowledge – would we get hired automatically by clients simply because we have the most technically competent engineers? Or should we firstly determine whether our strength would actually match the client's needs for that project? Unfortunately, our educational experience typically has

limited exposure to these other disciplines. It is not to say that we must possess a similar depth of understanding as those who have majored in those disciplines in earning their degrees. On the contrary, we are placed at the other extreme – knowing far too little about these aspects that surprisingly play an important role in our day-to-day construction business. Isn't it time to tilt the scale a little towards the weaker side by devoting more efforts towards these areas that similarly have a significant impact on the industry? Is our workforce and resource allocation correspondingly balanced with the significance of each technical *and* non-technical component that *collectively* makes up the entire business and project delivery process? Is civil engineering practice really "*civil engineering*" *per se*?

In the November/December 1997 issue of the *Journal of Management in Engineering*, this challenge of educational reform was brought out prominently in the editor's letter. Inside the same issue, Farr (1997) has taken a neutral role in outlining the pros and cons of the reform. Through the findings developed in this thesis, the author believes that any remaining doubt should be eliminated. It is no longer an issue, but a necessity for civil engineers to take on those topics that will enable them to understand their role from a system perspective (just recall the failure causes of the "underperformers" studied in the firm sample). There is also an urgent call for such reform as the definition of projects starts to incorporate a larger scope and 'total solutions' are sought.

Referring back to the conceptual model, full determination of interactions could only come from the collective efforts of those who can think "out-of-the-box" and appreciate the existence and importance of other fields. In the practical world, a company can only succeed when top executives – the CEO, CFO, CIO and VPs in charge of various lines and functions, speak the same language in identifying those higher order-differentiating factors. In order to play a successful leading role in a unique profession and industry, civil engineers should really learn to forget the past and take on the new role and challenge.

APPENDIX A

A SAMPLE OF THE COMPLETE ANALYTICAL TEMPLATE

Skanska - Background Information

NAME	COUNTRY	YEAR
SKANSKA	Sweden	1887

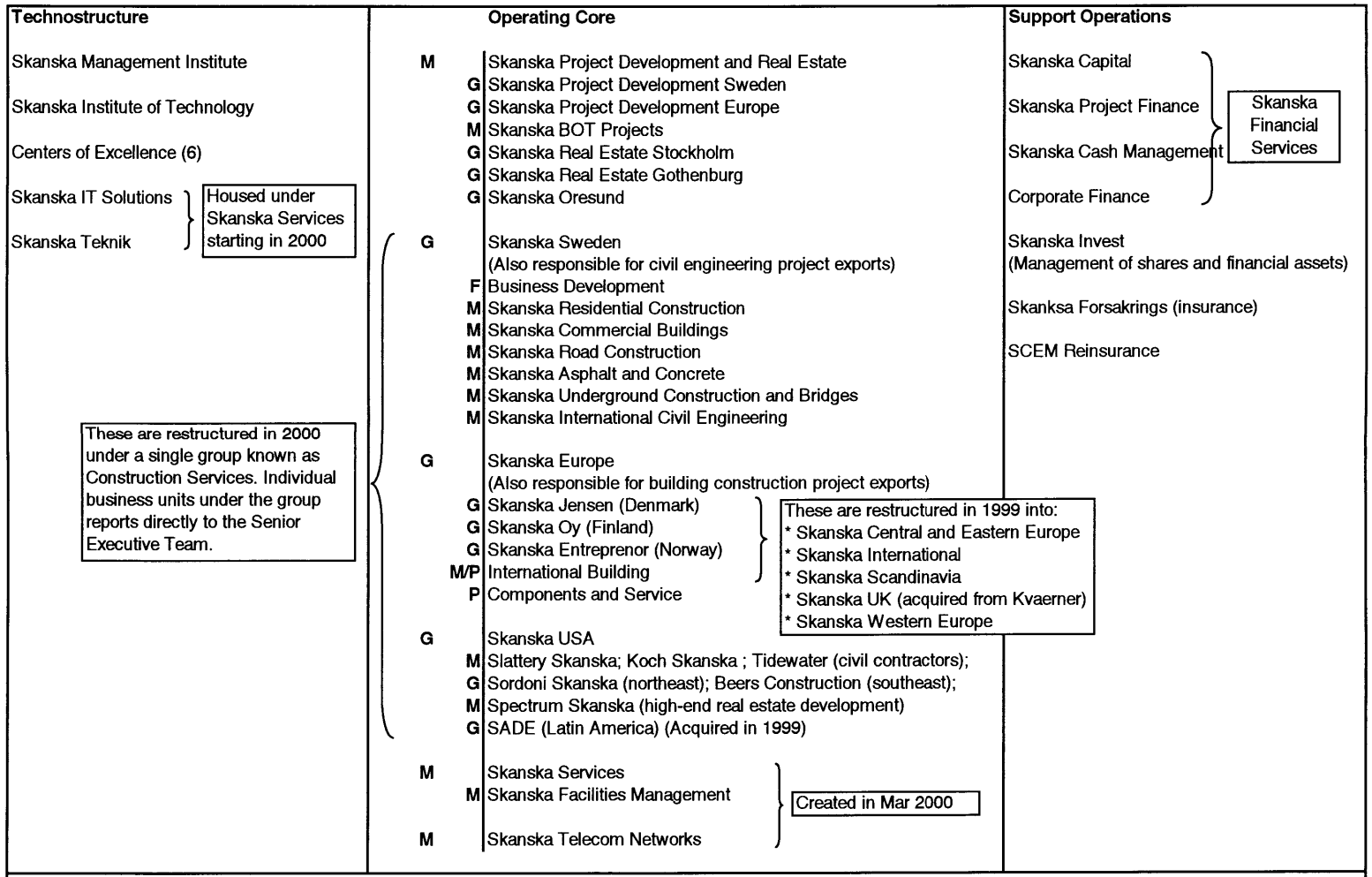
	1997	1998	1999	2000
No. of Employees	37,240	39,246	45,063	63,368
No. of Shareholders	61,772	59,160	62,050	64,181
No. of Shares Outstanding (Including both Series A & B)	113,854,968	113,854,968	113,854,968	113,854,968

Changed Leader during term of study? NO.

Ownership Structure	1997	1998	1999	2000
Swedbank mutual funds		13.4%	14.0%	11.4%
Sparbankerna mutual funds	13.9%			
Custos, AB (investment company)	6.2%			
Swedish National Pension Insurance Fund	6.0%	6.5%	6.7%	
AMF Pension			4.6%	5.8%
Industrivarden, AB (investment company)	3.8%	7.4%	7.1%	6.7%
Nordbanken mutual funds	3.4%	3.5%	4.4%	2.8%
Others	66.7%	82.6%	77.2%	84.7%
	100.0%	100.0%	100.0%	100.0%

Skanska - Background Information (continue)

Organizational Setting



Notes: **2000**

The most significant acquisition in the year is no doubt the acquisition of the construction division from Kvaerner. This not only strengthens Skanska position in the UK but also brought the firm substantial interests in businesses in Hong Kong (through 50% owned Gammon) and India.

To form closer links between the business units and the Group's Senior Executive Team so as to react more quickly to new market trends and transfer of resources across business units, the various business units above are no longer differentiated geographically or in terms of market. Rather, these will report directly to the Senior Executive Team.

Skanska - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply	1	1	1	1	1	1	1	1						
Feasibility studies & Planning	*	*	*	*	*	*	*	*	2	2				
A&E Design	*	*	*	*	*	*	*	*	2	2			4	4
Construction	*	*	*	*	*	*	*	*	2	2			4	4
O&M Renovation	*	*			*	*	*	*					4	4
Finance	3	3			3	3			2	2				
Own / Develop / Equity Investment	3	3			3	3			2	2				
Combined	*	*			*	*	*	*	2	2				

Notes:

1 Building component companies that manufacture flooring, kitchens, windows etc. Also holdings in buildable land, gravel pits and quarries, asphalt plants and concrete mixing plants plus prefabricated building element factories.

2 Skanska has a separate business unit (Skanska Project Development and Real Estate) to target the market for infrastructure projects in Europe, Asia, Africa and Latin America. This business area collaborate with other Skanska units for design and construction of the projects.

3 Skanska is one of Sweden's largest private real estate owners, with property holdings, excluding those for own operations, totaling 3.6 million square meters. Most of this (3.5 m) resides within Sweden, particularly in Stockholm, Gothenburg and Oresund regions. The firm sometimes provides financing itself in developing properties when it is confident that these can be sold profitably upon completion (i.e. weighing the market timing opportunity and risk).

4 Skanska ventured into the data and telecommunications industry through an alliance with MasTec Inc. The joint efforts focus on development of fiber-based networks; planning, design and construction services; and performing maintenance of large data and telecommunications systems.

Skanska - Operating & Financial Performance (Consolidated)

1) Operational Performance (SEK millions)

Yr.	97	98	99	00
Revenue	54,847	63,935	79,128	108,022
Growth	20%	17%	24%	37%
COGS	47,409	57,252	70,314	97,243
Growth	23%	21%	23%	38%
Operating Income	1,766	1,407	2,259	2,571
Growth	-22%	-20%	61%	14%
Net Income	7,889	2,856	4,379	5,999
Growth	95%	-64%	53%	37%
Backlog	53,070	68,398	93,686	160,675
Growth	31%	29%	37%	72%
Order Received	62,133	80,150	96,984	127,031
Growth	19%	29%	21%	31%

2) Capital Structure (SEK millions)

Yr.	97	98	99	00
Equity + Minor Int.	18,973	13,790	16,683	18,928
Non-current Liab.	15,093	9,222	11,210	11,688
Long-term Debt	6,892	1,650	3,841	5,772
Total Liabilities	33,626	31,093	34,655	58,253
Total Assets	52,599	44,883	51,338	77,181
Current Assets	17,970	21,421	29,955	47,861
Current Liabilities	18,533	21,871	23,445	46,565
Quick Assets	14,052	16,908	23,681	38,277
Acct. Receivables	8,148	10,036	13,772	26,167

Note: Minority interests are insignificant.

3a) Backlog by Business Areas/Regions (SEK millions)

Yr.	97	98	99	00
Sweden	14,074	14,223	13,553	19,581
USA	27,642	43,050	67,124	93,597
Europe	10,029	11,125	13,009	47,291
Services				206
	51,745	68,398	93,686	160,675

4a) New Orders by Business Areas/Regions (SEK millions)

Yr.	97	98	99	00
Sweden	21,726	22,625	23,430	30,054
USA	22,021	38,869	50,278	60,210
Europe	15,203	18,656	23,186	31,648
Services				1,981
	58,950	80,150	96,894	123,893

5a) Revenue by Regions (in SEK millions)

Yr.	97	98	99	00
Sweden	24,089	20,260	22,214	24,841
Other Nordic Ctry.	6,403	10,235	11,963	16,585
Europe, Other	6,411	7,043	7,687	14,063
North America	15,650	24,759	32,896	46,678
Other Countries	2,294	1,638	4,368	5,855
	54,847	63,935	79,128	108,022

6a) Revenue by Business Units (in SEK millions)

Yr.	97	98	99	00
Skanska USA	15,410	24,472	35,437	49,356
Skanska Sweden	21,528	22,677	23,561	24,630
Skanska Europe	13,493	18,560	20,959	30,184
Services				1,867
Proj. Dev. & R.E.	1,316	1,265	1,309	1,387
Eliminations etc.	-2,170	-3,039	-2,138	598
	49,577	63,935	79,128	108,022

6c) Operating Profit by Business Units (in SEK millions)

Yr.	97	98	99	00
Skanska USA	321	398	851	1,004
Skanska Sweden	485	496	737	1,002
Skanska Europe	358	370	674	400
Services				82
Proj. Dev. & R.E.	780	1,585	1,390	2,386
Eliminations etc.	-1,148	1,527	3,249	2,316
	796	4,376	6,901	7,190

6e) Return on Capital Employed by Business Units

Yr.	97	98	99	00
Skanska USA	39.4%	40.7%	42.9%	
Skanska Sweden	16.1%	15.3%	18.6%	17.6%
Skanska Europe	8.3%	7.1%	10.2%	
Services				33.9%
Proj. Dev. & R.E.	10.0%	20.3%	15.7%	23.6%

8) Cash Flow Profile (SEK millions)

Yr.	97	98	99	00
Net Cash Flow from Operatns.	3,462	(707)	2,603	1,347
Net Cash Flow from Investmnt.	9,614	228	1,834	(593)
Capital Expenditure	4,453	2,226	4,016	5,295
Corporate Financing Gap	13,076	(479)	4,437	754
CAPEX Ratio	0.78	-0.32	0.65	0.25
Cash Balance at Year End	2,553	3,505	5,583	6,769

Key Financial Ratios

Yr.	97	98	99	00
Dividend (SEK/share)	11	12	16	13.5
Net Income/share	62.6	24.4	37.6	53.6
Dividend Payout ratio	0.18	0.49	0.43	0.25
NCL/(NCL+Equity)	0.44	0.40	0.40	0.38
LT Debt/Total Capital.	0.27	0.11	0.19	0.23
Total Debt ratio	0.64	0.69	0.68	0.75
Current Asset/Total A	0.34	0.48	0.58	0.62
Non-Current Asset/Total	0.66	0.52	0.42	0.38
Current Liab./Total Liab.	0.55	0.70	0.68	0.80
Current Ratio	0.97	0.98	1.28	1.03
Quick Ratio	0.76	0.77	1.01	0.82
Avg. Collection Period	49.7	51.9	54.9	67.5
Total Asset Turnover	1.05	1.31	1.64	1.68
Rev(t)/Backlog(t-1)	1.352	1.205	1.157	1.153
ROA	16.6%	6.8%	10.1%	10.3%
ROE	45.9%	17.4%	28.7%	33.7%
Gross Profit Margin	13.6%	10.5%	11.1%	10.0%
Operating Profit Margin	3.2%	2.2%	2.9%	2.4%
Net Profit Margin	15.7%	5.2%	6.1%	6.2%
Assumed Tax Rate	28%			
Yr.	97	98	99	00
Interest Payment	1,033	614	650	904
NI + (1-t)*Interest	8,633	3,298	4,847	6,650

3b) Backlog by Business Areas/Regions

Yr.	97	98	99	00
Sweden	27%	21%	14%	12%
USA	53%	63%	72%	58%
Europe	19%	16%	14%	29%
Services	0%	0%	0%	0.1%
	100%	100%	100%	100%

4b) New Orders by Business Areas/Regions

Yr.	97	98	99	00
Sweden	37%	28%	24%	24%
USA	37%	48%	52%	49%
Europe	26%	23%	24%	26%
Services	0%	0%	0%	2%
	100%	100%	100%	100%

5b) Revenue by Regions

Yr.	97	98	99	00
Sweden	44%	32%	28%	23%
Other Nordic Countries	12%	16%	15%	15%
Europe, Other	12%	11%	10%	13%
North America	29%	39%	42%	43%
Other Countries	4%	3%	6%	5%
	100%	100%	100%	100%

6b) Revenue by Business Units

Yr.	97	98	99	00
Skanska USA	31%	38%	45%	46%
Skanska Sweden	43%	35%	30%	23%
Skanska Europe	27%	29%	26%	28%
Services	0%	0%	0%	2%
Proj. Dev. & Real Estate	3%	2%	2%	1%
Eliminations & Others	-4%	-5%	-3%	1%
	100%	100%	100%	100%

6d) Operating Profit Margin by Business Units

Yr.	97	98	99	00
Skanska USA	2.1%	1.6%	2.4%	2.0%
Skanska Sweden	2.3%	2.2%	3.1%	4.1%
Skanska Europe	2.7%	2.0%	3.2%	1.3%
Services				4.4%
Proj. Dev. & Real Estate	59%	125%	106%	172%

7) Research & Development Expenses (in SEK millions)

Yr.	97	98	99	00
Product Dev.	120	N/A	N/A	N/A
Process Dev.	95	N/A	N/A	N/A
Build-up of Knowledge	35	N/A	N/A	N/A
Total	250			
% of Sales	0.5%			

Skanska - Observations on Strategy

General

1) **Structure**: Skanska adopts a hybrid structure that is organized geographically and by products: A Project Development and Real Estate business area; three geographic business areas that are roughly equal in terms of sales volume - Skanska Sweden; Skanska Europe and Skanska USA.
   * The geographical business units are responsible for the building consturction and civil engineering services in the respective markets. They are organized geographically to facilitate more effective markeing efforts and achieve better overview and focus on the local markets.
   * Separate project organization is adopted for large projects especially those in Quadrant II (BOT). The structure is staffed by employees from Skanska units in different parts of the world and by internationally recruited personnel and local employees.

2) Another good indicator to keep track of is the % of repeat business. This gives a direct reflection of client relationship and effectiveness of tapping into their value chain. E.g. Skanska USA's 80% repeat business validate its effectiveness in targeted clients (Fortune 500 comps.)

3) Segmenting the balance sheet/income statement: in an industry characterized by narrow margins, every item counts in terms of sensitivity to the bottom line.

4) Growth strategy both by means of organic growth and acquisitions (for new geographical areas, mostly the latter method). Essential criteria for acquistions are that the company has strong fundamentals (market position, management) but required financial resources to accelerate its growth and profitability - resources of which Skanska can readily provide. Strong local or niche brand names are focused upon.
   * Becoming 'local' through acquisitions.
   * An increasingly competitive landscape has caused medium-sized firms to look for new owners or seek mergers with larger companies. This may mean attractive expansion opportunity for Skanska that has a strong financial base.

5) **Financial Strategy**: Increase the level of borrowed funds relative to shareholders' equity in order to achieve a more efficient capital structure and thereby a lower WACC. (1998p12)
   * Divest most of the financial assets that Skanska holds and use the resulting funds for further development of its core business (acquisition moves). Excess funds are transferred to shareholders in a tax-efficient way. In the past, Skanska has distributed more than SEK 20 billion to its shareholders by means of regular cash dividends, share redemption, sale of shares at a discount price and spin-off of profitable subsidiaries to shareholders (e.g. Drott)

6) Skanska correctly point out the importance of distinguishing the common and differing factors among a group of countries especially if one is adopting a geographical setting:
   * Financial and economical risk: there is not much difference among most countries in SEA since most are having similar economic policies
   * Political and economical risk: the same might not be true in Central and Eastern Europe. While there is substantial growth as a whole, each country differs widely in terms of stability in the risk factors. This is in general true for emerging markets. (analogy of correlation among growth and value stocks)
   - This is a "higher order" assessment to examine the geographcial and risk profiles determine in the first steps of corporate strategic planning.

Skanska - Observations on Strategy (continue)

7) **Financial strategy**: Pooling of resources and expertise - risk assessment takes place in line operations (where they have better knowledge
   * of first-hand operational risks), while insurance coverage, financial hedging etc. are carried out by central support functions.
   * To minimize liquidity risks, the maturity structure of Group's borrowing is spread over time, with at least 75% having a remaining maturity of more than 1 year (1997p24)

8) The private sector clearly prefers Quadrant II,I > IV, since these projects allow for their offering of integrated services and expertise and
   * more differentiated provisions - Skanska key motive is to offer the services in the entire value chain and life cycle (Concept & Planning -> Construction -> Service Life/aftermarket)

9) Active assessment of business portfolio: Unlike the other companies (e.g. Kvaerner) that divest non-core assets (after redefining identity) when they need cash, Skanska is actively managing its portfolio and divesting non-core assets even when they are profitable. The strategy is to make use of the financial resources freed up and invest in the expansion of core businesses (geographical and product breadth, local knowledge depth).

10) Skanska is challenging its capability to expand the frontier at both fronts: new businesses and new geographical markets. This may be a bit of a stretch but it has no sign of slowing down currently due to its abundent financial resources to pursue this strategy, thanks to gain on disposal of some non-core businesses in recent years. (2000p8)
   * More than once, Skanska mentioned that the one important factor that can hinder this strategy is the lack of capable human resources.

CSFs of Various Business Areas

Project Development and Real Estate

1) To mitigate the risks involved in the development business, Skanska typically seek buyers prior to employing capital to commence project development. (1998p12). A similar strategy is adopted by Holzmann after its huge loss in the real estate business.
   * General conclusion: contractual conditions, negotiations and delivery methods still represent critical tools in Bus/Op. Strategy.

2) Skanska has developed a very unique strategy that synergizes the expertise of its financial services division and even its external client like IKEA. Firstly, the business unit has a diverse portfolio holding of lands especially in Sweden. It then creates a new market for small households by building affordable and standardized housing for the group by combining its expertise in building, property development and leasing and IKEA's product concepts and home furnishings know-how. Further, it takes on the role of a financial intermediary by offering and providing loans for some of these products (and its financial services division has the resources and know-how to do so).

Construction

1) In the US, Skanska adopts a strategy that is much like Cisco's - acquiring businesses in states with high growth. The firm views the fragmentation of the industry as a large potential for continued growth. Its reputation and strong capital base and resources make it attractive for smaller firms to be acquired to pursue higher growth rate that they themselves are not capable in achieving.

Skanska - Issues on Opportunity and Threat

1) Environmental concerns:
   * Opportunity to provide additional services to clients. Construction projects will increasingly embody environmental standards, which include environmental management systems, selection of materials, energy solutions and waste management.
   * Preventive measures of liabilities, e.g., unintended incidents such as the toxic leak at the Halland Ridge rail tunnel project (1997)
   * Since the incident Skanska has introduced environmental management systems for all its units and strived for certification of all units by 2000.
   * Increase in environmental awareness in general among the society. Construction and development companies are perceived to bear even more social responsibility in a broader sense.

2) Regional environmental changes:
   * assessing the impact of Euro in the company's operations especially in the area of foreign exchange risk management. In general the effect is a positive one since repatriation of profits and procurement activities in other coutries within the Euro is now denominated in a single currency.
   * Macroeconomic factors: interest rate movements - systematic risk/opportunity.
   * Regional & product niche differences - idiosyncratic threat/opportunity.
   * Classification of risk level - remote: international economic conditions affecting clients in private business sector that are dependent on exports.

3) Though closely related to construction in the value system, real estate development requires special expertise about trends in vacancy rates, rental rates, interest rates, property prices and knowledge of tenants and local market conditions. As such, it has to be structured as a separate business unit within the company to provide focus on the market and functions required to track business and market performance. Further, since real estate is a local business, geographical divisions within this business unit also makes sense.
   * Real estate investment is particularly sensitive to interest rate movements - low rate generally stimulates more interest in investment. Thus this market has a vastly different posture compared to upstream: different risk control techniques required (VAR may be necessary); different competitive strategy due to more concentrated market structure (game theory for oligopolistic market vs. a competitive market upstream).
   * Yet, linkage has to be maintained with other construction operations of the company to have first-hand knowledge on development costs and time.
   * Holzmann's loss in this market is due to the treatment of this segment as a simple extension of vertical integration.
   * Once becoming knowledgeable and profitable though, the return can be very attractive. Skanska has a high turnover of property development and it partly makes use of the cash available (through various divestments of properties and other fixed financial assets) to pursue growth through acquisitions.
   * Because it has its own property portfolio, which is continuously being renewed, Skanska has developed a good knowledge of the rental market.
   * Because of its relatively high level of holdings in property investments, Skanska's Fixed/Total Asset ratio is high. The firm better makes sure that the value of its property portfolio does not decrease considerably as to trigger a huge writedown and losses.
   - A high risk, high return quadrant (aggressive) (compare the structure and logic with Holzmann, see (1999p14)

Skanska - Issues on Opportunity and Threat (continue)

4) Construction operations are characterized by narrow margins but high capital turnover, thus imposing a distorted scale of risk (1997p27). side is that it has little tie-up capital (offset by large current liabilities though - thus managing liquidity is a key), thus giving a potential high return. Efficiency, quality and cost control are three mandates in such low margin business.
   * On the other hand, real estate operations tie up the most capital because of the large portfolio of investment properties and sizable investment in new projects. When the market has the upswing, it has the highest growth in capital gains and asset value.

5) A reminder of the fragmented nature of construction, which varies across geographical locations, market segments and value systems:
   * The U.S. construction industry has more than SEK 5000 billion in annual sales, with a half million contractors competing. Only 70 of these have more than 1000 employees and none has an overall market share exceeding 1%. (1998p22)
   * The Swedish construction industry has 23000 companies, while Skanska has approximately 15% market share.

6) HR Strategy and structural concern:
   - Due to its growth and acquistion strategy, most of Skanska's operations still remain relatively independent. The structure evolves naturally to one that is highly decentralized. The management realized that each business unit must therefore handle employee issues relatively independently. On the other hand, a balance must be struck at the Group level to coordinate manager evaluation and development, so as to ensure a good succession of managers in key positions to manage the decentralized units. A common set of values and coherent culture also has to be instilled among managers to stimulate collaboration and mobility between companies and countries. Skanska achieve this partly through appropriate training and development programs at the Skanska Management Institute.

7) Skanska Risk Management Philosophy - the fallacy of the insurance principle:
   * The firm claims that its operations can be compared to an insurance portfolio, with systematic risk spreading.
   * This may not be true if the increase in number of projects/client categories/geographical markets comes with an increase in scale due to its active acquistion and growth strategy. In such cases, risk pooling (i.e. accumulating independent risky prospects) does not act to eliminate risk.
   * It has been reported that given n number of independent random events, while the volatility of the rate of return decreases by a factor of sqrt(n), the standard deviation of the dollar return (i.e. in absolute $ terms) increases by a factor of the sqrt (n). In other words, the liquidity risk that the firm faces actually increases due to the increase in scale of the firm's project investments and operations, even though the fluctuation of the rate of return sought has decreased. Lastly, since construction projects are rarely totally uncorrelated (since most are fundamentally related to the general economical condition), the risk is in fact more than what has been described above.

APPENDIX B

COMPLETE DATA SET FOR FIRMS ON BACKGROUND INFORMATION, MARKET SEGMENTATION MATRIX, AND OPERATING & FINANCIAL PERFORMANCE

NAME	COUNTRY	YEAR
AMEC	U.K.	1848

(The Matthew Hall Group of Companies was originally founded in 1848, but was brought into AMEC Group in 1988)

	1997	1998	1999	2000
No. of Employees	23,694	22,031	20,571	26,909
No. of Shares Outstanding	205,243,407	208,880,212	215,522,626	229,313,927

Changed Leader during term of study? NO.

Staff Composition by Business Segments				
Capital Projects	71%	66%	67%	56%
Services	26%	31%	32%	44%
Housing and Proj. Investment	3%	3%	1%	0%
TOTAL	100%	100%	100%	100%

Organizational Setting (After 1999)

Strategic Apex

Audit Committee
- comprises all non-executive directors

Nomination Committee
- comprises the Chairman, the chief executive and the senior non-executive directors

Remuneration Committee
- comprises all non-executive directors

Technostructure

Operating Core

- M Client Support Services Sector
  - M Consulting and Design
  - M Operations Support
- M Capital Projects
  - M Construction Management
  - M Construction
    - Infrastructure, manufacturing and process industries
- M Investments
  - M Property Development
  - M Project Investment / Public Private Partnerships

Support Operations

Notes: **1997**
The business objective of the Process and Energy business continues to be to change the balance of activities from fabrication to engineering and service work.
AMEC acquired the onshore process division of Babcock International in line with this objective.

AMEC also acquired a 41.6% stake in Spie Batignolles, a French company with strong core businesses in mechanical and electrical engineering and contracting businesses.
(As of 1997, AMEC has 22% of revenues from M&E, but 45% from building and civil engineering. Note the two areas complement each other for large projects. There is notable success especially in the area of rail systems. The AMEC SPIE Rail Systems partnership won the contract to build the rail link infrastructure between the Channel Tunnel and Swanley in Kent in January 2000.)

Notes: **1999**
The various market segments are restructured under three business sectors: Capital Projects, Client Support Services, and Investments.
Fairclough Homes, the housing development arm of AMEC, was sold to Centex Corp. of U.S.

Notes: **2000**
Acquired AGRA, a North American engineering and professional service group.

AMEC - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply							4	4	6	6				
Feasibility studies & Planning							*	*	*	*				
A&E Design	*	*			*	*	*	*	*	*			3	3
Construction	*	*			*	*	*	*	*	*			3	3
O&M Renovation							5	5	*	*			3	3
Finance									*	*				
Own / Develop	2	2							*	*				
Combined			1	1					1	1				

Notes:

1 Active participant (either independently or through JV and consortium) of the PFI schemes in projects such as toll roads and hospitals.
2 Fairclough Homes - AMEC's housing development arm of the group (sold in 1999).
3 Rail and lubrication business; transmission sector in the power industry.
4 Wallsend - Fabrication facilities for oil & gas construction
5 Offshore O&M service business through the acquisition of Grootcon.
6 Tunnel lining segments; factory engineered concrete accomodation units; other precast prestressed concrete elements.

AMEC (Consolidated)

1) Operational Performance (£ millions)

Yr.	97	98	99	00	01
Revenue (inc. JV)	3,370.9	3,392.8	3,062.5	3,980.0	
Growth	16%	1%	-10%	30%	
Revenue	2,774.3	2,721.9	2,427.5	3,195.9	
Growth	0.2%	-2%	-11%	32%	
COGS	2,601.9	2,522.5	2,239.6	2,901.2	
Growth	-1%	-3%	-11.2%	30%	
Operating Income	41.4	56.9	58.2	83.3	
Growth	189%	37%	2%	43%	
Net Income	44.7	47.3	57.0	53.3	
Growth	111%	6%	21%	-6%	
Backlog	3,000	3,000	3,300	5,000	
Growth	9%	0%	10%	51.5%	
Order Received	N/A	N/A	N/A	N/A	
Growth					

2) Capital Structure (£ millions)

Yr.	97	98	99	00	01
Equity + Minor Int.	194.8	202.2	258.8	302.2	
Non-current Liab.	110.7	163.9	129.5	400.6	
Long-term Debt	69.1	48.3	46.9	291.3	
Total Liabilities	992.9	1,135.4	1,000.0	1,646.9	
Total Assets	1,187.7	1,337.6	1,258.8	1,949.1	
Current Assets	1,017.6	1,099.2	1,016.5	1,364.7	
Current Liabilities	882.2	971.5	870.5	1,246.3	
Quick Assets	817.2	890.0	947.2	1,289.5	
Acct. Receivables	629.2	697.5	757.7	1,038.7	

Notes:
1) Minority Interests are insignificant.
2) Gross and Operating Profit Margin are evaluated without consideration revenues of joint ventures and other associated investment (principally SPIE) to maintain consistency in assessing operational efficiency.

Key Financial Ratios

Yr.	97	98	99	00	01
Dividend (pence/share)	5	6.25	7.5	8.5	
Net Income/share	15.5	16.5	19.6	18.7	
Dividend Payout ratio	0.32	0.38	0.38	0.45	
NCL/(NCL+Equity)	0.36	0.45	0.33	0.57	
LT Debt/Total Capital.	0.26	0.19	0.15	0.49	
Total Debt ratio	0.84	0.85	0.79	0.84	
Current Asset/Total A	0.86	0.82	0.81	0.70	
Non-Current Asset/Total	0.14	0.18	0.19	0.30	
Current Liab./Total Liab.	0.89	0.86	0.87	0.76	
Current Ratio	1.15	1.13	1.17	1.10	
Quick Ratio	0.93	0.92	1.09	1.03	
Avg. Collection Period	83.0	89.0	109.4	102.6	
Total Asset Turnover	2.86	2.69	2.36	2.48	
Rev(t)/Backlog(t-1)	1.009	0.907	0.809	0.968	
ROA	4.6%	4.4%	5.0%	4.9%	
ROE	21.6%	23.8%	24.7%	19.0%	
Gross Profit Margin	6.2%	7.3%	7.7%	9.2%	
Operating Profit Margin	1.5%	2.1%	2.4%	2.6%	
Net Profit Margin	1.6%	1.6%	2.1%	2.0%	
Assumed Tax Rate	31%				
Yr.	97	98	99	00	01
Interest Payment	14.0	11.5	11.3	36.5	
NI + (1-t)*Interest	54.4	55.2	64.8	78.5	0

3a) Revenue by Regions (in £ million)

Yr.	97	98	99	00	01
U.K.	2,010.3	2,066.2	1,700.5	1,873.5	0
Rest of Europe	714.3	600.5	584.3	676.0	
Americas	460.9	501.7	576.2	1,174.8	
Rest of World	185.4	224.4	201.5	255.7	
	3,370.9	3,392.8	3,062.5	3,980.0	

3b) Revenue by Regions

Yr.	97	98	99	00	01
U.K.	60%	61%	56%	47%	0
Rest of Europe	21%	18%	19%	17%	
Americas	14%	15%	19%	30%	
Rest of World	6%	7%	7%	6%	
	100%	100%	100%	100%	

4) Operating Profit by Regions (in £ million)

Yr.	97	98	99	00	01
U.K.	54.4	69.6	81.4	99.2	0
Rest of Europe	-3.6	1.7	5.6	11.0	
Americas	0.2	2.0	-4.2	22.0	
Rest of World	5.7	3.2	-1.1	4.2	
Corporate Costs & Unallocated Items	-4.1	-4.1	-4.5	-20.1	
	52.6	72.4	77.2	116.3	

5) Operating Profit Margin by Regions

Yr.	97	98	99	00	01
U.K.	2.7%	3.4%	4.8%	5.3%	0
Rest of Europe	-0.5%	0.3%	1.0%	1.6%	
Americas	0.0%	0.4%	-0.7%	1.9%	
Rest of World	3.1%	1.4%	-0.5%	1.6%	

6a) Revenue by Business Areas (in £ millions)

Yr.	97	98	99	00	01
Capital Projects	2,383.2	2,172.5	2,101.0	2,475.3	
Services	778.9	859.9	975.5	1,356.7	
Prop. Developmt. & Proj. Investmt.	252.7	418.4	76.2	200.6	
Internal Turnover	-43.9	-58.0	-90.2	-52.6	
	3,370.9	3,392.8	3,062.5	3,980.0	

6b) Revenue by Business Areas

Yr.	97	98	99	00	01
Capital Projects	70%	63%	67%	61%	
Services	23%	25%	31%	34%	
Prop. Development & Project Investment	7%	12%	2%	5%	
	100%	100%	100%	100%	

7) Operating Profit by Business Areas (in £ millions)

Yr.	97	98	99	00	01
Capital Projects	9.5	20.6	34.5	55.0	
Services	31.0	38.3	46.5	60.5	
Prop. Developmt. & Proj. Investmt.	16.2	17.6	10.5	20.9	
Internal Turnover	-4.1	-4.1	-14.3	-20.1	
	52.6	72.4	77.2	116.3	

8) Operating Profit Margin by Business Areas

Yr.	97	98	99	00	01
Capital Projects	0.4%	0.9%	1.6%	2.2%	
Services	4.0%	4.5%	4.8%	4.5%	
Prop. Development & Project Investment	6.4%	4.2%	13.8%	10.4%	

9) Cash Flow Profile (in £ millions)

Yr.	97	98	99	00	01
Net Cash Flow from Operatns.	54.2	51.8	-5.5	32.8	
Net Cash Flow from Investmnt.	(7.6)	(30.7)	15.8	(333.2)	
Capital Expenditure	20.2	23.1	21.1	38.1	
Corporate Financing Gap	46.6	21.1	10.3	(300.4)	
CAPEX Ratio	2.68	2.24	-0.26	0.86	

NAME	COUNTRY	YEAR	
BOUYGUES	France	1952	(Founded; went public in 1970)

	1997	1998	1999	2000
No. of Employees	105,668	103,350	111,352	118,892
No. of Shares Outstanding	25,573,108	26,167,178	30,340,472	332,074,968

A ten-for-one split was initiated in July 2000.

Changed Leader during term of study? NO.

Ownership Structure	1997	1998	1999	2000
SCDM	14.7%	16.2%	15.9%	15.7%
Artemis		15.2%	14.5%	14.2%
Bouygues Group Employees	6.5%	6.0%	7.9%	6.7%
Groupe Arnault		6.3%	9.8%	9.8%
Schroder I.M.		6.8%	4.6%	
Others	78.8%	49.5%	47.3%	53.6%
	100.0%	100.0%	100.0%	100.0%

Notes:
SCDM is a holding company controlled by Martin (Chairman and CEO of Bouygues) and Olivier Bouygues.
Corporate governance is tight. As a successor of the founder Francis Bouygues, Martin has been holding the top spot since 1989.

Composition of Employees				
Building & Civil Works	36.9%	34.6%	34.8%	30.9%
Roads	35.0%	36.0%	37.3%	40.2%
Property	0.9%	0.8%	0.7%	0.7%
Public Utility Management	19.7%	21.5%	19.9%	19.7%
Media	2.2%	2.3%	2.3%	2.4%
Telecommunicaions	2.7%	4.1%	4.6%	5.9%
Other activities & holding co.	2.7%	0.7%	0.5%	0.3%
	100.0%	100.0%	100.0%	100.0%

Notes:
About 230 members of the Group's staff work in R&D. This constitutes 0.2% of total employees. (cf. Obayashi 1.9%)

Organizational Setting

Technostructure		Operating Core	Support Operations
Bouygues Management Institute (set up in 1999)	M	Building & Civil Works (100%)	
	M	- Bouygues Construction (Building and Civil Works)	
	M	- Bouygues Offshore (Oil and gas contractor)	
Colas University and research centers	M	- ETDE (Electrical Works)	
	G	Construction Subsidiaries France & International	
	M	Roads (COLAS) (96%) (Publicly Listed)	
	G	Subsidiaries in U.S. and other parts of Europe - decentralized locally	
	M	Property (100%)	
		- Bouygues Immobilier	
	M	Public Utilities Management (Water, waste management, energy, facilities management)	
		- Saur (100%)	
	G	Regional centres	
	M	Media (Broadcasting , Advertising, publishing/distribution, thematic channels, sale of audiovisual rights, investment in film production)	
		- TF1 (40%) (Publicly listed)	
	M	Telecommunications	
		- BDT -> Bouygues Telecom (54%)	
		- Infomobile	

Notes: **1999**
Building and civil works were made a subsidiary within Bouygues Construction in 1999. At the same time, Bouygues sold 100% of ETDE and 51% of Bouygues Offshore to Bouygues Construction. All these internal restructuring and spun off is simply a move to create a holding structure by the parent company.

