CHALMERS TEKNISKA HÖGSKOLA

TURNKEY VS MANAGEMENT CONTRACTING

En handledning för byggherrar om hur man väljer en lämplig projektorganisation och huruvida koncept baserade på teori om Traditionell Totalentreprenad eller Byggledare är att föredra samt hur erfarenheter från tidigare projekt kan användas som del av beslutsunderlag.

A guide to owners about how to choose an appropriate projectorganization and whether concepts of Traditional Turnkey or Management Contracting should be used plus how to make use of experiences from earlier projects to improve the process of decisionmaking.

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Turnkey vs Management Contracting

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SYNOPSIS

This report is concerned with methods of how to best organize the process of constructing, i.e. how to get the object built. Emphasis is placed upon the view of owners in order to develop a framework for decision making about what concept used by consultants to prefer. Especially the question is penetrated, whether nowadays emerging Management Firms of contracting and construction are becoming the only feasible alternative for still more complex objects, or if traditional contractors with "Turnkey capacity", i.e. Systems Sellers, still have a future.

The first section of the three, is a broad outline of the construction industry as background. The development of the industry over the last decades is here reviewed, alternative strategies and the process of contracting is described. A general methodology for the owners to choose the right way of how to organize projects is outlined.

Section two is a qualitative evaluation and comparision of the in this report opposed concepts of Construction Management / Management Contracting and Systems Selling / Turnkey. Methodologies for owners how to evaluate proposals and decide what concept to use is reacned at, and conclusions drawn leading to recommendations to clients with necessary provisions.

The third section, finally, is devoted to case study as quantitative comparision of projects carried out by implementation of the two rival concepts respectively.

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INTRODUCTION

SYSTEMS SELLING

The future of industry is often said to lie in the export of advanced technological products, complete plants and systems and know-how where the aim is to supply clients with all elements required in order to fulfill a given, requested function. Transactions of this type are normally very time consuming as they result in great demand on the seller's managerial resources and in many cases also requires a substantial input of risk capital.

An engineering or construction firm set up in order to facilitate Systems Selling therefore elaborates project ideas and carries out feasibility studies; assembles or participates in a suitable consortium or group; organizes financing; acts as a Project Manager; selects and monitors effective teams for tender preparation; leads or participates in contract negotiations; administers construction work and undertakes purchase and testing of essential equipment; carries out commissioning and starting-up, training of personnel and organization of maintenance and operation.

CONSTRUCTION MANAGEMENT

Every year industrial companies and organizations make considerable investments in offices, plants, service facilities etc. Management of such projects may be problematic if the Parent Organization is lacking local knowledge and the Local Organization do not have the construction know-how required. Management firms therefore offers clients firm control of their investments by undertaking management of their projects perhaps all the way from initial idea, through design and construction phases to commissioning and operation of the completed works. Requirements of the client will be communicated and adapted to local conditions and regulations, to all parties engaged in the process.

PROCESS PLANTS

In the case of projects of a more complex nature it is advantageous to the client to from the very outset possess a guarantee for the overall functional performance of the project at agreed cost within a stipulated time limit. Systems Sellers therefore are prepared to undertake "Turnkey Projects" as main contractor with sole responsibility. When doing so they usually concentrate on projects of a type for which considerable process know-how is available within the consulting group; for instance desalination plants, waste disposal plants, diesel engine power plants, slaughterhouses and dairies, and finally hotels and hospitals as well.

SECTION ONE

CHAPTER 1

1.1 THE INTERNATIONAL PERSPECTIVE

In the debate concerning international competitiveness many people are arguing to make the industry increase the part of technology of its export. The underlying reason is the emerging of Newly Industrialized Countries, (NIC), which are producing traditional export products of the Western World as good or even better, and to lower prices as well. By this they increase their part of the total market and make it more difficult for countries of Western Europe and USA to expand export markets. Furthermore as economic growth, and by that demand, has declined or decreased on many of the most important markets, companies will more and more have to continously develop new methods of working in, and approaching new markets.

Obstacles to export.

Difficulties to maintain a sufficient level of export may sometimes be caused by the country itself. Consider for instance the commonly known reasons listed below:

1. By tradition enterprises are more aimed at technology than actual conditions of the market. The client instead must always be in focus.
2. Firms are not used to cooperate with other firms. A single company may not be able to supply all parts of the system required.

3. An annoying bureaucracy of established institutions often cause potential opportunities of business to be neglected.

4. Especially in developing countries the client often regard short and effective sessions, fast decisions, rational procedures of planning etc as insensible to local tradition and social rules. The need for to successively step by step help the client to manage the system after delivery is essential as he might lack experience of both how to administer and carry out the maintenance.

Generally is very important to realize the necessity to apply a different strategy when selling a system, as compared to selling single products. A reasonable aim must be to for each delivery of a system, put togetner precisely the combination that is expected to have the greatest possibility to be successful. By this sometimes in first place larger companies will be favoured as the smaller are less likely to raise necessary funds for marketing and to take financial risks. Instead smaller companies have an important role to play as suppliers of different components of the systems.

Formation of industrial resources.

To work with projects abroad usually means an environment characterised by more uncertainty than what is common under domestic conditions. In addition systems selling to many companies is something quite new. Basic theory of organization indicate powerful management and

short span of control. Hence the conclusion must be to minimize the number of companies in control of e.g. a consortium and establish firm relationships in order to in the long run decrease the uncertainty of the organization.

Chances of success are better if the group or single Systems Seller have the financial strength necessary, experience of working abroad, good contacts with the market, knowledge of the process and ability to control the project. From the point of view of control is of course preferable if a company itself alone comprehend all activities required. As a next step a consortium would be built around companies with prominent capacity within certain main areas. Alternatively a smaller group of companies manufacturing essential equipment might be conformed.

In particular the knowledge of certain processes is important in this context to enable total responsibility of the function. Of course an advantage with Systems Selling as compared to traditional contracting procedure, is the possibility to achieve a reasonable know-how fee.

Aspects of marketing.

How you should put together a consortium is naturally very much depending on conditions of the actual market and by that on the specific competence of the companies involved. Hence the rational composition will vary depending upon whether the purpose is to go for a single project, project in certain geografical areas or over the whole world. The critical factor may be the access to a local network, knowledge about the country or a well

developed selling organisation. Above all must to an with time increasingly higher extent, commitments to take responsibility for operation and maintenance be connected to deliveries of systems.

However can not be neglected that costs and risks of turnkey projects are substantial, why sellers of systems sometimes nowaday instead are marketing "Project Management Contracts" as substitute for "Lump Sum Fixed Price Turnkey Contracts".

Project Management might be defined as "the planning, organization, direction and control of construction and engineering projects to establish know-how and products required to fulfill the project w.r.t. stipulated time, quality and cost". Some of the engagements usually included in a Project Management Commitment are listed below:

Economy analyzation; e.g. comparision of alternative methods of production or investigation of cost and revenue for different alternatives.

Finance analyzation; increased size and complexity of technology of projects make specialist know-how necessary.

Technology transfer; education of local engineers, operative and maintenance personnel.

Planning of resources; logistics.

Environmental considerations; permissions according to local laws and common practice.

"Engineering"; teams of engineers check standards and fulfillment of required function w.r.t. stipulated time and budget.

Procurement; equipment, services etc.

The role of consultancy companies as "spearheads" are commonly known; as technological solutions and specifications naturally are based upon conditions of the country where the consultant is coming from, this will give spin off effects to domestic suppliers involved.

In the case of systems selling is however pro primo traditional services of contractors usually not relevant or at least not sufficient, and pro secundo is the contractor usually lacking necessary specific know how about certain industrial processes. Back up support services from industrial companies are required or alternatively the industrial company itself will sell services. Irrespective of details the procedure however will generally cause a situation of competition when contracts are awarded and hence the effect of "spearhead" will occur regardless of selling of components, packages or turnkey offers.

In the case of responsibility for function, operation and maintenance the cooperation between industrial process companies and consultancy firms will result in systems selling of "software", i.e. approach the concept of "Project Management Contract". Which method to choose in each case is depending upon not only preference of the client but also the credibility of the seller as well.

1.2 ROLE OF THE CONSULTANT

As the competition in the international market is becoming more fierce, the generally positive attitude to

deliveries of systems will be of utmost importance to companies with capability of systems selling. Notable is that deliveries of systems are encompassing precisely the very task of detailed design which is exposed to very hard competition from local firms and firms of NIC. The seller of systems must therefore rely upon his experience of co operation with domestic industry from earlier projects, carried out in different environments. In some companies up to 75 % of the employed people might have experience of work on international projects. Hence is in particular important for the consortium to ensure the participation of a member, which through his experience and financial strength has possibility to take the greater responsibility always connected to delivery of systems.

In general terms will the even more advanced technology of tne future probably raise demand on experts of technology and administration on the same time ! Therefore, e.g. Systems Sellers will be increasingly engaged because of their overall experience not least of how to in different environments, solve througnout the period of a project occuring new problems. In other terms they make a valuable contribution to the local knowledge of the client. As furthermore the resources of society is becoming more scarce, the main areas of responsibility of professionals might be summed up as below:

1. Evaluation of technological resources of society.
2. Coordination of resources w.r.t. economy, technology and environment.
3. To administer resources to a functioning whole.

In conclusion therefore, sensitivity to demand of the market and cooperation between companies, is required to increase export and the general turn over of business. Sellers of systems have in this context an important role to play. With big resources and experience, they have ability to give advice in early stages of a project, and contribute to involvement of certain companies to make the export necessarily integrated.

1.3. RECENT DEVELOPMENTS - NEW TRENDS

To buy design and construction services is undoubtedly a management function, making every client or owner a manager as well as simply a buyer. Hence is very important to help cients to understand management aspects of construction. Thougn construction of complex projects of course always has been requiring someone to manage it, Construction Management, (CM), did not emerge as a significant profession until the 1970's.

Several different variations of the approach of CM are prevailing, but the essence of the concept centers around the introduction of a Construction Manager as agent of the owner and manager of the entire building process. The Construction Manager - nowadays commonly a group, company or partnership - assists the owner in arranging for the contractors and architects who will actually do the work. By this there is no prime contractor since each segment of construction is contracted separately directly witn the owner with the advisement of the Construction Manager.

A principal benefit of CM is the possibility to "Fast Track" or Phased Construction as one can contract out portions of a project and start work as soon as those portions have been designed and approved. Thus overlapping phases, as opposed to sequential phases are the keynote of this concept.

A question of interest in this context usually causing a lot of dissention among architects or contractors is why the CM Process emerged so suddenly and grew so rapidly. Some likely reasons are listed below:

1. Inflation.

Though the construction industry was long overdue for CM, enormous pressure was needed to change a process institutionalized over decades of practice. That pressure was inflation as clients became susceptible to arguments when time savings meant substantial cost savings !

When using the traditional process buildings were designed, and construction did not begin until a fixed bid was made for the total project. Architects and engineers often redesigned for no increase in their design fee if the budget was exceeded. However, inflation created risk in the traditional process if the budget was exceeded on the day of the bid - it was not anymore simply a question of redesign. But nevertheless clients were willing to take some risk with the potential of saving money through Fast Track, and soon separate companies emerged whose sole business was to provide management services. Time was

shortened simply by arranging the process in such a way that more people could work simultaneously, and great need occurred for accurate estimating and scheduling; reorganizing preparation of working drawings and specifications; management of the bidding and for co ordination of construction contracts bid over several months.

2. Fragmentation and specialization.

General contractors might very well subcontract the majority of the construction work to specialty trade contractors. Indeed already some contractors provided overall coordination, control and the bond, took the financial risk and subcontracted all the work. The next logical step was to explain to an owner, that a Construction Manager could contract and communicate directly with subcontractors on the behalf of the owner, bidding or negotiating each contract in sequence as the construction schedule demanded the work.

3. Public laws on bidding and negotiation.

Traditionally the survival of the contractor depended on having the lowest bid and for public work he could not be selected on the basis of his past performance. Adversary relationships developed as the contractor was not selected by the client, and since his profits were the difference between bid and actual cost. Therefore public clients looked for ways to contract with those who would direct construction on the basis of their ability and skills and their allegiance to the need of the owner.

Buying through competitive bidding served two objectives: first; it reduced the risk of unfair procedure and arrangements, and secondly; it did put pressure on prices implying that the job would go to whoever could do the work at least cost and therefore spend the fewest tax money. A new title (Construction Manager) was required - the contractor had become a true professional, just as architects and engineers working on behalf of the client.

4. Primitive state of management in the Construction Industry.

The competitive process of bidding hindered evolution of modern tools and techniques of management. Prices from subcontractors would be very much the same as for other competitors and usually built-in corporate overheads that was not entirely project related, could not be afforded. As a result of necessarily limited overheads, few contractors had funds available for Research and Development of the management function.

5. Focus of design professions on environmental and aesthetic issues.

Previously architects were primarily interested in design issues rather than management or technological skills. Rising costs of errors and omissions insurance, persuaded architects to limit their responsibility and liability during construction which caused limited authority and, ultimately, expertise. In general, the design profession had moved to the front end, and away from construction activities. So instead the need of

construction management and technology was filled by contractors and specialized companies outside the architectual profession.

6. Inability of awkward fixed price contracting methods to meet needs of the building public.

In short, competitive bidding may make competition difficult for single large projects, as the ability of the contractor to put together the collection of subcontractors at the lowest cost is limited by the fact that he does not yet have the job. Until all drawings were done prices were difficult to pin down resulting in inflexibility. A cure was the Construction Manager approaching the project in a more logical, business-like way.

Eventhough the Construction Manager has emerged as a new professional in the Construction Industry, it would surely be a mistake to regard him as something inevitable successfully revolutionary;

First; there are few really new techniques in project delivery - most ideas have been tried before.

Secondly; clients are primarily interested in getting a building to meet their special needs. Construction Managers, architects, engineers or contractors are just something necessary they would be just as happy without.

Third; buildings are designed and built in very many different ways, and the pros and cons of a strategy are often argued outside the context of the project; e.g. objectives of the owner, the economy of the area etc.

To sum up some prevailing concepts wee see the Quantity Survey Process in Great Britain, Construction Management in the US, Project Management in Canada, Turnkey Housing in developing nations, Design & Build for plants, prepurchasing techniques, different techniques of Financial Guarantees and Bonding from country to country.

A prospective owner is required to evaluate and determine which method that is the best. But sites are different, so are functions and buildings and processes as well, why probably no variation with certainty can be said to be the best. To conclude, one can be as creative about management as about design, a point worthwile to consider.

CHAPTER 2

A CONSTRUCTION PROJECT

Below is described a typical, traditional building project, following a division into four major stages of Briefing, Designing, Constructing and Commissioning.

The major stages of a project, together with various "aspects" to be considered during each stage, form the frame work of the construction process. For organizational convenience, these aspects can be divided into four main groups:

1. Functional aspects.

   General concepts, operational patterns, department- and room programs.

2. Location and site aspects.

   Climate, topography, accessibility, infra structure, legal formalities.

3. Construction aspects.

   Principles of design, technical standards, availability of building materials, building methods.

4. Operational aspects.

   Project administration, cash flow, maintenance needs.

Examination of each aspect should start during the Briefing Stage, and continue in greater detail during subsequent stages until each aspect has been satisfactorily

dealt with. Each aspect, or group of aspects, will be attended to at different points during the various project stages. Preferably is a conclusion reached on each aspect through a process of subsequent phases of Survey, Analysis and Recommendation.

In many respects each project stage can be considered as a separate entity. However, the conclusion of one of the stages, forms in this simplified theory the starting point for the subsequent stage(s). To maintain control over available resources, completion of one stage should be coupled to a commitment or decision by the Client, or his authorised representative. Clearly defining the comprehensiveness of each stage can mean considerable savings. In practice therefore, e.g. when using the concept of Construction Management is often a substantial degree of overlap between different stages frequently occurring.