Bouygues - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply							5	5	3	3			1	
Feasibility studies & Planning	*	*	*	*	*	*			*	*				
A&E Design	*	*	*	*	*	*	2	2	4	4				
Construction	*	*	*	*	*	*	2	2	4	4			1	
O&M Renovation	*	*	*	*	*	*			4	4	4	4		
Finance	6				6				*	*				
Own / Develop / Equity Investment	6				6				*	*				
Combined	*	*	*	*	*	*			*	*				

Notes:

1 Includes businesses in the media and telecommunications industry; food businesses.
2 Offshore works in the oil & gas sector including construction of FPSOs; and DBO of power and communication networks.
3 Ownership of quarries, binder plants and coating plants; provision of road equipment in the roadworks sector.
4 Bouygues has a separate business arm, Saur, in public utility management. Saur merged with Cise, France's fourth largest water and sewage management company, in 1997. Saur's second core business covers solid waste collection (from sorting to processing).
5 Saur International, a joint subsidiary of Saur and Electricite de France (EDF), has business activities in gas production and distribution, power generation, transmission and supply.
6 Bouygues Immobilier is the Group's property development arm. Its business portfolio and operations are mostly contained within France. (>90%)

Bouygues (Consolidated)

1) Operational Performance (Euro millions)

Yr.	97	98	99	00	01
Revenue	13,884	14,789	15,857	19,060	
Growth	24%	7%	7.2%	20%	
COGS	10,096	10,662	11,614	14,335	
Growth	27%	6%	8.9%	23%	
Operating Income	389	440	474	812	
Growth	131%	13%	8%	71%	
Net Income	227	213	244	627	
Growth	15%	-6%	15%	157%	
Net Income (Group Share)	115	81	62	421	
Growth	15%	-30%	-23%	579%	
Backlog	N/A	N/A	N/A	N/A	
Growth					

2) Capital Structure (Euro millions)

Yr.	97	98	99	00	01
Equity (w/o Minor)	1,253	1,288	2,178	4,500	
Equity + Minor Int.	1,901	1,998	3,036	5,168	
Non-current Liab.	3,869	3,781	4,645	5,431	
Long-term Debt	1,682	1,618	2,453	2,859	
Total Liabilities	10,533	10,879	13,607	16,015	
Total Assets	12,434	12,877	16,643	21,183	
Current Assets	7,975	8,069	9,960	12,802	
Current Liabilities	6,664	7,098	8,962	10,584	
Quick Assets	4,766	4,658	5,177	7,585	
Acct. Receivables	3,433	3,593	4,118	5,354	

3a) Revenue by Regions (in Euro millions)

Yr.	97	98	99	00	01
France	8,924	9,465	10,073	11,999	
Europe, Other	1,808	2,122	2,238	2,926	
Africa	1,420	1,350	1,511	1,473	
Middle East	46	97	140	92	
North America	619	896	1,098	1,489	
Latin America	7	44	36	53	
Asia Pacific	1,062	815	762	1,029	
	13,885	14,789	15,858	19,061	

4a) Revenue by Business Areas (in Euro millions)

Yr.	97	98	99	00	01
Bldg. & Civil Wrks	5,211	5,229	5,097	5,948	
Roadworks	3,973	4,359	5,251	6,475	
Property Dev.	602	892	824	923	
Utility Mgmt.	2,073	2,133	2,274	2,388	
Media	1,540	1,630	1,806	2,211	
Telecom.	92	210	578	1,091	
Others	395	336	28	25	
	13,885	14,790	15,858	19,062	

4c) Operating Income by Business Areas (in Euro millions)

Yr.	97	98	99	00	01
Bldg. & Civil Wrks	N/A	100	126	116	
Roadworks	N/A	102	156	222	
Property Dev.	N/A	28	42	59	
Utility Mgmt.	N/A	118	110	116	
Media	N/A	219	304	423	
Telecom.	N/A	-126	-211	-105	
Elimination etc.	N/A	-1	-32	-19	
		440	495	812	

4e) Operating Profit Margin by Business Areas

Yr.	97	98	99	00	01
Bldg. & Civil Wrks	N/A	1.9%	2.5%	2.0%	
Roadworks	N/A	2.3%	3.0%	3.4%	
Property Dev.	N/A	3.1%	5.1%	6.4%	
Utility Mgmt.	N/A	5.5%	4.8%	4.9%	
Media	N/A	13.4%	16.8%	19.1%	
Telecom.	N/A	-59.9%	-36.5%	-9.6%	

6) Revenue Breakdown by Types of Contract

Yr.	97	98	99	00	01
France, Public	42.6%	38.3%	35.1%	33.0%	
France, Private	57.4%	61.7%	64.9%	67.0%	
Int'l., Public	42.7%	47.5%	50.5%	35.0%	
Int'l., Private	57.3%	52.5%	49.5%	65.0%	
Combined, Public	42.6%	41.6%	40.9%	34.0%	
Combined, Private	57.4%	58.4%	59.1%	66.0%	

8) Revenue Breakdown by Business Areas and Regions

Yr.	97	98	99	00	01
Building & Civil, France	50.2%	48.7%	46.0%	45.4%	
Building & Civil, Int'l	49.8%	51.3%	54.0%	54.6%	
Roadworks, France	64.0%	60.2%	60.3%	58.5%	
Roadworks, Int'l.	36.0%	39.8%	39.7%	41.5%	
Property, France	96.6%	97.2%	91.5%	92.8%	
Property, Int'l.	3.4%	2.8%	8.5%	7.2%	
Utility Mgmt., France	64.9%	66.8%	64.7%	64.4%	
Utility Mgmt., Int'l.	35.1%	33.2%	35.3%	35.6%	
Media, France	98.2%	97.5%	96.8%	91.0%	
Media, Int'l.	1.8%	2.5%	3.2%	9.0%	
Telecom., France	100.0%	100.0%	100.0%	100.0%	
Telecom., Int'l.	0.0%	0.0%	0.0%	0.0%	

Key Financial Ratios

Yr.	97	98	99	00	01
Dividend (Euro/share)	3.89	3.89	3.89	0.54	
Net Income/share	4.5	3.1	2.3	1.3	
Dividend Payout ratio	0.86	1.25	1.69	0.41	
NCL/(NCL+Equity)	0.67	0.65	0.60	0.51	
LT Debt/Total Capital.	0.47	0.45	0.45	0.36	
Total Debt ratio	0.85	0.84	0.82	0.76	
Current Asset/Total A	0.64	0.63	0.60	0.60	
Non-Current Asset/Total	0.36	0.37	0.40	0.40	
Current Liab./Total Liab.	0.63	0.65	0.66	0.66	
Current Ratio	1.20	1.14	1.11	1.21	
Quick Ratio	0.72	0.66	0.58	0.72	
Avg. Collection Period	74.6	86.7	88.7	90.7	
Total Asset Turnover	1.18	1.17	1.07	1.01	
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A	
ROA	2.4%	2.2%	2.2%	3.8%	
ROE	9.9%	6.4%	3.6%	12.6%	
Gross Profit Margin	27.3%	27.9%	26.8%	24.8%	
Operating Profit Margin	2.8%	3.0%	3.0%	4.3%	
Net Profit Margin	2.0%	1.9%	2.1%	3.7%	
Assumed Tax Rate	38%				

Yr.	97	98	99	00	01
Interest Payment	79	112	133	138	
NI + (1-t)*Interest	276	282	326	713	

3b) Revenue by Regions

Yr.	97	98	99	00	01
France	64%	64%	64%	63%	0
Europe, Other	13%	14%	14%	15%	
Africa	10%	9%	10%	8%	
Middle East	0%	1%	1%	0%	
North America	4%	6%	7%	8%	
Latin America	0%	0%	0%	0%	
Asia Pacific	8%	6%	5%	5%	
	100%	100%	100%	100%	

4b) Revenue by Business Areas

Yr.	97	98	99	00	01
Building & Civil Works	38%	35%	32%	31%	
Roadworks	29%	29%	33%	34%	
Property Development	4%	6%	5%	5%	
Utility Management	15%	14%	14%	13%	
Media	11%	11%	11%	12%	
Telecommunications	1%	1%	4%	6%	
Others	3%	2%	0%	0%	
	100%	100%	100%	100%	0

4d) Operating Income by Business Areas

Yr.	97	98	99	00	01
Building & Civil Works	N/A	23%	25%	14%	
Roadworks	N/A	23%	32%	27%	
Property Development	N/A	6%	8%	7%	
Utility Management	N/A	27%	22%	14%	
Media	N/A	50%	61%	52%	
Telecommunications	N/A	-29%	-43%	-13%	
Elimination & Others	N/A	0%	-6%	-2%	
		100%	100%	100%	0

5) Research & Development Expenses (in Euro millions)

Yr.	97	98	99	00	01
Bldg. & Civil Works	N/A	34	34	21	
Roadworks	N/A	24	30	32	
Property Development	N/A	5	7	7	
Utility Management	N/A	4	5	4	
Media	N/A	3	2	2	
Telecommunications	N/A	11	28	51	
Total		83	106	117	
As % of Sales		0.6%	0.7%	0.6%	

7) Cash Flow Profile (Euro millions)

Yr.	97	98	99	00	01
Net CF from Operations	641	937	704	1,382	
Net CF from Investment	(963)	(991)	(1,850)	(1,930)	
CAPEX	706	792	922	1,358	
Corporate Financing Gap	(322)	(54)	(1,146)	(548)	
CAPEX Ratio	0.91	1.18	0.76	1.02	
Cash Balance, Year End	1,180	933	936	2,060	

NAME	COUNTRY	YEAR
CHIYODA	Japan	1948

	1997	1998	1999	2000
No. of Employees	2,954	2,825	2,334	2,003
No. of Shareholders	9,461	12,532	18,125	19,324
No. of Shares Outstanding	195,224,059	195,224,059	248,357,059	248,357,059

Changed Leader during Term? YES. (1999)
Nicholas Gallinaro, a non-Japanese, was elected as a new executive vice-president, a representative from KBR after the capital infusion by the company to bailout Chiyoda.

Organizational Setting

Technostructure		Operating Core	Support Operations
Tokyo Engineering Center (closed in 1999)	M	Hydrocarbon Processing Industry (HPI) Consolidated Division - Petroleum, Petrochemical, gas-related	Contract Administration Division
Chiyoda Research Park	M	Non-HPI Consolidated Division	Mgmt Controllers' Office (internal auditing)
Technowave Office	M	Technology, Engineering and Logistics Division	

Notes:
Chiyoda consolidates liked-markets to achieve economies of scales, functional collaboration. It also splits between low growth and high growth markets to formulate tailored strategies for different groups of market. The three market divisions are treated as profit centers to facilitate control, evaluation, accountability and compensation purposes.
Business development, project execution and technical support functions are integrated into each division to enhance communication: effectively downplaying the importance of functional settings.
Divisions are headed by senior executives to provide more political clout and resources.

Chiyoda - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply														
Feasibility studies & Planning					*	*	*	*						
A&E Design					*	*	*	*			4	4	2	
Construction					3	3	1	1			4	4		
O&M Renovation														
Finance														
Own / Develop														
Combined							*	*						

Notes:

1 The non-HPI diversification is still highly related to industrial sectors: power plant, automotive plants, metal processing, pharmaceutical manufacturing, food processing

2 Space development. Contracted by National Space Development Agency of Japan to develop an image processing unit for data transmitted from space in cooperation with the Space-Missions Service Division of Lockheed Martin Corp.

3 Amusement facilities: theme park development

4 Environmental preservation projects are highly related to industrial/HPI sectors. The flue gas desulfurization process is very marketable as investment in environmental systems by electric power companies continued to be strong.
Chiyoda established an Environmental Project Division to consolidate Chiyoda's environment-related skills and technologies.

Chiyoda (Non-consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98
Revenue	411,976	272,674
Growth	13.1%	-33.81%
COGS	446,001	298,256
Growth	28.9%	-33.13%
Operating Income	-50,191	-39,481
Growth	-11854%	21.34%
Net Income	-48,265	-53,754
Growth	-2324%	11.37%
Backlog	436,851	517,318
Growth	-18.9%	18.42%
Order Received	327,600	367,178
Growth	19.3%	12.08%

2) Capital Structure (¥ millions)

Yr.	97	98
Equity	59,084	5,330
Non-current Liab.	11,681	11,390
Long Term Debt	3,019	3,488
Total Liabilities	258,319	228,053
Total Assets	317,403	233,383
Current Assets	266,264	185,415
Current Liabilities	246,638	216,663
Quick Assets	171,584	131,528
Acct. Receivables	80,745	57,190

3a) Revenue by Business Areas (¥ billions)

Yr.	97	98
Petroleum	139.5	64.0
Gas & Elec Power	100.2	73.9
Petrochemical	72.2	67.6
Chemical	23.3	14.4
Other	76.8	52.8
TOTAL	412.0	272.7

4) Revenue, New Orders and Backlog by Regions (¥ billions)

Yr.	97	98
Rev., Domestic	39%	26%
Revenue, Int'l.	61%	74%
Orders, Domestic	24%	42%
Orders, Int'l.	76%	59%
Backlog, Domestic	29%	38%
Backlog, Int'l.	71%	62%

Key Financial Ratios

Yr.	97	98
Dividend (yen/share)	0	0
Net Income/share	-247	-275
Dividend Payout ratio	0.00	0.00
NCL/(NCL+Equity)	0.17	0.68
LT Debt/Total Capital.	0.05	0.40
Total Debt ratio	0.81	0.98
Current Asset/Total A	0.84	0.79
Non-Current Asset/Total	0.16	0.21
Current Liab./Total Liab.	0.95	0.95
Current Ratio	1.08	0.86
Quick Ratio	0.70	0.61
Avg. Collection Period	65.9	92.3
Total Asset Turnover	1.30	0.99
Rev(t)/Backlog(t-1)	0.765	0.624
ROA	-15.0%	-19.2%
ROE	-57.4%	-166.9%
Gross Profit Margin	-8.3%	-9.4%
Operating Profit Margin	-12.2%	-14.5%
Net Profit Margin	-11.6%	-19.4%
Assumed tax rate:	50%	
Yr.	97	98
Interest Payment	1,254	1,847
NI + (1-t)*Interest	-47,638	-52,831

3b) Revenue by Business Areas

Yr.	97	98
Petroleum	34%	23%
Gas & Elec Power	24%	27%
Petrochemical	18%	25%
Chemical	6%	5%
Other	19%	19%
	100%	100%

5) Cash Flow Profile (¥ millions)

Yr.	97	98
Net CF from Operations	(82,589)	(6,192)
Net CF from Investment	2,227	15,823
CAPEX	N/A	N/A
Corporate Financing Gap	(80,362)	9,631
CAPEX Ratio	N/A	N/A
Cash Balance, Year End	27,026	31,439

Chiyoda (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	445,350	303,476	312,234	168,963
Growth	14.3%	-31.9%	2.9%	-45.9%
COGS	478,031	329,446	308,703	154,112
Growth	28.5%	-31.1%	-6.3%	-50.1%
Operating Income	-53,355	-42,559	-12,949	-153
Growth	-22318%	20.2%	69.6%	99%
Net Income	-53,368	-51,763	-11,685	710
Growth	-3439%	3.0%	77%	106%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity + Minor Int.	58,000	6,199	6,892	8,583
Non-current Liab.	17,791	16,266	20,566	17,793
Long Term Debt	8,401	7,569	13,518	12,545
Total Liabilities	292,537	251,547	207,028	144,516
Total Assets	350,537	257,746	213,920	153,099
Current Assets	295,691	205,657	163,520	107,129
Current Liabilities	274,746	235,281	186,462	126,723
Quick Assets	196,217	145,375	126,347	82,752
Acct. Receivables	85,787	58,872	36,939	22,685

Note: Minority Interests are insignificant.

3a) Revenue by Regions (in ¥ billions)

Yr.	97	98	99	00
Rev., Domestic	180.2	88.9	85.4	69.1
Revenue, Int'l.	265.2	214.5	226.8	99.8
	445.4	303.5	312.2	169.0

4a) Revenue by Location of Subsidiaries (in ¥ billions)

Yr.	97	98	99	00
Japan	429.9	288.0	296.3	
North America	15.5	3.6	5.2	
Europe		0.1	0.1	
Asia		11.8	10.6	
	445.4	303.5	312.2	

5a) Performance of Domestic Subsidiaries (¥ millions)

Yr.	97	98	99	00
Revenue	475,909	317,937	315,753	
Op. Expenses	525,949	357,456	326,781	
Op. Income	-50,040	-39,519	-11,028	
Operating Margin	-11%	-12%	-3%	

6) R&D Expenses (¥ millions)

Yr.	97	98	99	00
Expense	N/A	N/A	410	1,041
As % of Sales	N/A	N/A	0.13%	0.62%

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	0	0	0	0
Net Income/share	-273	-265	-58	3
Dividend Payout ratio	0.00	0.00	0.00	0.00
NCL/(NCL+Equity)	0.23	0.72	0.75	0.67
LT Debt/Total Capital.	0.13	0.55	0.66	0.59
Total Debt ratio	0.83	0.98	0.97	0.94
Current Asset/Total A	0.84	0.80	0.76	0.70
Non-Current Asset/Total	0.16	0.20	0.24	0.30
Current Liab./Total Liab.	0.94	0.94	0.90	0.88
Current Ratio	1.08	0.87	0.88	0.85
Quick Ratio	0.71	0.62	0.68	0.65
Avg. Collection Period	66.0	87.0	56.0	64.4
Total Asset Turnover	1.27	1.00	1.32	0.92
ROA	-15.0%	-16.7%	-4.5%	0.8%
ROE	-62.4%	-161.3%	-178.5%	9.2%
Gross Profit Margin	-7.3%	-8.6%	1.1%	8.8%
Operating Profit Margin	-12.0%	-14.0%	-4.1%	-0.1%
Net Profit Margin	-11.8%	-16.8%	-3.4%	0.9%

Assumed tax rate: 50%

Yr.	97	98	99	00
Interest Payment	1,266	1,845	1,935	1,556
NI + (1-t)*Interest	-52,735	-50,841	-10,718	1,488

3b) Revenue by Regions

Yr.	97	98	99	00
Revenue, Domestic	40.5%	29.3%	27.4%	40.9%
Revenue, International	59.5%	70.7%	72.6%	59.1%
	100.0%	100.0%	100.0%	100.0%

4b) Revenue by Location of Subsidiaries

Yr.	97	98	99	00
Japan	96.5%	94.9%	94.9%	
North America	3.5%	1.2%	1.7%	
Europe		0.0%	0.0%	
Asia		3.9%	3.4%	
	100%	100%	100%	

5b) Performance of International Subsidiaries (¥ millions)

Yr.	97	98	99	00
Revenue	22,553	21,125	24,110	
Operating Expenses	24,668	23,670	25,945	
Operating Income	-2,115	-2,545	-1,835	
Operating Margin	-9%	-12%	-8%	

7) Cash Flow Profile (¥ millions)

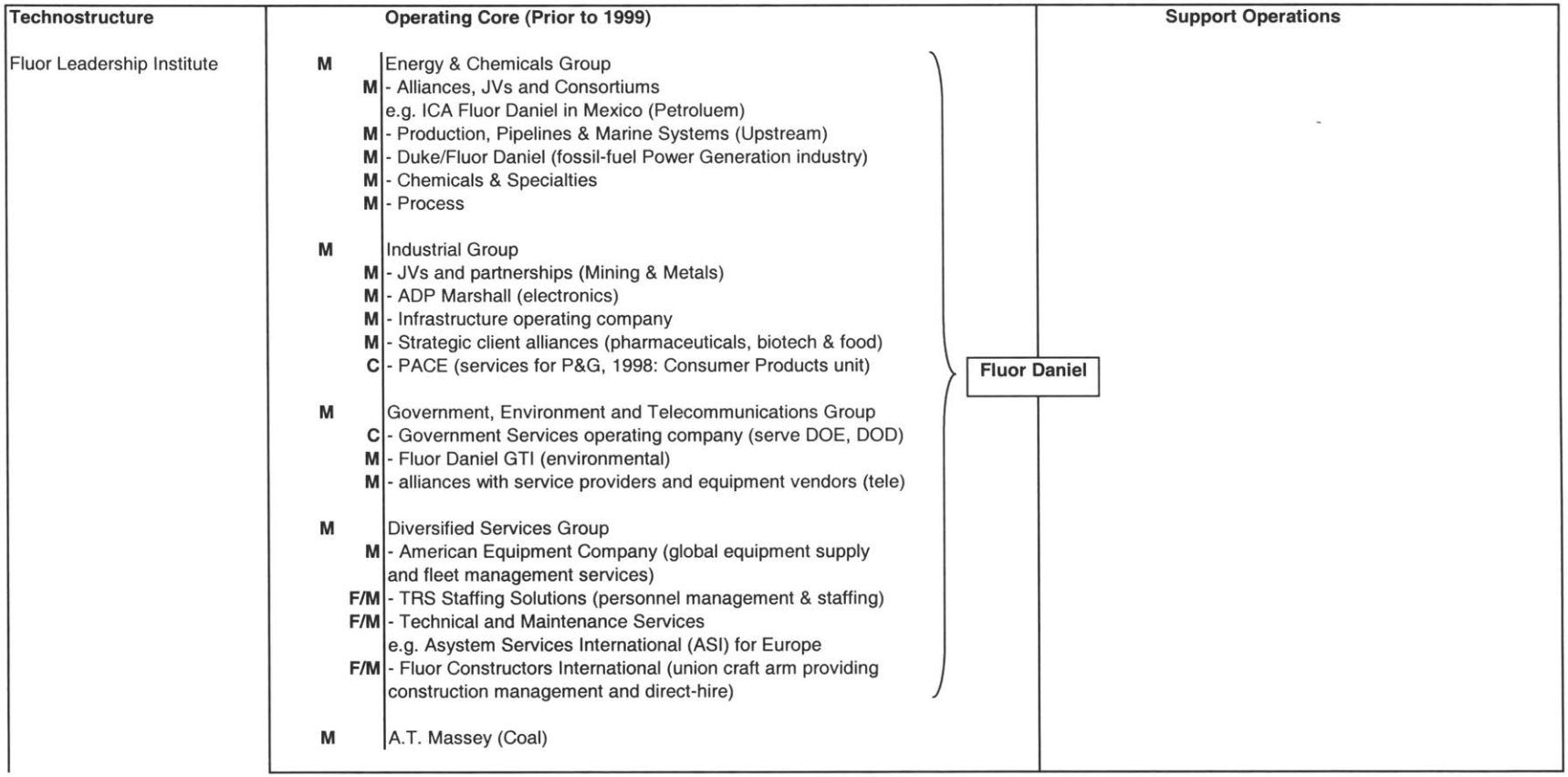
Yr.	97	98	99	00
Net CF from Operations	(80,125)	(14,188)	(9,508)	(16,524)
Net CF from Investment	2,514	19,285	29,951	20,716
CAPEX	N/A	N/A	N/A	N/A
Corporate Financing Gap	(77,611)	5,097	20,443	4,192
CAPEX Ratio	N/A	N/A	N/A	N/A
Cash Balance, Year End	40,141	40,049	47,356	33,286

NAME	COUNTRY
FLUOR CORP.	U.S.

	1997	1998	1999	2000
Employees	60,679	56,886	53,561	47,113
Shareholders	13,140	12,640	12,099	11,725
Shares Issued	83,242,322	75,793,796	76,246,247	74,609,050

Changed Leader during term? NO.

Organizational Setting



Operating Core (Since 1999)

M Fluor Daniel
- Focus purely on EPC opportunities

M Chemical & Life Sciences
M Oil, Gas & Power
M Manufacturing
M Mining
M Infrastructure

2000: combined into 2 SBUs - Energy & Chemical; Manufacturing & Life Sciences

M Fluor Global Services
- Integrated portfolio of services capitalizing on opportunities outside traditional EPC VC

M AMECO (2000: Scope reduced to site and fleet services)
F/M TRS Staffing Solutions (2000: realigned under FSS)
M Fluor Federal Services
M Telecommunications
M Operations & Maintenance
M Consulting Services (eliminated in 2000)
M Asset Management Services (new in 2000)
M Property Services (new in 2000)

M A.T. Massey Coal (Spun-off in 2000)

Support Operations (Since 1999)

F/M Fluor Signature Services (FSS)
- Provide business and administrative support to Fluor operating units and external clients
- Organized into individual lines of business in areas of finance, IT, safety, HR, office services and performance solutions

Notes: **1997**
1) Elimination of matrix decision-making, strengthening of the sales and marketing organization to enhance selectivity, and the consolidation of operating units into four global groups which now have line-of-sight responsibility for all project activities.
2) Fluor Daniel's activities are organized into four global operating groups: Energy & Chemicals; Industrial; Government, Environment and Telecommunications; and Diversified Services. Each group consists of specific operating companies, offices and functions with global responsibility.

Notes: **1998**
1) Diversified Services have been separated from E&C. Fluor Daniel makes Mining & Mineral as its fourth global operating group instead.
2) The operating units under the Industrial Group is reorganized into four: ADP Marshall (electronics); Consumer Products (previously PACE); Infrastructure; and Manufacturing (food, automobile, metals, etc.). Pharmaceutical and biotechnology is regrouped under the Process unit of the Energy & Chemicals Group.

Notes: **1999**
1) The creation of FSS is hoped to free operating units to concentrate on core competencies, while at the same time consolidate some of the supporting activities for cost reduction purposes.
2) To increase selectivity of higher margin projects, a global account management organization is formed, which directly reports to the CEO.

Notes: **2000**
A.T. Massey Coal was spun-off from Fluor Corporation.

Fluor - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial, 1		Infrastructure		Environment		Diversification,4	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply							2, 3	2	3	3			*	*
Feasibility studies & Planning							6	6	6	6			6	6
A&E Design							*	*	*	*			*	*
Construction							*	*	*	*			*	*
O&M Renovation							6	6	6	6			6	6
Finance							5	5	5	5				
Own / Develop							7	7						
Combined							*	*	*	*			*	*

Notes:

1 Global energy, chemical and mining, manufacturing, pharmaceutical and biotechnology.
2 A.T. Massey, Fluor's coal operation and a subsidiary, ranks among the top 5 U.S. coal companies and produces steam coal for the electric generating industry and industrial customers, and metallurgical coal for the steel industry.
3 American Equipment Company - equipment leasing subsidiary of Fluor Daniel.
4 Telecommunication
5 Provide expertise in sourcing and arranging for financing only. No equity investment.
6 Complementary services such as O&M and consulting services are housed in Fluor Global Services SBE.
7 Some equity investment in JVs.

Fluor (Consolidated)

1) Operational Performance ($ thousands)

Yr.	97	98	99	00
Revenue	14,298,541	13,504,773	12,417,385	11,055,987
Growth	30%	-6%	-8.1%	-11%
COGS	14,022,570	13,095,436	12,026,693	10,604,683
Growth	33%	-7%	-8.2%	-12%
Operating Income	262,741	386,739	335,342	185,224
Growth	-35%	47%	-13%	-45%
Net Income	146,187	235,344	104,187	123,949
Growth	-45%	61%	-56%	19%
Backlog	14,369,900	12,645,300	9,142,000	10,012,200
Growth	-9%	-12%	-28%	9.5%
Order Received	12,122,100	9,991,900	6,789,400	9,644,200
Growth	-3%	-18%	-32%	42%

2) Capital Structure ($ thousands)

Yr.	97	98	99	00
Equity	1,741,050	1,525,609	1,581,372	1,609,257
Non-current Liab.	966,106	998,045	1,100,435	423,102
Long-term Debt	300,508	300,428	317,555	17,573
Total Liabilities	2,956,790	3,493,599	3,304,745	2,043,477
Total Assets	4,697,840	5,019,208	4,886,117	3,652,734
Current Assets	2,225,886	2,277,151	1,910,171	1,447,793
Current Liabilities	1,990,684	2,495,554	1,100,435	1,620,375
Quick Assets	1,239,517	1,299,960	1,060,171	734,543
Acct. Receivables	930,104	959,416	850,557	665,117

Note: Minority Interests not determinable - assumed to be insignificant.

3) Backlog by Regions

Yr.	97	98	99	00
U.S.	39%	47%	55%	57%
Europe	10%	8%	8%	8%
Mid East/Africa	17%	8%	4%	1%
Canada	1%	10%	14%	14%
Latin America	5%	9%	8%	14%
Asia	17%	12%	7%	2%
Australia	11%	6%	4%	4%
	100%	100%	100%	100%

5) New Orders by Regions (for E&C Sector only)

Yr.	97	98	99	00
U.S.	45%	56%	N/A	N/A
International	55%	44%	N/A	N/A
	100%	100%		

7a) Revenue by Regions (in $ millions)

Yr.	97	98	99	00
U.S.	9,347.2	8,323.6	7,139	6,347
Europe	1,420.0	1,196.2	1,228	714
Canada	328.2	315.4	855	1,421
Asia & Australia	1,544.5	1,434.4	1,575	832
Middle East	549.3	993.0	795	151
Latin America	1,109.3	1,242.2	825	505
	14,298.5	13,504.8	12,417	9,970

Note: From year 2000, data does not include revenues from A.T. Massey Coal (spun-off)

8a) Revenues by Strategic Business Enterprises (in $ millions)

Yr.	97	98	99	00
Fluor Daniel	10,180	9,736	8,403	6,998
F. Global Services	3,038	2,642	2,931	2,953
A.T. Massey	1,081	1,127	1,083	1,086
F. Sign. Services				19
	14,299	13,505	12,417	11,056

8c) Operating Margin by Strategic Business Enterprises

Yr.	97	98	99	00
Fluor Daniel	0.7%	1.7%	1.9%	1.8%
F. Global Services	1.7%	3.1%	3.1%	2.6%
A.T. Massey	14.3%	15.4%	13.6%	9.7%
FSS				5.3%

Key Financial Ratios

Yr.	97	98	99	00
Dividend ($/share)	0.76	0.8	0.8	1.0
Net Income/share	1.75	2.97	1.37	1.62
Dividend Payout ratio	0.43	0.27	0.58	0.62
NCL/(NCL+Equity)	0.36	0.40	0.41	0.21
LT Debt/Total Capital.	0.147	0.165	0.167	0.011
Total Debt ratio	0.63	0.70	0.68	0.56
Current Asset/Total A	0.47	0.45	0.39	0.40
Non-Current Asset/Total	0.53	0.55	0.61	0.60
Current Liab./Total Liab.	0.67	0.71	0.33	0.79
Current Ratio	1.12	0.91	1.74	0.89
Quick Ratio	0.62	0.52	0.96	0.45
Avg. Collection Period	21.3	25.5	26.6	25.0
Total Asset Turnover	3.31	2.78	2.51	2.59
Rev(t)/Backlog(t-1)	0.907	0.940	0.982	1.209
ROA	3.8%	5.5%	2.8%	3.3%
ROE	8.6%	14.4%	6.7%	7.8%
Gross Profit Margin	1.9%	3.0%	3.1%	4.1%
Operating Profit Margin	1.8%	2.9%	2.7%	1.7%
Net Profit Margin	1.2%	2.0%	1.1%	1.3%
Assumed Tax Rate	34%			
Yr.	97	98	99	00
Interest Payment	30,758	45,277	50,918	26,315
NI + (1-t)*Interest	166,487	265,227	137,793	141,317

4) Backlog by Business Areas (within E&C Sector only)

Yr.	97	98	99	00
Diversified Services	5%	10%	N/A	N/A
Government	7%	6%	N/A	N/A
Industrial	36%	38%	N/A	N/A
Power	8%	4%	N/A	N/A
Process	44%	42%	N/A	N/A
	100%	100%		

6) New Orders by Business Areas (within E&C Sector only)

Yr.	97	98	99	00
Diversified Services	7%	13%	N/A	N/A
Government }	9%	8%	N/A	N/A
Power }			N/A	N/A
Industrial	34%	34%	N/A	N/A
Process	50%	45%	N/A	N/A
	100%	100%		

7b) Revenue by Regions

Yr.	97	98	99	00
U.S.	65%	62%	57%	64%
Europe	10%	9%	10%	7%
Canada	2%	2%	7%	14%
Asia & Australia	11%	11%	13%	8%
Middle East	4%	7%	6%	2%
Latin America	8%	9%	7%	5%
	100%	100%	100%	100%

8b) Operating Profit by SBEs (in $ millions)

Yr.	97	98	99	00
Fluor Daniel	70	161	160	128
Fluor Global Services	52	81	92	77
A.T. Massey	155	173	147	105
Fluor Signature Services				1
	277	415	399	311

9a) New Orders by Business Areas (within Fluor Daniel, in $ millions)

Yr.	97	98	99
Chem.& Life Sci.	4,166	3,053	1,211
Oil, Gas & Power	2,814	2,302	2,599
Manufacturing	1,741	1,856	785
Mining	1,595	464	26
Infrastructure	50	498	136
	10,366	8,173	4,757

Note: Section 9(a) and 9(b) are reported according to Fluor Daniel's structure in **1999**.

9b) New Orders by Business Areas (within Fluor Daniel)

Yr.	97	98	99
Chemical & Life Science	40%	37%	25%
Oil, Gas & Power	27%	28%	55%
Manufacturing	17%	23%	17%
Mining	15%	6%	1%
Infrastructure	0.5%	6%	3%
	100%	100%	100%

9c) New Orders by Business Areas (within Fluor Daniel, in $ millions)

Yr.	97	98	99	00
Energy & Chem.	N/A	4,756	3,363	3,923
Manu. & Life Sci.	N/A	2,455	1,232	1,292
Mining	N/A	464	26	691
Infrastructure	N/A	498	136	169
		8,173	4,757	6,075

Note: Section 9(c) and 9(d) are reported according to Fluor Daniel's structure in **2000**.

9d) New Orders by Segments 2000 (Fluor Daniel)

Yr.	97	98	99	00
Energy & Chemicals	N/A	58%	71%	65%
Manu. & Life Sciences	N/A	30%	26%	21%
Mining	N/A	6%	1%	11%
Infrastructure	N/A	6%	3%	3%
		100%	100%	100%

10) New Orders by Region (for Fluor Daniel only)

Yr.	97	98	99	00
U.S.	37%	50%	47%	49%
International	63%	50%	53%	51%
	100%	100%	100%	100%

11a) New Orders by Business Areas (Fluor Global Services, in $ m)

Yr.	97	98	99	00
Federal Services	497	451	582	800
Telecommunicatn.	277	30	646	1,099
O&M	713	1,106	772	1,660
Consulting Serv.	269	232	32	10
	1,756	1,819	2,032	3,569

11b) New Orders by Business Areas (Fluor Global Services)

Yr.	97	98	99	00
Fluor Federal Services	28%	25%	29%	22%
Telecommunication	16%	2%	32%	31%
O&M	41%	61%	38%	47%
Consulting Services	15%	13%	2%	0.3%
	100%	100%	100%	100%

12) New Orders by Regions (for Fluor Global Services only)

Yr.	97	98	99	00
U.S.	89%	84%	95%	83%
International	11%	16%	5%	17%
	100%	100%	100%	100%

13) Expected Volatility assumed in Option Valuation

Yr.	97	98	99	00
Expected Volatility	24.6%	29.9%	33.8%	39.8%

14) Cash Flow Profile ($ thousands)

Yr.	97	98	99	00
Net CF from Operations	328,624	702,519	464,876	141,800
Net CF from Investment	(511,971)	(563,317)	(375,179)	(386,897)
CAPEX	466,202	600,933	504,334	495,566
Corporate Financing Gap	(183,347)	139,202	89,697	(245,097)
CAPEX Ratio	0.70	1.17	0.92	0.29
Cash Balance, Year End	299,324	340,544	209,614	62,946

NAME	COUNTRY	YEAR
FOSTER WHEELER	U.S.	1892

	1997	1998	1999	2000
No. of Employees	11,090	11,120	10,220	10,170
No. of Shareholders	6,480	6,835	6,827	6,464
No. of Shares Outstanding	40,735,000	40,717,000	40,731,000	40,723,000

Changed Leader during term? NO.

Organizational Setting

Technostructure		Operating Core	Support Operations
Various Centers of Excellence	**M**	Engineering & Construction Group	
	M	Energy Equipment Group	
	M	Power Systems Group - a holding company (FW Power Systems, Inc.) - and a no. of special-purpose subsidiaries.	
	F/M	Global Project Finance Group	

Notes: **1998**
There exists dedicated global operation specific to some industries such as the pharmaceuticals and fine chemicals industry. In this case the three Centers of Excellence in U.S., U.K., and Italy, plus key supporting offices in Singapore, Basel, Paris and Puerto Rico, serve clients such as Pfizer, Merck and Glaxo.

Notes: **1999**
FW stated that it will eliminate the Power Systems Group as a separate reporting segment and combine it within the Energy Equipment Group; the strategy is to decrease overhead and limit equity commitmnets by reducing FW's ownership position in existing facilities and seeking third-party equity participation in new ventures.

Foster Wheeler - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial, 1		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply							*	*						
Feasibility studies & Planning							*	*			*			
A&E Design							*	*			*			
Construction							*	*						
O&M Renovation							*	*						
Finance							2	2						
Own / Develop														
Combined							*	*						

Notes:

1 Industrial activities include petroleum and gas, petrochemical, pharmaceutical, chemical processing and power generation. Supply of equipment include steam generators and auxiliary equipment, power-generation facilities, and fired heaters.

2 Although not directly involved in fund provisions and investment, the Global Project Finance Group of Foster Wheeler prepares to offer customers the best trade or project financing package available. By drawing on sources from multilaternal, government and commercial institutions, Foster Wheeler is able to develop stronger project profiles and manufacture goods more cost-effectively.