Especially is the work done in early stages very important as once the stage of Construction is reached and funds fast expended, it is almost impossible to influence size and shape of the building. As illustrated in Fig. 1, the crucial period in this model is when the project Brief is reviewed by the Client for final approval.

Sequences of work and various participants involved throughout stages of a project is shown in Fig. 2. Note that the Management Team here consist of the Project Manager and supporters active during all stages.

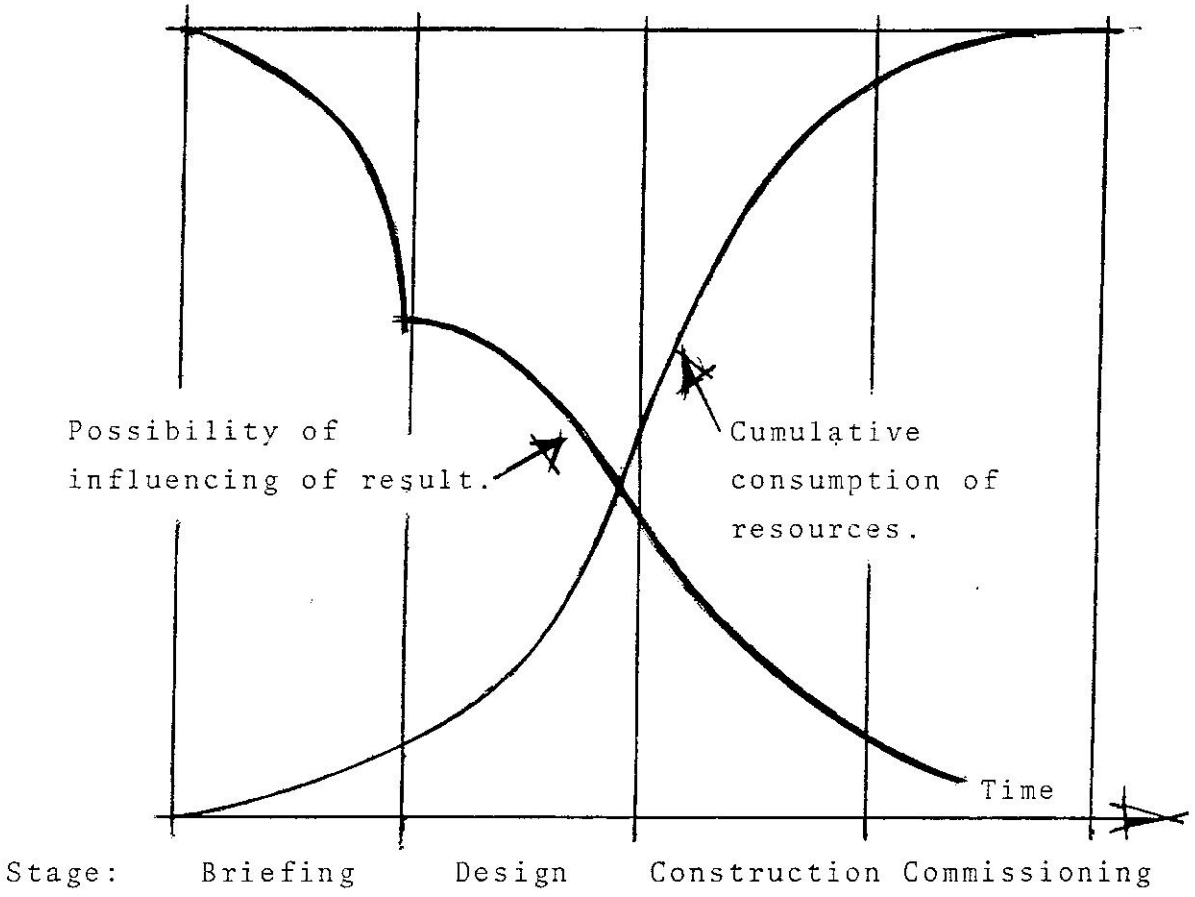


Fig. 1

Participants \ Stage No:	1	2	3	4
Management team: Project Manager supported by planners, administrators etc.	X	X	X	X
Users, incl. representatives of operational staff.	X			
Designers and Specialists such as: architects, engineers, quantity surveyors, health planners etc.	X	X		
Contractor and suppliers			X	

Fig. 2

ALTERNATIVES OF THE CLIENT

If as concluded in the introduction, there is no single superior strategy for getting buildings built; how should the client structure and examine all the alternatives and their variations ? One way to reach at a systematic method is to classify choises into three major categories:

1. Contract Strategy; the number of contracts.
2. Contract Type; contractual relationships.
3. Selection Criteria; choise of contractor.

Not only do we have many intermediate steps on the spectrum of Strategies, but also infinite ways in which various components can be combined. Where a client places himself on each of the three scales, in detail described below, is largely depening upon his administrative skills, komplexity of the project and relative importance of quality.

2.1 STRATEGY OF CONTRACTING

One -------- Number of contracts ---------- Many

Turnkey	Design	Design	Separate Trade	Separate
Design&Build	Bid	Preorder	Contracts	Material &
Single Point	Trad.	Bid	US/CM	Construction
				Purchase

As illustrated above, Contract Strategy determines the number of contracts required for a job. Typically Construction Management uses a multiple contract approach while Turnkey usually is a one choise prospect.

Generally the potential for cost and time savings as well as flexibility increases with the number of contracts, while the drawbacks attached are increased involvement of client, greater required management among contractors and usually; lacking stipulated bottom line price.

Hereafter are described some standard project strategies and less common variations. For graphical representation of relationships between stages and hierarchy of participants, see Appendix 1.

2.1.1 The traditional process.

Simplicity, safety and little management required are the features of this approach where the owner who needs a building is assumed to be an inexperienced layman. He therefore hire an Architect which for a fee will design the building, have it bid by contractors and finally check the construction.

While the architect is acting as the owner's agent, the Contractor however, is more like a vendor of a product, i.e. the building not yet existing ! In theory then, the product orientated buyer/vendor relationship should emphasise the price, while the people orientated client/agent connection is based on the obligation the professional has to act in the interest of the owner.

Because of an unquestionable logic of the Traditional Strategy, some advantages are obvious: first; management simplicity as everything is planned in advance and second, cost security as a guaranteed fixed price for the total project is required before any construction will commence.

Nevertheless this kind of process nowadays takes too long and costs too much. Furthermore the Contractor who know most about construction techniques and costs have no influence on designing Architects and Engineers. By this the final result is likely to be not optimal as the two categories mentioned lastly, usually have no routine experience with actually buying materials or directing physical construction.

Note in this context of traditional project delivery system, a Construction Manager will mean an extra cost of an advisor possible to be left out. Particularily this is the case if architect, engineer or owner themselves have experience of construction technology and cost estimating.

2.1.2 Fast Track and Construction Management.

Scheduling of Fast Track, (FT), telescopes processes of design and construction and can be used either with the Traditional or the Construction Management process of building.

CM as previously explained is a contracting procedure usually replacing the General Contractor by a Construction Manager under a special fee arrangement. FT or Traditional Methods of bidding a job with complete set of drawings and

specifications can both be used for this form of contracting, but because FT and CM are working so well together, they are here treated together.

Now there is no general contractor anymore so the term Subcontractor no longer applies, but still someone has to coordinate the work. The Construction Manager fills the need, and is paid a fee for eliminating the General Contractor's overhead and profit.

However the owner has no assurance that all downstream contracts will come within the budget. Note that the early stages, such as site work and foundations, may already be under contract. This basic problem has two common answers:

Answer 1 is a Guaranteed Maximum Price, (GMP), and run over costs paid by the Construction Manager himself. In spite of the fact that the owner does not initially know exactly what it is that will not exceed GMP, this process with responsible, competent managers will work very well. A good reputation is essential to the Manager, but when he guarantees a building for a certain price, he becomes a Vendor, and perhaps not any longer is primarily concerned with the best interest of the owner.

Answer 2 therefore is having the Construction Manager acting as just an - Agent. While working on behalf of the owner only, he assures continously control and successful completion of the project.