Foster Wheeler (Consolidated)

1) Operational Performance ($ thousands)

Yr.	97	98	99	00
Revenue	4,059,965	4,536,800	3,867,000	3,891,400
Growth	1.4%	11.7%	-14.8%	0.6%
COGS	3,816,748	4,166,300	3,569,200	3,565,100
Growth	8.7%	9.2%	-14.3%	-0.1%
Operating Income	-24,809	117,100	-280,300	106,900
Growth	-113%	572%	-339%	138%
Net Income	5,624	-31,506	-143,635	39,494
Growth	-93%	-660%	-356%	127%
Backlog	7,184,628	7,411,907	6,050,525	6,142,347
Growth	0.7%	3.2%	-18.4%	1.5%
New Orders	5,063,940	5,269,398	3,623,202	4,480,000
Growth	-9.1%	4.1%	-31.2%	23.6%

2) Capital Structure ($ thousands)

Yr.	97	98	99	00
Equity + Minor Int.	646,160	572,118	375,863	364,089
Non-current Liab.	1,283,151	1,424,224	1,590,694	1,658,836
Long Term Debt	855,668	990,714	702,754	561,305
Total Liabilities	2,720,203	2,922,901	3,062,246	3,113,439
Total Assets	3,366,363	3,495,019	3,438,109	3,477,528
Current Assets	1,545,271	1,672,842	1,615,096	1,622,976
Current Liabilities	1,437,052	1,498,677	1,471,552	1,454,603
Quick Assets	1,058,680	1,098,296	1,106,219	1,082,875
Acct. Receivables	1,205,800	857,000	1,327,300	1,342,500

Note: Minority Interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend ($/share)	0.835	0.835	0.54	0.24
Net Income/share	0.14	-0.77	-3.53	0.97
Dividend Payout ratio	5.96	-1.08	-0.15	0.25
NCL/(NCL+Equity)	0.67	0.71	0.81	0.82
LT Debt/Total Capital.	0.57	0.63	0.65	0.61
Total Debt ratio	0.81	0.84	0.89	0.90
Current Asset/Total A	0.46	0.48	0.47	0.47
Non-Current Asset/Total	0.54	0.52	0.53	0.53
Current Liab./Total Liab.	0.53	0.51	0.48	0.47
Current Ratio	1.08	1.12	1.10	1.12
Quick Ratio	0.74	0.73	0.75	0.74
Avg. Collection Period	94.0	83.0	103.1	125.2
Total Asset Turnover	1.18	1.32	1.12	1.13
Rev(t)/Backlog(t-1)	0.569	0.631	0.522	0.643
ROA	1.2%	0.3%	-3.1%	2.4%
ROE	0.8%	-5.2%	-30.3%	10.7%
Gross Profit Margin	6.0%	8.2%	7.7%	8.4%
Operating Profit Margin	-0.6%	2.6%	-7.2%	2.7%
Net Profit Margin	1.0%	0.2%	-2.8%	2.2%
Assumed Tax Rate	34%			

Yr.	97	98	99	00
Interest Payment	54,675	62,535	55,032	67,504
NI + (1-t)*Interest	41,710	9,767	-107,314	84,047

3) 1997 Revenue by Regions and Business Areas (for Engineering and Construction Group)

Region		Business Areas	
Europe	35%	Chemical & Pharmaceuticals	35%
North America	34%	Power/Industrial	27%
Middle East	17%	Refining/Oil & Gas	27%
Asia	8%	Environmental	11%
Latin America	6%		
	100%		100%

4) 1997 Revenue by Regions and Business Areas (for Energy Equipment Group)

Region		Business Areas	
Europe	24%	Fluidized-Bed Boilers	27%
North America	27%	Pulverized-Coal Boilers	23%
Asia	44%	Industrial Boilers	22%
Other	5%	Service/Aftermarket	16.0%
		Other	12%
	100%		100%

5) Revenue by Business Groups (in $ millions)

Yr.	97	98	99	00
Eng. & Const.	2,928.6	3,459.5	3,015.9	2979.5
Energy Equip.	1,197.2	1,111.2	852.4	1,094.2
Power Systems	208.5	184.3	187.3	
Elimination, Other	-162.3	-158.0	-111.5	-104.3
	4,172.0	4,597.0	3,944.1	3,969.4

Yr.	97	98	99	00
Eng. & Const.	70.2%	75.3%	76.5%	75.1%
Energy Equip.	28.7%	24.2%	21.6%	27.6%
Power Systems	5.0%	4.0%	4.7%	
Elimination & Others	-3.9%	-3.4%	-2.8%	-2.6%
	100%	100%	100%	100%

6) Backlog by Business Groups (in $ million)

Yr.	97	98	99	00
Eng. & Const.	5,295.6	5,867.8	4,741.5	4,534.6
Energy Equip.	1,604.5	1,383.5	1,309.4	1,727.4
Power Systems	255.0	213.5	136.4	
Elimination, Other	29.5	-52.9	-136.8	-119.7
	7,184.6	7,411.9	6,050.5	6,142.3

Yr.	97	98	99	00
Eng. & Const.	73.7%	79.2%	78.4%	73.8%
Energy Equip.	22.3%	18.7%	21.6%	28.1%
Power Systems	3.5%	2.9%	2.3%	
Elimination & Others	0.4%	-0.7%	-2.3%	-1.9%
	100%	100%	100%	100%

7) New Orders by Business Groups (in $ million)

Yr.	97	98	99	00
Eng. & Const.	3,610.7	4,329.1	2,752.2	3,094.6
Energy Equip.	1,312.6	841.5	901.1	1,468.7
Power Systems	140.1	182.7	144.8	(Elim.)
Elimination, Other	0.5	-83.9	-174.9	-83.3
	5,063.9	5,269.4	3,623.2	4,480.0

Yr.	97	98	99	00
Eng. & Const.	71.3%	82.2%	76.0%	69.1%
Energy Equip.	25.9%	16.0%	24.9%	32.8%
Power Systems	2.8%	3.5%	4.0%	
Elimination & Others	0.0%	-1.6%	-4.8%	-1.9%
	100%	100%	100%	100%

8a) Revenue by Regions (in $ millions)

Yr.	97	98	99	00
U.S.	1,755.7	1,877.9	1,430.5	1,897.0
Europe	2,478.2	2,806.2	2,533.7	2,099.5
Canada	100.4	70.9	91.4	77.2
Elimination, Other	-162.3	-158.0	-111.5	-104.3
	4,172.0	4,597.0	3,944.1	3,969.4

8b) Revenue by Regions (in $ millions)

Yr.	97	98	99	00
U.S.	42.1%	40.9%	36.3%	47.8%
Europe	59.4%	61.0%	64.2%	52.9%
Canada	2.4%	1.5%	2.3%	1.9%
Elimination & Others	-3.9%	-3.4%	-2.8%	-2.6%
	100%	100%	100%	100%

9) Backlog by Regions (in $ millions)

Yr.	97	98	99	00
U.S.	48.7%	N/A	44%	N/A
Europe	50.0%	N/A	23%	N/A
Canada	0.9%	N/A		N/A
Asia		N/A	24%	N/A
Middle East		N/A	6%	N/A
Latin America		N/A	3%	N/A
Elimination, Other	0.4%	N/A		N/A
	100%		100%	

10) New Orders by Regions (in $ millions)

Yr.	97	98	99	00
U.S.	41.7%	N/A	N/A	N/A
Europe	55.5%	N/A	N/A	N/A
Canada	2.2%	N/A	N/A	N/A
Corporate and Fin.	0.5%	N/A	N/A	N/A
	100%	0	0	0

11) R&D Expenditure (in $ million)

Yr.	97	98	99	00
Corp-sponsored	16.1	14.1	12.5	12.0
% of Sales	0.4%	0.3%	0.3%	0.3%
Cust-sponsored	40.4	32.7	27.1	27.6
% of Sales	1.0%	0.7%	0.7%	0.7%

12) Expected Volatility assumed in Option Valuation

Yr.	97	98	99	00
Volatility	27.5%	33.1%	48.7%	59.2%

13) Cash Flow Profile ($ thousands)

Yr.	97	98	99	00
Net Cash Flow from Oper	(120,057)	(26,296)	(5,620)	(16,744)
Net Cash Flow from Inves	(2,716)	(106,950)	55,914	35,649
CAPEX	189,767	N/A	N/A	N/A
Corporate Financing Gap	(122,773)	(133,246)	50,294	18,905
CAPEX Ratio	-0.63	N/A	N/A	N/A
Cash Balance	167,417	180,068	170,268	191,893

NAME	COUNTRY	YEAR
Groupe GTM	France	1891

	1997	1998	1999
No. of Employees	63,233	61,231	64,149
No. of Shares Outstanding	15,073,625	15,284,213	15,431,216
Changed Leader during term of study?		NO.	
Ownership Structure			
Suez Lyonnaise des Eaux Grp.	50.02%	48.95%	49.45%
Mobil Oil	3.90%	2.53%	2.52%
Public	46.08%	48.52%	45.38%
Employee Mutual Fund	0%	0%	2.65%
	100.00%	100.00%	100.00%
Composition of Employees			
Groupe GTM and Concessions	1.7%	1.6%	2.9%
Roads	27.2%	30.7%	30.3%
Building and Civil Engineering	46.6%	39.9%	33.1%
Industrial	22.7%	25.8%	31.6%
Eng. Consult. & Real Estate	1.8%	2.0%	2.1%
	100.0%	100.0%	100.0%

Organizational Setting

Technostructure	Operating Core	Support Operations
	M Concessions - Cofiroute (33.5% equity stake) - Car Parks (Les Parcs GTM) - Infrastructure **M** Building and Civil Engineering - Dumez-GTM - CFE (Belgium firm, with 44.5% stake) - Soletanche Bachy (Foundations) **M** Roads - Entreprise Jean Lefebvre **M** Industrial - Entrepose - Delattre-Levivier - GTMH (Electrical Works) - L'Entreprise Industrielle (Electrical) (acquired in 1999) - ETPM (Offshore) (sold in 2000) **M** Engineering Consultancy - Ingerop	

Notes: **1997**
The merger of Soletanche Entreprise and Bachy. Alliance between ETPM and McDermott was terminated. GTM acquired MSCL to enter the deepsea exploration market.

Notes: **2000**
Disengaged from offshore business by selling ETPM to Stolt Comex Seaway(SCS) in exchange for 7.9% in SCS.
This act is executed in accordance to the corporate strategic plan to exit cyclical business and concentrateinstead on "highly visible" activities such as concessions, the road industry, and electrical and industrial maintenance.

Groupe GTM - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply									5	5	2	2		
Feasibility studies & Planning					*	*					*	*		
A&E Design					*	*	*	*	*	*	*	*	6	6
Construction					*	*	*	*	*	*	2	2	6	6
O&M Renovation					*	*	*	*	*	*			3	3
Finance					*	*			*	*			*	*
Own / Develop / Equity Investment	4				1, 4	1			1	1			1	1
Combined					*	*			*	*				

Notes:

1 GTM is active in the concession market for projects such as bridges, motorways, airports and even car parks, stadium and prisons.
2 Innovative product and process in waste recycling and removal of asbestos material.
3 As part of the concession business, Les Parcs GTM manages 155,000 parking places and over 200 facilities, some with long-term leases.
4 GTM is involved in real estate development through its 80% stake in Elige, a residential and commercial property developer.
5 GTM's subsidiary in road works, Jean Lefebvre, is also involved in the production of materials: asphalt, binders, aggregate, recycled concrete, clinker from domestic garbage incineration etc.
6 Electrical engineering works and telecommunications.

Groupe GTM (Consolidated)

1) Operational Performance (million Euros)

Yr.	97	98	99
Revenue	6,631	6,882	7,696
Growth	9%	4%	12%
COGS	4,811	5,004	5,477
Growth	15%	4%	9%
Operating Income	94	128	174
Growth		36%	36%
Net Income	48	64	155
Growth	657%	33%	142%
Net Income (Group Share)	39	65	143
Growth		67%	120%
Backlog	4,686	4,964	4,688
Growth		6%	-6%
Order Received	N/A	N/A	N/A
Growth			

2) Capital Structure (million Euros)

Yr.	97	98	99
Equity (w/o Minor)	736	736	890
Equity + Minor Int.	891	867	1,023
Non-current Liab.	1,257	1,520	1,993
Long-term Debt	389	427	634
Total Liabilities	6,464	6,284	6,385
Total Assets	7,355	7,151	7,408
Current Assets	5,755	5,277	5,162
Current Liabilities	5,207	4,764	4,392
Quick Assets	2,927	2,916	3,348
Acct. Receivables	2,238	2,273	2,607

Key Financial Ratios

Yr.	97	98	99
Dividend (Euro/share)	1.3	1.5	2.35
Net Income/share	2.57	4.28	9.35
Dividend Payout ratio	0.51	0.35	0.25
NCL/(NCL+Equity)	0.59	0.64	0.66
LT Debt/Total Capital.	0.30	0.33	0.38
Total Debt ratio	0.88	0.88	0.86
Current Asset/Total A	0.78	0.74	0.70
Non-Current Asset/Total	0.22	0.26	0.30
Current Liab./Total Liab.	0.81	0.76	0.69
Current Ratio	1.11	1.11	1.18
Quick Ratio	0.56	0.61	0.76
Avg. Collection Period	119.0	119.6	115.7
Total Asset Turnover	0.92	0.95	1.06
Rev(t)/Backlog(t-1)	1.385	1.469	1.550
ROA	1.3%	1.5%	2.8%
ROE	5.4%	8.8%	17.6%
Gross Profit Margin	27.4%	27.3%	28.8%
Operating Profit Margin	1.4%	1.9%	2.3%
Net Profit Margin	1.4%	1.6%	2.6%
Assumed Tax Rate	37%		

Yr.	97	98	99
Interest Payment	74	74	74
NI + (1-t)*Interest	95	111	202

3) Backlog by Business Areas

Yr.	97	98	99
Roads	18.2%	22.0%	26.4%
Building & Civil Engineering and Foundation	59.1%	47.8%	51.3%
Industrial	21.0%	27.6%	19.8%
Engineering Consultancy, Real Estate, and Miscellaneous	1.7%	2.5%	2.5%
	100%	100%	100%

4) Revenue by Regions

Yr.	97	98	99
France	57.8%	56.4%	60.8%
Europe, Other	20.5%	23.2%	20.7%
North America	4.7%	6.2%	6.2%
South America	1.0%	1.2%	1.3%
Africa	7.1%	6.4%	6.8%
Middle East	2.1%	1.8%	1.5%
Far East	6.8%	4.8%	2.7%
	100.0%	100.0%	100.0%

5a) Revenue by Business Areas (million Euros)

Yr.	97	98	99
Concession	388	451	492
Roads	1,824	2,055	2,359
Building & Civil E. & Foundation	2,825	2,548	2,270
Industrial	1,660	1,984	2,368
Eng. Consultancy, Real Estate, Misc	186	338	334
	6,883	7,376	7,823

5b) Revenues by Business Areas

Yr.	97	98	99
Concession	5.6%	6.1%	6.3%
Roads	26.5%	27.9%	30.2%
Building & Civil Eng. and Foundation	41.0%	34.5%	29.0%
Industrial	24.1%	26.9%	30.3%
Eng. Consultancy, Real Estate, and Misc.	2.7%	4.6%	4.3%
	100%	100%	100%

6) Net Income by Business Areas (million Euros)

Yr.	97	98	99
Concession	45	52	66
Roads	18	25	30
Building & Civil E. & Foundation	-27	1	31
Industrial	31	13	13
Eng. Consultancy, Real Estate, Misc	-28	-26	3
	39	65	143

7) Net Profit Margin by Business Areas

Yr.	97	98	99
Concession	11.6%	11.5%	13.4%
Roads	1.0%	1.2%	1.3%
Building & Civil Eng. and Foundation	-1.0%	0.0%	1.4%
Industrial	1.9%	0.7%	0.5%
Eng. Consultancy, Real Estate, and Misc.	-15.1%	-7.7%	0.9%

8) Cash Flow Profile (million Euros)

Yr.	97	98	99
Net Cash Flow from Operatns.	337	589	629
Net Cash Flow from Investmnt.	(339)	(352)	(432)
Capital Expenditure	238	318	281
Corporate Financing Gap	(2)	237	197
CAPEX Ratio	1.42	1.85	2.24
Cash Balance at Year End	358	363	595

NAME	COUNTRY
HALLIBURTON	U.S.

	1997	1998	1999	2000
No. of Employees	102,000	107,800	103,000	93,000
No. of Shares Outstanding (in millions)	436.1	438.8	443	446

Changed Leader during term? YES. (2000, but only because Dick Cheney retired and ran for vice president of the U.S.)

Organizational Setting

Technostructure	Operating Core	Support Operations
	B/M Brown & Root Engineering and Construction **B/M** B&R Government Services → Becomes Kellogg Brown & Root and Brown & Root Services in 1998	
	B/M Halliburton Energy Services - oil and gas exploration, development and production **B/M** B&R Energy Services - E&C services for upstream oil and gas industry **B/M** Landmark Graphics Corporation - Exploration and production information systems, software and services to help petroleum companies to find, produce and manage oil and gas reservoirs. → Forms the Energy Services Group	
	B/M Halliburton Energy Development - Integrated solutions of B&R Energy, Halliburton Energy and Landmark	
	B/M Dresser Equipment Group (merged in 1998, then divested in 2000)	

Notes: **1998**
1) The merger with Dresser Industries added an additional "Dresser Equipment Group" that design and manufacture equipment used in the energy, refining and petrochemical industries.
2) Operations are integrated into 3 main business groups , supported by a shared services organization across the entire company.

Notes: **2000**
Halliburton subsequently divested its Dresser Equipment Group in 2000.

Halliburton - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply							*	*						
Feasibility studies & Planning							*	*	*	*				
A&E Design							*	*	*	*				
Construction							*	*	*	*				
O&M Renovation							*	*	*	*				
Finance														
Own / Develop							1	1						
Combined							*	*	*	*				

Notes:

1 Production sharing agreement in upstream oil and gas industries.

Halliburton (Consolidated)

1) Operational Performance ($ millions)

Yr.	97	98	99	00
Revenue	8,818.6	17,353.1	14,898	11,944
Growth	19%	97%	-14.1%	-20%
COGS	7,772	15,376.4	13,781	11,218
Growth		98%	-10.4%	-19%
Operating Income	798.1	396.5	650	462
Growth	91%	-50%	64%	-29%
Net Income	466.3	34.4	481	519
Growth	51%	-93%	-1298%	8%
Backlog	12,678	11,177	9,145	9,403
Growth	44%	-12%	-18%	2.8%
Order Received	N/A	N/A	N/A	N/A
Growth				

2) Capital Structure ($ millions)

Yr.	97	98	99	00
Equity + Minor Int.	2,604.4	4,231.4	4,440	3,966
Non-current Liab.	1,225.7	2,876.9	2,595	2,311
Long-term Debt	538.9	1,369.7	1,056	1,049
Total Liabilities	2,998.6	6,880.6	6,288	6,137
Total Assets	5,603.0	11,112.0	10,728	10,103
Current Assets	2,971.6	6,083.1	6,022	5,568
Current Liabilities	1,772.9	4,003.7	3,693	3,826
Quick Assets	2,427.1	4,063.0	4,345	4,076
Acct. Receivables	2,205.8	3,860.4	3,879	3,845

Note: Minority Interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend ($/share)	0.5	0.5	0.5	0.5
Net Income/share	1.77	-0.03	0.99	1.12
Dividend Payout ratio	0.28	-16.67	0.51	0.45
NCL/(NCL+Equity)	0.32	0.40	0.37	0.37
LT Debt/Total Capital.	0.17	0.24	0.19	0.21
Total Debt ratio	0.54	0.62	0.59	0.61
Current Asset/Total A	0.53	0.55	0.56	0.55
Non-Current Asset/Total	0.47	0.45	0.44	0.45
Current Liab./Total Liab.	0.59	0.58	0.59	0.62
Current Ratio	1.68	1.52	1.63	1.46
Quick Ratio	1.37	1.01	1.18	1.07
Avg. Collection Period	80.9	63.8	94.8	118.0
Total Asset Turnover	1.76	2.08	1.36	1.15
Rev(t)/Backlog(t-1)	1.82	1.369	1.333	1.306
ROA	9.9%	1.5%	5.3%	5.9%
ROE	19.6%	1.0%	11.1%	12.3%
Gross Profit Margin	11.9%	11.4%	7.5%	6.1%
Operating Profit Margin	9.1%	2.3%	4.4%	3.9%
Net Profit Margin	5.6%	0.7%	3.9%	5.2%
Assumed Tax Rate	34%			
Yr.	97	98	99	00
Interest Payment	42.7	137	144	146
NI + (1-t)*Interest	494.5	125	576	615

* The drop in Operating Income and Net Income in 1998 includes a special charge of $945 m ($722 m after-tax) to provide for consolidation, restructuring and merger related expenses related to the merger with Dresser Industries, Inc.

* Financial data for the Dresser Equipment Group is not included in 2000 as Halliburton intends to divest the business and reclassified it as discontinued business
Profit margins in 2000 are thus computed without the inclusion of DEG's revenue in the denominator.
Similarly, the backlog of 1999 and 2000 does not include DEG for the purpose of calculating Rev(t)/Backlog(t-1)

3a) Revenue by Regions (in $ millions)

Yr.	97	98	99	00
U.S.	4,238.7	6,132.2	4,781	4,073
Europe/U.K.	2,443.2	2,246.7	1,740	1,512
Latin America	677.0			
Other Areas	1,459.7	8,974.2	8,377	6,359
	8,818.6	17,353.1	14,898	11,944

3b) Revenue by Regions

Yr.	97	98	99	00
U.S.	48%	35%	32%	34%
Europe	28%	13%	12%	13%
Latin America	8%	0%	0%	0%
Other Areas	17%	52%	56%	53%
	100%	100%	100%	100%

4a) Operating Income by Regions (in $ millions)

Yr.	97	98	99	00
U.S.	617.1	N/A	N/A	N/A
Europe	101.2	N/A	N/A	N/A
Latin America	37.1	N/A	N/A	N/A
Other Areas	84.9	N/A	N/A	N/A
	840.3			

4b) Operating Income by Regions

Yr.	97	98	99	00
U.S.	73%	N/A	N/A	N/A
Europe	12%	N/A	N/A	N/A
Latin America	4%	N/A	N/A	N/A
Other Areas	10%	N/A	N/A	N/A
	100%			

5) Operating Profit Margin by Regions

Yr.	97	98	99	00
U.S.	14.6%	N/A	N/A	N/A
Europe	4.1%	N/A	N/A	N/A
Latin America	5.5%	N/A	N/A	N/A
Other Areas	5.8%	N/A	N/A	N/A

6a) Revenue by Business Areas (in $ millions)

Yr.	97	98	99	00
Energy Group	5,756.4	9,009.5	6,999	7,916
Eng. & Const.	3,062.2	5,494.8	5,314	4,028
Dresser Equip.		2,848.8	2,585	
	8,818.6	17,353.1	14,898	11,944

6b) Revenue by Business Areas

Yr.	97	98	99	00
Energy Group	65%	52%	47%	66%
Engineering & Construct.	35%	32%	36%	34%
Dresser Equipment		16%	17%	0%
	100%	100%	100%	100%

7a) Operating Profit by Business Areas (in $ millions)

Yr.	97	98	99	00
Energy Group	706.4	971.0	222	526
Eng. & Const.	133.9	237.2	203	14
Dresser Equip.		247.8	249	
	840.3	1,456.0	674	540

7b) Operating Profit by Business Areas

Yr.	97	98	99	00
Energy Group	84%	67%	33%	97%
Engineering & Construct.	16%	16%	30%	3%
Dresser Equipment		17%	37%	
	100%	100%	100%	100%

8c) Operating Profit Margin by Business Areas

Yr.	97	98	99	00
Energy Group	12.3%	10.8%	3.2%	6.6%
Eng. & Const.	4.4%	4.3%	3.8%	0.3%
Dresser Equip.		8.7%	9.6%	

9) Expected Volatility assumed in Option Valuation

Yr.	97	98	99	00
Volatility	43.3%	38%	56%	54%

10) R&D Expenses (in $ millions)

Yr.	97	98	99	00
R&D (Energy)	163.6	220.0	207	224
R&D (E&C)	1.1	3.9	4	7
R&D (DEG)		84.2	36	
Total R&D	164.7	308.1	247	231
As % of Sales	1.9%	1.8%	1.7%	1.9%

11) Capital Expenditures by Business Areas (in $ millions)

Yr.	97	98	99	00
Energy Group	466.7	707	414	495
Engineering & Construct.	52.3	34	34	32
Dresser Equipment		73	73	
General Corporate	58.1	100	72	51
	577.1	914	593	578

12) Cash Flow Profile ($ millions)

Yr.	97	98	99	00
Net Cash Flow from Operations	548.2	454.1	233	(57)
Net Cash Flow from Investment	(686.7)	(846.1)	(159)	(411)
CAPEX	577.1	914.3	593	578
Corporate Financing Gap	(139)	(392)	74	(468)
CAPEX Ratio	0.95	0.50	0.39	-0.10
Cash Balance	221.3	202.6	466	231

NAME	COUNTRY	YEAR
PHILIPP HOLZMANN	Germany	1849

	1997	1998	1999	2000
No. of Employees	38,562	30,048	28,380	22,900
No. of Shares Outstanding	4,387,500	5,704,000	5,707,000	13,317,000

Note: The effect of increase in equity capital to reduce debt is evident.

Changed Leader during term of study? YES (Dec 1999)

Organizational Setting

Technostructure		Operating Core	Support Operations
Competence Centres - Marine, Habor and Inland Waterway Const. - Tunneling - Industrial Construction		**Philipp Holzmann AG**	
	G	Regional Divisions - North, East, West, Central, South	
	M	imbau (Prefabricated structures and structural steel construction)	
	M	Franki Grundbau (Specialized civil engineering)	
	M	Deutsche Asphalt (Construction of Transportation Systems and Extraction of Construction Materials - primarily road construction business) — Planned divestment in 2001	
	M	Philipp Holzmann Anlagen (Infrastructure Project Development)	
	M	HSG Philipp Holzmann Technischer Service GmbH (Facility management and other construction-related services)	
	M	Steinmuller (Energy and Environmental Technology) — Divested in 1998	
	F	Philipp Holzmann Planung (Engineering)	
	G	**Philipp Holzmann International Ltd.** (Manages all major international projects, excluding the US; closely involved in regional start-ups) - PH's European business is predominantly conducted by subsidiaries in each country. Many of these operations were dissolved after the crisis (in Spain, Netherland, France)	
	G	**Philipp Holzmann USA, Inc.** - Lockwood Greene (Industrial design and construction, production technology) - J.A. Jones (Construction and Infrastructure; Services; Development)	

Notes: **2000**
In Germany, the 5 Regional Divisions were disbanded in February 2000 and replaced by a network of 5 main and 10 associated branches to enhance local presence and become more oriented towards domestic customers.

Holzmann - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply														
Feasibility studies & Planning					*				*	*				
A&E Design	*		*		*		*	*	*	*	*	*		
Construction	*		*		*		*	*	*	*	*	*		
O&M Renovation										*				
Finance										*				
Own / Develop / Equity Investment					*					*				
Combined										*				

Holzmann (Consolidated)

1) Operational Performance (DM millions)

Yr.	97	98	99	00
Output	14,415	12,054	12,083	12,506
Growth	2%	-16%	0%	4%
Revenue	12,260	9,973	9,528	11,675
Growth	1%	-19%	-4.5%	23%
COGS	8,319	6,760	7,109	8,451
Growth	2%	-19%	5%	19%
Operating Income	206	408	-389	352
Growth	-38%	98%	-195%	-191%
Net Income	-768	-36	-2,706	-156
Growth	-603%	95%	7348%	94%
Net Income (Group Share)	-790	-31	-2,703	-153
Growth		-96%	8561%	-94%
Backlog	13,543	11,685	14,516	13,593
Growth	-13%	-14%	24%	-6.4%
Order Received	12,127	11,728	13,820	12,234
Growth	-26%	-3%	18%	-11%

2) Capital Structure (DM thousands)

Yr.	97	98	99	00
Equity (w/o Minor)	643,118	977,262	-1,686,533	201,823
Equity + Minor Int.	733,243	1,033,572	-1,639,972	246,806
Non-current Liab.	4,145,857	3,300,525	3,843,311	2,829,579
Long-term Debt	1,362,811	1,061,200	1,315,048	688,188
Total Liabilities	9,706,890	7,944,393	9,328,089	7,330,973
Total Assets	10,440,133	8,977,965	7,688,117	7,577,779
Current Assets	7,902,009	6,413,360	5,376,858	5,425,097
Current Liabilities	5,561,033	4,643,868	5,484,778	4,501,394
Quick Assets	5,325,617	4,280,655	3,353,261	3,529,451
Acct. Receivables	2,596,328	2,170,240	2,180,482	2,321,545

3a) Backlog by Regions (in DM millions)

Yr.	97	98	99	00
Germany	6,147	5,012	4,615	3,563
Europe, Others	1,832	1,451	1,769	1,227
America	5,054	5,089	7,481	8,252
Asia, Africa, Aust.	510	133	651	551
	13,543	11,685	14,516	13,593

4a) New Orders by Regions (in DM millions)

Yr.	97	98	99	00
Germany	6,480	6,137	5,091	4,290
Europe, Others	1,448	1,201	1,529	1,256
America	3,823	4,216	6,526	6,410
Asia, Africa, Aust.	376	174	674	278
	12,127	11,728	13,820	12,234

5a) Output by Regions (in DM millions)

Yr.	97	98	99	00
Germany	8,967	6,652	5,591	4,986
Europe, Others	1,629	1,220	1,560	1,258
America	3,192	3,830	4,809	5,927
Asia, Africa, Aust.	627	352	123	335
	14,415	12,054	12,083	12,506

6) Revenue by Domestic Market Segments

Yr.	97	98	99	00
Residential	18.2%	15.0%	N/A	N/A
Commercial	55.3%	54.2%	N/A	N/A
Public	26.5%	30.8%	N/A	N/A
Structural Eng.	76.7%	75.0%	N/A	N/A
Civil Engineering	23.3%	25.0%	N/A	N/A

8) Cash Flow Profile (DM thousands)

Yr.	97	98	99	00
Net Cash Flow from Operations	(762,494)	(824,428)	(1,446,215)	(674,754)
Net Cash Flow from Investment	391,582	375,991	(47,228)	(26,625)
CAPEX	290,353	306,908	275,424	179,846
Corporate Financing Gap	(370,912)	(448,437)	(1,493,443)	(701,379)
CAPEX Ratio	-2.63	-2.69	-5.25	-3.75
Cash Balance	1,698,062	1,162,000	614,679	579,296

Key Financial Ratios

Yr.	97	98	99	00
Dividend (DM/share)	0	0	0	0
Net Income/share	-175.12	-7.89	-474.21	-12.98
Dividend Payout ratio	0.00	0.00	0.00	0.00
NCL/(NCL+Equity)	0.85	0.76	1.74	0.92
LT Debt/Total Capital.	0.65	0.51	-4.05	0.74
Total Debt ratio	0.93	0.88	1.21	0.97
Current Asset/Total A	0.76	0.71	0.70	0.72
Non-Current Asset/Total	0.24	0.29	0.30	0.28
Current Liab./Total Liab.	0.57	0.58	0.59	0.61
Current Ratio	1.42	1.38	0.98	1.21
Quick Ratio	0.96	0.92	0.61	0.78
Avg. Collection Period	77.7	87.2	83.3	70.4
Total Asset Turnover	1.07	1.03	1.14	1.53
Output(t)/Backlog(t-1)	0.925	0.890	1.034	0.862
ROA	-5.5%	0.8%	-31.1%	-0.3%
ROE	-73.9%	-3.9%	762.3%	-75.6%
Gross Profit Margin	32.1%	32.2%	25.4%	27.6%
Operating Profit Margin	1.7%	4.1%	-4.1%	3.0%
Net Profit Margin	-5.2%	0.8%	-27.2%	-0.2%

Assumed Tax Rate 40%

Yr.	97	98	99	00
Interest Payment	221	193	184	219
NI + (1-t)*Interest	-636	80	-2,596	-25

3b) Backlog by Regions

Yr.	97	98	99	00
Germany	45%	43%	32%	26%
Europe, Others	14%	12%	12%	9%
America	37%	44%	52%	61%
Asia, Africa, Australia	4%	1%	4%	4%
	100%	100%	100%	100%

4b) New Orders by Regions

Yr.	97	98	99	00
Germany	53%	52%	37%	35%
Europe, Others	12%	10%	11%	10%
America	32%	36%	47%	52%
Asia, Africa, Australia	3%	1%	5%	2%
	100%	100%	100%	100%

5b) Output by Regions

Yr.	97	98	99	00
Germany	62%	55%	46%	40%
Europe, Others	11%	10%	13%	10%
America	22%	32%	40%	47%
Asia, Africa, Australia	4%	3%	1%	3%
	100%	100%	100%	100%

7) Sales by Business Segments

Yr.	99	00	99	00
General construction	5,952	7,990	66.8%	70.0%
Project business	552	484	6.2%	4.2%
Services	1,666	1,870	18.7%	16.4%
Road const. & Bldg Mat.	1,058	1,281	11.9%	11.2%
Eliminations	-317	-208	-3.6%	-1.8%
	8,911	11,417	100.0%	100.0%

9) Growth Trends of Industrial Design and Construction Segment

Yr.	97	98	99	00
Output (US$ millions)	227	278	385	792
Growth		22%	38%	106%
New Orders (US$ mil.)	236	324	686	850
Growth		37%	112%	24%
Backlog (US$ millions)	66	114	416	472
Growth		73%	265%	13%
Employees	1,843	2,056	2,108	2,140
Growth		12%	3%	2%

NAME	REGION	YEAR
JACOBS ENGINEERING	U.S.	1947

(Founded; incorporated in 1957; went public in 1970)

	1997	1998	1999	2000
No. of Employees	9,570	10,080	15,900	18,800
No. of Shareholders	1,592	1,352	1,208	1,115
No. of Shares Outstanding	25,989,000	26,096,000	26,478,000	26,473,000

Changed Leader during term of study? NO.

Jacobs - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply														
Feasibility studies & Planning							3	3						
A&E Design	*		*	*	*	*	3	3	*	*	2		1	1
Construction	*		*	*	*	*	3	3	*	*	2		1	1
O&M Renovation							3	3						
Finance														
Own / Develop / Equity Investment														
Combined	*		*		*		*	*	*	*				

Notes:

1 Engineering/Construction/Startup support for extracting and processing mineral resources.

2 Environmental cleanups, systems operations and construction programs of the DOD, DOE, EPA and Army Corps of Engineers.

3 As the most diversified segment, specific industrial sectors targeted include: chemicals and polymers; pharmaceuticals and biotechnology; petroleum; semiconductor; pulp and paper; other consumer product lines.

Jacobs (Consolidated)

1) Operational Performance ($ thousands)

Yr.	97	98	99	00	01
Revenue	1,780,616	2,101,145	2,875,007	3,418,942	3,956,993
Growth	-1%	18%	37%	19%	16%
COGS	1,546,898	1,830,618	2,477,678	2,983,247	3,452,320
Growth	-3%	18%	35%	20%	16%
Operating Income	73,561	86,484	108,295	124,613	143,852
Growth	14%	18%	25%	15%	15%
Net Income	46,895	54,385	65,445	50,981	87,760
Growth	16%	16%	20%	-22%	72%
Backlog	3,050,000	3,329,500	4,448,200	5,430,100	5,912,500
Growth	11%	9%	34%	22.1%	8.9%
Order Received					
Growth		#DIV/0!	#DIV/0!	#DIV/0!	

2) Capital Structure ($ thousands)

Yr.	97	98	99	00	01
Equity	324,308	371,405	448,717	495,543	591,801
Non-current Liab.	94,177	67,736	186,487	204,970	264,580
Long-term Debt	54,095	26,221	135,371	146,820	164,308
Total Liabilities	419,895	436,084	771,469	888,833	965,239
Total Assets	744,203	807,489	1,220,186	1,384,376	1,557,040
Current Assets	503,921	566,007	729,620	851,023	946,159
Current Liabilities	325,718	368,348	584,982	683,863	700,659
Quick Assets	459,173	514,651	639,487	776,827	866,423
Acct. Receivables	382,051	394,841	586,005	710,979	817,160

3a) Revenue by Business Activities ($ thousands)

Yr.	97	98	99	00	01
Project Services	734,619	861,608	1,318,027	1,809,309	2,340,304
Process Scientific & Sys. Consulting	11,587	11,163	87,990	118,232	133,639
Construction	769,788	961,576	994,479	969,792	977,627
O&M	264,622	266,798	474,511	521,609	505,423
	1,780,616	2,101,145	2,875,007	3,418,942	3,956,993

4a) Revenue by Business Areas ($ thousands)

Yr.	97	98	99	00	01
Chemicals & Poly.	490,347	785,727	796,501	693,034	653,573
Tech. & Manufact.	335,627	128,501	173,023	213,557	332,995
Oil & Gas Refining	248,799	255,579	243,311	280,942	451,103
Federal Programs	201,643	169,474	481,302	614,048	732,362
Buildings	169,286	314,293	454,589	539,691	457,488
Infrastructure	11,748	11,278	218,828	238,278	246,420
Pulp & Paper	154,135	191,595	99,189	254,861	182,456
Pharm. & Biotech.	140,545	211,501	373,520	481,947	715,407
Other Businesses	28,486	33,197	34,744	102,584	185,189
	1,780,616	2,101,145	2,875,007	3,418,942	3,956,993

5a) Revenue by Regions (in $ thousands)

Yr.	97	98	99	00	01
U.S.	1,363,016	1,676,997	2,421,871	2,858,197	3,075,969
Europe	412,298	410,944	440,545	532,887	825,456
Asia & others	5,302	13,204	12,591	27,858	55,568
	1,780,616	2,101,145	2,875,007	3,418,942	3,956,993

6) Cash Flow Profile (NOK millions)

Yr.	97	98	99	00	01
Net Cash Flow from Operations	43,943	90,458	83,512	81,301	15,108
Net Cash Flow from Investment	(69,541)	(9,620)	(220,639)	(106,705)	(63,628)
CAPEX	31,332	46,335	240,022	71,653	57,400
Corporate Financing Gap	(25,598)	80,838	(137,127)	(25,404)	(48,520)
CAPEX Ratio	1.40	1.95	0.35	1.13	0.26
Cash Balance	55,992	101,328	53,482	55,992	55,992

Key Financial Ratios

Yr.	97	98	99	00	01
Dividend ($/share)	0	0	0	0	0
Net Income/share	1.8	2.08	2.47	1.93	3.22
Dividend Payout ratio	0.00	0.00	0.00	0.00	0.00
NCL/(NCL+Equity)	0.23	0.15	0.29	0.29	0.31
LT Debt/Total Capital.	0.14	0.07	0.23	0.23	0.22
Total Debt ratio	0.56	0.54	0.63	0.64	0.62
Current Asset/Total A	0.68	0.70	0.60	0.61	0.61
Non-Current Asset/Total	0.32	0.30	0.40	0.39	0.39
Current Liab./Total Liab.	0.78	0.84	0.76	0.77	0.73
Current Ratio	1.55	1.54	1.25	1.24	1.35
Quick Ratio	1.41	1.40	1.09	1.14	1.24
Avg. Collection Period	67.5	67.5	62.3	69.2	70.5
Total Asset Turnover	2.70	2.71	2.84	2.63	2.69
Rev(t)/Backlog(t-1)	0.65	0.69	0.86	0.77	0.73
ROA	7.3%	7.2%	7.0%	4.5%	6.5%
ROE	15.4%	15.6%	16.0%	10.8%	16.1%
Gross Profit Margin	13.1%	12.9%	13.8%	12.7%	12.8%
Operating Profit Margin	4.1%	4.1%	3.8%	3.6%	3.6%
Net Profit Margin	2.7%	2.7%	2.5%	1.7%	2.4%
Assumed Tax Rate	34%				

Yr.	97	98	99	00	01
Interest Payment	2,226	2,356	8,767	11,420	11,705
NI + (1-t)*Interest	48,364	55,940	71,231	58,518	95,485

3b) Revenue by Business Activities

Yr.	97	98	99	00	01
Engineering Services	41%	41%	46%	53%	59%
Process, Scientific & Systemic Consulting	1%	1%	3%	3%	3%
Construction	43%	46%	35%	28%	25%
Operation & Maintain.	15%	13%	17%	15%	13%
	100%	100%	100%	100%	100%

4b) Revenue by Business Areas

Yr.	97	98	99	00	01
Chemicals & Polymers	28%	37%	28%	20%	17%
Tech. & Manufacturing	19%	6%	6%	6%	8%
Oil & Gas Refining	14%	12%	8%	8%	11%
Federal Programs	11%	8%	17%	18%	19%
Buildings	10%	15%	16%	16%	12%
Infrastructure	1%	1%	8%	7%	6%
Pulp and Paper	9%	9%	3%	7%	5%
Pharmaceuticals & Bio.	8%	10%	13%	14%	18%
Other Businesses	2%	2%	1%	3%	5%
	100%	100%	100%	100%	100%

5b) Revenue by Regions

Yr.	97	98	99	00	01
U.S.	76.5%	79.8%	84.2%	83.6%	77.7%
Europe	23.2%	19.6%	15.3%	15.6%	20.9%
Asia & others	0.3%	0.6%	0.4%	0.8%	1.4%
	100.0%	100.0%	100.0%	100.0%	100.0%

7) Expected Volatility assumed in Option Valuation

Yr.	97	98	99	00	01
Expected Volatility	21.6%	24.2%	25.3%	27.6%	39.7%

NAME	COUNTRY	YEAR
JGC	Japan	1928

	1997	1998	1999	2000
No. of Employees	2,527	2,436	2,359	2,012
No. of Shareholders	11,476	14,237	18,087	25,284
No. of Shares Outstanding	176,408,547	176,408,547	192,139,890	228,838,159

Changed Leader during term? NO.