Again there is a problem. If the Construction Manager

is bad at estimating prices of downstream contracts, he will cause owner and architect a lot of trouble and is likely to have interfering areas of responsibility w.r.t. the latter.

Among several distinct advantages over the Traditional Process to be noticed are:

1. Someone from the very beginning of the project has experience of construction techniques and costs.
2. Overlapping save considerable amount of time.
3. Public agencies may select organization based on qualifications rather than purely on low price.
4. Control of costs in incremental steps.

Finally, perhaps most important of all is the quality of the people involved. Irrespective of how good working drawings and how complete specifications are; without competent and responsible managers the result will be a bad job.

2.1.3 Design & Build, Turnkey and Single Point Responsibility Contracts.

Often the terms Design & Build (D&B), Turnkey and Single Point (SP) are used interchangeably. All three of them are based on the same notion: integration of design and construction within a single contract. Differences in application of this concept will however make distinctions necessary as explained below.

2.1.3.a Design & Build.

In D & B, trade contracts frequently are with the D & B contractor, and the owner is reimbursing at face value and has the right to approve those contracts. Usually a basic fee is set, sometimes with incentives and a target cost or GMP. The D & B contractor is acting much like tne client of the agent with disclosure of all costs, improving close relationships between design and construction functions and increased efficiency. Results are faster delivery, lower cost, extensive control of the owner and flexibility throughout the process.

By breaking down the project into many separate parts, contractors can be selected on basis of qualifications for each of them as well as of fee and management plan.

Frequently D & B is used in highly complex projects and therefore not so easy to administer, since the owner all the time must monitor the project delivery process and audit expenditures. In addition laws, codes and tradition are not usually established with D & B functions in mind.

2.1.3.b Turnkey.

A single organization is responsible for design and construction, and the price is based upon specifications of performance or general descriptions of what the owner wants. Stipulated sum and unit price contracts normally are used, but if the initial proposal is not accepted, the owner is assumed to begin the process all over again.

Major advantages are simplicity of administration with one contract only to manage, speed and low cost can be expected and efficiency of design and construction is likely to increase.

However, with a classical, traditional Turnkey contract the control or flexibility of the owner is restricted as the Turnkey organization prepares everything. Because of this also public bidding is difficult since without plans and specs, the end result may be hard to specify at start. Therefore Turnkey frequently is seen with projects possible to describe by performance objectives, like industrial plants etc.

2.1.3.c Single Point.

In a single SP Contract, both design and CM Services are combined. It differs from Turnkey and D & B in that the owner directly holds all separately awarded construction contracts of the total project.

Advantages are good coordination and efficiency with speed and to low cost through competitive bids, using the objectivity which public bidding laws commonly require.

Variations as adaption to specific problems.

2.1.4 Fast Track Single Contract.

In the Traditional Method, benefits of overlapping design and construction is achieved without multiple contracts or a Construction Manager. An experienced contractor with good reputation may be selected at the same time as the architect. Usually the contract is a Cost Plus or Unit Price, but may sometimes during construction be transformed into a Lump Sum contract.

Distinct advantages are the overlap of design and construction and selection of contractor on basis of qualifications which will ensure good advices.

Still there is less control over the project delivery and still public clients can not use the process since the overall Construction Contract can not be competitively bid.

2.1.5 Staged Design and Construction.

Often the time schedule for many individual projects as parts of the whole is not known when the total project begins. Work is therefore started and contracts of any form subsequently awarded. The incentive of contractors is the assumption of allowance to continue the work as long they are doing a good job. Of course flexibility is a result of this approach, but the owner requires a staff controlling his complex construction program.

2.1.6 Sprint Start or Premobilization.

In remote, inaccessible or not developed areas, a contractor must provide more resources and facilities than

in an urban area. For this reason then, the usual Fast Track Multiple Contract Process will not work very well.

Often on large, international projects in developing countries or isolated locations, the first six to nine months of the construction contract is devoted to the Mobilization Phase. Time can be saved by purchasing Mobilization Contracts of any form for facilities, materials and equipment during the Design Phase before the General Construction Contract is awarded.

2.1.7 Multiple Contracts without Fast Track.

FT and CM are in fact completely separable, eventhough they are normally used together. Time savings of FT is lost when a Construction Manager is involved in projects which do not have overlapped design and construction, but no construction is begun until total costs of projects is known ! All other advantages of CM remain unchanged.

CM Organizations may of course provide consulting services to clients with many possible forms of Construction Strategy. If a Construction Manager is used as the representative of the owner , he is rather a Consultant than an essential participant in the project team. Therefore the term "CM" is not only covering standard arrangements where a professional is stand in for a General Contractor as coordinator, but is also denoting many forms of general consulting services in the construction program.

2.2 TYPE OF CONTRACT

Agency -------- Contract type -------- Vendor

Cost Plus	Target Price	GMP	Escalation Clause	Unit Price Q.S.	Nego. Fixed Price	Bid Fixed Price

As mentioned above, a vendor sells you a product for a price while the other extreme, the agent, operates in your interest for a service fee. Agents usually are e.g. architects, lawyers, doctors etc., while vendors might be project salesmen, contractors and so on.

Actually, for instance design could be bought from an architect, and then a Cost Plus Contract made with a contractor. If the architect is not asked to provide inspection or represent the owner, and the contractor is fully responsible for quality, the architect would be a vendor and the contractor an agent !

Simplicity of a contract is usually related to simplicity of the corresponding project. Straightforward Lump Sum Contracts are reasonable for buildings, but as complexities and uncertainties increase so do the need to respond to them specifically. How good the type of contract is an important factor of the project;

2.2.1 Cost of Work Plus a Fee.

Cost Plus Contracts for an Agency essentially is the contractor getting a fee for overheads and profit, and beeing reimbursed at cost for expenses. Advantages occur when time and flexibility are of concern, but the final monetary commitment is not at all tied down at start.

2.2.1.a Simple Cost Plus Fee.

If percentage is used, the fee moves with the size of the project. The contractor may have little incentive to not increase his fee by permitting high costs.

2.2.1.b Target Price Plus a Fee.

A usually fixed fee is connected to a Target Price for the entire scope of the project. Bonus/penalty provisions is recommended to allow the contractor to share savings and cost overruns.

2.2.1.c Partial Guarantees Plus a Fee.

Guarantees commonly are given for pre purchasings, and occasionally for labour. Because of reduced risk, the contractor can offer lower price with less contingency when the contract is signed.

2.2.1.d Cost Plus a Fee with a Guaranteed Price.

Because the contractor is likely to include a substantial contingency and set as high a maximum as possible, a bonus aspect is recommended to enable sharing of savings if the final price is less than the guaranteed.

2.2.2 Unit Price - Quantity Survey.

A Q.S., widely used in UK, supply potential contractors with detailed lists of building material quantities (Bills of Quantities). Contractors then apply unit prices for installed price of materials. Contracts therefore can be awarded before completion of drawings and specifiations.

Bidding is accelerated since contractors do not have to estimate quantities themselves. Payment is based on actual quantities used at specified prices, and hence the Q.S. usually is responsible for substantial errors. Because of this uncertainty the contractor sometimes is compensated if large changes in specified quantities affect his unit prices.

2.2.3 Stipulated Sum.

All construction documents must be finished before the contract is signed and any work begun. Quality and workmanship may be secondary considerations as any savings directly increase profits of the contractor. So although the client from the very start exactly know the extent of his financial commitment, a watchdog attitude might be required to assure contract compliance.

2.3 SELECTION OF CONTRACTOR

Qualifications ---- Selection Criteria -------- Price

Experience & Resources	Fee Proposal Management Plan	Restricted Bid	Open Bid

Selecting a contractor ultimately depends on 1: what the client wants, and 2: what he is willing to pay for it.

Areas of evaluation.

2.3.1 Experience and resources.

Important for high quality or distinguished projects. In particular the client should look for experience of local conditions and of similar types of construction, company turnover, management and administrative capabilities, capital plant and equipment, manpower and special capabilities.