Ownership Structure	
Banks	24.72%
Life and non-life insurance corporations	5.75%
Securities corporations	1.51%
Individuals and others	42.93%
Foreign investors	9.05%
Other domestic corporations	16.04%
	100.00%

List of Major Financial and Institutional Owners	
Nikki Shoji Co. Ltd.	4.7%
Saneyoshi Scholarship Foundation	3.6%
The Sakura Bank, Ltd.	3.4%
The Sanwa Bank, Ltd.	2.7%
The Fuji Bank, Ltd.	2.7%
The Sumitomo Bank, Ltd.	2.7%
The Dai-Ichi Kangyo Bank, Ltd.	2.0%
The Bank of Tokyo-Mitsubishi, Ltd.	1.6%
The Sumitomo Trust and Banking Co. Ltd.	1.1%
The Chase Manhattan Bank N.A. London	1.0%
	25.5%

Organizational Setting

Technostructure	Operating Core	Support Operations
Research & Development Center Nuclear Research Center Kinuura Laboratory	(Engineering and Procurement) - Central F - Project Systems Division F - Engineering Division F - Procurement Division } Have self-supporting accounting system F (Sales and Project Management Divisions) - Central M - Hydrocarbon M - General Indstries (Nonhydrocarbon) } Individual project "divisions" F - Business Development Division G/F Worldwide Engineering Network M.W. Kellogg (U.K.); JGC Dordtse Eng. B.V. (Netherland); JGC Singapore Pte. Ltd.; Technoserve Int'l Co. Inc. (Philippines); P.T. Pertafenikki Eng. (Indonesia); ADTECHS Corp. (U.S.) G/F Worldwide Procurement Network JGC Corporation (Japan); JGC Corp. Europe B.V. (Netherlands); JGC Singapore Pte. Ltd.; JGC USA Inc.	Planning & Administrative - CATV Business Promotion Office - Corporate Planning & Administration Division - Operations Administration Division

Notes: **1997**

1) Engineering & Project Execution:
Realize once-through engineering execution to substantially reduce man-hours and achieve shorter delivery times. The challenge is to develop multifunctional engineers by breaking the walls between functional silos. The divisions have their self-supporting accounting systems for proper accountability, contribution to earnings and tracking of performance.

2) Sales and Project Management Divisions:
Previously each organized into 4 separate divisions: Domestic & Overseas hydrocarbon, nonhydrocarbon, nuclear and environmental-related markets.

3) Rapid response to client needs arising in a **borderless business development** division.

4) Planning & Administrative Divisions:
Previously four, now reduced to two to simplify and flatten organization - faster flow of decisions, elimination of middle managers. In 1996, JGC examined the idea of forming a business for rationalizing its administrative functions and operation of business expansion into own real estate -> founded a new company known as Nikki Business Service Co. Ltd.

5) Co-locate key operations such as the admin & sales divisions and the eng. & project execution divisions which were previously divided geographically
=> achieve **operational efficiency and communication**
=> corporate LAN set up to enable high-speed, large-capacity data transfers, strengthening IT technology

6) Overseas affiliated companies or subsidiaries are mainly engaged in construction and engineering services. Other peripheral activities are mostly managed from offices in Japan: catalysts and chemical equipment supply; information processing; broadcasting services; new materials; specialized consulting services; field work and maintenance services; process licensing services; and office support services.

Notes: **1998**

Procurement function and related personnel were moved to project management division to strengthen JGC's advantageous turnkey project execution system. On the other hand, Information Management was centralized. Administrative divisions were reorganized: a new project support division was established to increase project efficiency, with the aim of improving administrative staff producitivity. Unify R&D which had been conducted at various locations.

Notes: **1999**

1) Leveling corporate hierarchy and accelerating decision making: Trimmed Board of Directors from 24 to 19. Produce a more **horizontal corporate hierarchy** by eliminating the traditional support system and requiring all decisions to reach the President after only four levels of approval (still too many levels?)

2) Amidst cutting staff and overhead costs, JGC made very considerable efforts to develop overseas engineering centers, and to foster outsourcing in order to reduce engineering costs.

3) Introduced the **chief engineer system**. 18 new chief engineers were chosen from various specialized fields, and began working outside the boundaries of the traditional team system. Engineers who excel in job knowledge and experience to become mentors for the others. Introduced a new staff performance evaluation system that links compensation to results.

JGC - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial, 1		Infrastructure		Environment, 2		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply							5	5						
Feasibility studies & Planning			8				6	6			*	*		
A&E Design			*	*			7	7			*	*		
Construction			*	*			7	7			*	*	9	9
O&M Renovation	4	4					*	*			*	*		
Finance							3	3						
Own / Develop														
Combined			*	*			*	*			*	*		

Notes:

1 Nonhydrocarbon includes pharmaceutical, automobile, medical and welfare, power generation and regional development fields, nuclear energy and social development
2 E.g. flue gas desulphurization plant, used car recycling factories, spent nuclear fuel reprocessing plant.
3 For clients operating at a smaller scale in the refining market.
4 Building Maintenance, document service, efficient management of owned real estate and utilization consultation
5 Sale of various plant equipment and materials
6 Fiscal 99: Venture into management consulting with the new Refinery Profitability Service (RPS), a consulting survey that provides valuable advice for improving the profitability of refineries: (I) construction model that reflect processes; (ii) present improvement proposals with priority driven by high ROI; (iii) taking full responsibility for service until customer achieves profit point
7 Enter specific niche of a market - research laboratory construction for major manufacturers. Complements plant construction -> position as a unique service provider supporting the global management strategies of manufacturers worldwide
8 Make use of important technologies at the basic concept and planning stages of hospital, including proprietary estimates of future demand for medical services. - integrate into client's functions - demand on new expertise is tough.
9 Software development business based on IT technologies and experience from EPC business . E.g. production information system help manufacturers to realize supply chain management.

JGC (Non-consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	239,222	359,504	341,478	230,592
Growth	-14.0%	50.3%	-5.0%	-32.5%
COGS	235,237	354,273	328,338	213,714
Growth	-10.5%	50.6%	-7.32%	-34.9%
Operating Income	-8,352	-5,686	3,290	7,597
Growth	-586%	31.9%	158%	131%
Net Income	-12,227	-10,207	67	1,383
Growth	-647%	16.5%	101%	1964%
Backlog	657,966	649,710	578,134	537,237
Growth	20.1%	-1.3%	-11.0%	-7.1%
New Orders	340,936	325,344	262,473	211,473
Growth	4.7%	-4.6%	-19.3%	-19.4%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity	91,463	79,492	98,932	109,195
Non-current Liab.	82,762	102,235	98,472	71,497
Long Term Debt	69,975	87,079	82,397	56,410
Total Liabilities	228,361	250,969	263,289	205,503
Total Assets	319,824	330,461	362,221	314,698
Current Assets	236,652	238,467	254,470	210,165
Current Liabilities	145,599	148,734	164,817	134,006
Quick Assets	151,368	160,400	192,100	162,325
Acct. Receivables	59,702	79,497	99,992	66,183

3a) Revenue, Backlog and New Orders by Regions (¥ millions)

Yr.	97	98	99	00
Rev., Domestic	78,682	N/A	90,375	64,971
Rev., International	160,540	N/A	251,103	165,621
Backlog, Domestic	181,055	208,031	176,180	167,164
Backlog, Int'l.	476,911	441,679	401,954	370,073
New Ord, Domestic	82,999	N/A	58,523	56,954
New Orders, Int'l.	259,937	N/A	203,950	154,519

4a) Revenue by Business Areas (in ¥ millions)

Yr.	97	98	99	00
Petrol Refining	56,308	48,228	78,196	
Petro. & Chemical	35,066	80,837	66,254	
Gas Processing	82,866	164,229	117,299	
Productn. Facilities	44,053	34,145	43,970	
Nuclear energy	11,126	13,320	17,010	
Social development	6,453	5,755	17,648	
Other	3,350	12,990	1,101	
TOTAL	239,222	359,504	341,478	

5a) New Orders by Business Areas (in ¥ millions)

Yr.	97	98	99	00
Petrol Refining	34,776	110,873	64,189	
Petro. & Chemical	146,434	71,010	67,443	
Gas Processing	80,368	46,545	87,113	
Productn. Facilities	34,875	31,704	20,127	
Nuclear energy	22,936	11,229	13,204	
Social development	18,562	51,509	8,803	
Other	2,985	2,474	1,594	
TOTAL	340,936	325,344	262,473	

6a) Backlog by Business Areas (in ¥ millions)

Yr.	97	98	99	00
Petrol Refining	50,199	115,536	104,948	
Petro. & Chemical	190,329	185,894	173,417	
Gas Processing	236,689	147,009	135,651	
Productn. Facilities	48,140	45,342	21,304	
Nuclear energy	92,250	83,297	73,491	
Social development	28,341	71,130	67,328	
Other	12,018	1,502	1,995	
TOTAL	657,966	649,710	578,134	

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	10	5	0	3
Net Income/share	-69.3	-57.9	0.38	6.16
Dividend Payout ratio	-0.14	-0.09	0.00	0.49
NCL/(NCL+Equity)	0.48	0.56	0.50	0.40
LT Debt/Total Capital.	0.43	0.52	0.45	0.34
Total Debt ratio	0.71	0.76	0.73	0.65
Current Asset/Total A	0.74	0.72	0.70	0.67
Non-Current Asset/Total	0.26	0.28	0.30	0.33
Current Liab./Total Liab.	0.64	0.59	0.63	0.65
Current Ratio	1.63	1.60	1.54	1.57
Quick Ratio	1.04	1.08	1.17	1.21
Avg. Collection Period	94.4	70.7	95.9	131.5
Total Asset Turnover	0.74	1.11	0.99	0.68
Rev(t)/Backlog(t-1)	0.437	0.546	0.526	0.399
ROA	-3.3%	-2.6%	0.5%	0.9%
ROE	-12.4%	-11.9%	0.1%	1.3%
Gross Profit Margin	1.7%	1.5%	3.8%	7.3%
Operating Profit Margin	-3.5%	-1.6%	1.0%	3.3%
Net Profit Margin	-4.5%	-2.3%	0.5%	1.2%
Assumed Tax Rate	50%			
Yr.	97	98	99	00
Interest Payment	3,091	3,614	3,162	2,991
NI + (1-t)*Interest	-10,682	-8,400	1,648	2,879

3b) Revenue, Backlog and New Orders by Regions

Yr.	97	98	99	00
Revenue, Domestic	33%	N/A	26%	28%
Revenue, International	67%	N/A	74%	72%
Backlog, Domestic	28%	32%	30%	31%
Backlog, International	72%	68%	70%	69%
New Orders, Domestic	24%	N/A	22%	27%
New Orders, International	76%	N/A	78%	73%

4b) Revenue by Business Areas

Yr.	97	98	99	00
Petroleum Refining Projects	24%	13%	23%	
Petrochemical & Chemical	15%	22%	19%	
Gas Processing	35%	46%	34%	
General Production Facilities	18%	9%	13%	
Nuclear energy	5%	4%	5%	
Social development	3%	2%	5%	
Other	1%	4%	0%	
HPI	73%	82%	77%	
Non-HPI	27%	18%	23%	

5b) New Orders by Business Areas

Yr.	97	98	99	00
Petroleum Refining Projects	10%	34%	24%	
Petrochemical & Chemical	43%	22%	26%	
Gas Processing	24%	14%	33%	
General Production Facilities	10%	10%	8%	
Nuclear energy	7%	3%	5%	
Social development	5%	16%	3%	
Other	1%	1%	1%	
HPI	77%	70%	83%	
Non-HPI	23%	30%	17%	

6b) Backlog by Business Areas

Yr.	97	98	99	00
Petroleum Refining Projects	8%	18%	18%	
Petrochemical & Chemical	29%	29%	30%	
Gas Processing	36%	23%	23%	
General Production Facilities	7%	7%	4%	
Nuclear energy	14%	13%	13%	
Social development	4%	11%	12%	
Other	2%	0%	0%	
HPI	73%	69%	72%	
Non-HPI	27%	31%	28%	

JGC (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	273,494	397,159	390,283	280,620
Growth	-12.7%	45.2%	-1.7%	-28.1%
COGS	262,454	383,826	367,076	254,076
Growth	-9.2%	46.2%	-4.4%	-30.78%
Operating Income	-7,432	-3,981	5,627	11,023
Growth	-268%	46.4%	241.3%	95.89%
Net Income	-13,831	-13,495	347	1,123
Growth	-687%	2.4%	103%	224%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity + Minor Int.	104,541	88,556	110,704	120,434
Non-current Liab.	87,930	109,145	105,615	77,556
Long Term Debt	72,142	89,849	85,137	58,348
Total Liabilities	249,500	275,538	294,091	229,353
Total Assets	354,041	364,094	404,795	349,787
Current Assets	261,385	264,353	287,984	238,211
Current Liabilities	161,570	166,393	188,476	151,797
Quick Assets	171,190	189,459	220,018	186,077
Acct. Receivables	71,181	91,464	114,497	79,716

Note: Minority Interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	10	5	0	3
Net Income/share	-79.32	-77.94	0.75	1.96
Dividend Payout ratio	-0.13	-0.06	0.00	1.53
NCL/(NCL+Equity)	0.46	0.55	0.49	0.39
LT Debt/Total Capital.	0.41	0.50	0.43	0.33
Total Debt ratio	0.70	0.76	0.73	0.66
Current Asset/Total A	0.74	0.73	0.71	0.68
Non-Current Asset/Total	0.26	0.27	0.29	0.32
Current Liab./Total Liab.	0.65	0.60	0.64	0.66
Current Ratio	1.62	1.59	1.53	1.57
Quick Ratio	1.06	1.14	1.17	1.23
Avg. Collection Period	98.4	74.7	96.3	126.3
Total Asset Turnover	0.76	1.11	1.02	0.74
ROA	-3.4%	-3.2%	0.5%	0.7%
ROE	-12.5%	-14.0%	0.3%	1.0%
Gross Profit Margin	4.0%	3.4%	5.9%	9.5%
Operating Profit Margin	-2.7%	-1.0%	1.4%	3.9%
Net Profit Margin	-4.5%	-2.9%	0.5%	1.0%
Assumed Tax Rate	50%			
Yr.	**97**	**98**	**99**	**00**
Interest Payment	3,259	3,804	3,383	3,176
NI + (1-t)*Interest	-12,202	-11,593	2,039	2,711

3a) Revenue by Regions (in ¥ millions)

Yr.	97	98	99	00
Japan	108,781	93,451	129,334	98,272
SEA		131,441	72,848	26,427
Middle East	164,713	90,860	54,329	37,642
Africa		55,144	55,724	32,489
Other		26,263	78,048	85,790
	273,494	397,159	390,283	280,620

3b) Revenue by Regions

Yr.	97	98	99	00	01
Japan	40%	24%	33%	35%	#DIV/0!
SEA		33%	19%	9%	#DIV/0!
Middle East	60%	23%	14%	13%	#DIV/0!
Africa		14%	14%	12%	
Other		7%	20%	31%	#DIV/0!
	100%	100%	100%	100%	#DIV/0!

4) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00	01
Net Cash Flow from Operations	(35,338)	20,425	(7,786)	43,500	
Net Cash Flow from Investment	6,139	(13,485)	(1,195)	(2,635)	
Capital Expenditure	3,780	18,336	6,189	5,293	
Corporate Financing Gap	(29,199)	6,940	(8,981)	40,865	
CAPEX Ratio	-9.35	1.11	-1.26	8.22	
Cash Balance at Year End	57,699	51,086	77,863	79,018	

NAME	COUNTRY	YEAR
KAJIMA	Japan	1840

Changed leader during term? NO.

Organizational Setting

Technostructure

R&D Committee - chaired by senior management

Technical Research Institute (TRI)

Advanced Technology Department
- Construction
- Civil Eng.
- Environmental

} Research in technology is also organized by market to provide interface with practical applications.

Environmental Committee (HQ)
Chair : president
Members: GMs of each bus.group and branch offices

Environmental Management Sub-com.
- Design Sub-com
- Construction Sub-com
- Office Work Sub-com

Environmental Committee (division and branch)
- Chair: GM of bus. Group or branch
- Members: GMs of each related section and dept.

Operating Core

G	Headquarters and subs. in Japan overseeing domestic market
G	Subsidiaries in U.S., Europe & Asia form the Overseas Group; Regional HQs function as hubs of the global network
G	Kajima USA inc.
G	Kajim Europe B.V.
G	Kajima Overseas Asia Pte. Ltd.
G	International Division oversees directly: - Middle East - Africa
M	Building Engineering Department
M	Civil Engineering Department
M	Environmental Engineering Department
F	Architectural and Engineering Division
F	Kajima Associate Inc.
G	Kajima Design Europe Ltd.
G	Kajima Design Asia Pte. Ltd.
M	Building maintenance, inspection, survey and analysis services
M	Kajima Overall Control Automatic Management of Building (sub.)

} Design Bases

Support Operations

Notes:
1) Within R&D, Kajima established units that horizontally interlink operations in individual technology development fields, and those units are working to integrate the R&D planning, implementation, and evaluation processes with respect to all the Company's R&D activities.

2) In Feb 1999, Kajima undertook organizational restructuring of the TRI by shifting certain resources from the Building Engineering Dept. and the Civil Engineering Dept. To expedite the development of strategic technologies, these and other resources were used to create the Environmental Eng. Dept., Advanced Technology Department, and a Life-Cycle Engineering project team (which is a form of special-purpose "tiger team").

Kajima - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply	2		2		2		2		2		2			
Feasibility studies & Planning	*				*									
A&E Design	*	*	*		*	*	*	*	5	5	*			
Construction	*	*	*		*	*	*	*	5	5	*			
O&M Renovation	* *		* *		* *									
Finance	1	1												
Own / Develop	3				3									
Combined	*	* 4	*	4	*	*				4				

Notes:

1 Real estate asset securitization. Other fund-raising services rendered on fee basis.

2 Taiko Trading subsidiary - markets and leases diverse construction materials, including steel materials, temporary construction materials, cement, and concrete as well as such construction equipment as excavation machinery, transporter machiner, cranes. Leverage on wealth of experience and know-how to accurately evaluate products and technologies and help customers select and procure the equipment and materials that best meet their needs. - more like a broker, intermediary

3 Real estate development and investment.

4 Selective investments in Private Finance Initiatives (PFI) projects.

5 Infrastructure projects make up a much smaller volume as compared to building projects, the main revenue generator. Building projects also provide a more stable stream of revenues. As such, it is more efficient to manage civil engineering projects centrally in the headquarters. Design for civil engineering is centralized as well.

Kajima (Non-consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	1,602,150	1,512,804	1,250,260	1,174,910
Growth	10.1%	-5.58%	-17.35%	-6.03%
COGS	1,452,491	1,376,468	1,126,300	1,057,628
Growth	11.3%	-5.23%	-18.17%	-6.10%
Operating Income	37,036	31,892	39,112	39,361
Growth	-1.3%	-13.89%	22.64%	0.64%
Net Income	10,025	6,003	-196,675	7,633
Growth	-0.2%	-40.12%	-3376%	-103.88%
Backlog	2,185,086	1,996,767	2,026,794	2,139,507
Growth	-3.4%	-8.62%	1.50%	5.56%
New Orders	1,524,289	1,324,485	1,280,287	1,287,623
Growth	5.9%	-13.11%	-3.34%	0.57%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity	408,189	405,241	214,117	215,020
Non-current Liab.	400,840	460,886	500,762	452,305
Long Term Debt	307,878	363,870	328,819	290,376
Total Liabilities	2,010,562	1,859,055	1,813,688	1,802,736
Total Assets	2,418,751	2,264,296	2,027,805	2,017,756
Current Assets	1,728,099	1,515,530	1,376,641	1,360,445
Current Liabilities	1,609,722	1,398,169	1,312,926	1,350,431
Quick Assets	694,369	584,153	484,166	456,695
Acct. Receivables	422,986	356,797	255,193	238,081

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	9	9	7	7
Net Income/share	10.43	6.24	-204.6	7.94
Dividend Payout ratio	0.86	1.44	-0.03	0.88
NCL/(NCL+Equity)	0.50	0.53	0.70	0.68
LT Debt/Total Capital.	0.43	0.47	0.61	0.57
Total Debt ratio	0.83	0.82	0.89	0.89
Current Asset/Total A	0.71	0.67	0.68	0.67
Non-Current Asset/Total	0.29	0.33	0.32	0.33
Current Liab./Total Liab.	0.80	0.75	0.72	0.75
Current Ratio	1.07	1.08	1.05	1.01
Quick Ratio	0.43	0.42	0.37	0.34
Avg. Collection Period	93.3	94.1	89.3	76.6
Total Asset Turnover	0.65	0.65	0.58	0.58
Rev(t)/Backlog(t-1)	0.708	0.692	0.626	0.580
ROA	0.7%	0.5%	-8.9%	0.6%
ROE	2.5%	1.5%	-63.5%	3.6%
Gross Profit Margin	9.3%	9.0%	9.9%	10.0%
Operating Profit Margin	2.3%	2.1%	3.1%	3.4%
Net Profit Margin	1.1%	0.8%	-15.2%	1.1%
Assumed tax rate:	50%			
Yr.	97	98	99	00
Interest Payment	16,288	13,141	12,274	9,858
NI + (1-t)*Interest	18,169	12,574	-190,538	12,562

Notes:

a. Huge drop in Net Income in 1998 due to valuation loss of marketable and investment securities triggered by the domestic stock market decline.

b. Huge drop in Net Income in 1999 - extraordinary losses of ¥ 347 billion due to (I) write down of real estate and provision for loss on investmnets in subsidiaries; (ii) severance payments provision increased; (iii) cost of restructuring in accordance with the 3-yr plan.

3a) Revenue by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	413.3	363.4	318.3	N/A
Architectural Eng.	1,070.2	1,063.8	834.0	N/A
Real Estate, Oth.	118.7	85.6	98.0	N/A
	1,602.2	1,512.8	1,250.3	

3b) Revenue by Business Areas

Yr.	97	98	99	00
Civil Engineering	26%	24%	25%	
Architectural Engineering	67%	70%	67%	
Development Projects	7%	6%	8%	
	100%	100%	100%	

4a) New Orders by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	396.0	325.0	360.5	338.7
Architectural Eng.	1,000.1	920.8	806.3	848.0
Development Proj.	128.1	77.7	113.5	100.9
	1,524.2	1,323.5	1,280.3	1,287.6

4b) New Orders by Business Areas

Yr.	97	98	99	00
Civil Engineering	26%	25%	28%	26%
Architectural Engineering	66%	70%	63%	66%
Development Projects	8%	6%	9%	8%
	100%	100%	100%	100%

5) R&D Investment (¥ millions)

Yr.	97	98	99	00
Investment	19,567	18,465	15,960	12,756
As % of Sales	1.2%	1.2%	1.3%	1.1%

6) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net CF from Operations	80,200	6,794	63,568	62,979
Net CFfrom Investment	(3,762)	(32,550)	(7,135)	4,904
Capital Expenditure	18,803	18,947	10,071	6,207
Corporate Financing Gap	76,438	(25,756)	56,433	67,883
CAPEX Ratio	4.27	0.36	6.31	10.15
Cash Balance, Year End	140,762	92,188	78,633	89,189

Kajima (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	2,100,701	1,938,933	1,658,884	1,727,871
Growth	19.1%	-7.70%	-14.44%	4.16%
COGS	1,926,792	1,778,719	1,511,117	1,561,888
Growth	21.0%	-7.68%	-15.04%	3.36%
Operating Income	31,921	23,382	33,188	51,610
Growth	-15.3%	-26.75%	41.94%	55.51%
Net Income	4,300	-5,980	-199,357	9,229
Growth		-239%	-3234%	-105%
Net Income (Group Share)	7,345	-7,604	-198,557	9,018
Growth	46%	-204%	2511%	105%

Increase due to change in rules of accounting for consolidation

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity (w/o Minor)	383,102	366,445	174,595	176,058
Equity + Minor Int.	395,454	375,780	182,616	195,009
Non-current Liab.	579,506	646,539	653,980	611,710
Long Term Debt	448,754	506,566	450,053	407,694
Total Liabilities	2,472,925	2,308,548	2,219,865	2,228,533
Total Assets	2,868,379	2,684,328	2,402,481	2,432,542
Current Assets	1,991,280	1,784,265	1,589,172	1,635,370
Current Liabilities	1,893,419	1,662,009	1,565,885	1,616,823
Quick Assets	743,515	680,479	535,913	604,851
Acct. Receivables	429,268	411,703	268,202	346,247

3a) Revenue by Regions (in ¥ billions)

Yr.	97	98	99	00
Japan	1,851.4	1,715.7	1,453.6	1,538.6
North America	249.3	131.3	107.1	97.0
Europe		17.9	33.1	44.4
Asia		64.0	53.8	34.7
Other Area		10.1	11.3	13.2
	2,100.7	1,939.0	1,658.9	1,727.9

4) R&D Investment (¥ millions)

Yr.	97	98	99	00
Investment	20,286	19,315	16,678.0	13,071.0
% of Sales	1.0%	1.0%	1.0%	0.8%

6) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net Cash Flow from Operations	76,561	5,097	54,864	86,179
Net Cash Flow from Investment	(54,157)	(11,741)	2,075	39,162
Capital Expenditure	41,329	40,258	50,959	42,181
Corporate Financing Gap	22,404	(6,644)	56,939	125,341
CAPEX Ratio	1.85	0.13	1.08	2.04
Cash Balance, Year End	182,350	133,465	114,435	127,531

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	9	9	7	7
Net Income/share	7.64	-7.91	-206.6	9.43
Dividend Payout ratio	1.18	-1.14	-0.03	0.74
NCL/(NCL+Equity)	0.59	0.63	0.78	0.76
LT Debt/Total Capital.	0.53	0.57	0.71	0.68
Total Debt ratio	0.86	0.86	0.92	0.92
Current Asset/Total A	0.69	0.66	0.66	0.67
Non-Current Asset/Total	0.31	0.34	0.34	0.33
Current Liab./Total Liab.	0.77	0.72	0.71	0.73
Current Ratio	1.05	1.07	1.01	1.01
Quick Ratio	0.39	0.41	0.34	0.37
Avg. Collection Period	72.8	79.2	74.8	64.9
Total Asset Turnover	0.73	0.70	0.65	0.71
ROA	0.6%	0.2%	-7.4%	0.7%
ROE	1.9%	-2.0%	-73.4%	5.1%
Gross Profit Margin	8.3%	8.3%	8.9%	9.6%
Operating Profit Margin	1.5%	1.2%	2.0%	3.0%
Net Profit Margin	0.8%	0.3%	-11.4%	1.0%

Assumed tax rate: 50%

Yr.	97	98	99	00
Interest Payment	26,376	24,836	22,103	16,910
NI + (1-t)*Interest	17,488	6,438	-188,306	17,684

3b) Revenue by Region

Yr.	97	98	99	00
Japan	88.1%	88.5%	87.6%	89.0%
North America	11.9%	6.8%	6.5%	5.6%
Europe		0.9%	2.0%	2.6%
Asia		3.3%	3.2%	2.0%
Other Area		0.5%	0.7%	0.8%
	100%	100%	100%	100%

5) Performance of the Overseas Group (in ¥ billions)

Yr.	97	98	99	00
Revenue	249.3	190.5	182.5	165.4
Operating Expenses	258.3	198.4	191.1	159.2
Operating Income	-9.0	-7.9	-8.6	6.2

NAME	COUNTRY	YEAR
KUMAGAI GUMI	Japan	1898

	1997	1998	1999	2000
No. of Employees	8,112	8,112	7,555	6,688
No. of Shareholders	92987	N/A	N/A	N/A
No. of Shares Outstanding	680,724,000	680,727,047	680,727,047	680,727,047

Changed leader during term? YES. (1998, 2000)

Employee Structure	1997	1998	1999	2000
Civil Engineers	27.8%	27.8%	27.4%	27.5%
Architectural Engineers	38.9%	38.9%	39.7%	40.3%
Electrical Engineers	2.8%	2.8%	2.7%	2.6%
Mechanical Engineers	2.9%	2.9%	2.6%	1.6%
Administrative staff	26.7%	26.7%	26.7%	27.2%
Others	0.9%	0.9%	0.9%	0.8%
	100%	100%	100%	100%

Organizational Setting

Technostructure	Operating Core		Support Operations
Institute of Construction Technology	F	Marketing divisions	
	M	Public sector and civil eng.	
International Engineering Center (Singapore)	M	Architectural construction (private)	
	M	Renovation division	
	F	Sales division (Target greater Tokyo)	
	M	Global Environment Office Environmental Business Project Division	

Notes: **1997**
Combined six existing marketing divisions into two, with one concentrating on clients in the public sector and civil engineering areas, the other in architectural construction for private-sector clients. Divisions will be directly responsible for capturing orders as well as developing consulting and post-construction services

Kumagai Gumi - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply	2	2	2	2	2	2	2	2	2	2				
Feasibility studies & Planning					*	*	*	*	*	*				
A&E Design					*	*	*	*	*	*				
Construction	3		3		3	*	*	*	*	*				
O&M Renovation			1		1		*	*	*	*				
Finance														
Own / Develop														
Combined							*	*	*	*				

Notes:

1 Operation of hotels, health and medical facilities, sports facilities and recreation facilities.
2 Design, manufacture, and sale of construction machinery and equipment.
3 Notably in working with developers in urban (re)/development projects: Canal-Town Hyogo, Tsuchiura Station Area Redevelopment.