2.3.2 Fee Proposal and Management Plan.

Contractors proposing should submit a detailed Management Plan outlining approaches to project organization, proposed contract schedules and general operating strategies along with the proposal fee. Also a personal interview should be a part of the evaluation scheme.

2.3.3 Restricted Bid.

Participation is someties limited by prequalification as a result of local laws, bonding requirements, public procedures etc. Qualifying contractors are because of this almost certain to be very good, so awards are normally in this case based on price alone.

2.3.4 Open Bid.

When clients are interested in price alone, the contract normally is awarded to the lowest bidder.

2.4 RELATIONSHIPS BETWEEN OWNER, DESIGNER AND CONSTRUCTOR

Troubles in construction processes are often due to conflicting objectives or viewpoints of the participants; owner, designer and constructor. Various combinations or relationships between these parties have tneir distinct advantages and disadvantages. A subjective rating based on experience of Prof. WA McLaughlin and Prof. VK Handa, University of Waterloo, Ontario, Canada, (4), is developed for these relationships. It should prove nelpful for the owner in choosing most appropriate form for different types of construction.

2.4.1 Objectives of Parties.

Objectives of parties in the construction process are many times mutually exclusive. By recognizing these differences, appropriate action, in terms of contracts, tenders and relationships, may be established by the owner.

2.4.1.1 Owners Viewpoint.

Lowest possible cost may mean low quality and slow completion; highest possible quality may mean high cost and slow completion; and most rapid completion may mean high cost and low quality. Compromises are necessary.

2.4.1.2 Designers Viewpoint.

In any contract the Consultant must consider:

a) Design - independence of action;

- capability of controlling design costs,
- design's financing requirements.

b) Construction services - freedom of action on substitutions proposed by contractor;

- evaluating contractor's claim.
- liability due to contractor's action.

c) Resident inspection - quality control.

d) Overall aspects - nature and degree of risks.

2.4.1.3 Contractor's Viewpoint.

Generally, if contracts are so structured that contractors will make a higher profit by achieving goals on which owners places greatest importance, then the profit motivation of contractors is correctly harnessed.

2.4.2 Relationships.

Depending upon various weights the owner may place on multi dimensional objectives, appropriate relationships can be selected. With nothing implied by the ranking of relationships below, the following forms of associations will be considered:

1. Owner/Designer/Constructor (conventional method of design by consultant, construction by general contractor).
2. Owner + Designer/Constructor (design by owner, construction by general contractor).
3. Owner + Designer + Constructor (design and construction by owner).

4. Owner/Designer + Constructor (design and construction by general contractor).

5. Owner + Constructor/Designer (design by consultant, construction by owner).

6. Design by Owner with Contractor Participating.

7. Design by Consultant with Constructor participating.

8. Partial Design & Build between Owner and Constructor.

9. Project Management.

10. Construction Management.

In the tables of Appendix 2,3,and 4, (4), is shown how each relationship will fulfill the viewpoints of Owner, Designer and Constructor resp.

So, by making clear to himself what contract strategy and type, and selection criteria are most applicable to his own organization, and thereafter perhaps check with experiences as above, the client should be able to reach an appropriate choise of by what alternative to get his building built.

In summary the crucial decision of selecting a contractor is eventually a decision of the client who also might be influenced by e.g. 1: objectives of the project, 2: mode of operation, or perhaps 3: external pressure. The most important aspects of these factors are normally:

1. quality, cost and time

2. control flexibility and client involvement

3. fairness, national goals, traditions, laws and codes, financial guarantees & bonds plus conditions of economics, all pointing to the importance of the environmental context.

CHAPTER 3

THE PROCESS OF CONTRACTING - A REVIEW OF THE CHRONOLOGY

Preparation of a contracting plan is an essential step in the execution of any project. What form of plan to use is never given. Each plan represents a compromise between conflicting interests such as time against capital cost, delegation of responsibility against retended control etc.

Because of trade-offs involved, preparation of plans must be coordinated and authorized by a Planning Team which is primarily interested in the whole of the project.

Ultimate responsibility however always rests with the owner. An individual should therefore be appointed at the commencement of the planning process to represent the owner and coordinate activities.

3.1 CONTRACT PLANNING

Contracting in short, is planning for optimal utilisation of resources and know how. Commercial aspects as briefly described in the following, are mainly planning of projects and tenders, process of tendering and placing of contracts, and finally how to administer the process. Note however, in this outline in first place the "Traditional Approach" is considered, while e.g. concepts of Construction Management not in particular are regarded.

3.1.1 Process of Planning

For a constructional or engineering project a logic procedure of planning is:

1. Identify objectives to achieve; e.g. stipulated price, quality and time.
2. Express objectives in terms of time.
3. Assess available and required resources.
4. Establish most economic method to achieve objectives w.r.t time required and resources available.
5. Allocate responsibilities from selected method.

3.1.2 Planning Team.

First step of management, having decided to initiate a project is to appoint a planning team. Size and complexity of the project determine what persons to include in the team, but the members following are thought to be essential:

* Project Manager
* Project Engineer
* Representatives of Department or Function in the firm for whom the project is constructed
* Purchasing or Contracts Officer
* Project Accountant

3.1.3 Definition of Planning Objective.

Compromises are almost always a necessity. For instance may the absolute need from a safety point of view, to ensure reliability and conformity with specifications, limit the choise of suppliers. Therefore, definition of planning objectives will start with selection of factors of maximum importance to the transaction in question.

3.1.3.a Time to be achieved.

Time available will have a major effect on:

1. Method of contracting; possible shortage.
2. Cost of working overtime.
3. Method of construction.

3.1.3.b Assessment of resources.

Aspects to consider are:

1. Design, engineering and management resources available to the customer, and whether they are compatible with objective within time.
2. The money available and the level of profit required, as related to capacity and design factors which will affect cost and time.

3.2 ALLOCATION OF RESPONSIBILITY

A most important decision of the owner is whether to entrust responsibility to one contractor, or to divide the project into several and undertake coordination himself.

In short, as explained above, integration into one contract only means simplified administration, but also probably loss of control and risk of higher price. Some considerations of the owner in order to arrive at a decision on his contracting plan are listed below:

3.2.1 Economics of the Project.

Provided necessary resources to plan in most economic manner and to coordinate execution are available, then breaking a project down into separate contracts should theoretically produce lowest initial cost because:

1. No Fee paid to Main Contractor for the responsibility of work of others.
2. Possibility to separately select most favourable tenders from specialists.

3.2.2 Operating Costs.

In the case of particular items with operation and maintenance costs crucial to the owner, he is recommended to buy them straight from the actual manufacturer if they are not with certainty available from the main contractor.

3.2.3 Plant installation and Commissioning.

By broadly three alternative methods can a mechanical or electrical plant be installed:

1. Each subcontractor undertake his own installation and commissioning - clear responsibilities but most expensive to the owner.

2. As in 1. above except that plant contractors supervise installation personnel provided by the owner - lower initial cost but risk for problems on responsibility.

3. Equipment manufacturers are responsible for design, manufacture and delivery of own equipment only - expected extra payment for supervision of installation labour.

3.2.4 Size of Project.

Easiness of owners of dividing projects into separate contracts is generally inversely related to the size of the project. If possible, sub divide into large well defined, separated packages and make the contractor of each totally responsible for his own package.

3.2.5 Technical Interrelationships.

Important to sub division and coordination.

3.2.6 Range of Engineering Skills Required.

Sub division and coordination of the owner is better facilitated the more closely the range of engineering skills approximates to the owner's own experience.

3.2.7 Timescale for Completion.

Generally, integration of procurement and construction activities through single organizations will produce time economics.

If the main contractor is also responsible for design of closely inter related sections of the project, even further time economics can nowever often be achieved. Reasons for this are given below:

1. Reduced flow of information.
2. Data for design are not released until assured to be correct and complete.
3. Contractors will act on final, complete data only.
4. Less public or formal administrative procedures.
5. Avoidance of time consuming Lump Sum Tendering.