Kumagai (Non-consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	930,315	1,013,237	900,311	691,426
Growth	-5.4%	8.9%	-11.1%	-23.2%
COGS	844,710	934,077	824,829	626,244
Growth	-5.6%	10.58%	-11.7%	-24.1%
Operating Income	30,900	24,416	26,144	17,618
Growth	-9.5%	-21.0%	7.1%	-32.6%
Net Income	1,099	-217,645	1,432	2,755
Growth	0.5%	-19904%	101%	92.4%
Backlog	2,075,440	1,451,465	1,383,468	1,338,441
Growth	4.3%	-30.1%	-4.7%	-3.3%
New Orders	1,001,584	903,861	841,483	650,215
Growth	14.8%	-9.8%	-6.9%	-22.7%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity	353,543	133,856	135,288	166,375
Non-current Liab.	387,001	320,624	314,907	303,876
Long Term Debt	352,885	268,516	284,754	279,841
Total Liabilities	1,317,982	1,425,476	1,369,857	1,364,220
Total Assets	1,671,525	1,559,332	1,505,145	1,530,595
Current Assets	1,118,758	1,034,950	874,208	812,067
Current Liabilities	930,981	1,104,852	1,054,950	1,060,344
Quick Assets	422,221	375,278	318,598	294,151
Acct. Receivables	326,153	289,270	227,864	196,085

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	3	0	0	0
Net Income/share	1.61	-319.72	2.1	4.04
Dividend Payout ratio	1.86	0.00	0.00	0.00
NCL/(NCL+Equity)	0.52	0.71	0.70	0.65
LT Debt/Total Capital.	0.50	0.67	0.68	0.63
Total Debt ratio	0.79	0.91	0.91	0.89
Current Asset/Total A	0.67	0.66	0.58	0.53
Non-Current Asset/Total	0.33	0.34	0.42	0.47
Current Liab./Total Liab.	0.71	0.78	0.77	0.78
Current Ratio	1.20	0.94	0.83	0.77
Quick Ratio	0.45	0.34	0.30	0.28
Avg. Collection Period	132.4	110.8	104.8	111.9
Total Asset Turnover	0.55	0.63	0.59	0.46
Rev(t)/Backlog(t-1)	0.468	0.488	0.620	0.500
ROA	0.86%	-12.70%	0.79%	0.79%
ROE	0.31%	-89.31%	1.06%	1.83%
Gross Profit Margin	9.2%	7.8%	8.4%	9.4%
Operating Profit Margin	3.3%	2.4%	2.9%	2.5%
Net Profit Margin	1.56%	-20.24%	1.34%	1.74%
Assumed tax rate:	50%			
Yr.	97	98	99	00
Interest Payment	26,842	25,054	21,277	18,608
NI + (1-t)*Interest	14,520	-205,118	12,071	12,059

3a) Revenue by Business Areas (in ¥ millions)

Yr.	96	97
Civil Engineering	288,566	253,451
Building Projects	663,840	644,782
Others	31,014	32,082
	983,420	930,315

3b) Revenue by Business Areas

Yr.	96	97
Civil Engineering	29%	27%
Architectural Engineering	68%	69%
Others	3%	3%
	100%	100%

4a) New Orders by Business Areas (in ¥ millions)

Yr.	96	97
Civil Engineering	234,863	276,159
Building Projects	601,300	705,949
Others	36,297	19,476
	872,460	1,001,584

4b) New Orders by Business Areas

Yr.	96	97
Civil Engineering	27%	28%
Architectural Engineering	69%	70%
Others	4%	2%
	100%	100%

5a) Backlog by Business Areas (in ¥ millions)

Yr.	96	97
Civil Engineering	727,400	755,089
Building Projects	1,230,331	1,301,140
Others	32,144	19,211
	1,989,875	2,075,440

5b) Backlog by Business Areas

Yr.	96	97
Civil Engineering	37%	36%
Architectural Engineering	62%	63%
Others	2%	1%
	100%	100%

6) Revenue by Public/Private Sectors and Business Areas

Yr.	96	97
Civil Eng., Public	53%	55%
Civil Eng., Private	47%	45%
Building, Public	19%	18%
Building, Private	81%	82%

7) New Orders by Public/Private Sectors and Business Areas

Yr.	96	97
Civil Eng., Public	56%	61%
Civil Eng., Private	44%	39%
Building Projects, Public	14%	11%
Building Projects, Private	86%	89%

8) Backlog by Public/Private Sectors and Business Areas

Yr.	96	97
Civil Eng., Public	40%	43%
Civil Eng., Private	60%	57%
Building, Public	13%	9%
Building, Private	87%	91%

9) Revenue, New Orders and Backlog by Regions

Yr.	96	97
Revenue, Domestic	97%	98%
Revenue, International	3%	2%
New Orders, Domestic	95%	92%
New Orders, International	5%	8%
Backlog, Domestic	94%	90%
Backlog, International	6%	10%

10) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net Cash Flow from Operations	(304)	(26,644)	8,577	N/A
Net Cash Flow from Investment	(38,293)	(73,281)	(118,381)	N/A
Capital Expenditure	3,284	6,480	6,055	N/A
Corporate Financing Gap	(38,597)	(99,925)	(109,804)	N/A
CAPEX Ratio	-0.09	-4.11	1.42	N/A
Cash Balance, Year End	56,769	56,694	52,726	N/A

Kumagai (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	1,058,751	1,134,315	998,294	799,066
Growth	-2.9%	7.1%	-12.0%	-20.0%
COGS	963,116	1,044,820	913,145	721,573
Growth	-2.8%	8.5%	-12.6%	-21.0%
Operating Income	31,981	25,140	28,158	17,265
Growth	-10.4%	-21.4%	12.0%	-38.7%
Net Income	-6,085	-229,005	-2,450	-5,572
Growth		-3663%	99%	-127%
Net Income (Group Share)	-7,357	-229,794	-2,528	-4,620
Growth		-3023%	99%	-83%

Increase due to change in consolidating rules of accounting

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity (w/o Minor)	260,387	28,468	25,517	11,877
Equity + Minor Int.	262,426	30,613	26,916	18,935
Non-current Liab.	447,244	368,290	358,172	418,483
Long Term Debt	409,231	311,807	321,871	369,970
Total Liabilities	1,630,099	1,684,643	1,522,589	1,601,470
Total Assets	1,892,525	1,715,256	1,549,505	1,620,405
Current Assets	1,297,652	1,210,808	1,063,312	911,160
Current Liabilities	1,182,855	1,316,353	1,164,417	1,182,987
Quick Assets	482,103	426,837	370,075	338,090
Acct. Receivables	362,606	322,762	260,600	222,557

3a) Revenue by Regions (in ¥ millions)

Yr.	97	98	99	00
Japan	1,029,292	1,030,613	938,483	760,747
North America Europe Asia Other Area	29,459	103,702	59,811	38,319
	1,058,751	1,134,315	998,294	799,066

3b) Revenue by Region

Yr.	97	98	99	00	01
Japan	97%	91%	94%	95%	0
North America Europe Asia Other Area	3%	9%	6%	5%	
	100%	100%	100%	100%	

4) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net Cash Flow from Operations	(5,859)	(40,956)	10,388	6,935
Net Cash Flow from Investment	(87,972)	(26,153)	(16,078)	(23,674)
Capital Expenditure	5,868	7,514	6,592	27,936
Corporate Financing Gap	(93,831)	(67,109)	(5,690)	(16,739)
CAPEX Ratio	-1.00	-5.45	1.58	0.25
Cash Balance, Year End	80,049	74,587	71,350	88,696

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	3	0	0	0
Net Income/share	-10.81	-337.57	-3.71	-6.78
Dividend Payout ratio (1)	-0.28	0.00	0.00	0.00
NCL/(NCL+Equity)	0.63	0.92	0.93	0.96
LT Debt/Total Capital.	0.61	0.91	0.92	0.95
Total Debt ratio	0.86	0.98	0.98	0.99
Current Asset/Total A	0.69	0.71	0.69	0.56
Non-Current Asset/Total	0.31	0.29	0.31	0.44
Current Liab./Total Liab.	0.73	0.78	0.76	0.74
Current Ratio	1.10	0.92	0.91	0.77
Quick Ratio	0.41	0.32	0.32	0.29
Avg. Collection Period	126.8	110.3	106.6	110.3
Total Asset Turnover	0.57	0.63	0.61	0.50
ROA	0.5%	-11.9%	0.6%	0.4%
ROE	-3.1%	-159%	-9.4%	-24.7%
Gross Profit Margin	9.0%	7.9%	8.5%	9.7%
Operating Profit Margin	3.0%	2.2%	2.8%	2.2%
Net Profit Margin	0.9%	-18.9%	0.9%	0.8%

Assumed tax rate: 50%

Yr.	97	98	99	00
Interest Payment	30,494	28,160	23,700	23,328
NI + (1-t)*Interest	9,162	-214,925	9,400	6,092

NAME	COUNTRY	YEAR
KVAERNER	Norway	1853

(Kvaerner Brug was founded on 1853; the Group was listed in Oslo Stock Exchange since 1967)

	1997	1998	1999	2000
No. of Employees	55,400	56,421	43,614	28,205
No. of Shareholders	13,395	18,821	17,409	18,883
No. of Shares Outstanding	43,555,064	43,555,064	60,977,090	106,633,916

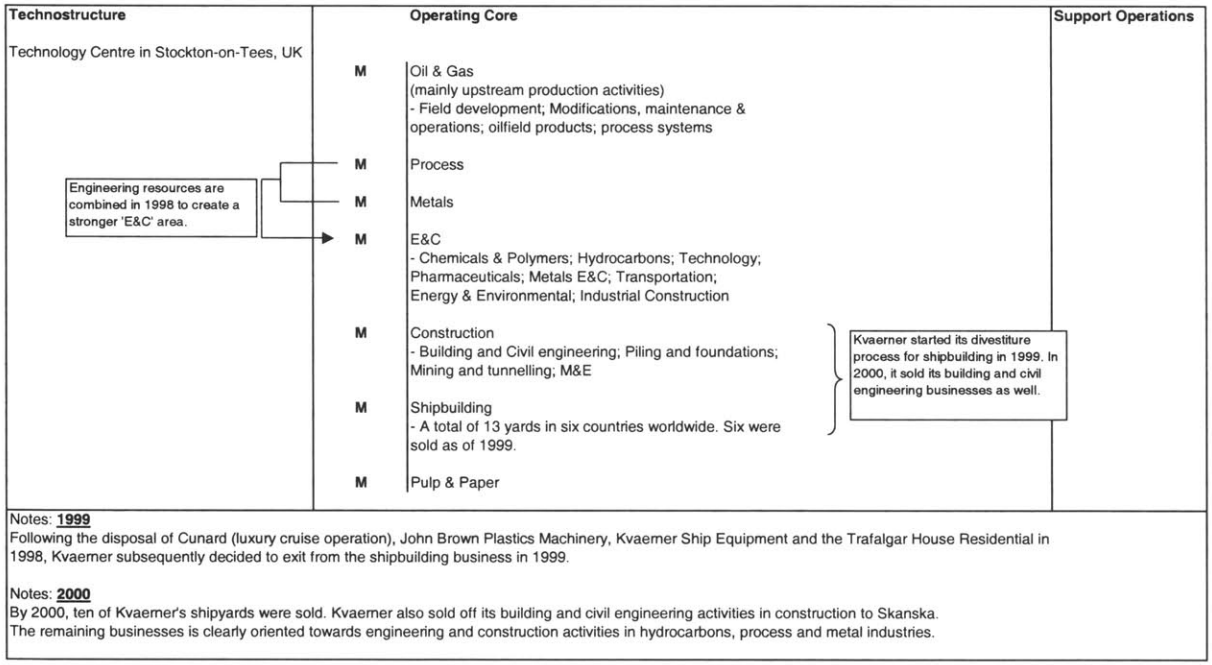
In moves to reduce debt and ameliorate liquidity problem, Kvaerner offered two rights issue for NOK 1.936 billion and NOK 2.588 billion in 1999 and 2000 respectively.

Changed Leader during term of study? YES (End of 1998; September 2001)

Ownership Structure	1997	1998	1999	2000
Aker Maritime ASA				17.8%
Chase Manhattan	14.0%	16.0%	14.0%	13.9%
Bergesen d.y. ASA	13.3%	15.9%	15.9%	
Aksjefondet Odin	6.6%	9.4%	9.3%	6.2%
State Street Bank	6.2%	3.6%	4.1%	3.2%
Folketrygdfondet	4.7%	6.3%	6.4%	8.1%
Others	55.2%	48.8%	50.3%	50.8%
	100.0%	100.0%	100.0%	100.0%

Composition of Employees				
E&C	18.6%	16.8%	17.5%	25.5%
Oil & Gas	21.5%	23.2%	25.9%	32.8%
Construction	16.8%	16.5%	17.6%	0.0%
Shipping	19.1%	17.8%	19.8%	21.8%
Pulp & Paper	6.3%	5.7%	5.5%	8.0%
Other Businesses	17.7%	20.0%	13.7%	11.9%
	100.0%	100.0%	100.0%	100.0%

Organizational Setting



Notes: **1999**
Following the disposal of Cunard (luxury cruise operation), John Brown Plastics Machinery, Kvaerner Ship Equipment and the Trafalgar House Residential in 1998, Kvaerner subsequently decided to exit from the shipbuilding business in 1999.

Notes: **2000**
By 2000, ten of Kvaerner's shipyards were sold. Kvaerner also sold off its building and civil engineering activities in construction to Skanska.
The remaining businesses is clearly oriented towards engineering and construction activities in hydrocarbons, process and metal industries.

Kvaerner - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply													2 4	2 4
Feasibility studies & Planning							*	*						
A&E Design	*	*	*	*	*	*	*	*	*	*			1, 2	1, 2
Construction	*	*	*	*	*	*	*	*	*	*			1, 2, 3	1, 2, 3
O&M Renovation							*	*						
Finance														
Own / Develop / Equity Investment		4												
Combined							*	*						

Notes:

1 Engineering and construction services to various metals and mining industries.
2 Provides design, engineering, fabrication, project management services, supply of pollution control systems and technology and equipment to the fibre board industry.
3 Shipbuilding business, with 14 yards in Finland, Norway, Germany, UK, Singapore, Russia and the US.
4 Other non-core businesses include the luxury cruise operation (Cunard); John Brown Plastics Machinery; Kvaerner Ship Equipment. These businesses, together with the residential housing development business in the US (Trafalgar House Residential), were divested in 1998 to salvage some liquidity.

Kvaerner (Consolidated)

1) Operational Performance (NOK millions)

Yr.	97	98	99	00
Revenue	72,962	82,290	70,864	54,472
Growth	26%	13%	-14%	-23%
COGS	47,964	52,576	50,926	38,086
Growth	36%	10%	-3%	-25%
Operating Income	1,187	58	18	968
Growth	72%	-95%	-69%	5278%
Net Income	1,229	-2,014	-5,601	369
Growth	44%	-264%	-178%	-107%
Backlog	86,597	89,837	60,583	51,122
Growth	28%	4%	-33%	-15.6%
Order Received	87,319	84,733	54,570	66,067
Growth	75%	-3%	-36%	21%

2) Capital Structure (NOK millions)

Yr.	97	98	99	00
Equity + Minor Int.	10,519	8,919	4,526	7,339
Non-current Liab.	13,012	16,530	15,405	10,374
Long-term Debt	10,703	14,197	13,106	8,258
Total Liabilities	47,739	45,087	39,546	25,317
Total Assets	58,258	54,006	44,072	32,656
Current Assets	33,661	32,391	25,958	17,463
Current Liabilities	34,727	28,557	24,141	14,943
Quick Assets	18,361	17,582	14,318	10,603
Acct. Receivables	14,462	13,909	11,560	8,375

Note: Minority interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend (NOK/share)	7	0	0	0
Net Income/share	28.22	-41.34	-96.05	4.31
Dividend Payout ratio	0.25	0.00	0.00	0.00
NCL/(NCL+Equity)	0.55	0.65	0.77	0.59
LT Debt/Total Capital.	0.50	0.61	0.74	0.53
Total Debt ratio	0.82	0.83	0.90	0.78
Current Asset/Total A	0.58	0.60	0.59	0.53
Non-Current Asset/Total	0.42	0.40	0.41	0.47
Current Liab./Total Liab.	0.73	0.63	0.61	0.59
Current Ratio	0.97	1.13	1.08	1.17
Quick Ratio	0.53	0.62	0.59	0.71
Avg. Collection Period	67.5	62.9	65.6	66.8
Total Asset Turnover	1.32	1.47	1.45	1.42
Rev(t)/Backlog(t-1)	1.07	0.95	0.79	0.90
ROA	3.9%	-1.9%	-9.8%	2.9%
ROE	12.2%	-20.7%	-83.3%	6.2%
Gross Profit Margin	34.3%	36.1%	28.1%	30.1%
Operating Profit Margin	1.6%	0.1%	0.0%	1.8%
Net Profit Margin	3.0%	-1.3%	-6.8%	2.0%
Assumed Tax Rate	30%			
Yr.	97	98	99	00
Interest Payment	1,350	1,353	1,102	1,036
NI + (1-t)*Interest	2,174	-1,067	-4,830	1,094

3) Backlog by Business Areas

Yr.	97	98	99	00
Shipbuilding	20%	27%	26%	48%
E&C	14%	13%	18%	24%
Oil & Gas	27%	20%	12%	18%
Construction	17%	19%	25%	0%
Pulp & Paper	4%	6%	6%	7%
Others	18%	16%	11%	4%
	100%	100%	100%	100%

4) New Orders by Business Areas

Yr.	97	98	99	00
Shipbuilding	16%	21%	9%	30%
E&C	16%	18%	27%	26%
Oil & Gas	32%	18%	16%	19%
Construction	13%	18%	22%	13%
Pulp & Paper	6%	7%	8%	7%
Others	17%	18%	18%	4%
	100%	100%	100%	100%

5a) Revenue by Business Areas (NOK millions)

Yr.	97	98	99	00
Shipping	11,703	12,579	11,402	9,815
E&C	14,945	16,725	15,325	16,407
Oil & Gas	18,899	21,052	18,764	11,304
Construction	8,279	10,916	12,441	10,207
Pulp & Paper	5,440	5,109	5,323	5,175
Other Businesses	15,574	18,103	9,139	2,304
Eliminations	-1,878	-2,194	-1,530	-740
	72,962	82,290	70,864	54,472

5b) Revenue by Business Areas

Yr.	97	98	99	00
Shipping	16%	15%	16%	18%
E&C	20%	20%	22%	30%
Oil & Gas	26%	26%	26%	21%
Construction	11%	13%	18%	19%
Pulp & Paper	7%	6%	8%	10%
Other Businesses	21%	22%	13%	4%
Eliminations	-3%	-3%	-2%	-1%
	100%	100%	100%	100%

6) Operating Profit by Business Areas (NOK millions)

Yr.	97	98	99	00
Shipping	749	251	47	32
E&C	166	-41	336	508
Oil & Gas	207	-235	238	148
Construction	-123	-19	139	171
Pulp & Paper	-139	-283	-118	183
Other Businesses	327	385	-624	-74
	1,187	58	18	968

7) Operating Profit Margin by Business Areas

Yr.	97	98	99	00
Shipping	6.4%	2.0%	0.4%	0.3%
E&C	1.1%	-0.2%	2.2%	3.1%
Oil & Gas	1.1%	-1.1%	1.3%	1.3%
Construction	-1.5%	-0.2%	1.1%	1.7%
Pulp & Paper	-2.6%	-5.5%	-2.2%	3.5%
Other Businesses	2.1%	2.1%	-6.8%	-3.2%

Discontinued operations starting from 1999 (divestiture partly completed by 2001).

8a) Revenue by Regions (in NOK millions)

Yr.	97	98	99	00
Norway	14,985	14,539	14,126	6,697
Europe, Other	24,313	30,860	28,352	20,753
North America	13,836	18,323	17,113	15,815
Asia	10,764	9,418	6,440	5,355
World, Other	5,719	7,671	4,833	5,852
Shipping	3,345	1,479	0	0
	72,962	82,290	70,864	54,472

8b) Revenue by Regions

Yr.	97	98	99	00
Norway	21%	18%	20%	12%
Europe, Other	33%	38%	40%	38%
North America	19%	22%	24%	29%
Asia	15%	11%	9%	10%
World, Other	8%	9%	7%	11%
Shipping	5%	2%	0%	0%
	100%	100%	100%	100%

9) Cash Flow Profile (NOK millions)

Yr.	97	98	99	00
Net Cash Flow from Operations	(1,503)	2,719	(2,880)	(125)
Net Cash Flow from Investment	1,095	2,756	2,689	2,043
CAPEX	1,794	2,185	720	615
Corporate Financing Gap	(408)	5,475	(191)	1,918
CAPEX Ratio	-0.84	1.24	-4.00	-0.20
Cash Balance	1,911	2,692	2,399	1,859

NAME	COUNTRY	YEAR	
Mc DERMOTT	U.S.	1923	
Babcock & Wilcox	U.S.	1867	(acquired by JRM in 1978)

	Mar-97	Mar-98	Mar-99	1999	2000
No. of Employees	24,600	24,700	20,350	17,500	11,800
No. of Shareholders	5,684	4,974	4,609	4,396	4,110
No. of Shares outstanding	54,322,804	55,432,949	59,015,091	59,033,154	59,769,662

Changed Leader during term? YES . (1996, 2000)

Ownership Structure	1999
Individuals	2.3%
Fiduciaries and Nominies	0.2%
Institutions, Pensions, and Corporations	3.4%
Depositories and Security Dealers	94.1%
	100.0%

Organizational Setting (Prior to 1999)

Technostructure	Operating Core		Support Operations
	M	J. Ray McDermott, S.A. (marine construction services)	
	M	Babcock & Wilcox Power Generation Group	
	M	Babcock & Wilcox Government Group (later BWX Technologies, Inc.)	
	M	Industrial Group	

Notes: **1997**
In the process of eliminating corporate entities in order to simplify structure, nearly 50 legal entities have been eliminated or in the process of being eliminated. The bottom line is given as: Cost consolidation.

McDermott - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply							*	*					2	
Feasibility studies & Planning							*	*					2	
A&E Design							*	*					2	
Construction							*	*					2	
O&M Renovation							*	*					2	
Finance														
Own / Develop							1	1						
Combined							*	*					2	

Notes:

1 Ownership interests in provision of power through cogeneration, refuse-fueled power plants, and other independent power producing facilities.

2 Provides nuclear fuel assemblies and nuclear reactor components to the U.S. Navy for the Naval Reactors Program. The Segment also provide environmental restoration services and management of government-owned facilities, primarily within the DOE nuclear weapons complex. It is also the sole supplier to the Navy of major nuclear steam system equipment.

McDermott (Consolidated)

1) Operational Performance ($ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Revenue	3,150,850	3,674,635	3,149,985	1,891,088	1,877,753
Growth	-3%	17%	-14.3%	-40.0%	-0.7%
COGS	2,878,972	3,117,279	2,635,229	1,583,195	1,603,771
Growth	2%	8%	-15.5%	-39.9%	1.3%
Operating Income	-147,245	355,457	217,416	74,707	-1,748
Growth	-268%	341%	-39%	-66%	-102%
Net Income	-200,543	263,674	199,404	6,119	-22,082
Growth		231%	-24%	-97%	-461%
Net Income (Group Share)	-206,105	215,690	153,362	440	-22,082
Growth		205%	-29%	-100%	-5119%
Backlog	4,227,422	3,409,230	2,573,096	3,285,297	2,065,510
Growth	24%	-19%	-25%	28%	-37%
CAPEX	93,192	75,649	111,787	52,801	56,244
Growth	-19%	-19%	48%	-53%	7%

2) Capital Structure ($ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99	00
Equity (w/o Minor)	437,001	679,773	793,734	791,858	776,603
Equity + Minor Int.	597,860	869,739	989,101	791,886	776,603
Non-current Liab.	2,392,866	2,170,265	2,050,008	1,780,599	588,797
Long-term Debt	667,174	598,182	323,774	323,014	323,157
Total Liabilities	4,001,622	3,631,391	3,316,419	3,083,005	1,248,523
Total Assets	4,599,482	4,501,130	4,305,520	3,874,891	2,025,126
Current Assets	1,834,327	1,596,556	1,375,366	1,468,808	574,528
Current Liabilities	1,608,756	1,461,126	1,266,411	1,302,406	659,726
Quick Assets	1,132,023	1,020,778	809,601	892,108	386,299
Acct. Receivables	798,294	742,767	572,452	618,270	267,239

Note: Minority Interests are insignificant.
Change in reporting practice: From Year 1999, fiscal year is taken as ending in December.

Key Financial Ratios

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Dividend ($/share)	0.6	0.2	0.2	0.15	0.1
Net Income/share	-3.95	3.48	2.53	0.01	-0.37
Dividend Payout ratio	-0.15	0.06	0.08	15.00	-0.27
NCL/(NCL+Equity)	0.80	0.71	0.67	0.69	0.43
LT Debt/Total Capital.	0.53	0.41	0.25	0.29	0.29
Total Debt ratio	0.87	0.81	0.77	0.80	0.62
Current Asset/Total A	0.40	0.35	0.32	0.38	0.28
Non-Current Asset/Total	0.60	0.65	0.68	0.62	0.72
Current Liab./Total Liab.	0.40	0.40	0.38	0.42	0.53
Current Ratio	1.14	1.09	1.09	1.13	0.87
Quick Ratio	0.70	0.70	0.64	0.68	0.59
Avg. Collection Period	85.5	76.5	76.2	114.9	86.1
Total Asset Turnover	0.70	0.81	0.72	0.46	0.64
Rev(t)/Backlog(t-1)	0.927	0.869	0.924	0.980	0.925
ROA	-3.1%	7.0%	5.5%	0.7%	0.2%
ROE	-36.8%	38.6%	20.8%	0.1%	-2.8%
Gross Profit Margin	8.6%	15.2%	16.3%	16.3%	14.6%
Operating Profit Margin	-4.7%	9.7%	6.9%	4.0%	-0.1%
Net Profit Margin	-4.4%	8.6%	7.7%	1.6%	0.4%

Assumed Tax Rate 34%

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Interest Payment	95,100	81,454	63,262	35,743	43,709
NI + (1-t)*Interest	-137,777	317,434	241,157	29,709	6,766

Note: Rev(t)/Backlog(t-1) for Dec-99 has been adjusted for 1-yr period; Dec-00 has been adjusted to include revenue of B&W for consistency in calculation of the ratio.

3a) Backlog by Business Areas ($ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99	00
Power Generation	1,495,885	1,070,351	905,283	1,202,695	48,631
Marine Services	1,771,170	1,266,310	406,183	514,822	541,647
Government	791,981	810,230	860,981	1,151,960	1,078,803
Industrial	168,416	262,339	400,649	415,820	396,429
	4,227,452	3,409,230	2,573,096	3,285,297	2,065,510

Backlog excluding B&W ($1,136 m) due to bankruptcy filing.

3b) Backlog by Business Areas

Yr.	Mar-97	Mar-98	Mar-99	99	00
Power Generation	35%	31%	35%	37%	2%
Marine Services	42%	37%	16%	16%	26%
Government	19%	24%	33%	35%	52%
Industrial	4%	8%	16%	13%	19%
	100%	100%	100%	100%	100%

4a) Revenue by Business Areas ($ millions)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Power Generation	985.4	1,142.7	1,066.2	730.0	189.6
Marine Services	1,408.5	1,855.5	1,279.6	490.7	757.5
Government	373.1	370.5	382.7	306.3	431.3
Industrial	458.1	337.8	427.5	366.6	504.0
Eliminations	-74.2	-31.9	-6.0	-2.5	-4.6
	3,150.9	3,674.6	3,150.0	1,891.1	1,877.8

4b) Revenue by Business Areas

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Power Generation	31%	31%	34%	39%	10%
Marine Services	45%	50%	41%	26%	40%
Government	12%	10%	12%	16%	23%
Industrial	15%	9%	14%	19%	27%
Eliminations	-2%	-1%	0%	0%	0%
	100%	100%	100%	100%	100%

5a) Operating Income by Business Areas ($ millions)

(Excluding allocation of general corporate expenses - net, asset disposals and income from investees)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Power Generation	-34.6	82.5	90.3	52.1	4.7
Marine Services	10.8	107.1	126.5	31.1	-33.5
Government	32.5	35.8	39.4	28.6	39.8
Industrial	-30.6	4.7	16.9	8.5	10.7
	-21.9	230.1	273.1	120.3	21.7

5b) Operating Income by Business Areas

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Power Generation	158%	36%	33%	43%	22%
Marine Services	-49%	47%	46%	26%	-154%
Government	-148%	16%	14%	24%	183%
Industrial	140%	2%	6%	7%	49%
	100%	100%	100%	100%	100%

5c) Operating Profit Margin by Business Areas

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Power Generation	-3.5%	7.2%	8.5%	7.1%	2.5%
Marine Services	0.8%	5.8%	9.9%	6.3%	-4.4%
Government	8.7%	9.7%	10.3%	9.3%	9.2%
Industrial	-6.7%	1.4%	4.0%	2.3%	2.1%

6) R&D Expenses (in $ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Total	50,749	37,928	28,064	35,534	50,586
(Total/Rev)%	1.6%	1.0%	0.9%	1.9%	2.7%
Customer-Sponsored	34,170	22,803	15,752	18,487	34,838
(CS/Rev)%	1.1%	0.6%	0.5%	1.0%	1.9%

7a) International Revenue by Business Areas ($ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Int'l - PGS&E	296,544	196,831	189,148	154,324	48,593
Int'l - Marine	839,583	1,112,685	731,022	182,120	261,922
Int'l - Industrial	242,973	195,886	319,937	309,175	425,980
Domestic	1,771,750	2,169,233	1,909,878	1,245,469	1,141,258
	3,150,850	3,674,635	3,149,985	1,891,088	1,877,753

7b) International Revenue by Business Areas

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Int'l - PGS&E	9%	5%	6%	8%	3%
Int'l - Marine	27%	30%	23%	10%	14%
Int'l - Industrial	8%	5%	10%	16%	23%
Domestic	56%	59%	61%	66%	61%
	100%	100%	100%	100%	100%

8a) International Operating Income by Business Areas ($ thousands)

(Excluding allocation of general corporate expenses - net, but including asset disposals and income from investees)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Int'l - PGS&E	-33,701	25,694	8,283	14,125	-33,546
Int'l - Marine	14,525	317,482	129,440	-18,724	5,865
Int'l - Industrial	-29,614	90,516	4,592	5,570	8,209
Domestic	21,383	-35,698	162,157	107,944	29,820
	-27,407	397,994	304,472	108,915	10,348

8b) International Operating Income by Business Areas

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Int'l - PGS&E	123%	6%	3%	13%	-324%
Int'l - Marine	-53%	80%	43%	-17%	57%
Int'l - Industrial	108%	23%	2%	5%	79%
Domestic	-78%	-9%	53%	99%	288%
	100%	100%	100%	100%	100%

9a) Revenue by Regions ($ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
U.S.	1,431,868	1,688,388	1,573,896	1,139,010	902,279
Canada	257,285	264,846	437,363	277,917	336,431
U.K.	322,760	364,894	133,403	50,456	59,447
Asia	379,101	587,048	451,117	93,760	393,569
Middle East	99,617	271,525	138,173	62,649	27,069
Others	660,219	497,934	416,033	267,296	158,958
	3,150,850	3,674,635	3,149,985	1,891,088	1,877,753

9b) Revenue by Regions

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
U.S.	45%	46%	50%	60%	48%
Canada	8%	7%	14%	15%	18%
Europe & W. Afric.	10%	10%	4%	3%	3%
Asia	12%	16%	14%	5%	21%
Middle East	3%	7%	4%	3%	1%
Others	21%	14%	13%	14%	8%
	100%	100%	100%	100%	100%

10a) Operating Income by Region ($ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
U.S.	-72,075	N/A	N/A	N/A	N/A
Canada	-31,173	N/A	N/A	N/A	N/A
Europe & W. Afric.	8,669	N/A	N/A	N/A	N/A
Asia	-6,253	N/A	N/A	N/A	N/A
Middle East	-29,147	N/A	N/A	N/A	N/A
Others	34,288	N/A	N/A	N/A	N/A
	-95,691				

10b) Operating Income by Region

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
U.S.	75%	N/A	N/A	N/A	N/A
Canada	33%	N/A	N/A	N/A	N/A
Europe & W. Afric.	-9%	N/A	N/A	N/A	N/A
Asia	7%	N/A	N/A	N/A	N/A
Middle East	30%	N/A	N/A	N/A	N/A
Others	-36%	N/A	N/A	N/A	N/A
	100%				

11) Operating Profit Margin by Region

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
U.S.	-5%	N/A	N/A	N/A	N/A
Canada	-12%	N/A	N/A	N/A	N/A
Europe & W. Afric.	3%	N/A	N/A	N/A	N/A
Asia	-2%	N/A	N/A	N/A	N/A
Middle East	-29%	N/A	N/A	N/A	N/A
Others*	5%	N/A	N/A	N/A	N/A

* Include a gain on sale of two derrick barges of $30.2 m.

12) Cash Flow Profile ($ thousands)

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Net CF from Operations	106,647	577,737	300,285	(5,218)	(49,066)
Net CF from Investment	(234,754)	(177,351)	242,752	(63,944)	(27,991)
CAPEX	91,371	45,090	78,787	52,801	49,300
Corporate Financing Gap	(128,107)	400,386	543,037	(69,162)	(77,057)
CAPEX Ratio	1.17	12.81	3.81	-0.10	-1.00
Cash Balance	257,783	277,876	181,503	162,734	84,620

13) Expected Volatility assumed in Option Valuation

Yr.	Mar-97	Mar-98	Mar-99	99 (9 mth.)	00
Volatility	36%	36%	46%	49%	48%

NAME	COUNTRY	YEAR
NISHIMATSU	Japan	1937

	1997	1998	1999	2000
No. of Employees	5,856	5,654	5,363	5,033
No. of Shareholders	27,857	27,849	27,739	31,853
No. of Shares Outstanding	276,540,999	276,540,999	276,540,999	277,955,718

Changed leader during term? NO.

Employee Structure	1997	1998	1999	2000
Administrative Officers	34.5%	33.9%	33.1%	33.7%
Building Engineers	27.8%	28.9%	29.5%	30.3%
Civil Engineers	27.0%	27.5%	29.0%	29.4%
Mechanical Engineers	3.7%	3.4%	3.3%	3.1%
Electrical Engineers	1.6%	1.5%	1.6%	1.5%
Others	5.4%	4.8%	3.5%	2.0%
	100%	100%	100%	100%

List of Major Financial and Insitutional Owners				
Sumitomo Trust and Banking	5.6%	5.2%	5.3%	3.4%
Fuji Bank	5.0%	5.0%	5.0%	5.0%
Yasuda Trust and Banking	4.4%	4.3%	4.2%	3.5%
Asahi Bank	3.4%	3.4%	3.4%	3.4%
Nippon Credit Bank	3.4%	3.4%	3.4%	3.4%
Yasuda Life Insurance Co.	2.3%	2.3%	2.4%	2.3%
Toyo Trust and Banking	2.3%	2.1%	1.9%	
Mitsui Trust and Banking	1.8%			
Mitsubishi Trust and Banking	1.8%	2.5%	2.7%	2.3%
Chase Manhattan Bank N.A., London	1.4%		2.4%	1.4%
European Bank of Recovery Development		3.7%		
Chuo Trust and Banking		1.3%		
J.P. Morgan Trust Bank			1.9%	2.4%
Deutsche Bank AG, London				1.2%
	31.4%	33.2%	32.6%	28.3%

Nishimatsu - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply														
Feasibility studies & Planning	*													
A&E Design	*		*		*				*	*	*	*		
Construction	*	*	*		*	*	*	*	*	*	*	*		
O&M Renovation														
Finance														
Own / Develop														
Combined									*	*				

Nishimatsu (Non-consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	727,935	711,672	710,012	558,118
Growth	0.8%	-2.2%	-0.2%	-21.4%
COGS	666,791	658,949	661,152	509,280
Growth	1.9%	-1.18%	0.3%	-23.0%
Operating Income	26,370	16,668	16,547	19,396
Growth	-16.5%	-36.8%	-0.7%	17.2%
Net Income	12,564	6,416	7,638	8,182
Growth	-12.3%	-49%	19%	7.1%
Backlog	1,270,700	1,159,100	985,900	906,900
Growth	-2.2%	-8.8%	-14.9%	-8.0%
New Orders	709,686	601,468	551,740	538,720
Growth	0.2%	-15.2%	-8.3%	-2.4%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity	156,795	159,593	164,266	170,330
Non-current Liab.	60,719	50,150	80,468	76,282
Long Term Debt	51,329	40,700	71,498	61,446
Total Liabilities	719,728	725,769	632,870	574,740
Total Assets	876,523	885,362	797,136	745,070
Current Assets	774,495	774,652	679,865	601,523
Current Liabilities	659,009	675,619	552,402	498,458
Quick Assets	294,030	283,563	272,485	229,484
Acct. Receivables	184,784	153,259	181,690	142,622

3a) Revenue by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	391.3	310.0	372.6	274.7
Architectural Eng.	331.4	379.1	330.2	278.2
Development Proj.	5.2	22.6	7.3	5.2
	727.9	711.7	710.1	558.1

4a) New Orders by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	362.4	263.3	237.2	199.0
Architectural Eng.	342.1	315.6	307.2	334.5
Development Proj.	5.2	22.6	7.3	5.2
	709.7	601.5	551.7	538.7

5) Revenue by Public/Private Sectors and Business Areas

Yr.	97	98	99	00
Civil Eng., Public	60.9%	62.8%	54.4%	52.9%
Civil Eng., Private	39.1%	37.2%	45.6%	47.1%
Arch. Eng., Public	26.9%	25.3%	19.8%	22.1%
Arch. Eng., Private	73.1%	74.7%	80.2%	77.9%

7) Revenue and Orders by Regions

Yr.	97	98	99	00
Order, Domestic	78.8%	75.0%	84.3%	86.6%
Order, International	21.2%	25.0%	15.7%	13.4%
Rev., Domestic	83.4%	78.9%	72.1%	86.3%
Revenue, Int'l.	16.6%	21.1%	27.9%	13.7%

9) R&D Investment (¥ billions)

Yr.	97	98	99	00
Investment	5.79	4.50	3.24	2.66
% of Sales	0.8%	0.6%	0.5%	0.5%

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	12	10	10	10
Net Income/share	45.46	23.2	27.62	29.47
Dividend Payout ratio	0.26	0.43	0.36	0.34
NCL/(NCL+Equity)	0.28	0.24	0.33	0.31
LT Debt/Total Capital.	0.25	0.20	0.30	0.27
Total Debt ratio	0.82	0.82	0.79	0.77
Current Asset/Total A	0.88	0.87	0.85	0.81
Non-Current Asset/Total	0.12	0.13	0.15	0.19
Current Liab./Total Liab.	0.92	0.93	0.87	0.87
Current Ratio	1.18	1.15	1.23	1.21
Quick Ratio	0.45	0.42	0.49	0.46
Avg. Collection Period	91.2	86.7	86.1	106.0
Total Asset Turnover	0.84	0.81	0.84	0.72
Rev(t)/Backlog(t-1)	0.560	0.560	0.613	0.566
ROA	1.6%	0.79%	0.96%	1.11%
ROE	8.3%	4.1%	4.7%	4.9%
Gross Profit Margin	8.4%	7.4%	6.9%	8.8%
Operating Profit Margin	3.6%	2.3%	2.3%	3.5%
Net Profit Margin	1.9%	1.0%	1.1%	1.5%
Assumed tax rate:	50%			
Yr.	97	98	99	00
Interest Payment	2,253	1,108	956	748
NI + (1-t)*Interest	13,691	6,970	8,116	8,556

3b) Revenue by Business Areas

Yr.	97	98	99	00
Civil Engineering	54%	44%	52%	49%
Architectural Engineering	46%	53%	47%	50%
Development Projects	1%	3%	1%	1%
	100%	100%	100%	100%

4b) New Orders by Business Areas

Yr.	97	98	99	00
Civil Engineering	51%	44%	43%	37%
Architectural Engineering	48%	52%	56%	62%
Development Projects	1%	4%	1%	1%
	100%	100%	100%	100%

6) New Orders by Public/Private Sectors

Yr.	97	98	99	00
Public sector	37%	42%	41%	39%
Private sector	63%	58%	59%	61%

8) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net CF from Operations	(5,637)	44,076	(42,295)	N/A
Net CFfrom Investment	(4,263)	(17,898)	(13,434)	N/A
Capital Expenditure	6,285	8,906	10,382	N/A
Corporate Financing Gap	(9,900)	26,178	(55,729)	N/A
CAPEX Ratio	-0.90	4.95	-4.07	N/A
Cash Balance, Year End	93,483	116,271	77,088	N/A

NAME	COUNTRY	YEAR
Obayashi	Japan	1892

	1997	1998	1999	2000	2001
No. of Employees	12,014	11,721	11,584	11,261	
Changed leader during term?	No.				

Employee Structure	1997	1998	1999	2000	2001
Architecture	7.3%	7.4%	7.3%	7.3%	
Construction	29.2%	29.3%	28.6%	30.0%	
Civil Engineering	16.4%	16.5%	16.9%	17.1%	
Research	2.0%	2.0%	2.0%	1.9%	
IT	0.8%	0.8%	0.5%	0.5%	
Other technicians	14.0%	14.1%	15.1%	14.2%	
Support	30.3%	29.9%	29.6%	29.1%	
	100%	100%	100%	100%	

List of Major Financial and Insitutional Owners	2000
Yoshiro Obayashi (Chairman)	8.68%
Nippon Life Insurance Comp	6.40%
Sanwa Bank Ltd	4.11%
Sumitomo Trust & Banking	2.86%
Hakuyo-Kai	2.67%
Mitsubishi Trust & Banking	1.95%
Sakura Bank Ltd	1.79%
Employee Share-holding Assoc.	1.56%
Chuo Trust & Banking	1.47%
	31.49%

Organizational Setting

Technostructure		Operating Core	Support Operations
Overseas Business Department	M	Civil Eng. Construction Division	
	G	Overseas Civil Eng. Const. Depts.	
Information System Center			
	M	Building Construction Division	
Technical Research Institute	F	Marketing Depts.	
	G	Overseas Marketing Dept.	
	G	Overseas Building Const. Depts.	
	G	Overseas M&E Dept.	
	M	Renewal Center	
	M	Nuclear Facilities Division	
	F	A&E Division	
	F	Engineering Division	
	F	Civil Eng. Technology Division	

Obayashi - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure, 8		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	3, 4, 5	
Feasibility studies & Planning	*				*				*	*	*			
A&E Design	*				*				*	*	*			
Construction	*	*	*	*	*	*	*	10	*	*	*			
O&M	*		*		*				*	*			6	
Finance	*		*		*		*		*	*	*			
Own	*						9			7				
Combined	*	*							*	*				

Notes:

1 Manufacture, supply, sale and lease of construction machinery and equipment
2 Manufacture and sale of concrete products
3 Acquisition, development, licensing for use, and sale of software industrial properties and providing know-how related to the utilization of computers
4 Information processing services; providing information and supply of telecommunication circuits
5 Sale, lease, and maintenance of electronic office machinery and equipment including computers
6 Operation of insurance agencies
7 BOT projects - Sydney M2 Toll Road, Stadium Australia
8 Focus on BOT projects, in segments of transportation, energy and environment
9 Diversified into power generation, supply of electricity and heat business in 1999/2000.
10 Some projects are initiated by following global customer from Japan (Sumitomo Sitix, Komatsu Electronics)

Obayashi (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	1,541,485	1,487,495	1,379,840	1,132,028
Growth	23.9%	-3.50%	-7.24%	-17.96%
COGS	1,379,891	1,345,920	1,246,493	1,013,774
Growth	27.8%	-2.46%	-7.39%	-18.67%
Operating Income	43,835	39,796	35,721	28,802
Growth	4.6%	-9.21%	-10.24%	-19.37%
Net Income	13,622	11,723	8,893	5,711
Growth	13.4%	-13.94%	-24.14%	-35.78%
Backlog	2,217,429	2,066,214	1,930,250	2,063,706
Growth	-2.68%	-6.82%	-6.58%	6.91%
New Orders	1,479,970	1,335,399	1,244,829	1,271,722
Growth	5.4%	-9.77%	-6.78%	2.16%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity + Minor Int.	301,558	307,009	309,670	329,530
Non-current Liab.	271,002	283,754	329,862	342,948
Long Term Debt	194,727	208,312	252,049	260,069
Total Liabilities	2,128,467	1,960,852	1,760,799	1,731,405
Total Assets	2,430,025	2,267,861	2,070,469	2,060,935
Current Assets	1,851,028	1,686,044	1,452,252	1,353,471
Current Liabilities	1,857,465	1,677,098	1,430,937	1,388,457
Quick Assets	679,509	615,990	522,710	498,155
Acct. Receivables	355,987	302,675	265,558	241,802

Note: Minority Interests are insignificant.

3a) New Orders by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	401.4	352.3	354.7	
Architectural Eng.	1,000.4	826.5	798.4	
Others	78.2	156.6	91.7	
	1,480.0	1,335.4	1,244.8	0.0

4a) Revenue by Regions (in ¥ billions)

Yr.	97	98	99	00
Japan	1,420.8	1,323.0	1,195.9	1,079.9
U.S.	-	99.2	52.7	-
Australia	120.7	19.8	66.5	52.1
Other	-	45.5	64.8	-
	1,541.5	1,487.5	1,379.9	1,132.0

5a) New Orders by Regions (Civil Engineering) (¥ billions)

Yr.	97	98	99	00
Domestic	356.5	280.9	320.6	N/A
International	44.9	71.4	34.1	N/A
	401.4	352.3	354.7	

6) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net Cash Flow from Operations	100,185	37,633	32,342	76,001
Net Cash Flow from Investment	(30,477)	(24,348)	3,705	4,102
Capital Expenditure	19,372	16,701	16,826	13,577
Corporate Financing Gap	69,708	13,285	36,047	80,103
CAPEX Ratio	5.17	2.25	1.92	5.60
Cash Balance, Year End	108,341	88,718	95,376	96,744

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	8	8	8	8
Net Income/share	18.28	15.73	11.93	7.66
Dividend Payout ratio	0.44	0.51	0.67	1.04
NCL/(NCL+Equity)	0.47	0.48	0.52	0.51
LT Debt/Total Capital.	0.39	0.40	0.45	0.44
Total Debt ratio	0.88	0.86	0.85	0.84
Current Asset/Total A	0.76	0.74	0.70	0.66
Non-Current Asset/Total	0.24	0.26	0.30	0.34
Current Liab./Total Liab.	0.87	0.86	0.81	0.80
Current Ratio	1.00	1.01	1.01	0.97
Quick Ratio	0.37	0.37	0.37	0.36
Avg. Collection Period	84.8	80.8	75.2	81.8
Total Asset Turnover	0.63	0.63	0.64	0.55
Rev(t)/Backlog(t-1)	0.677	0.671	0.668	0.586
ROA	0.8%	0.7%	0.6%	0.5%
ROE	4.6%	3.9%	2.9%	1.8%
Gross Profit Margin	10.5%	9.5%	9.7%	10.4%
Operating Profit Margin	2.8%	2.7%	2.6%	2.5%
Net Profit Margin	1.2%	1.1%	0.9%	0.9%
Assumed tax rate:	50%			
Yr.	97	98	99	00
Interest Payment	10,681	8,619	8,028	8,013
NI + (1-t)*Interest	18,963	16,033	12,907	9,718

3b) Revenue by Business Areas

Yr.	97	98	99	00
Civil Engineering	27%	26%	28%	
Architectural Engineering	68%	62%	64%	
Development Projects	5%	12%	7%	
	100%	100%	100%	

4b) Revenue by Regions

Yr.	97	98	99	00
Japan	92%	89%	87%	95%
U.S.		7%	4%	
Australia	8%	1%	5%	5%
Other		3%	5%	
	100%	100%	100%	100%

5b) New Orders by Regions (Civil Engineering)

Yr.	97	98	99	00
Domestic	88.8%	79.7%	90.4%	N/A
International	11.2%	20.3%	9.6%	N/A
	100.0%	100.0%	100.0%	

NAME	COUNTRY	YEAR
PENTA-OCEAN	Japan	1896

	1997	1998	1999	2000	2001
No. of Employees	5080	4671	3937	3774	

Changed leader during term? NO.

Organizational Setting

Technostructure	Operating Core	Support Operations
PO Institute of Technology	M Civil Eng. Headquarters	Safety/Environmental Control Division Group
	F Planning Divison	F Safety Control Division
General Administration Headquarters,	F Marketing Division	M/F Environmental Control Division
Corporate Planning Divisions Group:	F Design Division	F Personnel Division
F Corporate Planning Division	F 2010 Business Promotion Division Group	F Public Relations Division
F Project Development Division	M Plant & Machinery Division	F ISO Promotion Division
F Affiliated Enterprises Division		F Material Procurement Division
F Information Systems Division	M Architectural Headquarters	
	F Planning Division	
	M Urban Development Division	General Affairs Division Group
	F Material Procurement Division	F General Affairs Division
	F Marketing Division	F Legal Affairs Division
	F Design Division	F Auditing Division
	F Construction Control Division	
	F Project Promotion Division	Adminstration Divisions Group
	F Facilities Division	F Finance Division
		F Accounting Division
	G International Headquarters	
	F International Marketing Division	
	F International Construction Division	
	F International Administration Division	

Penta-Ocean - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply	1		1		1		1		1		1			
Feasibility studies & Planning	3										2			
A&E Design	3								*	*				
Construction	3		*		*		*	*	*	*				
O&M Renovation														
Finance														
Own / Develop	3													
Combined														

Notes:

1 Activities include shipbuilding, development of construction materials and equipment, vessel leasing and rental, management of golf courses.

2 Develop environmentally friendly systems.

3 These are typically larger, full-scale urban housing and residential town development projects. Involve building an entire community.

Penta-Ocean (Non-consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	550,695	567,176	508,925	434,811
Growth	-1.4%	3.0%	-10.3%	-14.6%
COGS	496,566	516,244	467,737	389,234
Growth	-0.8%	4.0%	-9.4%	-16.8%
Operating Income	14,685	14,276	5,684	15,747
Growth	-22.4%	-2.8%	-60.2%	177%
Net Income	3,807	3,209	-41,341	-15,024
Growth	-11.8%	-16%	-1388%	63.7%
Backlog	634,771	571,317	527,701	487,252
Growth	15.2%	-10.0%	-7.6%	-7.7%
Order Received	628,185	516,020	470,010	404,259
Growth	15.2%	-17.9%	-8.9%	-14.0%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity	88,616	88,978	44,606	51,634
Non-current Liab.	65,766	56,919	66,100	68,731
Long Term Debt	59,717	52,159	60,284	56,983
Total Liabilities	445,169	495,000	458,666	423,325
Total Assets	533,785	583,978	503,272	474,959
Current Assets	395,420	447,741	376,225	336,067
Current Liabilities	379,403	438,081	392,566	354,594
Quick Assets	248,400	289,684	261,207	220,217
Acct. Receivables	209,495	241,628	204,972	174,832

3a) Revenue by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	335.0	319.2	280.2	270.4
Architectural Eng.	212.6	244.6	225.5	153.3
Development Proj.	3.1	3.4	3.2	11.1
	550.7	567.2	508.9	434.8

4a) New Orders by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	385.4	265.7	319.2	249.3
Architectural Eng.	240.4	246.7	147.3	144.1
Development Proj.	2.3	3.6	3.5	10.9
	628.2	516.0	470.0	404.3

5a) Backlog by Business Areas (in ¥ billions)

Yr.	97	98	99	00
Civil Engineering	360.1	295.8	330.9	302.5
Architectural Eng.	274.7	275.3	196.4	184.5
Development Proj.	0.0	0.2	0.5	0.3
	634.8	571.3	527.7	487.3

6) Revenue and New Orders by Regions

Yr.	97	98	99	00
Order, Domestic	69.9%	86.2%	73.8%	
Order, International	30.1%	13.8%	26.2%	
Rev., Domestic	88.1%	80.1%	78.9%	82.7%
Revenue, Int'l.	11.9%	19.9%	21.1%	17.3%

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	7.5	7.5	0	0
Net Income/share	10.56	8.86	-114.22	-41.57
Dividend Payout ratio	0.71	0.85	0.00	0.00
NCL/(NCL+Equity)	0.43	0.39	0.60	0.57
LT Debt/Total Capital.	0.40	0.37	0.57	0.52
Total Debt ratio	0.83	0.85	0.91	0.89
Current Asset/Total A	0.74	0.77	0.75	0.71
Non-Current Asset/Total	0.26	0.23	0.25	0.29
Current Liab./Total Liab.	0.85	0.89	0.86	0.84
Current Ratio	1.04	1.02	0.96	0.95
Quick Ratio	0.65	0.66	0.67	0.62
Avg. Collection Period	149.9	145.2	160.2	159.4
Total Asset Turnover	0.97	1.01	0.94	0.89
Rev(t)/Backlog(t-1)	0.999	0.894	0.891	0.824
ROA	1.11%	1.04%	-7.22%	-2.57%
ROE	4.41%	3.61%	-61.90%	-31.22%
Gross Profit Margin	9.8%	9.0%	8.1%	10.5%
Operating Profit Margin	2.7%	2.5%	1.1%	3.6%
Net Profit Margin	1.14%	1.02%	-7.71%	-2.89%
Assumed tax rate:	50%			
Yr.	97	98	99	00
Interest Payment	4,970	5,201	4,210	4,930
NI + (1-t)*Interest	6,292	5,810	-39,236	-12,559

3b) Revenue by Business Areas

Yr.	97	98	99	00
Civil Engineering	61%	56%	55%	62%
Architectural Engineering	39%	43%	44%	35%
Development Projects	1%	1%	1%	3%
	100%	100%	100%	100%

4b) New Orders by Business Areas

Yr.	97	98	99	00
Civil Engineering	61%	51%	68%	62%
Architectural Engineering	38%	48%	31%	36%
Development Projects	0%	1%	1%	3%
	100%	100%	100%	100%

5b) Backlog by Business Areas

Yr.	97	98	99	00
Civil Engineering	57%	52%	63%	62%
Architectural Engineering	43%	48%	37%	38%
Development Projects	0%	0%	0%	0%
	100%	100%	100%	100%

7) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net CF from Operations	8,153	(22,085)	11,760	N/A
Net CFfrom Investment	(5,559)	(3,606)	(554)	N/A
Capital Expenditure	4,627	5,043	4,287	N/A
Corporate Financing Gap	2,594	(25,691)	11,206	N/A
CAPEX Ratio	1.76	-4.38	2.74	N/A
Cash Balance, Year End	38,905	48,057	56,234	N/A

NAME	COUNTRY
RAYTHEON	U.S.

Changed Leader during term? YES. (1998, due to retirement of previous chairman)

Organizational Setting (Raytheon Company)

Technostructure	Operating Core	Support Operations
Centers of Excellence (organizations that design and manufacture key components and subassemblies to serve all of RSC's segments with best-of-class engineering and manufacturing practices and processes)	**M** Raytheon Systems Company (Defense, Sensor, Control and Comm Sys) **M** Raytheon Commercial Electronics **M** Raytheon Aircraft **M** Raytheon E&C **M** - Energy **M** - Process **M** - Infrastructure **M** - Metals & Piping **M** - Pulp and Paper **M** - Chemical Weapons Destruction **M** - Road Construction Equipment	

Notes: **1997**
Very distinct business segments, but better synergy can proabably be achieved between Raytheon Systems Company, Raytheon Commercial Electronics and Raytheon Aircraft.

Raytheon Company (Consolidated)

1a) Revenue by Business Areas (in $ millions)

Yr.	97	98	99
Electronics	8,194	14,822	14,489
Aircraft	2,446	2,643	2,696
Eng. & Construct.	3,033	2,065	2,656
	13,673	19,530	19,841

1b) Percentage of Revenue by Business Areas

Yr.	97	98	99
Electronics	60%	76%	73%
Aircraft	18%	14%	14%
Eng. & Construction	22%	11%	13%
	100%	100%	100%

2) Operating Income by Business Areas (in $ millions)

Yr.	97	98	99
Electronics	1,159	2,032	1,426
Aircraft	239	257	162
Eng. & Construct.	181	-253	-61
	1,579	2,036	1,527

3) Operating Margin by Business Areas

Yr.	97	98	99
Electronics	14.1%	13.7%	9.8%
Aircraft	9.8%	9.7%	6.0%
Eng. & Construction	6.0%	-12.3%	-2.3%

4a) Capital Expenditures by Business Areas ($ millions)

Yr.	97	98	99
Electronics	239	320	408
Aircraft	184	148	116
Eng. & Construct.	36	41	8
	459	509	532

4b) Capital Expenditures by Business Areas

Yr.	97	98	99
Electronics	52%	63%	77%
Aircraft	40%	29%	22%
Eng. & Construction	8%	8%	2%
	100%	100%	100%

5) Identifiable Assets (in $ millions)

Yr.	97	98	99
Eng. & Construct.	1,758	1,478	1,521
Asset Turnover	1.73	1.40	1.75

NAME	COUNTRY	YEAR
STONE & WEBSTER	U.S.	1889

	1996	1997	1998	1999
No. of Shares Outstanding	12,834,618	12,822,513	13,038,555	13,116,000

Changed Leader during term? NO. (Since 1996)

Organizational Setting

Technostructure		Operating Core	Support Operations
	M	Power → Acquired Power Technologies in 1998	
	M	Process	
	M	Environmental/Infrastructure - Federal facilities/Environmental remediation - Water and wastewater facilities - Transportation	
	M	Industrial → Acquired Belmont Constructors in 1998 which serves hydrocarbons, water, industrial, power	
	M	Consulting	
	M	Prescient Technologies	
	M	Commercial Cold Storage → Acquired Nordic Group in 1998	

Stone & Webster - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply													2	2
Feasibility studies & Planning							*	*	*	*	*	*		
A&E Design							*	*	*	*	*	*		
Construction							*	*	*	*	*	*		
O&M Renovation							*	*						
Finance														
Own / Develop							1	1						
Combined							*	*	*	*	*	*		

Notes:

1 Some equity investment through joint venture in wholesale gas marketing.

2 Refrigeration services, warehousing, software for aerospace and manufacturing design, management consulting especially for asset divestiture and privatization.

Stone & Webster (Consolidated)

1) Operational Performance ($ thousands)

Yr.	96	97	98	99
Revenue	1,164,837	1,322,540	1,248,780	1,167,848
Growth		14%	-5.6%	-6.5%
COGS	1,109,828	1,206,677	1,250,598	1,212,979
Growth		9%	3.6%	-3.0%
Operating Income	-25,920	47,292	-72,534	-115,024
Growth		282%	-253%	-59%
Net Income	-10,644	33,510	-49,302	20,472
Growth		415%	-247%	142%
Backlog	2,487,552	2,519,302	2,636,166	2,600,000
Growth		1%	5%	-1%
Order Received	1,714,139	1,330,970	1,331,332	N/A
Growth		-22%	0%	

2) Capital Structure ($ thousands)

Yr.	96	97	98	99
Equity	317,133	345,232	291,576	324,349
Non-current Liab.	89,411	96,687	69,685	80,648
Long-term Debt	24,260	22,510	22,228	19,950
Total Liabilities	374,932	393,545	543,106	608,947
Total Assets	692,065	738,777	834,682	933,296
Current Assets	394,424	408,644	392,005	535,658
Current Liabilities	285,521	296,858	473,421	528,299
Quick Assets	243,793	286,996	321,727	395,305
Acct. Receivables	181,900	180,057	276,235	288,824

Note: Minority Interests is insignificant.

3a) Revenue by Regions (in $ thousands)

Yr.	96	97	98
U.S.	703,832	659,005	517,644
International	461,005	663,535	731,136
	1,164,837	1,322,540	1,248,780

4a) Operating Income by Regions (in $ thousands)

Yr.	96	97	98
U.S.	-31,071	27,995	-76,885
International	5,151	19,297	4,351
	-25,920	47,292	-72,534

5) Operating Profit Margin by Regions

Yr.	96	97	98
U.S.	-4.4%	4.2%	-14.9%
International	1.1%	2.9%	0.6%

7a) Revenue by Business Areas (in $ thousands)

Yr.	96	97	98
Power	412,375	537,809	610,013
Process	409,322	452,122	284,582
Env/Infrastructure	107,422	108,165	109,989
Industrial	182,370	169,417	140,116
Other EPC work	29,753	31,707	69,768
Cold Storage	21,250	23,320	34,312
	1,162,492	1,322,540	1,248,780

8a) New Orders by Business Areas (in $ thousands) (EPC Only)

Yr.	96	97	98
Power	262,137	640,843	1,070,117
Process	701,354	340,880	210,932
Env/Infrastructure	532,163	55,542	-168,861
Industrial	188,871	256,916	112,333
Other EPC work	29,614	36,789	106,811
	1,714,139	1,330,970	1,331,332

9) Cash Flow Profile ($ thousands)

Yr.	96	97	98
Net Cash Flow from Operations	28,455	83,184	(72,468)
Net Cash Flow from Investment	26,509	(48,893)	(54,265)
Capital Expenditure	24,383	25,909	20,290
Corporate Financing Gap	54,964	34,291	(126,733)
CAPEX Ratio	1.17	3.21	-3.57
Cash Balance	57,887	75,030	45,492

Key Financial Ratios

Yr.	96	97	98	98
Dividend ($/share)	0.6	0.6	0.6	0.45
Net Income/share	-0.8	2.59	-3.83	1.56
Dividend Payout ratio	-0.75	0.23	-0.16	0.29
NCL/(NCL+Equity)	0.22	0.22	0.19	0.20
LT Debt/Total Capital.	0.071	0.061	0.071	0.058
Total Debt ratio	0.54	0.53	0.65	0.65
Current Asset/Total A	0.57	0.55	0.47	0.57
Non-Current Asset/Total	0.43	0.45	0.53	0.43
Current Liab./Total Liab.	0.76	0.75	0.87	0.87
Current Ratio	1.38	1.38	0.83	1.01
Quick Ratio	0.85	0.97	0.68	0.75
Avg. Collection Period	54.2	49.9	66.7	88.3
Total Asset Turnover	1.65	1.85	1.59	1.32
Rev(t)/Backlog(t-1)	0.608	0.532	0.496	0.443
ROA	-0.9%	4.8%	-5.9%	3.3%
ROE	-3.1%	10.1%	-15.5%	6.6%
Gross Profit Margin	4.7%	8.8%	-0.1%	-3.9%
Operating Profit Margin	-2.2%	3.6%	-5.8%	-9.8%
Net Profit Margin	-0.5%	2.6%	-3.7%	2.5%
Assumed Tax Rate	34%			
Yr.	96	97	98	99
Interest Payment	6,737	1,739	4,076	12,959
NI + (1-t)*Interest	-6,198	34,658	-46,612	29,025

3b) Revenues by Regions

Yr.	97	98	99
U.S.	60%	50%	41%
International	40%	50%	59%
	100%	100%	100%

4b) Operating Income by Regions

Yr.	97	98	99
U.S.	120%	59%	106%
International	-20%	41%	-6%
	100%	100%	100%

6) Expected Volatility assumed in Option Valuation

Yr.	96	97	98
Expected Volatility	19.3%	21.0%	23.7%

7b) Revenues by Business Areas

Yr.	96	97	98
Power	35%	41%	49%
Process	35%	34%	23%
Env/Infrastructure	9%	8%	9%
Industrial	16%	13%	11%
Other EPC work	3%	2%	6%
Cold Storage	2%	2%	3%
	100%	100%	100%

8b) New Orders by Business Areas (EPC Only)

Yr.	96	97	98
Power	15%	48%	80%
Process	41%	26%	16%
Env/Infrastructure	31%	4%	-13%
Industrial	11%	19%	8%
Other EPC work	1.7%	3%	8%
	100%	100%	100%

NAME	COUNTRY	YEAR
TECHNIP Group	France	1958 (Incorporated)

	1997	1998	1999	2000
No. of Employees	6,402	6,420	9,709	9,800
No. of Shares Outstanding	16,532,549	15,775,999	15,758,537	16,029,305

Changed Leader during term of study? YES (1999) (Due to retirement of previous chairman and CEO.)

Ownership Structure				
ISIS	12.4%	13.3%	12.1%	11.3%
Gaz de France	11.1%	11.6%	11.1%	10.6%
TOTAL	6.1%	6.3%	5.1% }	6.2%
ELF Group	3.0%	3.2%	1.3% }	
Technip (Treasury shares)		1.0%	2.9%	3.9%
Personnel	3.8%	3.5%	3.0%	3.5%
Retail & Institutional Investors	31.1%	34.9%	37.7%	28.5%
International Investors & Others	32.5%	26.2%	26.8%	36.0%
	100.0%	100.0%	100.0%	100.0%

Notes:
Notably a balanced structure between original shareholders, French and international investors.
In Oct 1998, a stock repurchase program amounting to 10% of outstanding stock is authorized. 5.85% of share capital was cancelled (Financial Strategy).
The 16.3% increase in earnings per share is partially attributed to the share capital cancellation.

Organizational Setting

Technostructure	Operating Core	Support Operations
	M Oil and Gas Production (Upstream) **M** Oil Refining (Downstream) **M** Petrochemical **M** Diversified Industries **M** Chemicals/Fertilizers **M** Life Sciences (e.g. pharmaceutical) **M** Power generation and cogeneration **M** Buildings **M** Cement	

Notes: **1999**
Technip acquired KTI/MDEU for 192 million Euros (subsequently reduced by 63 m Euros) in 1999. The new affiliates, renamed as Technip Germany, Technip Benelux and Technip USA, generated a net profit in the first year, showing good signs of turnaround.

At the completion of structural reorganization of the group, which in 1999 had led to the transfer of the engineering operations of Technip to Technip France, Technip (parent) become essentially a holding company.

Technip - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial, 2		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply														
Feasibility studies & Planning							*	*						
A&E Design							*	*					1	1
Construction							*	*					1	1
O&M Renovation													3	3
Finance							*	*						
Own / Develop														
Combined							*	*						

Notes:

1 Cement plant and equipment based on its proprietary technologies (1997p33)

2 Core businesses are mainly in oil and gas, petrochemicals and fertilizers. Non-core (which more resemble a diversification motive) includes pharmaceutical, cosmetics and agro-industries.

3 FORWARD software for scheduling crudes and in operational decisions; installation of centralized control and security systems (DCS/ESD)

Technip (Consolidated)

1) Operational Performance (million Euros)

Yr.	97	98	99	00
Revenue	1,809.3	1,846.4	2,782.2	2,972.0
Growth	17%	2%	50.7%	7%
COGS	1,428.9	1,433.6	2,160.6	2,313.4
Growth	17%	0%	51%	7%
Operating Income	128.9	142.9	163.5	182.6
Growth	29%	11%	14%	12%
Net Income	95.7	105.6	172.8	215.4
Growth	17%	10%	64%	25%
Backlog	2,488	2,793	3,468	3,410
Growth	33%	12%	24%	-2%
Order Received	N/A	N/A	2,380	2,910
Growth				22%

2) Capital Structure (million Euros)

Yr.	97	98	99	00
Equity + Minor Int.	501.8	504.4	636.2	769.8
Non-current Liab.	485.1	367.2	475.8	481.8
Long-term Debt	17.6	0.3	2.5	0.0
Total Liabilities	1,179.6	1,080.9	1,657.8	1,710.3
Total Assets	1,681.4	1,585.3	2,294.0	2,480.1
Current Assets	1406.1	1,321.2	1,862.2	1,429.4
Current Liabilities	694.5	713.7	1,182.0	1,228.5
Quick Assets	1,177.7	1,109.3	1,484.8	1,151.0
Acct. Receivables	241.4	247.8	465.4	587.9

Key Financial Ratios

Yr.	97	98	99	00
Dividend (Euro/share)	2.21	2.45	3	3.3
Net Income/share	5.6	6.51	10.75	12.85
Dividend Payout ratio	0.39	0.38	0.28	0.26
NCL/(NCL+Equity)	0.49	0.42	0.43	0.38
LT Debt/Total Capital.	0.034	0.001	0.004	0.000
Total Debt ratio	0.70	0.68	0.72	0.69
Current Asset/Total A	0.84	0.83	0.81	0.58
Non-Current Asset/Total	0.16	0.17	0.19	0.42
Current Liab./Total Liab.	0.59	0.66	0.71	0.72
Current Ratio	2.02	1.85	1.58	1.16
Quick Ratio	1.70	1.55	1.26	0.94
Avg. Collection Period	42.8	48.4	46.8	64.7
Total Asset Turnover	1.09	1.13	1.43	1.25
Rev(t)/Backlog(t-1)	0.973	0.742	0.996	0.857
ROA	5.8%	6.5%	8.9%	9.0%
ROE	20.8%	21.0%	30.3%	30.6%
Gross Profit Margin	21.0%	22.4%	22.3%	22.2%
Operating Profit Margin	7.1%	7.7%	5.9%	6.1%
Net Profit Margin	5.3%	5.7%	6.2%	7.2%
Assumed Tax Rate	37%			
Yr.	**97**	**98**	**99**	**00**
Interest Payment				
NI + (1-t)*Interest	96	106	173	215

Notes:

1) Total assets have been adjusted to eliminate "Work in progress" (which is total accrued costs), offsetting the "Advances Received from Customers on Contract" which are effectively progress payments. Such adjustment is helpful to facilitate comparison with U.S. and Japanese companies (whereby only revenus in excess of billing is classified under "Work in Progress" or Inventory. Also, the adjustment will avoid underestimation of ROA and Asset Turnover.

2) Due to the acquistion of two engineering divisions of Mannesmann, the volume of sales and staff grew by 50% in 1999.

3) Interest payment is minimum in this case since there is very little long-term debt.

3a) Backlog by Regions (million Euros)

Yr.	97	98	99	00
France/W. Europe	498	335	478	437
Central Asia/CIS	199	140	222	152
Middle East	498	978	1313	1254
Far East	199	279	405	728
Africa	970	754	715	503
Americas	124	307	335	336
	2488	2793	3468	3410

3b) Backlog by Regions

Yr.	97	98	99	00
France/W. Europe	20%	12%	14%	13%
Central Asia/CIS	8%	5%	6%	4%
Middle East	20%	35%	38%	37%
Far East	8%	10%	12%	21%
Africa	39%	27%	21%	15%
Americas	5%	11%	10%	10%
	100%	100%	100%	100%

4a) Backlog by Business Areas (million Euros)

Yr.	97	98	99	00
Refining, Gas	1,468	1,424	1,221	567
Petrolm. Upstream	448	670	814	1,310
Petrochem/Fert.	323	531	1,087	1,100
Industries				
Arch. & Building	249	168	346	432.1
Eng., Other				
	2,488	2,793	3,468	3,410

4b) Backlog by Business Areas

Yr.	97	98	99	00
Refining, Gas	59%	51%	35%	17%
Petroleum Upstream	18%	24%	23%	38%
Petrochemical/Fertilizer	13%	19%	31%	32%
Industries				
Architectural & Building	10%	6%	10%	13%
Engineering, Other				
	100%	100%	100%	100%

5a) Revenue by Regions (million Euros)

Yr.	97	98	99	00
France/W. Europe	724	534	725	577
Central Asia/CIS	119	108	197	140
Middle East	310	472	661	974
Far East	198	173	225	352
Africa	318	429	636	475
Americas	140	130	338	455
	1,809	1,846	2,782	2,972

5b) Revenue by Regions

Yr.	97	98	99	00
France/Western Europe	40%	29%	26%	19%
Central Asia/ C.I.S.	7%	6%	7%	5%
Middle East	17%	26%	24%	33%
Far East	11%	9%	8%	12%
Africa	18%	23%	23%	16%
Americas	8%	7%	12%	15%
	100%	100%	100%	100%

6a) Revenue by Business Areas (million Euros)

Yr.	97	98	99	00
Refining, Gas	853	1,001	1,103	846
Petrolm. Upstream	128	223	590	885
Petrochem/Fert.	522	328	485	690
Industries	222	196		
Arch. & Building			604	551.1
Eng., Other	84	98		
	1,809	1,846	2,782	2,972

6b) Revenue by Business Areas

Yr.	97	98	99	00
Refining, Gas	47%	54%	40%	28%
Petroleum Upstream	7%	12%	21%	30%
Petrochemical/Fertilizer	29%	18%	17%	23%
Industries	12%	11%		
Architectural & Building			22%	19%
Engineering, Other	5%	5%		
	100%	100%	100%	100%

7) Cash Flow Profile (million Euros)

Yr.	97	98	99	00
Net Cash Flow from Operatns.	(53.4)	46.4	283.5	(99.2)
Net Cash Flow from Investmnt.	(33.7)	4.2	(163.2)	(525.9)
Capital Expenditure	10.8	7.3	8.1	4.2
Corporate Financing Gap	(87.1)	50.6	120.3	(625.1)
CAPEX Ratio	-4.94	6.36	35.00	-23.62
Cash Balance at Year End	932.1	859.4	1,017.4	563.1

NAME	COUNTRY	YEAR
TOYO ENGINEERING CORP.	Japan	1961

	1997	1998	1999	2000
No. of Employees	1,562	1,532	1,509	1,142
No. of Shareholders	12,977	15,629	17,124	18,025
No. of Shares Outstanding	175,692,539	175,692,539	175,692,539	175,692,539

Changed Leader during Term? YES. (1999, Replaced Internally - Previously an EVP)

Ownership Structure				
Financial Institutions	23.4%	18.4%	13.9%	10.0%
Individuals	14.7%	24.6%	30.8%	37.8%
Foreign Shareholders	10.6%	5.6%	3.8%	1.4%
Other domestic companies	51.1%	51.0%	51.2%	50.4%
Others	0.2%	0.3%	0.4%	0.3%
	100.0%	100.0%	100.0%	100.0%
Shareholders with > 1m shs.	67.42%	55.91%	54.66%	51.37%

Overseas Operations

	China+India	SEA & Indochina	Africa	Europe	North Am.	South Am.	Middle East	Rest of World	Total	Japan
1) Rep. Offices, 1997	3	3	0	0	0	0	0	Moscow, Korea	8	
2) Subsidiaries	1	2	0	2	2	0	0	Korea	8	15
1) Rep. Offices, 1998	3	3	0	0	0	0	0	Moscow, Korea	8	
2) Subsidiaries	1	2	0	2	2	0	0	Korea	8	14
1) Rep. Offices, 1999	3	3	0	0	0	0	0	Moscow, Korea	8	
2) Subsidiaries	2	2	0	2	2	1	0	Korea	10	15
1) Rep. Offices, 2000	3	3	0	0	0	0	0	Moscow, Korea	8	
2) Subsidiaries	2	2	0	2	1	1	0	Korea	9	12

Liquidation of a financial subsidiary, TEC International Ltd.

Toyo Engineering Corp. - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply													1	1
Feasibility studies & Planning							*	*	*				2	2
A&E Design							*	*	*					
Construction							*	*	*					
O&M Renovation							*	*						
Finance														
Own / Develop														
Combined							*	*						

Notes:

1 Fields of computer-integrated manufacturing (CIM), advanced information system, pharmaceuticals, and logistics that combine engineering technology with software development.

2 Consulting and implementation work related to SAP R/3, orders primarily from the pharmaceutical and chemical industries.

Toyo (Non-consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	202,674	244,402	228,771	139,845
Growth	21%	21%	-6%	-39%
COGS	189,698	232,031	228,681	131,914
Growth	25%	22%	-1%	-42%
Operating Income	169	336	-11,746	-995
Growth	-94%	99%	-3596%	92%
Net Income	849	-32,448	-15,518	188
Growth	-39%	-3922%	52%	101%
Backlog	389,330	387,165	263,380	222,000
Growth	-2.0%	-0.6%	-32%	-16%
Order Received	176,957	239,000	116,535	117,000
Growth	-7.3%	35%	-51%	0.4%

(Consolidated Figures)

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity	87,624	54,358	42,184	42,372
Non-current Liab.	65,578	63,170	63,869	46,572
Long Term Debt	64,113	62,268	63,232	45,853
Total Liabilities	198,164	199,352	201,925	171,626
Total Assets	285,788	253,710	244,109	213,998
Current Assets	243,736	217,705	203,871	177,474
Current Liabilities	132,586	136,182	138,056	125,054
Quick Assets	153,739	142,000	133,044	121,266
Acct. Receivables	69,529	94,418	74,673	54,928

3) Revenue, Backlog and New Orders by Regions

Yr.	97	98	99	00
Rev., Domestic	31.4%	12.5%	14.9%	28.7%
Rev., International	68.6%	87.5%	85.1%	71.3%
Backlog, Domestic	11.5%	14.3%	13.5%	13.2%
Backlog, Int'l.	88.5%	85.7%	86.5%	86.8%
New Ord, Domestic	20.0%	18.8%	20.8%	25.6%
New Orders, Int'l.	80.0%	81.8%	79.2%	74.4%

5a) Revenue by Business Areas

Yr.	97	98	99	00
Refinery	13.8%	20.4%	15.1%	11.5%
Petrochemical	35.3%	37.6%	57.4%	54.5%
Energy-Related	30.4%	27.7%	7.8%	10.6%
Chemical Fertilizer	5.6%	3.7%	6.0%	4.5%
Industrial Systems	13.3%	10.1%	13.3%	13.3%
Others	1.6%	0.5%	0.4%	5.6%
TOTAL	100%	100%	100%	100%
HPI	79.5%	85.7%	80.3%	76.6%
Non-HPI	20.5%	14.3%	19.7%	23.4%

5c) Backlog by Business Areas

Yr.	97	98	99	00
Refinery	22.7%	12.2%	8.9%	3.9%
Petrochemical	37.9%	63.6%	63.2%	42.5%
Energy-Related	23.47%	10.6%	10.3%	30.6%
Chemical Fertilizer	7.0%	4.8%	11.5%	14.7%
Industrial Systems	8.9%	8.8%	6.1%	8.1%
Others	0.03%	0.0%	0.0%	0.2%
TOTAL	100%	100%	100%	100%
HPI	84.1%	86.4%	82.4%	77.0%
Non-HPI	15.9%	13.6%	17.6%	23.0%

7) R&D Expenses (in ¥ millions)

Yr.	97	98	99	00
R&D Expenses	2,006	1,900	N/A	N/A
As % of Sales	1.0%	0.8%	N/A	N/A

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	6	6	0	0
Net Income/share	4.83	-184.68	-88.32	1.07
Dividend Payout ratio	1.24	-0.03	0.00	0.00
NCL/(NCL+Equity)	0.43	0.54	0.60	0.52
LT Debt/Total Capital.	0.42	0.53	0.60	0.52
Total Debt ratio	0.69	0.79	0.83	0.80
Current Asset/Total A	0.85	0.86	0.84	0.83
Non-Current Asset/Total	0.15	0.14	0.16	0.17
Current Liab./Total Liab.	0.67	0.68	0.68	0.73
Current Ratio	1.84	1.60	1.48	1.42
Quick Ratio	1.16	1.04	0.96	0.97
Avg. Collection Period	119.1	122.4	134.9	169.1
Total Asset Turnover	0.70	0.91	0.92	0.61
Rev(t)/Backlog(t-1)	0.510	0.628	0.591	0.531
ROA	0.9%	-11.4%	-5.6%	0.8%
ROE	1.0%	-45.7%	-32.1%	0.4%
Gross Profit Margin	6.4%	5.1%	0.0%	5.7%
Operating Profit Margin	0.1%	0.1%	-5.1%	-0.7%
Net Profit Margin	1.3%	-12.5%	-6.1%	1.3%
Assumed tax rate:	50%			
Yr.	97	98	99	00
Interest Payment	3,530	3,579	3,318	3,231
NI + (1-t)*Interest	2,614	-30,659	-13,859	1,804

4) Backlog by Regions

Yr.	97	98	99	00
South East Asia	69.7%	35.7%	44.5%	28.8%
S. West Asia & Africa		26.7%	18.4%	11.8%
Russia & Central Asia	6.3%	13.1%	17.5%	17.0%
Central & South America	0.0%	5.8%	0.0%	24.2%
Others	12.5%	4.4%	6.1%	5.0%
Domestic	11.5%	14.3%	13.5%	13.2%
TOTAL	100.0%	100.0%	100.0%	100.0%

5b) New Orders by Business Areas

Yr.	97	98	99	00
Refinery	22.6%	4.9%	6.0%	2.3%
Petrochemical	29.9%	78.5%	48.4%	18.3%
Energy-Related	14.3%	3.3%	3.4%	47.2%
Chemical Fertilizer	12.2%	0.2%	22.6%	9.0%
Industrial Systems	20.7%	13.0%	19.3%	21.4%
Others	0.3%	0.1%	0.3%	1.8%
TOTAL	100%	100%	100%	100%
HPI	66.8%	86.7%	57.8%	67.8%
Non-HPI	33.2%	13.3%	42.2%	32.2%

6) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net CF from Operations	(14,824)	(54,334)	7,579	6,510
Net CFfrom Investment	(3,423)	32,066	(250)	8,829
Capital Expenditure	1,344	2,400	3,063	162
Corporate Financing Gap	(18,247)	(22,268)	7,329	15,339
CAPEX Ratio	-11.03	-22.64	2.47	40.19
Cash Balance, Year End	54,319	33,721	51,490	59,013

Toyo (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00
Revenue	208,280	251,209	237,505	155,812
Growth	21.5%	20.6%	-5.5%	-34.4%
COGS	194,017	236,955	234,233	143,669
Growth	25.2%	22.1%	-1.1%	-38.7%
Operating Income	267	659	-11,015	279
Growth	-90%	146.8%	-1771%	102.5%
Net Income	682	-44,783	-15,261	-620
Growth	-61%	-6666%	66%	96%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00
Equity + Minor Int.	88,944	43,496	32,549	32,305
Non-current Liab.	65,778	84,715	90,558	73,159
Long Term Debt	64,113	82,968	87,053	69,435
Total Liabilities	201,669	226,462	232,513	205,557
Total Assets	290,613	269,958	265,062	237,862
Current Assets	248,279	225,000	210,735	186,719
Current Liabilities	135,891	141,747	141,955	132,398
Quick Assets	158,573	151,872	141,724	129,922
Acct. Receivables	72,287	96,940	77,750	58,418

Note: Minority Interests are insignificant.