3.2.8 Alternatives of Design Responsibility.

1. Total "Turnkey".

As the name implies, the single contractor undertakes entire responsibility for projects through construction and commissioning to "turning of the key" by the owner.

2. Partial "Turnkey".

A contractor is engaged for the heart of the project by the owner who design peripheral works himself or through consultants, and will place procurement/construction

contracts only for these.

3. Separate Design and Construction.

The traditional approach in building and civil engineering industry.

3.2.9 Employment of Managing Directors / Project Managers.

Between the Turnkey Main Contractor and use of consulting engineers in traditional roles, a Managing Drector or Project Manager, (PM), can be employed. According to Institute of Building, London, (1979), Project Management is defined as "overall planning, control and coordination of projects from inception to completion time, within cost and to required quality standards". The PM is commissioned by prospective owners or by a gowernment control authority, and is acting in the interest of clients or employers for the duration of the whole process. Stages of the process over which the PM will be accountable, in the broadest form, are:

1. Initial Stages; terms of engagement of the PM, degree of client involvement, extent of the PM's authority and responsibility and lines of communication.

2. Feasibility Stage; selecting or investigating site and selecting and briefing consultants.

3. Approvals Management; gaining of development and building application approvals.

4. Design Management; outlines, environmental and cost comsiderations.

5. Documentation management; constructual and contractual.

6. Pricing Management; incl. selection of contractors.

7. Construction Management by person directly in charge.
8. Contract Management.
9. Post Contract Management; incl training of users.

This scope of duties of the PM is shown in Appendix 5, with V Ireland, The New South Wales Institute of Technology, Sydney, Australia, (4), as source.

3.2.10 Consortia.

Modern projects particularly overseas are impractical to be undertaken by single contractors with increasing size and complexity. From the viewpoint of the owner, most significant for the formation of a consortium is:

1. Acceptance of joint and several liability of each member.
2. Management atructure and mode of operation.

OVERSEAS CONTRACTS:

3.2.11 Local Contractors and Resources.

For political and economic reasons governments of most overseas developing countries are anxious to provide work for own contractors and develop indigenous skills. Also, they want to retain within the country a major proportion of profits and minimize outflow of foreign exchange. General considerations of overseas contract planning are:

* Discrete packages of work at local firms preferable
* Development of local Skills
* Transfer of technological and managerial skills

* Overseas manufacturer initially responsible for quality assurance
* Local training programmes in factory and on site.

3.2.12 Method of Financing.

When the project is financed through overseas credit, the effect on contract planning will mainly be:

1. Generally countries make available finance on preferential terms only, in order to stimulate own export business. Hence usually a substantial portion of the project concerned must be manufactured in the same country.
2. Usually, export credit agencies require contracting companies to enter recourse agreements, under which they undertake to repay the agency involved if default of owner should be due to a breach by the company of contractual obligations.

3.3 TENDERING AND PLACING OF CONTRACT

3.3.1 Methods for Choise of Contractor.

3.3.1.1 Open Competitive Tendering by Advertisement.

Public and local authorities are mainly using this very much criticised method; the purchaser is forced to accept a low bid by any firm and therefore, more competent contractors avoid such "cut price" competition voluntarily.

3.3.1.2 Competitive Tendering from Selected List.

Normally is the purchaser expected to from experience

of his own organization or with advice from consultants, be able to select on own initiative.

Within the purchaser's Tender Inviting Office then the procedure should be as follows:

1. Ensure seriousness of all firms selected.
2. Assess realistic period for tendering.
3. Check availability of all information required.
4. Select general conditions of the contract.
5. Examine appropriateness of specifications.
6. Prepare form of tender. On standard building or civil contract, prices will be shown in Bills of Quantities. For design and supply of e.g. plants, a more detailed form is required as follows:

Section I Tender declaration.
II Schedule of prices.
III Programme.
IV Conditions of contract.
V List of sub contractors and suppliers.
VI Management chart.

3.3.1.3 Selection from List Limited to Rates and Fees.

Because of urgency of the project and perhaps lack of design data, it is sometimes advantageous to appoint contractors on less than a total firm price. For instance, situations might arise when Critical Path Analysis shows need for collaboration between purchaser's and contractor's designers. Under such circumstances tenders should be obtained as price for profit and commercial overheads, rates and a fee for material procurement.

3.3.1.4 Single Tender Negotiation.

Due to need for speed or because the firm concerned is sole licensee for equipment required etc, negotiations with a single contractor may be necessary. The method of negotiation then , would be as follows:

1. Advise the firm of intentions of Single Tender Basis, but send under no circumstances out a formal invitation to tender as for competition.
2. Agree upon basis of negotiation.
3. Confirm agreed basis of negotiation.
4. Basis of negotiation.

3.3.1.4.a Methods of Price Negotiation.

Two basically, not necessarily mutually exclusive methods should both (!) be used on a major project:

1. Compare estimations of contractors with other prices already known to the purchaser, and which were obtained in competition for similar classes of work. Of course the major difficulty is the obvious one to compare like with like, and establish norms for adjustments.
2. Alternatively the tenderer is required to separate out commercial overheads and profit, and then break unit costs and quantities for each item of work into component elements.

Such a break down on a building or civil engineering contract could consist of:

* Indirect preliminaries
* Direct preliminaries
* Measured work

* Major materials and sub contracts
* Attendances and builders' work in connection
* Miscellaneous items.
* Temporary works
* Design
* Contingency

On mechanical and electrical contracts an appropriate break down would be:

* Design charges
* Bought in equipment
* Own manufacture shop costs
* Delivery charges to site
* Installation establishment cost corr. to preliminaries
* Installation materials
* Installation supervision and labour

3.3.1.4.b Discussion of costs and prices.

Particular points which may arise in price negotiations are: bought in items and materials, labour costs in work, design, method statements, materials on site and labour.

3.3.1.4.c Head Office Charges.

Normally charges for commercial or head office overheads are separated out from the remainder of structures of costing. Such overheads normally cover e.g. directors, secretariat, R&D, legal department, central finance etc.

3.3.1.4.d Price Escalation.

Because of the inflation of today, prices must only be agreed concurrently with agreement on the escalation formula in full detail on indices, fixed elements and method of application.

3.3.1.4.e Equality of Information.

All this means is that the purchaser is given reasonable confidential access to contractor's manufacturing costs, provided the item in question is frequently purchased.

3.3.1.4.f Proprietary Equipment.

If equipment manufactured by contractor, instead of ordinary negotiation, the contractor may satisfy the purchaser with ensurement of quality and comparision of list prices with those included within a total contract.

3.3.2 Planning the Tender.

Beyond specifications, prices and terms of offer, the point of view of the owner who will receive the bid is also very much a question of;

* Importance of tender in relation to markets as whole
* Totality of contractor's business occupied
* Likely actions of competitors.

Before putting tenders together, contractors therefore will carefully study inquiry documents, decide whether to treat inquiries seriously or not, and finally, if so, then prepare a tender plan.

3.3.3 Tender Preparation.

Most important points to consider when drafting a tender are:

* Essential requirements met
* Demonstration of skill and efficiency
* Pointing out advantages of the tender.

A tender for plant or equipment will generally consist of:

1. Covering letter - alternatives and reservations.
2. Specification - general and technicalities.
3. Exclusions and services provided by purchaser.
4. Terms and conditions of sale.
5. Quotation - validity, basis of escalation etc.

3.3.4 Tender Appraisal & Commercials.

Pay attention to in this context that:

* Civil engineering contracts under ICE condititions are re measurement contracts without initial Lump Sum Price. Errors in extention therefore have no effect on final price paid by the employer.
* Errors on Lump Sum Contracts always cause work to be carried out at tendered price or sum.
* Because of risks involved in design and construction, contracts may become battlefields for claims. At the stage of inviting and analysing tenders this situation might to a high extent be prevented by careful selection of which firms the client choose to invite and:

(a) ensuring availability of all information necessary

(b) examining of low bidders sufficiently.

After the contractor to whom the contract is to be awarded is selected two more steps are to be taken:

1. Make a permanent record of contractors' success w.r.t. Price of accepted tender, completion period and performance guaranteed.

2. Tell unsuccessful firms what to improve as a discussion about bids without criticism.

3.3.5 Placing of Contract.

Once authority is given by management to go ahead with the contract, strong pressure will occur to give the contractor instructions to start work immediately in advance of any formal Contract Documentation. The Contract Officer will therefore face a dilemma: how weigh risk of delay for following routines vs a week position of negotiating once work is started ?

By preventive actions, risks of such a situation can probably be avoided through:

* Issue complete inquiries
* Negotiate in advance about go ahead permission
* Split decision of placing of orders on many instances
* Sacrifice completeness against gain of time

Possibly a "Letter of Intent" issued to the contractor will be the solution, but misunderstandings may occur nevertheless.

3.4 TERMS AND CONDITIONS OF CONTRACT

3.4.1 Inter Relationships of Conditions of Contract.

Most engineering contracts have the same basic framework as illustrated in Appendix 6, (2). Quickly can be seen the extent to which sectors are interrelated. Solid lines indicate that two events will always be interdependent, while broken lines indicate two events may have a relationship. Thus take over is significant in connection with:

1. Passing of guarantee tests.
2. Reduction of liability for accidents, damage and insurance.
3. Release of part of the Retention Money.
4. Possibly commencement of the Defects Liability Period.

Some widely used conditions of contract are for:

* Civil Engineering: ICE Conditions.
* Building: Standard Form of Building Contract 1980.
* Process Plants: FIDIC

3.4.2 Security for performance.

Three types of Bond or Bank Guarantee which contractors may be required to provide are:

1. Advance Payment Bond.
2. Contract Performance Bond.
3. Maintenance or Retention Bond.

Also is necessary to distinguish between two more classes of Bond or Guarantee:

1. Conditional Guarantee; commonly employed by public authorities, and called only in case of occurrence of default precedent to enforcement of sum up to limit of value of guarantee.

2. "Cash" or On Demand Bond; possible to call by the owner without proof of default by contractors. Banks must then pay and have reimoursement from contractors concerned, under terms of agreement provided in the bond.

3.4.3 Contract Price.

Prices of contracts may broadly be expressed or calculated in three ways:

1. Lump Sum; the ideal of the owner. However, any divergence between contract price and actual cost of work, may spoil expected benefits and endanger the achievement of overall objectives. Furthermore, for building and civil engineering works where the owner is not responsible for design, the nature of subsoil and detailed requirements of specialists may cause delay.

2. Schedules of Rates or Bill of Appr. Quantities; activity items are priced by a contractor who is paid at those rates for work actually carried out irrespective of quantity !

3. Cost Reimbursement; speed of work is here more vital than lowest initial cost. Note that simple Cost Reimbursement provides no incentive to the contractor to minimise costs, nor any penalty should he fail. But because of risk of internal inefficiences, most contractors

actually dislike Straight Cost Plus.

Therefore Incentive, Target Cost or Cooperative forms of contracts have been devised to combine flexibility and speed of Reimbursement with measure of cost discipline and incentive to economy.

These contract forms have certain features in common:

* Parallel design and construction as opposed to in series
* Early establishment of target estimate
* Recording of actual costs compared to final target cost
* Owner and contractor share surplus / deficit
* Payment of a management fee.

In the diagram below is finally illustrated how the final contract price is arrived at under conventional and target incentive form resp. of contract:

Conventional contract.	Tender price.	+	Variations authorized.	+	Claims allowed.	
Final Contract price	=					
Target cost contract.	Final target cost after adjustments.	+	Mangement Fee.	+	Savings as per cent of: (Final Target cost - actual cost)	

SECTION TWO

CHAPTER 4

SYSTEMS SELLING AND CONSTRUCTION MANAGEMENT

Systems Selling, (SS), is denoting something of still more importance for decisions related to strategy and organization in the building industry. However, in spite of proof of practical importance and demanding procedures, SS is to a surprisingly low extent mentioned in the litterature. As a result also the term SS is not very well defined, and analysis of particular cases can not usually be related to any overall, authorized theory.

In the following therefore, an attempt is made to bring structure in the analysis of problems, conditions and consequences of SS.

Notable for the prevailing confusion of terminology, is the interchangable use of the terms: "Turnkey", "Large Industrial and Plant Projects" and "Systems Selling". In the following SS is assumed to be equal to "Turnkey".

4.1 SYSTEMS SELLING

Industrial Marketing is referring to goods and services which the buyer will use in his own processes or products. At one end of the scale the seller can offer a simple standard product alone, while at the other extreme end, a complete production, distribution and/or administrative process is provided. From now on selling of single products

is denoted "Selling of Components", (SC), while marketing of combinations of components, together providing a solution of the problem of the client is denoted SS.

Below the term SS is hopefully defined by an point by point outline. In first place however, the definition is adapted to industrial companies, by this less applicable to SS by companies with selling of services as speciality.

1. In SS the seller will offer solution to a problem more widely formulated than in the case of SC.

2. The system sold is composed of Hardware Components, (A and B), and Software Components, (C), e.g. problem solving service, commitments etc.

3. Components A, B and C are possible to procure separately to produce the System concerned.

4. The major parts of components in a system should be standard components, i.e. more than one of each must be available.

5. Each single system must be adapted to unique specifications of each client.

6. In SS, the seller is involved during all stages of the project, from the first analysis to operation and maintenance, and usually is responsible for the "function" as well.

Clearly this definition is very much depending upon what is meant by "Component" and "Function". Certain software is sometimes a necessary part of selling of more traditional components, and also is hard to establish an upper limit of the engagement in the business of the client. Therefore is introduced the phenomena of "Extension" of functions - e.g. selling of more

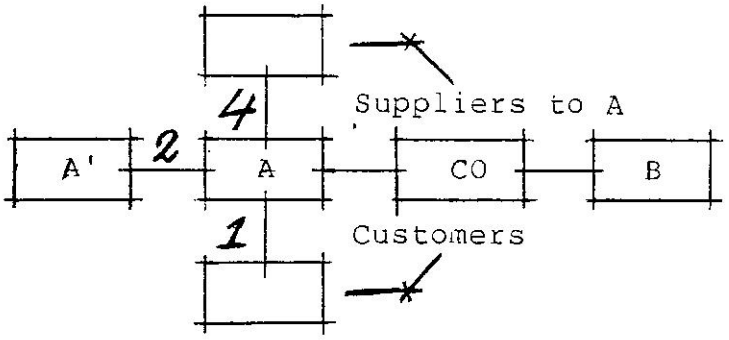
comprehensive and complex systems - and "Deepening" of SS - e.g. more engagement in business of clients - within concerned areas of functions.

4.1.1 Changes of market relationships.

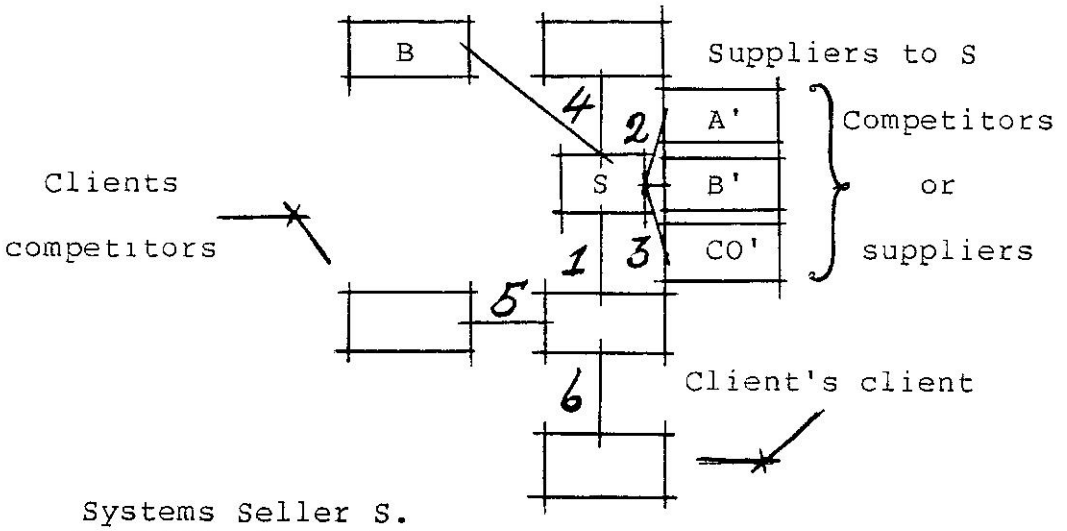
In particular, external relationships very much will change as a company is converted from SC into SS;

Relation 1: Clients; a illustration as below might show how the Systems Seller, (S = A+B+CO), will have to integrate the role of the Consultant, (CO), as well. Numbers are referring to relations examined.