3) Cash Flow Profile (¥ millions)

Yr.	97	98	99	00
Net Cash Flow from Operations	(16,259)	(52,354)	3,550	4,082
Net Cash Flow from Investment	(3,413)	12,395	(827)	7,238
Capital Expenditure	1,380	2,777	3,318	774
Corporate Financing Gap	(19,672)	(39,959)	2,723	11,320
CAPEX Ratio	-11.78	-18.85	1.07	5.27
Cash Balance, Year End	56,381	41,057	56,792	63,939

Key Financial Ratios

Yr.	97	98	99	00
Dividend (yen/share)	6	6	0	0
Net Income/share	3.89	-254.92	-86.85	-3.57
Dividend Payout ratio	1.54	-0.02	0.00	0.00
NCL/(NCL+Equity)	0.43	0.66	0.74	0.69
LT Debt/Total Capital.	0.42	0.66	0.73	0.68
Total Debt ratio	0.69	0.84	0.88	0.86
Current Asset/Total A	0.85	0.83	0.80	0.78
Non-Current Asset/Total	0.15	0.17	0.20	0.22
Current Liab./Total Liab.	0.67	0.63	0.61	0.64
Current Ratio	1.83	1.59	1.48	1.41
Quick Ratio	1.17	1.07	1.00	0.98
Avg. Collection Period	120.3	122.9	134.2	159.5
Total Asset Turnover	0.71	0.90	0.89	0.62
ROA	0.8%	-15.3%	-5.0%	0.5%
ROE	0.8%	-68%	-40%	-1.9%
Gross Profit Margin	6.8%	5.7%	1.4%	7.8%
Operating Profit Margin	0.1%	0.3%	-4.6%	0.2%
Net Profit Margin	1.2%	-17.1%	-5.6%	0.8%

Assumed tax rate:	50%			
Yr.	97	98	99	00
Interest Payment	3,532	3,579	3,797	3,759
NI + (1-t)*Interest	2,448	-42,994	-13,363	1,260

NAME	COUNTRY	YEAR
VINCI (SGE)	France	1910

	1997	1998	1999	2000
No. of Employees	68,251	64,451	70,699	122,070
No. of Shares Outstanding	40,323,352	41,487,757	40,261,023	79,154,601
Changed Leader during term?	NO.			

Ownership Structure	Dec-97	Dec-98	Mar-00	Dec-00
Vivendi Universal	51.2%	50.25%	16.9%	9.0%
Suez				17.0%
SGE Group's employee savings plan	1.6%	2.67%	3.0%	4.0%
Treasury Stock		3.24%	7.5%	7.0%
Other investors (Institutional & individual)	47.2%	43.84%	72.6%	63.0%
	100.0%	100.00%	100.0%	100.0%
Composition of Employees				
Concession	0.0%	0.1%	2.7%	7.7%
Building and Civil Engineering	42.3%	42.1%	38.9%	38.4%
Electrical & Mechanical Engineering	40.1%	39.8%	35.9%	20.8%
Roadworks	17.3%	17.9%	22.4%	30.7%
Holding Company and Others	0.3%	0.2%	0.2%	2.4%
	100.0%	100.0%	100.0%	100.0%

Organizational Setting (prior to merger with GTM)

Strategic Apex

Audit Committee

Investment Committee
* Created in Oct 2000, this is in charge of examining acquisition and divestment projects liable to have a significant impact on group sales and earnings.

Remuneration Committee

Technostructure

Operating Core

M — Concessions
- Cofiroute (31%)
- Stade de France (33%)
- Miscellaneous infrastructure

M — Building and Civil Engineering
- Campenon Bernard SGE (building & civil eng.)
- Freyssinet (pre-stressing specialist, bridge and tunnel repair)
- Sogea (building & civil eng., hydraulic eng.)
- Norwest Holst (subsidiary in the U.K.)

M — Electrical works and engineering
- Groupe GTIE

M — Roadworks

M — Thermal and Mechanical Activities
- Sohpiane (thermal & acoustic insulation, power and ventilation systems, fire protection and building services.

Support Operations

Notes: **2000**
Vinci took over GTM following a friendly exchange offer announced on 13 July 2000, subsequently resulting in the holdings of 97.44% of GTM. The two concession entities, Cofiroute and Stade de France were consolidated in the accounts of the new entity. The subsequent merger between Vinci and GTM was approved by the two companies' shareholders. Note the very different merging environment as compared to Raytheon E&C and Washington Group Int'l.

Vinci - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply									4	4				
Feasibility studies & Planning	*	*			*	*								
A&E Design	*	*			*	*	*	*	2	2	6	6	3	3
Construction	*	*			*	*	*	*	1	1	6	6	3	3
O&M Renovation	*	*			*	*								
Finance														
Own / Develop / Equity Investment									5	5				
Combined	*	*			*	*	*	*	*	*				

Notes:

1 Fressynet, one of SGE's subsidiaries, represents a specialist in pre-stressing and cable-stay structures, which provide some technological edge in bridge construction and repair (including tunnel repair).

2 Sogea, a subsidiary under the building and civil engineering business segment, provides design and management of water supply systems in France and abroad.

3 Electrical engineering works, such as the design and construction of electrical power (mainly for power lines in transmission and distribution); industrial works; information processing and telecommunication infrastructures.

4 With 400 coating plants, 95 blinder plants, 200 quarries and 90 recycling units, Vinci Roads (merged company between Eurovia and Entreprise Jean Lefebvre of GTM) has large supply network to support its logistics of roadwork construction.

5 An active participant in the concession market similar to GTM.

6 Although Vinci does have a division that specializes in the environmental market (design and construction of household and industrial waste treatment facilities), the operation is very minor in relative scale, contributing only Euro 16 million in sales (less than 0.2% of total sales of Vinci) and hence does not represent a strategic foray into the market at all. This might developed into a hurdle for future expansion in the core businesses since like most construction firms, Vinci is involved in large amount of activities that create detrimental effects to the environment at large (e.g. power generation and installation, demolition works)

Vinci (Consolidated)

1) Operational Performance (million Euros)

Yr.	97	98	99	00
Revenue (include concessions etc.)	8,341.8	8,262.2	9,328.3	N/A
Growth	24%	-1%	13%	
Revenue	8,140.2	8,011.5	9,056.8	14,126.8
Growth	24%	-2%	13%	56%
COGS	5,525.5	5,414.7	6,120.1	9,583.4
Growth	25%	-2%	13%	57%
Operating Income	43.0	123.6	223.4	722.4
Growth		187%	81%	223%
Net Income	49.4	96.2	150.8	355.6
Growth		95%	57%	136%
Net Income (Group Share)	46.9	92.3	146.3	299.8
Growth		97%	59%	105%
Backlog Growth	N/A	N/A	N/A	N/A

2) Capital Structure (million Euros)

Yr.	97	98	99	00
Equity (w/o Minor)	446.9	526.4	567.3	1,834.2
Equity + Minor Int.	469.6	551.6	593.4	2,316.6
Non-current Liab.	1,512.0	1,488.2	1,906.9	6,964.4
Long-term Debt	179.4	222.7	500.7	2,897.5
Total Liabilities	7,639.5	6,037.5	7,385.2	16,446.9
Total Assets	8,109.1	6,589.1	7,978.6	18,763.5
Current Assets	6,783.4	5,131.3	5,606.3	10,047.3
Current Liabilities	6,127.5	4,549.3	5,478.3	9,482.5
Quick Assets	5,146.5	4,828.6	5,273.7	9,587.5
Acct. Receivables	3,523.8	3,367.6	4,042.7	7,322.7

3a) Revenue by Regions (in million Euros)

Yr.	97	98	99	00
France	5,379.4	5,215.6	5,509.1	10,690
Europe, Other	2,364.4	2,325.6	3,040.1	4,929
Africa	254.1	286.1	266.6	
Asia	96.0	127.4	112.5	1,001
Middle East	26.7	41.1	46.9	
Americas	19.6	15.7	81.6	711
	8,140.2	8,011.5	9,056.8	17,331

4a) Revenue by Business Areas (million Euros)

Yr.	97	98	99	00
Concession	55.3	98.7	248.8	847.5
Building & Civil Eng.	3,763.5	3,626.8	3,811.4	5,849.1
Roadworks	1,557.3	1,559.3	2,149.1	4,061.3
Electrical Eng. and Works	1,702.7	1,735.4	1,854.1	3,096.4
Thermal & Mechanical Act.	1,099.3	1,047.2	1,052.3	
Holding & Misc.	-37.9	-55.9	-58.9	272.5
	8,140.2	8,011.5	9,056.8	14,126.8

5) Operating Income by Business Areas (million Euros)

Yr.	97	98	99	00
Concession	7.2	8.4	37.9	356.8
Building & Civil Eng.	-0.8	10.9	61.7	134.8
Roadworks	13.1	31.7	46.9	147.1
Electrical Eng. and Works	56.3	71.9	77.1	117.7
Thermal & Mechanical Act.	-31.6	2.9	18.9	
Holding & Misc.	-1.2	-2.2	-19.0	-34.0
	43.0	123.6	223.5	722.4

7) Cash Flow Profile (million Euros)

Yr.	97	98	99	00
Net Cash Flow from Operations	197.2	226.1	559.9	972.0
Net Cash Flow from Investment	(229.2)	(249.7)	(1022.2)	(2860.3)
CAPEX	172.5	231.7	252.2	769.2
Corporate Financing Gap	(32.0)	(23.6)	(462.3)	(1888.3)
CAPEX Ratio	1.14	0.98	2.22	1.26
Net Fin. Surplus	769.5	657.0	53.4	(1,855.4)

Key Financial Ratios

Yr.	97	98	99	00
Dividend (Euro/share)	0.61	1.40	1.60	1.65
Net Income/share	1.17	2.25	3.64	5.98
Dividend Payout ratio	0.52	0.62	0.44	0.28
NCL/(NCL+Equity)	0.76	0.73	0.76	0.75
LT Debt/Total Capital.	0.28	0.29	0.46	0.56
Total Debt ratio	0.94	0.92	0.93	0.88
Current Asset/Total A	0.84	0.78	0.70	0.54
Non-Current Asset/Total	0.16	0.22	0.30	0.46
Current Liab./Total Liab.	0.80	0.75	0.74	0.58
Current Ratio	1.11	1.13	1.02	1.06
Quick Ratio	0.84	1.06	0.96	1.01
Avg. Collection Period	136	157	149	147
Total Asset Turnover	1.17	1.09	1.24	1.06
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A
ROA	0.7%	1.3%	2.1%	2.7%
ROE	10.6%	19.0%	26.8%	25.0%
Gross Profit Margin	32.1%	32.4%	32.4%	32.2%
Operating Profit Margin	0.5%	1.5%	2.5%	5.1%
Net Profit Margin	0.6%	1.2%	1.6%	2.5%
Assumed Tax Rate	34%			

Yr.	97	98	99	00
Interest Payment				
NI + (1-t)*Interest	49.4	96.2	151	356

3b) Revenue by Regions

Yr.	97	98	99	00
France	66%	65%	61%	62%
Europe, Other	29%	29%	34%	28%
Africa	3%	4%	3%	
Asia	1%	2%	1%	6%
Middle East	0%	1%	1%	
Americas	0%	0%	1%	4%
	100%	100%	100%	100%

4b) Revenue by Business Areas

Yr.	97	98	99	00
Concession	0.7%	1.2%	2.7%	6.0%
Building & Civil Eng.	46.2%	45.3%	42.1%	41.4%
Roadworks	19.1%	19.5%	23.7%	28.7%
Electrical Eng. and Works	20.9%	21.7%	20.5%	21.9%
Thermal & Mechanical Activities	13.5%	13.1%	11.6%	
Elimination, Misc.	-0.5%	-0.7%	-0.7%	1.9%
	100%	100%	100%	100%

6) Operating Margin by Business Areas

Yr.	97	98	99	00
Concession	13.0%	8.5%	15.2%	42.1%
Building & Civil Eng.	0.0%	0.3%	1.6%	2.3%
Roadworks	0.8%	2.0%	2.2%	3.6%
Electrical Eng. and Works	3.3%	4.1%	4.2%	3.8%
Thermal & Mechanical Activities	-2.9%	0.3%	1.8%	

Note: For the "Concession" segment before 2000, the revenues and operating income of Cofiroute, Stade de France, the Tagus River Bridges and the Prado-Carenage Tunnel are all accounted for by the equity method and hence not included in these figures.

8) Trends for Concession Business

Yr.	97	98	99	00
Total Revenues of Concession Entities	647.5	812.8	883.7	197.1
Revenues - Group Share (million Euros)	201.6	250.7	271.5	N/A
Operating Income of	N/A	413.0	467.3	101.8
Net Income (Grp. Share)	37.2	39.2	53.6	1.4
Operating Profit Margin	N/A	50.8%	52.9%	51.6%
Net Profit Margin	18.5%	15.6%	19.7%	N/A

NAME	REGION	YEAR
WASHINGTON GROUP INTL	U.S.	1911

	1997	1998	1999	2000
No. of Employees	N/A	N/A	N/A	22,000
No. of Shares Outstanding	54,046,000	53,891,000	52,736,000	N/A

Changed Leader during term? YES. (1998, previous CEO "retired". New CEO, who is indeed the chairman of the board, is a 38% owner of the company.)

Organizational Setting

Technostructure	Operating Core (1997)	Support Operations
	M Engineering & Construction M Industrial/Process M Power M O&M M International Infrastructure M MK Centennial (Transportation) M Environmental/Government M Heavy Civil Construction M Mining	
	Operating Core (1999)	
	M Engineering & Construction M Industrial/Process M Energy M O&M M MK Centennial (Transportation) M Heavy Civil Construction M MK Government Services C Federal Projects (MK-owned, provider of env. remediation, planning & contracting services to DOD and DOE) M/C Westinghouse Government Services - Westinghouse Gov Services Company LLC (MK owned, defense-related operations and services to DOD and DOE) - Westinghouse Government Environmental Services Co. LLC (MK 60% BNFL 40%, non-defense-related gov. env. Services)	

Notes: **1998**
1) Within the E&C Group, the Power and Int'l Infrastructure units are reorganized under the Energy Division, which also houses operation to cater for demilitarization programs. Note the illogical grouping and overlap within the overall corporate structure.
2) The Heavy Civil Construction and Mining Groups are combined into one MK Contractors group.
3) The Environmental/Government group is dissolved.

Notes: **1999**
1) After the Westinghouse acquisition in March 1999, the Federal Programs division under the E&C group was combined with the Westinghouse government services operations to create a new business unit called MK Government Services Group.
2) The Int'l Infrastructure unit and the Transportation unit (Centennial) (within the Energy Division of E&C group) was merged into MK Contractors group.
3) The new MK Gov. Serv. Group is led by management team drawn from Westinghouse, MK and BNFL (cultural tension is a potential problem).

Washington Group International - Market Segmentation Matrix

	Residential		Institutional		Commercial		Industrial		Infrastructure		Environment		Diversification	
	D	I	D	I	D	I	D	I	D	I	D	I	D	I
Supply													1	1
Feasibility studies & Planning							*	*	*	*	*	*	1	1
A&E Design							*	*	*	*	*	*	1	1
Construction							*	*	*	*	*	*	1	1
O&M Renovation							*	*	*	*	*	*	1	1
Finance														
Own / Develop													1	1
Combined							*	*	*	*	*	*		

Notes:

1 Feasibility studies, resource evaluations, permitting services of mining operations, including engineering and construction in contract mining. MK also seeks equity positions in mining properties.

Washington Group International (Consolidated)

1) Operational Performance ($ thousands)

Yr.	97	98	99
Revenue	1,677,301	1,862,174	2,248,228
Growth		11%	21%
COGS	1,597,986	1,775,632	2,129,997
Growth		11%	20%
Operating Income	52,827	58,743	79,656
Growth		11%	36%
Net Income	32,031	37,553	53,491
Growth		17%	42%
Net Income (Group Share)	32,031	37,553	48,285
Growth		17%	29%
Backlog	2,759,300	2,680,100	3,328,000
Growth		-3%	24%

2) Capital Structure ($ thousands)

Yr.	97	98	99
Equity (w/o Minor)	343,131	370,903	403,090
Equity + Minor Int.	343,131	370,903	487,930
Non-current Liab.	127,218	114,224	322,998
Long-term Debt	18,000	0	100,000
Total Liabilities	427,113	417,248	708,093
Total Assets	770,244	788,151	1,196,023
Current Assets	405,014	427,722	531,963
Current Liabilities	299,895	303,024	385,095
Quick Assets	240,526	242,567	245,163
Acct. Receivables	187,311	175,513	215,523

3a) Revenue by Regions (in $ thousands)

Yr.	97	98	99
U.S.	1,474,831	1,595,463	1,948,132
International	202,470	266,711	300,096
	1,677,301	1,862,174	2,248,228

4a) Operating Income by Regions (in $ thousands)

Yr.	97	98	99
U.S.	50,182	61,753	N/A
International	29,133	24,789	N/A
	79,315	86,542	

5) Operating Margin by Regions

Yr.	97	98	99
U.S.	3.4%	3.9%	
International	14.4%	9.3%	

7a) Profile of Public Contracts - Revenue (in $ thousands)

Yr.	97	98	99
Caltran	127,136	106,855	
DOE	289,288	266,859	493,856
DOD	63,932	119,287	250,155
Other gov agen.	7,752	7,646	
	488,108	500,647	744,011

8a) Revenues by Business Areas (in $ millions)

Yr.	97	98	99
E&C Group	595.0	781.7	690.6
Gov. Service Grp.	346.6	355.5	760.9
Contractors Grp.	739.2	727.6	798.5
Elimination & Oth.	-3.5	-2.6	-1.8
	1,677.3	1,862.2	2,248.2

9a) Operating Income by Business Areas (in $ millions)

Yr.	97	98	99
E&C Group	7.9	9.4	16.6
Gov. Service Grp.	15.4	23.2	46.8
Contractors Grp.	48.6	51.2	43.4
Intersegment Elm.	3.8	-0.9	-1.1
	75.7	82.9	105.7

10) Operating Margin by Business Areas

Yr.	97	98	99
E&C Group	1.3%	1.2%	2.4%
Gov. Service Grp.	4.4%	6.5%	6.2%
Contractors Grp.	6.6%	7.0%	5.4%

Key Financial Ratios

Yr.	97	98	99
Dividend ($/share)	0	0	0
Net Income/share	0.59	0.69	0.91
Dividend Payout ratio	0.00	0.00	0.00
NCL/(NCL+Equity)	0.27	0.24	0.40
LT Debt/Total Capital.	0.05	0.00	0.17
Total Debt ratio	0.55	0.53	0.59
Current Asset/Total A	0.53	0.54	0.44
Non-Current Asset/Total	0.47	0.46	0.56
Current Liab./Total Liab.	0.70	0.73	0.54
Current Ratio	1.35	1.41	1.38
Quick Ratio	0.80	0.80	0.64
Avg. Collection Period	55.6	35.6	31.7
Total Asset Turnover	2.08	2.39	2.27
Rev(t)/Backlog(t-1)	0.640	0.675	0.839
ROA	4.1%	4.9%	5.9%
ROE	9.8%	10.5%	12.5%
Gross Profit Margin	4.7%	4.6%	5.3%
Operating Profit Margin	3.1%	3.2%	3.5%
Net Profit Margin	1.9%	2.0%	2.6%
Assumed Tax Rate	34%		

Yr.	97	98	99
Interest Payment	890	869	7,642
NI + (1-t)*Interest	32,618	38,127	58,535

3b) Revenue by Regions

Yr.	97	98	99
U.S.	88%	86%	87%
International	12%	14%	13%
	100%	100%	100%

4b) Operating Income by Regions

Yr.	97	98	99
U.S.	63%	71%	N/A
International	37%	29%	N/A
	100%	100%	

6) Expected Volatility assumed in Option Valuation

Yr.	97	98	99
Expected Volatility	30.7%	38.5%	35.7%

7b) Profile of Public Contracts - as a % of Total Revenue

Caltran	7.6%	5.7%	
DOE	17.2%	14.3%	22.0%
DOD	3.8%	6.4%	11.1%
Other gov. agencies	0.5%	0.4%	
	29.1%	26.9%	33.1%

8b) Revenues by Business Areas

Yr.	97	98	99
E&C Group	35%	42%	31%
Gov. Service Grp.	21%	19%	34%
Contractors Grp.	44%	39%	36%
Eliminations & Others	0%	0%	0%
	100%	100%	100%

9b) Operating Income by Business Areas

Yr.	97	98	99
E&C Group	10%	11%	16%
Gov. Service Grp.	20%	28%	44%
Contractors Grp.	64%	62%	41%
Intersegment Elm.	5%	-1%	-1%
	100%	100%	100%

11) Cash Flow Profile ($ thousands)

Yr.	97	98	99
Net CF from Operations	9,290	71,728	35,491
Net CF from Investment	(7,487)	(28,155)	(148,709)
CAPEX	19,700	25,493	48,417
Corporate Financing Gap	1,803	43,573	(113,218)
CAPEX Ratio	0.47	2.81	0.73
Cash Balance, Year End	53,215	67,054	29,640

$132 out of this $149 m net investment is spent on business acquisitions.

APPENDIX C

DETAILS AND ASSUMPTIONS OF SELECTED FINANCIAL PARAMETERS USED IN FUNDAMENTAL ANALYSIS

C.1 BACKLOG AND NEW ORDERS RECEIVED

Trends of order received reflects the ability of the company to continually secures new projects that will be recorded as backlog and later converted into revenues; thus the process can be conceptually represented by:

$$(New\ Orders)_{t-1} \rightarrow (Backlog)_{t-1} \rightarrow (Backlog)_t\ \&\ (Revenue)_t \rightarrow (Revenue)_{t+1}$$

Due to the lagging effect typically created by the long duration of a project, many uncertainty factors lure behind the conversion process from period **t-1** to **t+1**. The following are among some of these factors:

(i) Deferment / Reduction in Scope / Cancellation of a project by the client during a period of hardship such as economic downturn;

(ii) Change orders during actual execution of projects that render previous estimation of potential revenues to be recognized at period **t-1** no longer valid.

(iii) Deteriorating competitiveness of the firm or increasing intensity of competition in the market arena.

Some innovative indicators can reasonably trace the dynamics of the above, such as $[(Revenue)_t / (Backlog)_{t-1}]$. The trend of this ratio tracks how much backlog a firm can convert from the reserve recorded in the last period into current period earnings. A decreasing trend may signal the presence of factor (i) and/or (ii) above.

Both the trend of $(New\ Orders)_t$ and $(Backlog)_t$ track whether the firm has been able to secure sufficient new orders to maintain its level of backlog. As we have seen, reduction in backlog can be due to the usual conversion into revenues but also cancellation of project or other detrimental factors as provided in (i) and (ii) above. When the effects of detrimental factors are isolated, however, a decreasing trend of backlog simply signals factor (iii).

Lastly, the composition (by geographical regions or business areas) of orders, backlogs and revenues at the corporate level provides different signaling effect for the coming future. For example, a changing composition of order received in terms of business areas may predict a change in industrial environment. In the oil & gas value system, a reduction in % of upstream work may lead a subsequent reduction in downstream work in the coming medium term (1 ~ 2 years).

C.2 Other Income/Expenses & Extraordinary Items (Below the Operating Income line)

In any year, it is worthwhile to analyze the source of *Other Income/Expenses* and *Extraordinary Items*. Items such as write-offs of project estimation errors, liability charges from lawsuits, and financial losses on investments (e.g. equity investment in other companies and securities investment) deserve special attention, as these are the items that can potentially distort *Net Income* figures and create "skewness" in the corporation profitability. If a significantly different figure exists under these components for a particular year, the *Net Income* figure for that year may not be used to build ratios and trends.

C.3 Cash Flow Profile

Increasingly, investors and analysts are paying more attention to the cash-flow statement, which provides some new indicators that cannot be extracted from the balance sheet and income statement (*Business Week*, 2001). Many also view that cash-flow statement are subjected to less distortion, simply because "cash is real" and accounting gimmicks are harder to get into those numbers.

Two comparison measures based on cash flow are introduced in the analytical template:

(i) *Corporate Financing Gap*
= (*Net Cash Flow from Operations*) – (*Net Cash Flow from Investments*)

This measure is used to track how often a firm has to rely on external financing to make up for its cash flow needs for operations and investment activities. When the *Corporate Financing Gap* is negative, it implies that firms are not generating sufficient cash to cover its investment needs either for sustaining normal operations (such as incurring capital expenditure) or pursuing more aggressive strategies (such as acquiring new businesses and ventures). In that case, they would logically turn to the option of generating cash flow needs from financing activities (either by issuing new debt or equity – provided that they have a 'healthy' balance sheet to do so) or drawing down existing cash balance in the firm.

A firm that is in trouble would usually incur a negative figure of *Net Cash Flow from Operations*, while actively disposing fixed assets, market securities and existing business segments to boost up the *Net Cash Flow from Investments*. A check on the *Balance of Cash or Equivalent at Year End* for each year is also helpful to confirm the symptom, which is usually indicated by a decreasing trend during that period.

(ii) *CAPEX Ratio* = (*Net Cash Flow from Operations*) / (*Capital Expenditure*)

This measures the relationship between the firm's cash-generating ability from normal operations and its investment expenditures for asset replacement and a nominal addition of operating capacity. To the extent that the ratio exceeds 1, it indicates that the firm has cash left for debt repayment or dividends after payment of capital expenditures (White *et al.*, 1997). Obviously, the ratio usually goes below 1 since most companies have strong desire to pursue growth, thereby creating an imbalance between cash flows from operations and investments. However, it is wise to keep track of this ratio to prevent

the growth strategy being excessively aggressive at the expense of sound financial health for existing operations.

Since business acquisitions and new ventures would require an abnormally high level of investment cash flows (and a good proposal could easily raise new capital required to fund such acquisitions and ventures), cash flows drawn for such purposes are not counted as *Capital Expenditure*.

C.4 OTHER CALCULATION NUANCES

For analytical purposes in this research, *Minority Interest* is treated as equity. This is consistent with the view that minority shareholders have only a residual claim on the assets of the subsidiary or even those of the consolidated entity (White *et al.*, 1997), thus having a similar position as the parent company's or group's shareholders in viewing corporate issues as a whole (such as the extent of leverage and profitability).

As a result, *Minority Interest* is lumped under *Equity* in the calculation of *Leverage Ratios* (which include: *Total Debt Ratio* [Total Liabilities/(Total Liabilities + Equity)]; *Non-current Liabilities Ratio* [Non-current Liabilities/(Non-current Liabilities + Equity)]; and *Long-term Debt Ratio* [Long-term Debt/(Long-term Debt + Equity)].

Similarly, when calculating the *Net Profit Margin* [Net Income/Revenue], after-tax income belonging to minority shareholders are lumped together with the net income received by the parent company's or group's shareholders in considering the total *Net Income* in the numerator.

The same argument goes with the calculation of the *Return-on-Equity (ROE)*.

In most cases, *Minority Interest* is insignificant and this technicality makes immaterial differences to the ratios calculated. However, when *Minority Interest* exceeds about 5% of parent's or group's equity, it is deemed sufficiently significant to warrant its separation in calculating the *ROE* for the *parent's or group's shareholders*. In such cases, the numerator of the ratio is strictly determined as the residual *Net Income* attributed to the parent's or group's shareholders, and the denominator being their equity value in the consolidated entity.

APPENDIX D

OPERATING & FINANCIAL PERFORMANCE OF EIGHT ADDITIONAL FIRMS FOR *NPM-TAT* PLOT

Bilfinger + Berger (Consolidated)

1) Operational Performance (Euro thousands)

Yr.	97	98	99	00
Revenue	4,099,820	4,011,805	3,653,778	3,631,142
Growth	14%	-2%	-9%	-1%
COGS	2,919,982	2,457,623	2,572,184	2,490,514
Growth	10.8%	-15.8%	4.7%	-3.2%
Operating Income	-32,503	-103,178	6,759	8,150
Growth	-548%	-217%	107%	21%
Net Income	20,788	-46,418	22,049	42,500
Growth	-56%	-323%	148%	93%
Backlog	N/A	N/A	N/A	N/A
Growth				
New Orders	N/A	N/A	N/A	N/A
Growth				

2) Capital Structure (Euro thousands)

Yr.	97	98	99	00
Equity + Minor Int.	708,371	638,094	633,518	667,557
Non-current Liab.	930,765	840,956	1,013,393	991,243
Long Term Debt	44,320	18,435	212,948	220,453
Total Liabilities	2,346,068	2,225,565	2,441,762	2,332,621
Total Assets	3,054,439	2,863,659	3,075,280	3,000,178
Current Assets	2,473,424	2,282,600	2,356,371	2,297,698
Current Liabilities	1,415,303	1,384,609	1,428,369	1,341,378
Quick Assets	2,010,198	1,901,841	1,831,961	1,783,696
Acct. Receivables	862,892	905,457	929,824	907,588

Note: Minority Interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend (Euro/share)	0.51	0.41	0.41	0.00
Net Income/share	0.56	-1.28	0.62	1.17
Dividend Payout ratio	0.91	-0.32	0.66	0.00
NCL/(NCL+Equity)	0.57	0.57	0.62	0.60
LT Debt/Total Capital.	0.06	0.03	0.25	0.25
Total Debt ratio	0.77	0.78	0.79	0.78
Current Asset/Total A	0.81	0.80	0.77	0.77
Fixed Asset/Total Asset	0.19	0.20	0.23	0.23
Current Liab./Total Liab.	0.60	0.62	0.58	0.58
Current Ratio	1.75	1.65	1.65	1.71
Quick Ratio	1.42	1.37	1.28	1.33
Avg. Collection Period	79.0	80.4	91.7	92.3
Total Asset Turnover	1.30	1.36	1.23	1.20
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A
ROA	1.0%	-1.2%	1.2%	1.9%
ROE	2.9%	-6.9%	3.5%	6.5%
Gross Profit Margin	28.8%	38.7%	29.6%	31.4%
Operating Profit Margin	-0.8%	-2.6%	0.2%	0.2%
Net Profit Margin	0.8%	-0.9%	0.9%	1.6%
Assumed Tax Rate	40%			

Yr.	97	98	99	00
Interest Payment	18,774	19,344	20,776	24,490
NI + (1-t)*Interest	32,052	-34,812	34,515	57,194

Centex (Consolidated)

1) Operational Performance ($ thousands)

Yr.	97	98	99	00	01
Revenue	3,784,991	3,975,450	5,154,840	5,956,367	6,710,699
Growth		5%	30%	16%	13%
COGS	3,522,907	3,612,775	4,606,453	5,321,152	4,944,898
Growth		3%	28%	16%	-7%
Operating Income	231,755	315,776	484,112	553,226	598400
Growth		36%	53%	14%	8%
Net Income	138,253	188,253	285,575	321,904	314,400
Growth		36%	52%	13%	-2%
Net Income (Group Share)	106,563	144,806	231,962	257,132	282,000
Growth		36%	60%	11%	10%
Backlog	N/A	N/A	N/A	N/A	N/A
Growth					

2) Capital Structure ($ thousands)

Yr.	97	98	99	00	01
Equity (w/o Minor)	835,777	991,172	1,197,639	1,419,349	1,714,064
Equity + Minor Int.	835,777	991,172	1,338,360	1,548,701	1,857,688
Non-current Liab.	477,836	473,020	280,389	470,749	2,066,735
Long-term Debt	236,769	237,715	280,389	419,912	2,066,735
Total Liabilities	1,843,052	2,425,047	2,929,549	2,490,039	4,791,355
Total Assets	2,678,829	3,416,219	4,267,909	4,038,740	6,649,043
Current Assets	2,020,464	2,745,211	3,500,481	2,986,678	4,920,289
Current Liabilities	1,365,216	1,952,027	2,649,160	2,019,290	2,724,620
Quick Assets	1,018,705	1,680,657	1,966,662	1,032,641	2,717,995
Acct. Receivables	987,385	1,582,341	1,855,394	893,078	2,602,815

Key Financial Ratios

Yr.	97	98	99	00	01
Dividend ($/share)	0.10	0.13	0.16	0.16	0.16
Net Income/share	1.81	2.36	3.75	4.22	4.65
Dividend Payout ratio	0.06	0.06	0.04	0.04	0.03
NCL/(NCL+Equity)	0.36	0.32	0.17	0.23	0.53
LT Debt/Total Capital.	0.22	0.19	0.17	0.21	0.53
Total Debt ratio	0.69	0.71	0.69	0.62	0.72
Current Asset/Total A	0.75	0.80	0.82	0.74	0.74
Fixed Asset/Total Asset	0.25	0.20	0.18	0.26	0.26
Current Liab./Total Liab.	0.74	0.80	0.90	0.81	0.57
Current Ratio	1.48	1.41	1.32	1.48	1.81
Quick Ratio	0.75	0.86	0.74	0.51	1.00
Avg. Collection Period	95.2	118.0	121.7	84.2	95.1
Total Asset Turnover	1.41	1.30	1.34	1.43	1.26
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A	N/A
ROA	6.0%	6.9%	8.1%	8.8%	8.3%
ROE	12.8%	15.9%	21.2%	19.7%	18.0%
Gross Profit Margin	6.9%	9.1%	10.6%	10.7%	26.3%
Operating Profit Margin	6.1%	7.9%	9.4%	9.3%	8.9%
Net Profit Margin	4.2%	5.3%	6.1%	6.1%	6.6%
Assumed Tax Rate	34%				

Yr.	97	98	99	00	01
Interest Payment	34,062	33,256	41,581	66,844	191,700
NI + (1-t)*Interest	160,734	210,202	313,018	366,021	440,922

Granite (Consolidated)

1) Operational Performance ($ thousands)

Yr.	97	98	99	00
Revenue	1,028,205	1,226,100	1,328,774	1,348,325
Growth	11%	19%	8%	1%
COGS	878,256	1,034,884	1,107,210	1,113,083
Growth	13%	18%	7%	1%
Operating Income	38,137	69,258	84,262	85,575
Growth	-2%	82%	22%	2%
Net Income	27,832	46,507	52,916	55,815
Growth	2%	67%	-14%	5%
Backlog	N/A	N/A	N/A	N/A
Growth				
Order Received	N/A	N/A	N/A	N/A
Growth				

2) Capital Structure ($ thousands)

Yr.	97	98	99	00
Equity + Minor Int.	257,434	301,282	327,732	377,764
Non-current Liab.	84,002	96,929	93,176	101,801
Long-term Debt	58,396	69,137	64,853	63,891
Total Liabilities	294,375	325,289	351,840	333,378
Total Assets	551,809	626,571	679,572	711,142
Current Assets	314,283	370,808	402,321	411,628
Current Liabilities	210,373	228,360	258,664	231,577
Quick Assets	264,322	310,849	350,297	366,729
Acct. Receivables	191,553	189,425	211,609	240,847

Note: Minority Interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend ($/share)	0.16	0.20	0.27	0.31
Net Income/share	0.69	1.13	1.31	1.38
Dividend Payout ratio	0.23	0.18	0.21	0.22
NCL/(NCL+Equity)	0.25	0.24	0.22	0.21
LT Debt/Total Capital.	0.18	0.19	0.17	0.14
Total Debt ratio	0.53	0.52	0.52	0.47
Current Asset/Total A	0.57	0.59	0.59	0.58
Fixed Asset/Total Asset	0.43	0.41	0.41	0.42
Current Liab./Total Liab.	0.71	0.70	0.74	0.69
Current Ratio	1.49	1.62	1.56	1.78
Quick Ratio	1.26	1.36	1.35	1.58
Avg. Collection Period	61.3	56.7	55.1	61.2
Total Asset Turnover	2.01	2.08	2.03	1.94
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A
ROA	6.4%	9.0%	9.0%	8.9%
ROE	11.3%	16.6%	16.8%	15.8%
Gross Profit Margin	14.6%	15.6%	16.7%	17.4%
Operating Profit Margin	3.7%	5.6%	6.3%	6.3%
Net Profit Margin	3.2%	4.3%	4.4%	4.6%

Assumed Tax Rate 34%

Yr.	97	98	99	00
Interest Payment	7,515	9,551	8,791	8,954
NI + (1-t)*Interest	32,792	52,811	58,718	61,725

Hochtief (Consolidated)

1) Operational Performance (Euro thousands)

Yr.	97	98	99	00
Revenue	3,145,352	3,138,531	5,085,152	9,585,727
Growth	-9%	0%	62%	89%
COGS	2,211,649	2,287,808	3,882,789	8,125,148
Growth	-5%	3%	70%	109%
Operating Income	-13,923	68,112	115,009	-79,282
Growth		589%	69%	-169%
Net Income	80,693	88,065	205,299	126,954
Growth		9%	133%	-38%
Backlog	N/A	N/A	N/A	N/A
Growth				
New Orders	N/A	N/A	N/A	N/A
Growth				

2) Capital Structure (Euro thousands)

Yr.	97	98	99	00
Equity + Minor Int.	1,229,856	1,323,516	1,965,678	1,902,228
Non-current Liab.	1,110,431	1,356,611	1,607,027	2,183,139
Long Term Debt	119,514	223,757	231,323	439,829
Total Liabilities	2,911,090	2,853,575	4,017,139	4,667,147
Total Assets	4,140,941	4,177,094	5,982,816	6,569,375
Current Assets	2,460,179	2,630,213	3,675,337	3,873,305
Current Liabilities	1,800,659	1,496,964	2,410,112	2,484,008
Quick Assets	2,086,212	2,247,931	3,590,324	3,863,728
Acct. Receivables	852,371	771,439	1,871,581	2,340,110

Note: Minority Interests are insignificant.

3) R&D Expenditure (in Euro thousands)

Yr.	97	98	99	00
R&D Expenses	N/A	N/A	22,355	N/A
% of Sales			0.4%	

Key Financial Ratios

Yr.	97	98	99	00
Dividend (Euro/share)	0.61	0.66	0.75	0.85
Net Income/share	1.15	1.25	2.91	1.81
Dividend Payout ratio	0.53	0.53	0.26	0.47
NCL/(NCL+Equity)	0.47	0.51	0.45	0.53
LT Debt/Total Capital.	0.09	0.14	0.11	0.19
Total Debt ratio	0.70	0.68	0.67	0.71
Current Asset/Total A	0.59	0.63	0.61	0.59
Fixed Asset/Total Asset	0.41	0.37	0.39	0.41
Current Liab./Total Liab.	0.62	0.52	0.60	0.53
Current Ratio	1.37	1.76	1.52	1.56
Quick Ratio	1.16	1.50	1.49	1.56
Avg. Collection Period	100.5	94.4	94.9	80.2
Total Asset Turnover	0.77	0.75	1.00	1.53
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A
ROA	2.3%	2.5%	4.7%	2.7%
ROE	6.5%	6.9%	12.5%	6.6%
Gross Profit Margin	29.7%	27.1%	23.6%	15.2%
Operating Profit Margin	-0.4%	2.2%	2.3%	-0.8%
Net Profit Margin	3.0%	3.3%	4.7%	1.8%
Assumed Tax Rate	40%			

Yr.	97	98	99	00
Interest Payment	22,408	26,720	52,674	70,648
NI + (1-t)*Interest	94,138	104,097	236,903	169,343

NCC (Consolidated)

1) Operational Performance (SEK millions)

Yr.	97	98	99	00
Revenue	29,581	34,160	37,460	38,728
Growth	29%	15%	10%	3%
COGS	22,926	26,303	28,356	29,749
Growth	24%	15%	8%	5%
Operating Income	588	1,064	1,115	570
Growth	-32%	81%	5%	-49%
Net Income	-169	546	843	1,502
Growth	-169%	423%	54%	78%
Backlog	N/A	N/A	N/A	N/A
Growth				
Order Received	N/A	N/A	N/A	N/A
Growth				

2) Capital Structure (SEK millions)

Yr.	97	98	99	00
Equity + Minor Int.	9,262	9,696	9,825	9,991
Non-current Liab.	5,817	4,621	6,513	9,425
Long-term Debt	3,574	2,280	3,898	6,969
Total Liabilities	19,082	18,763	19,205	26,702
Total Assets	28,344	28,459	29,030	36,693
Current Assets	12,100	13,007	13,331	19,119
Current Liabilities	13,265	14,142	12,692	17,277
Quick Assets	10,748	11,425	10,966	15,246
Acct. Receivables	6,672	7,701	7,172	10,994

Note: Minority interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend (SEK/share)	1.45	2.41	11.00	4.50
Net Income/share	-1.54	4.83	7.70	13.65
Dividend Payout ratio	-0.94	0.50	1.43	0.33
NCL/(NCL+Equity)	0.39	0.32	0.40	0.49
LT Debt/Total Capital.	0.28	0.19	0.28	0.41
Total Debt ratio	0.67	0.66	0.66	0.73
Current Asset/Total A	0.43	0.46	0.46	0.52
Fixed Asset/Total Asset	0.57	0.54	0.54	0.48
Current Liab./Total Liab.	0.70	0.75	0.66	0.65
Current Ratio	0.91	0.92	1.05	1.11
Quick Ratio	0.81	0.81	0.86	0.88
Avg. Collection Period	150.6	76.8	72.5	85.6
Total Asset Turnover	1.13	1.20	1.30	1.18
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A
ROA	1.2%	3.3%	4.3%	5.8%
ROE	-2.1%	5.8%	8.6%	15.2%
Gross Profit Margin	22.5%	23.0%	24.3%	23.2%
Operating Profit Margin	2.0%	3.1%	3.0%	1.5%
Net Profit Margin	1.0%	2.8%	3.3%	4.9%
Assumed Tax Rate	28%			

Yr.	97	98	99	00
Interest Payment	661	552	555	565
NI + (1-t)*Interest	307	943	1,243	1,909

Perini (Consolidated)

1) Operational Performance ($ thousands)

Yr.	97	98	99	00
Revenue	755,876	657,600	618,814	1,105,660
Growth	-6%	-13%	-6%	79%
COGS	741,261	627,812	591,839	1,051,711
Growth	-5%	-15%	-6%	78%
Operating Income	-17,877	-455	-1,245	27,355
Growth	-45%	97%	-174%	2297%
Net Income	5,297	11,652	16,357	24,381
Growth	107%	120%	-40%	-49%
Net I (Eq.+Minor)	-26	5,743	9,394	20,999
Growth		22188%	64%	124%
Backlog	N/A	N/A	N/A	N/A
Growth				
New Orders	N/A	N/A	N/A	N/A
Growth				

2) Capital Structure ($ thousands)

Yr.	97	98	99	00
Equity + Minor Int.	13,860	23,891	-63,968	35,624
Eq., Minor + Pref.	71,720	85,162	1,067	60,622
Non-current Liab.	108,999	91,570	60,755	33,355
Long Term Debt	84,898	75,857	41,091	17,218
Total Liabilities	343,204	293,429	274,421	332,830
Total Assets	414,924	378,591	275,488	393,452
Current Assets	306,176	259,524	262,096	379,952
Current Liabilities	234,205	201,859	213,666	299,475
Quick Assets	207,100	179,947	166,261	267,203
Acct. Receivables	175,795	133,440	108,068	207,688

Note: Minority Interests are insignificant.

Key Financial Ratios

Yr.	97	98	99	00
Dividend ($/share)	0	0	0	0
Net Income/share	0.01	1.08	1.68	1.13
Dividend Payout ratio	0.00	0.00	0.00	0.00
NCL/(NCL+Equity)	0.60	0.52	0.98	0.35
LT Debt/Total Capital.	0.54	0.47	0.97	0.22
Total Debt ratio	0.83	0.78	1.00	0.85
Current Asset/Total A	0.74	0.69	0.95	0.97
Fixed Asset/Total Asset	0.26	0.31	0.05	0.03
Current Liab./Total Liab.	0.68	0.69	0.78	0.90
Current Ratio	1.31	1.29	1.23	1.27
Quick Ratio	0.88	0.89	0.78	0.89
Avg. Collection Period	96.5	85.8	71.2	52.1
Total Asset Turnover	1.72	1.66	1.89	3.31
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A
ROA	2.8%	4.4%	6.4%	8.1%
ROE	-0.1%	30.4%	-46.9%	-148.2%
Gross Profit Margin	1.9%	4.5%	4.4%	4.9%
Operating Profit Margin	-2.4%	-0.1%	-0.2%	2.5%
Net Profit Margin	1.6%	2.6%	3.4%	2.4%
Assumed Tax Rate	34%			

Yr.	97	98	99	00
Interest Payment	10,334	8,685	7,128	3,966
NI + (1-t)*Interest	12,117	17,384	21,061	26,999

Shimizu (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00	01
Revenue	1,718,037	1,756,892	1,599,296	1,564,715	1,711,982
Growth		2.3%	-9.0%	-2.2%	9.4%
COGS	1,553,966	1,606,881	1,458,788	1,419,559	1,559,663
Growth		3.4%	-9.2%	-2.7%	9.9%
Operating Income	47,326	35,644	31,558	44,325	57,629
Growth		-24.7%	-11.5%	40.5%	30.0%
Net Income	5,926	-43,689	-127,208	9,798	-64,538
Growth		-837%	-191%	108%	-759%
Backlog	N/A	N/A	N/A	N/A	N/A
Growth					
New Orders	N/A	N/A	N/A	N/A	N/A
Growth					

2) Capital Structure (¥ millions)

Yr.	97	98	99	00	01
Equity + Minor Int.	361,495	312,253	175,518	246,035	232,926
Non-current Liab.	449,421	433,052	541,495	482,489	398,143
Long Term Debt	364,206	331,383	438,751	387,450	252,603
Total Liabilities	2,067,329	2,004,572	2,011,444	1,953,057	1,842,736
Total Assets	2,428,824	2,316,825	2,186,962	2,199,092	2,075,662
Current Assets	1,593,999	1,520,719	1,443,049	1,440,183	1,418,353
Current Liabilities	1,617,908	1,571,520	1,469,949	1,470,568	1,444,593
Quick Assets	1,224,664	1,134,979	1,143,300	1,106,841	1,158,644
Acct. Receivables	336,546	369,042	360,891	373,351	454,314

Note: Minority Interests are insignificant.

3) R&D Investment (¥ millions)

Yr.	97	98	99	00	01
Investment	11,579	11,388	N/A	8,355	N/A
As % of Sales	0.7%	0.6%		0.5%	

Key Financial Ratios

Yr.	97	98	99	00	01
Dividend (¥/share)	9.00	9.00	5.00	5.00	5.00
Net Income/share	6.73	-57.19	-161.24	12.50	-81.72
Dividend Payout ratio	1.34	-0.16	-0.03	0.40	-0.06
NCL/(NCL+Equity)	0.55	0.58	0.76	0.66	0.63
LT Debt/Total Capital.	0.50	0.51	0.71	0.61	0.52
Total Debt ratio	0.85	0.87	0.92	0.89	0.89
Current Asset/Total A	0.66	0.66	0.66	0.65	0.68
Fixed Asset/Total Asset	0.34	0.34	0.34	0.35	0.32
Current Liab./Total Liab.	0.78	0.78	0.73	0.75	0.78
Current Ratio	0.99	0.97	0.98	0.98	0.98
Quick Ratio	0.76	0.72	0.78	0.75	0.80
Avg. Collection Period	71.5	73.3	83.3	85.6	88.2
Total Asset Turnover	0.71	0.74	0.71	0.71	0.80
Rev(t)/Backlog(t-1)	N/A	N/A	N/A	N/A	N/A
ROA	0.3%	-1.8%	-5.3%	0.7%	-2.7%
ROE	1.6%	-13.0%	-52.2%	4.6%	-26.9%
Gross Profit Margin	9.5%	8.5%	8.8%	9.3%	8.9%
Operating Profit Margin	2.8%	2.0%	2.0%	2.8%	3.4%
Net Profit Margin	0.4%	-2.4%	-7.5%	1.0%	-3.4%
Assumed tax rate:	50%				
Yr.	97	98	99	00	01
Interest Payment	2,581	2,168	15,344	11,414	11,634
NI + (1-t)*Interest	7,217	-42,605	-119,536	15,505	-58,721

Taisei (Consolidated)

1) Operational Performance (¥ millions)

Yr.	97	98	99	00	01
Revenue	1,982,163	1,830,597	1,772,970	1,681,305	1,750,390
Growth		-7.6%	-3.1%	-5.2%	4.1%
COGS	1,812,809	1,643,672	1,592,756	1,480,355	1,547,464
Growth		-9.3%	-3.1%	-7.1%	4.5%
Operating Income	14,991	46,951	41,414	43,639	66,748
Growth		213%	-12%	5.4%	53%
Net Income	2,002	-69,095	-8,560	-56,554	8,136
Growth		-3551%	88%	-561%	114%
Net Income (Group Share)	5,785	-66,964	-5,671	-52,802	8,382
Growth		-1258%	92%	-831%	116%

2) Capital Structure (¥ millions)

Yr.	97	98	99	00	01
Equity (w/o Minor)	389,352	293,666	283,590	185,154	230,264
Equity + Minor Int.	436,004	337,392	322,136	220,161	263,768
Non-current Liab.	617,488	578,012	524,152	487,691	500,658
Long Term Debt	539,554	494,704	433,328	333,451	361,851
Total Liabilities	2,572,110	2,559,002	2,423,938	2,065,167	1,925,575
Total Assets	3,008,114	2,896,394	2,746,074	2,285,328	2,189,343
Current Assets	1,999,525	1,828,792	1,719,360	1,403,908	1,286,326
Current Liabilities	1,954,622	1,980,990	1,899,786	1,577,476	1,424,917
Quick Assets	1,510,558	1,420,162	1,320,617	1,049,797	956,354
Acct. Receivables	447,280	386,152	415,868	344,315	395,944

3) R&D Investment (¥ millions)

Yr.	97	98	99	00	01
Investment	10,817	11,037	N/A	N/A	N/A
As % of Sales	0.5%	0.6%			

Key Financial Ratios

Yr.	97	98	99	00	01
Dividend (¥/share)	7.00	7.00	7.00	5.00	5.00
Net Income/share	5.67	-67.25	-5.88	-54.73	8.69
Dividend Payout ratio	1.23	-0.10	-1.19	-0.09	0.58
NCL/(NCL+Equity)	0.59	0.63	0.62	0.69	0.65
LT Debt/Total Capital.	0.55	0.59	0.57	0.60	0.58
Total Debt ratio	0.86	0.88	0.88	0.90	0.88
Current Asset/Total A	0.66	0.63	0.63	0.61	0.59
Fixed Asset/Total Asset	0.34	0.37	0.37	0.39	0.41
Current Liab./Total Liab.	0.76	0.77	0.78	0.76	0.74
Current Ratio	1.02	0.92	0.91	0.89	0.90
Quick Ratio	0.77	0.72	0.70	0.67	0.67
Avg. Collection Period	82.4	83.1	82.6	82.5	77.2
Total Asset Turnover	0.66	0.62	0.63	0.67	0.78
ROA	0.2%	-2.2%	0.0%	-1.9%	0.7%
ROE	1.5%	-19.6%	-2.0%	-22.5%	4.0%
Gross Profit Margin	8.5%	10.2%	10.2%	12.0%	11.6%
Operating Profit Margin	0.8%	2.6%	2.3%	2.6%	3.8%
Net Profit Margin	0.3%	-3.6%	0.1%	-2.9%	0.9%

Assumed tax rate:	50%				
Yr.	97	98	99	00	01
Interest Payment	6,294	5,649	19,053	15,814	16,765
NI + (1-t)*Interest	5,149	-66,271	967	-48,647	16,519

APPENDIX E

OUTLOOK OF INFORMATION TECHNOLOGY (IT) IN CONSTRUCTION AS OF YEAR 2000

In this appendix, the status as of 2000 and the emerging changes of IT strategies in construction is discussed.[E1] The first part addresses the current problems of information management in the construction industry. The second part elaborates on the emerging IT system providers (B2B and the dotcoms). Since the field of IT is ever changing, readers should be cautioned that new developments are always being added to the scene.

E.1 IT & THE CONSTRUCTION COMMUNITY

Construction industry traditionally lags the other industries in adopting new technology. Project information flow is always considered as one of the most critical issue in project management. There are several characteristics that affect the industry in applying IT in the construction business.

(i) Fragmented market

The construction business runs in a very fragmented manner. Unlike in the other industries, the participants of the construction projects have little access to the information of other players in the market. Firms often limit their contact to the network that they are familiar with. In some cases, this kind of fragmented market may create higher profit margin for the contractors because it generates fewer competitors in the bidding process. However, contractors also feel that they are losing the chance to create new business opportunities for their companies. This fragmented market nature provides a basis for B2B e-commerce to increase communication among various players.

[E1] This discussion is drawn from a group project and survey conducted by Charles Y.J. Cheah, I-Tsung Tsai, Yijun Shi and Guillaume Quiviger for submission to the class of 15.568 – Management Information System, in November, 2000.

(ii) Non-standardized platform

Unlike the other manufacturing or service industries, the construction is operated based on projects. Each company develops its process based on its target market, expertise and corporate constraints. Due to the diversity in nature of the projects that demands customized processes to handle, the construction industry has difficulty in generating a standard platform for information management. Knowledge management is considered as a critical tool to classify these diversities and integrate the information flow. However, the difficulty in codification of construction knowledge sets a strong barrier for knowledge dissemination. Proprietary technology and patented process further strengthen the barrier.

(iii) Inter-organizational communication

Except for certain EPC (Engineering-Procurement-Construction) firms that can incorporate the whole project process in their supply chain, most projects are driven by small- and medium-enterprises. The work team is set up on a project-by-project basis and the contractual relationship is dismissed when the project is completed. It is very difficult to implement a long-term IT system for projects since each participant considers the others as temporary partners. Consequently, there is a lack of incentives in promoting IT application in the construction projects.

E.2 B2B E-COMMERCE IN THE CONSTRUCTION INDUSTRY[E2]

There are currently more than a dozen of B2B websites emerging in the market to provide IT services for the construction community. Based on the problem described previously, there is a clear imperative to create a mutual platform to facilitate inter-organization communication and to integrate project information and documentation. These online service providers generally comprise two business models – as a whole package provider or a professional/niche player.

[E2] The source of information for this section comes from a report on IT, "e.Construction." *Engineering News Record*, McGraw-Hill, September 25, 2000.

E.2.1 Whole package provider

These players provides full online services covering one or both of the two following areas:

<1> Application Service Providers (ASP):[E3]

The ASPs serve the back-end of a project. This kind of online program is basically composed of two components:

- *Online meeting & team communication:* the programs enable project teams to capture practices and existing process knowledge and to leverage them through digital connection and online meeting. Participants of the project are given authority and notification to access updated project information gathered on the project website.
- *Document management:* ASP provides comprehensive document management and collaboration to standardize project documents and hook up these digital data with the corporate database. This standardization allows project team members to share project documents such as design drawings and specifications in a secure online environment.

Specifically, the ASPs are expected to fulfill the following functions at different stages of construction:

- *Pre-construction Stage*: The system should allows architects, contractors and owners to exchange drawings, schedules, specifications, permit applications, budgets, contracts, and other documents instantly over the Internet.
- *Construction Stage:* Services includes sets of workflow processes that streamline the management of Requests-For-Information (RFIs), material review submittals, progress billings for contractors, meeting minutes, and other standard business forms, contracts and documents.

[E3] Some of the better-known ASPs are: Cephren.com (which is a merger between bluelineonline.com & e-bricks.com that is formed by a HBS graduate); Bidcom.com; Viecon.com – a subsidiary of Bentley Systems; Bricsnet.com; Constructware.com; and Costructures.com – formed by an MIT adjunct professor.

- *Closeout and Commissioning Stage*: operations and maintenance manuals, CAD drawings and project-generated transactions records are saved in the server for backup.

<2> Marketplace:

The online marketplace provides one-stop shopping for procuring materials, equipment, operational goods and services. Buyers and sellers set up their catalogues in the marketplace for dealing. They can also create, issue and manage Request-For-Quotations (RFQs) and Purchase Orders (POs) for stock and custom-ordered items via the Internet to expedite and automate the procurement process.

Specifically, the current online market provides the following functions:

- Enhance existing vendor relationships by moving purchasing online -- streamlining the entire procurement process.
- Provide multiple authorized users within a company to access the market, allowing the project team to collaborate internally on the creation and review of bid packages.
- Issue RFQs automatically to multiple vendors at the click of a button.
- Attach electronic plans and specifications to bid packages through market.
- Keep track of all new and pending transactions through a single, personalized "dashboard" as well as maintaining a complete transaction history.
- Quickly compare and analyze bids received through the unique comparison worksheet, which is created automatically as bids are received.
- Automatically issue purchase orders to successful bidders.

A summary of these online services is indicated in Table E-1.

Collaboration Capabilities	Workflow Capabilities	Work Process Management	Communication
Review Drawing Check in/out Redline/comment Archive versions Lock Review CAD models Review photos Review without application Message board/discussions Schedule/host online meeting	Meeting minutes Manage correspondence RIFs, Transmittals Submittals Approvals Change notifications	Estimating/Budgeting Bid solicitation Bid submission Scheduling Job progress reporting Multiple project progress reporting Purchasing/procurement Accounting Facilities management	Print Fax E-mail within project E-mail outside project Personal digital assistant

TABLE E-1 Web-based Services Offered by Whole Package Provider

E.2.2 Professional/Niche Players

These companies are more focus in specific market niches, such as equipment rental and raw material supply online. These websites are mostly maintained or sponsored by existing bricks-and-mortar rental companies or material suppliers in an attempt to provide a hybrid model. They stand in a neutral position to provide people with the option to perform transaction online or in the traditional way.

E.2.3 Other emerging developments

The software industry is currently in the process of developing new software packages to create an alternative terminal for field operation in the construction site. Software packages (e.g. pdf readers) for handheld devices such as Palm Pilots are under development to expand their functionality to enable real-time retrieval of drawings from the project website. As a result these devices may unleash the restriction of the accessibility to real-time information in the field and facilitate the contractors to get convenient, adapted and accurate information.

REFERENCES

Allen, M.S. (2000). *Business Portfolio Management: Valuation, Risk Assessment, and EVA™ Strategies*, John Wiley & Sons, New York.

Allison, G.T. (1971). *Essence of Decision: Explaining the Cuban Missile Crisis*, Little, Brown, Boston, Massachusetts.

Altman, E. (1968). "Financial Ratios; Discriminate Analysis and the Prediction of Corporate Bankruptcy," *Journal of Finance*, **23**, 589 – 609.

------- (1970). "Ratio Analysis and the Prediction of Firm Failure: A Reply," (in Comments) *Journal of Finance*, **25**, 1169 – 1172.

AMEC. (1997 – 2000). *Annual Report*, Cheshire, United Kingdom.

Ansoff, H.I. (1965). *Corporate Strategy: An Analytical Approach to Business Policy for Growth and Expansion*, McGraw-Hill, New York.

------- (1991). "Critique of Henry Mintzberg's 'The Design School: Reconsidering the Basic Premises of Strategic Management," *Strategic Management Journal*, **12**, 449 – 461.

Ansoff, H.I., Declerck, R.P. and Hayes, R.L. (eds) (1976). *From Strategic Planning to Strategic Management*, Wiley-Interscience, London.

Anthony, R.N., Dearden, J. and Bedford, N.M. (1989). *Management Control Systems*, Irwin, Homewood, IL.

Asquith, P., Gertner, R. and Scharfstein, D. (1994). "Anatomy of Financial Distress: An Examination of Junk-bond Issuers," *The Quarterly Journal of Economics*, August.

Bartlett, C. and Ghoshal, S. (1998). *Managing Across Borders: The Transnational Solution*, Harvard Business School Press, Boston, Massachusetts.

------- (2000). "Going Global: Lessons from Late Movers," *Harvard Business Review*, March-April.

Batchelor, C. (2000). "Construction: Global Growth in Civil Engineering to Top 6%," *Financial Times*, February 11, 2000.

Betts, M. and Ofori, G. (1992). "Strategic Planning for Competitive Advantage in Construction," *Construction Management and Economics*, **10**, 511 – 532.

------- (1993). "Competitive Advantage in Construction: Reply," *Construction Management and Economics*, **11**, 73 – 74.

Black, J.A. and Boal, K.B. (1994). "Strategic Resources: Traits, Configurations and Paths to Sustainable Competitive Advantage," *Strategic Management Journal*, **15**, 131 – 148.

Bouygues. (1996 – 2000). *Annual Report*, Paris, France.

Bracker, J. (1980). "The Historical Development of the Strategic Management Concept," *Academy of Management Review*, **5**(2), 219 – 224.

Brealey R.A. and Myers, S.C. (1996). *Principles of Corporate Finance*, 5th ed., McGraw-Hill, New York.

Business Week. (2001). "The Ins and Outs of Cash Flow," January 22.

Chandler, Alfred D., Jr. (1962). *Strategy and Structure: Chapters in the History of the Industrial Enterprise*, MIT Press, Cambridge, Massachusetts.

Cheah, Y.J., Kuschinsky, N. and Miller, J.B. (2001). "Application of Portfolio Planning to Urban Settings," *Proceedings of CIB World Congress*, Wellington, New Zealand, April, **2**, 177 – 187.

Chesbrough, H.W. and Teece, D.J. (1996). "When is Virtual Virtuous? Organizing for Innovation," *Harvard Business Review*, January.

Chinowsky, Paul S. (2000). *Strategic Corporate Management for Engineering*, Oxford University Press, New York.

Chiyoda. (1997 – 2000). *Annual Report*, Yokohama, Japan.

Coase, R.H. (1937). "The Nature of the Firm," *Economica*, **4**, 386 – 405.

Dixit, A.K. and Pindyck, R.S. (1994). *Investment Under Uncertainty*, Princeton University Press, Princeton, New Jersey.

Downes, J. and Goodman, J.E. (1998). *Dictionary of Finance and Investment Terms*, 5th ed., Barron's Educational Series, Hauppauge, NY.

Dumaine, B. (1993). "Times are good? Create a Crisis," *Fortune*, June 28, 123 – 30.

Engineering News Record. (1999). "The Top 225 International Contractors – Taking Stock," August 16.

------- (2000a). "The Top 225 International Contractors – Slow Growth, High Hopes," August 14.

------- (2000b). "e.Construction," September 25.

------- (2001a). "The Top 225 International Contractors – Firms Scramble to Better Positions in Quiet Market," August 20.

------- (2001b). "Washington Walks Off Two Jobs," March 19.

Eccles, R.G. (1981). "The Quasifirm in the Construction Industry," *Journal of Economic Behavior and Organization*, **2**, 335 – 357.

Farr, John V. (1997). "Education Reform: Pros and Cons," *Journal of Management in Engineering*, November/December.

Fellows, Richard F. (1993). "Competitive Advantage in Construction: Comment," *Construction Management and Economics*, **11**, 71 –72.

Financial Times. (2001a). "Aker Shelves Plan for Merger with Kvaerner," June 14.

------- (2001b). "Kvaerner is refused Last-minute Lifeline," October 29.

------- (2001c). "Aker Challenges Plan to Save Kvaerner," November 21.

Flanagan, R. (1998). *Technology for Exports*, Lead presentation at Exportism workshop, July, Shinfield Grange, University of Reading, U.K.

Florman, S.C. (1987). *The Civilized Engineer*, St. Martin's Press, New York.

Flowers, E.B. (1998). *U.S. Utility Mergers and the Restructuring of the New Global Power Industry*, Quorum Books, Westport, Connecticut.

Fluor Corp. (1997 – 2000). *Annual Report*, Aliso Viejo, CA.

Foster Wheeler Inc. (1997 – 2000). *Annual Report*, Clinton, NJ.

Fuhrman, P. (1988). "Parlez-vous P/E?" *Forbes*, June 27.

Galbraith, J.R. (2000). *Designing the Global Corporation*, Jossey-Bass Publishers, San Francisco.

Goold, M., Campbell, A. and Alexander, M. (1994). *Corporate-Level Strategy: Creating Value in the Multibusiness Company*, John Wiley & Sons, New York.

Gorry, G.A. and Scott Morton, M.S. (1971). "A Framework for Management Information Systems," *Sloan Management Review*, Fall, **13**(1), 55 – 70.

Greiner, L.E. (1998). "Evolution and Revolution as Organizations Grow," *Harvard Business Review*, May – June.

Grinblatt, M., and Titman, S. (1998). *Financial Markets and Corporate Strategy*, Irwin/McGraw-Hill, Boston, Massachusetts.

Groupe GTM. (1997 – 1999). *Annual Report*, Nanterre, France.

Groupe SGE. (1997 – 1998). *Annual Report*, Rueil-Malmaison, France.

Halliburton Company. (1997 – 2000). *Annual Report*, Dallas, TX.

Hamel, G., Doz, Y.L. and Prahalad, C.K. (1989). "Collaborate with Your Competitors – and Win," *Harvard Business Review*, January – February.

Hamel, G. and Prahalad, C.K. (1994). *Competing for the Future*, Harvard Business School Press, Boston, Massachusetts.

Hasegawa, F. (1988). *Built by Japan: Competitive Strategies of the Japanese Construction Industry*, John Wiley and Sons, New York.

Haskins, M.E., Ferris, H.R., and Selling, T.I. (2000). *International Financial Reporting and Analysis: A Contextual Emphasis*, 2nd ed., McGraw-Hill, New York.

Hillebrandt, P.M. and Cannon, J. (eds) (1989). *The Management of Construction Firms: Aspects of Theory*, Macmillan, Houndmills, Basingstoke, Hampshire.

Hollis, M. and Nell, E.J. (1975). *Rational Economic Man: A Philosophical Critique of Neo-Classical Economics*, Blackwell, Oxford.

Hofstede, G. (1991). *Cultures and Organizations: Software of the Mind*, McGraw-Hill, Berkshire, U.K.

IASC. (1996). "EU Puts Weight behind IASC," *Insight*, March.

Jacobs Engineering Group, Inc. (1997 – 2000). *Annual Report*, Pasadena, CA.

JGC Corp. (1997 – 2000). *Annual Report*, Yokohama, Japan.

Johnson, C.G. (1970). "Ratio Analysis and the Prediction of Firm Failure," (in Comments) *Journal of Finance*, **25**, 1166 – 1168.

Kajima Corp. (1997 – 2000). *Annual Report*, Tokyo, Japan.

Kern, K.C. (2001). "Impact of Natural Gas Prices on the Domestic Power Generation Industry," *Foster Wheeler Review*, Winter, 5 – 6.

Kester, W. Carl. (1992). "Governance, Contracting, and Investment Horizon: A Look at Japan and Germany," *Journal of Applied Corporate Finance*, 83 – 98.

Klein, B. (1988). "Vertical Integration as Organizational Ownership: The Fisher Body – General Motors Relationship Revisited," *Journal of Law, Economics, and Organization*, **4**(1), 199 – 213.

Kumagai Gumi. (1997 – 2000). *Annual Report*, Tokyo, Japan.

Kvaerner ASA. (1997 – 2000). *Annual Report*, Lysaker, Norway.

Langford, D., Iyagba, R. and Komba, D.M. (1993). "Prediction of Solvency in Construction Companies," *Construction Management and Economics*, **11**, 317 – 325.

Langley, A. (1988). "The Role of Formal Strategic Planning," *Long Range Planning*, **21**(3), 40 – 50.

------- (1991). "Formal Analysis and Strategic Decision-Making," *OMEGA*, **19**(213), 79 – 99.

Lansley, P., Quince, T. and Lea, E. (1979). *Flexibility and Effciency in Construction Management*, Ashridge Management Research Unit, Berkhampstead.

Lea, E., Lansley, P. and Spencer, P. (1974). *Growth and Efficiency in the Building Industry*, Ashridge Management Research Unit, Berkhampstead.

Lintner, John. (1965). "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, February.

Lowi, T.J. (1979). *The End of Liberalism: The Second Republic of the United States*, Norton, New York.

Macomber, John D. (1991). "Eight Steps to Success," *Construction Business Review*, 31-35, 70-71.

------- (1999). "Yes, the Internet Changes Everything – (Don't be Left in the Techno-Dust)," *Construction Business Review*, **8**(1).

Male, S. and Stocks, R. (eds) (1991). *Competitive Advantage in Construction*, Butterworth Heinemann, Oxford.

March, J.G. (1976). "The Technology of Foolishness" in J. Marsh and J. Olsen (eds), *Ambiguity and Choice in Organizations*, Universitetsforlaget, Bergen.

Markowitz, H.M. (1952). "Portfolio Selection," *Journal of Finance*, **7**, 77 – 91.

Mawhinney, Mark (2001). *International Construction*, Blackwell Science, Oxford, U.K.

McDermott International, Inc. (1997 – 2000). *Annual Report*, New Orleans, LA.

Miller, John B. (1995). *Aligning Infrastructure Development Strategy to meet Current Public Needs*, Doctoral Thesis, Massachusetts Institute of Technology, Cambridge, MA.

------- (2000). *Principles of Public and Private Infrastructure Delivery*, Kluwer Academic Publishers, Boston.

------- (2002). *Case Studies in Infrastructure Delivery*, Kluwer Academic Publishers, Boston.

Miller, J.B. and Evje, R.H. (1999). "The Practical Application of Delivery Methods to Project Portfolios," *Construction Management and Economics*, **17**, 669 – 677.

Mintzberg, Henry. (1979). *The Structuring of Organizations*, Prentice-Hall, Englewood Cliffs, New Jersey.

------- (1990). "The Design School: Reconsidering the Basic Premises of Strategic Management," *Strategic Management Journal*, **11**, 171 – 195.

------- (1991). "Learning 1, Planning 0," *Strategic Management Journal*, **12**, 463 – 466.

Moavenzadeh, F. (1994). *Global Construction and the Environment*, John Wiley & Sons, New York.

Morrison Knudsen Corp. (1997 – 1999). *Annual Report*, Boise, ID.

Mossin, Jan. (1966). "Equilibrium in a Capital Asset Market," *Econometrica*, October.

Murray, E. (1978). "Strategic Choice as a Negotiated Outcome," *Management Science*, **24**(9), May, 960 – 972.

Nichols, Nancy A. (1994). "Scientific Management at Merck: An Interview with CFO Judy Lewent," *Harvard Business Review*, January – February.

Nishimatsu Construction Co., Ltd. (1997 – 2000). *Annual Report*, Tokyo, Japan.

Oakes, L., Townley, B. and Cooper, D. (1998). "Business Planning as Pedagogy: Language and Control in a Changing Institutional Field," *Administrative Science Quaterly*, **43**(2), 257 – 292.

Obayashi Corp. (1997 – 2000). *Annual Report*, Tokyo, Japan.

O'Reilly, C. (1989). "Corporations, Culture, and Commitment: Motivation and Social Control in Organizations," *California Management Review*, Summer.

Oster, Sharon M. (1999). *Modern Competitive Analysis*, 3rd ed., Oxford University Press, New York.

Penta-Ocean Construction Co., Ltd. (1997 – 2000). *Annual Report*, Tokyo, Japan.

Pettigrew, Andrew M. (1973). *The Politics of Organizational Decision-Making*, Tavistok, London.

Pettigrew, A.M. and Whipp, R. (1991). *Managing Change for Competitive Success*, Blackwell, Oxford.

Philipp Holzmann AG. (1997-2000). *Annual Report*, Frankfurt, Germany.

Porter, Michael E. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Firms*, Free Press and Macmillan, New York.

------- (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York.

------- (1990). *Competitive Advantage of Nations*, Free Press, New York.

------- (1998). "Competing Across Locations: Enhancing Competitive Advantage through a Global Strategy" in *On Competition*, Harvard Business School Press, Boston, Massachusetts.

Prahalad, C.K. and Doz, Y.L. (1987). *The Multinational Mission: Balancing Local Demands and Global Vision*, Free Press, New York.

Pratt, Jamie. (2000). *Financial Accounting in an Economic Context*, 4th ed., South-Western College Publishing, Cincinnati, OH.

Quinn, J.B. (1980). *Strategies for Change: Logical Incrementalism*, Richard D. Irwin, Homewood, IL.

Raytheon Company. (1997 – 2000). *Annual Report*, Lexington, MA.

Rice, J.A. (1995). *Mathematical Statistics and Data Analysis*, 2nd ed., Duxbury Press, Belmont, CA.

Robbins, S.P. (1998). *Organizational Behavior*, 8th ed., Prentice Hall, Upper Saddle River, N.J.

Ross, J. and Rockart, J. (1999). "Reconceptualizing IT," *CISR Working Paper No. 302*, Center for Information Systems Research, Sloan School of Management, M.I.T., January.

Ruefli, T. and Sarrazin, J. (1981). "Strategic Control of Corporate Development under Ambiguous Circumstances," *Management Science*, **27**(10), October, 1158 – 1170.

Rumelt, R.P., Schendel, D.E. and Teece, D.J. (1994). *Fundamental Issues in Strategy: A Research Agenda*, Harvard Business School Press, Boston, Massachusetts.

Sadler, P., Webb, T. and Lansley, P. (1974). *Management Style and Organisation Structure in the Smaller Enterprise*, Ashridge Management Research Unit, Berkhampstead.

Schein, Edgar H. (1992). *Organizational Culture and Leadership*, 2nd ed., Jossey-Bass Publishers, San Francisco.

Schoemaker, Paul J.H. (2001). "The Elusive Search for Integration" in H.W. Volberda and T. Elfring (eds), *Rethinking Strategy*, SAGE, London.

Scott, J. (1997). *Corporate Business and Capitalist Classes*, Oxford University Press, Oxford.

Senge, Peter M. (1994). *The Fifth Discipline: The Art and Practice of the Learning Organization*, Currency/Doubleday, New York.

Sharpe, William. (1964). "Capital Asset Prices: A Theory of Market Equilibrium," *Journal of Finance*, September.

Skanska AB. (1997 – 2000). *Annual Report*, Stockholm, Sweden.

Sloan, Alfred. P. (1963). *My Years with General Motors*, Sedgewick & Jackson, London.

Stone & Webster, Inc. (1996 – 1998). *Annual Report*, Boston, MA.

Sugimoto, Fumio. (1990). *Globalization of International Engineering and Construction Firms for Building Their Competitiveness*, Doctoral Thesis, Massachusetts Institute of Technology, Cambridge, MA.

Tatum, C.B. (1987). "Technology and Competitive Advantage in Civil Engineering," *ASCE Journal of Professional Issues in Engineering*, **114**, 256 – 264.

Technip. (1997 – 2000). *Annual Report*, Paris, France.

Toyo Engineering Corp. (1997 – 2000). *Annual Report*, Chiba, Japan.

Vinci. (1999 – 2000). *Annual Report*, Rueil-Malmaison, France.

Toyo Engineering Corp. (1997 – 2000). *Annual Report*, Chiba, Japan.

Vinci. (1999 – 2000). *Annual Report*, Rueil-Malmaison, France.

Ward, K. (1993). *Corporate Financial Strategy*, Butterworth Heinemann, Oxford.

Wheelwright, S.C. and Clark, K.B. (1992). *Revolutionizing Product Development: Quantum Leaps in Speed, Efficiency and Quality*, Free Press, New York.

White, G.I., Sondhi, A.C., and Fried D. (1997). *The Analysis and Use of Financial Statements*, 2nd ed., John Wiley & Sons, New York.

Whittington, Richard. (2001). *What is Strategy – and Does It Matter?* Thomson Learning, London.

Wilks, S. (1990). "The Embodiment of Industrial Culture in Bureaucracy and Management" in S. Clegg and S.G. Redding (eds), *Capitalism in Contrasting Cultures*, DeGruyter, Berlin.

Williamson, O.E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implication*, Free Press, New York.

------- (1979). "Transaction Cost Economics: The Governance of Contractual Relations," *Journal of Law and Economics*, **22**, 233 – 261.

Yip, George S. (1992). *Total Global Strategy: Managing for Worldwide Competitive Advantage*, Prentice-Hall, Englewood Cliffs, N.J.