Relationships in the Systems Selling Market.



Component Seller A.



Systems Seller S.

Relation 2: Competitors, (A'); not only other sellers of component A, but sellers of B and CO, are now competitors. Note how some components by specification must be supplied from competitors. Confusion may therefore occur whether A', B' or/and CO' are competitors or suppliers !

Relation 3: Consultants, (CO); the seller of systems is now a competitor to other CO, which he prefer to specify components of his own as required in their future contracts.

Relation 4: Suppliers; the question of who will initiate organization of the SS is crucial. Either it might be the Client, A, B, CO or a Joint Venture as a combination of A, B and CO, if no one of them from the very beginning is given.

Relation 5: Between clients and their competitors; because of the influence S will have on the function and many internal conditions of his client, S will sometimes have greater impact upon the competitiveness of the client than upon A !

Relation 6: Between clients and Clients of the Client; a result of Deepening of engagement in businesses of the Client. Also e.g. unions, authorities and channels of communication within the community must be considered.

4.1.2 Stages of Development of SS

In order to further define to what extent a firm is dealing with SS, three aspects are of importance to the involvement in SS; except from Extension and Deepening,

also must be considered the portion of SS as related to total turn over.

Four stages of development must be separated:

Stage 1: Components are dominant; SS is not yet a deliberate strategy of marketing.

Stage 2: Stage of introduction; SS is a deliberate strategy, but its portion of total business small, experience is insufficient and the organization mainly is reflecting requirements of SC.

Stage 3: Stage of development; relationships to external suppliers of soft and hardware are developed to facilitate Expansion and Deepening, (see above).

Stage 4: Matureness; Extension and Deepening are fully developed; most clients have experience of SS.

Undoubtedly SS cause pressure on acquirement and organization of still more resources required. Acquirement of resources is possible through four ways:

1. Internally already existing resources: overall know how and co ordination of specialists is most valuable.

2. Externally already existing resources: most crucial is the problem of whether to employ a supplier, enter a long term agreement or just enrol ad hoc

3. Internally newly created resources: distinguish in this case between unique and on basis of earlier experiences just copied resource. Examples might be to build new factories, establish new organizations for selling and service etc.

4. Externally newly created resources: in the very beginning of the process, external organizations might be

integrated; e.g. external R & D or take over of whole companies. This fourth alternative is the most uncertain and also most difficult to control, as quality and hence impact of incorporated (R & D) resources at present and in future is extremely hard to predict.

To in short touch upon Organization of SS, planning and control in Stage 1 in particular, is related to types of components as base units. Achievements are expressed in terms of sold volume, share of the market, contribution gained from each component etc. Personnel are furthermore usually specialised in, and have their reward from certain components only.

4.1.3 Procedure of Marketing in SS.

Characteristic features of organizations of clients very much depend on location of the markets concerned. For instance in Middle and North Europe, the client is technologically competent and will use planning departments of his own. Interaction between sellers of systems and clients is therefore custom. In South Europe, the banks are in a strong position at the expense of clients. In the USA and Canada, a consultant is engaged to supervise and procure. By this, commonly parts of plants only, are possible to tender for. A foreign seller of systems also in e.g. the USA, because of agreements with local unions face trouble when the question of sending own personnel is raised.

Organizations which are a part of, or will directly affect the decisionmaking process of SS, are interacting

according to a certain procedure. Decisionmaking is then related to certain sequential phases as explained:

1. Phase of Introduction; the seller is trying to:

a) Identify the client through e.g. previous contacts, exhibitions, agents or the foreign embassy of his country. Indirectly, advertisements in journals can persuade the client to make the first contact himself.

b) Evaluate the need of the client.

c) Collect necessary information for the future. Especially the client's plans of investment, competitors and consultants are very important to know.

2. Inquiry or Preliminary Study Phase; specification of technical matters, profit prospects and need. The seller is during this phase uncertain whether the client actually will realize his project or not, while the latter is not sure of what technical facilities are required. Of this reason, the seller is from now on mainly represented by specialists on technical matters, often having great influence on design.

3. Tender Specification Phase; the seller now will formulate a specification and will try to obtain guarantees from the banking system in terms of cash, completion in time etc.

4. Quotation phase; the client now will evaluate and collocate received tenders. Since the competitive bid procedure necessitate no information is released concerning other competitors, the client is in power position which he often will make use of in order to gain more favourable conditions.

5. Post Negotiation; when an agreement is reached, a

"Letter of Intent" is written and interpreted as not more than a promise only to the seller that he will be awarded the final contract. Formulation of the final contract will consume a lot of time, and through this arrangement both the seller and the client can start preparations in advance. The (technical) specialists of the client are now beeing replaced by a certain Committe which is more or less confronting the seller ! The battle of favourable conditions and reduction of prices now will escalate; the client trying to delay the procedure as sellers are vulnerable to expenditures due to fixed costs, while sellers will threat with withdrawal, however seldom realized because of previous investments.

6. Delivery and Commissioning Phase; encompassing construction and installment, and is ended by the complete system - e.g. a plant - finally is handed over to the client.

4.1.4 Aspects of Marketing Mix.

Below a systematization of pecularities of marketing of systems is outlined as opposed to marketing of components:

1. Price; while components are easy to compare and have a given price, systems are initially priced on basis of bid procedure. Because of much know how software involved, comparisions are difficult.

2. Product; products are judged on basis of attributes, while systems are related to functions of the client. Low quality in certain parts of a system might be disastrous.

3. Personal Salesmen; short, limited negotiations when

components bought one by one, while buying a system never is a matter of routine. Personal contacts and selling therefore is of utmost importance in the case of SS.

4. Sales Promotion; many customers of products make broad, extended promotion activities necessary, while proportion of costs of traditional marketing usually is almost neglectable as compared to cost of a certain system as a whole.

5. Distribution; many intermediary levels and alternative suppliers of components, while direct and smooth contact between seller and client is a necessity of SS. Finally time of delivery and responsibility of function are crucial matters for the end result, as experienced by the seller if commitments are not fulfilled.

Objectives of the part following are to provide details of experience with Management Contracting systems, their structure and applications. When clarifying distinctions between different organizational and contractual arrangements, management of design and construction is emphasised.

Construction Management, (CM), or rather as explained later on, the broader term "Management Contracting", (MC), covers various systems of project administration in which clients enters contracts with external management organizations operating as Management Contractor of projects with responsibility for management and coordination of in first place phases of design and construction. Initially, however a Management Contractor will provide pre construction services to an extent varying with character and stage of development of the project concerned. Normally a Management Contractor is assumed not to undertake any construction work on site but to provide services of control and coordination of activities. Note how in this report, organizations who carry out construction work within projects administered by management contractors are denoted "Construction Contractors", to avoid confusion with Sub Contractors in conventional contracts.

Since over the last decades, aspects of construction have become more complex technically, legally, financially, in speed and size and industrial relations, traditional approaches have proved to be inadequate. Many differing views on the value of new contracting arrangements

including Management Contracting Systems, are prevailing, but certainly must particular construction projects be carefully evaluated to ensure use of MC only in suitable circumstances.

4.2 CONSTRUCTION MANAGEMENT

Management of most Civil Engineering and Building Projects is divided between parties to a Construction Contract. In the case of:

a) Civil Engineering; Client, Engineer and Contractor

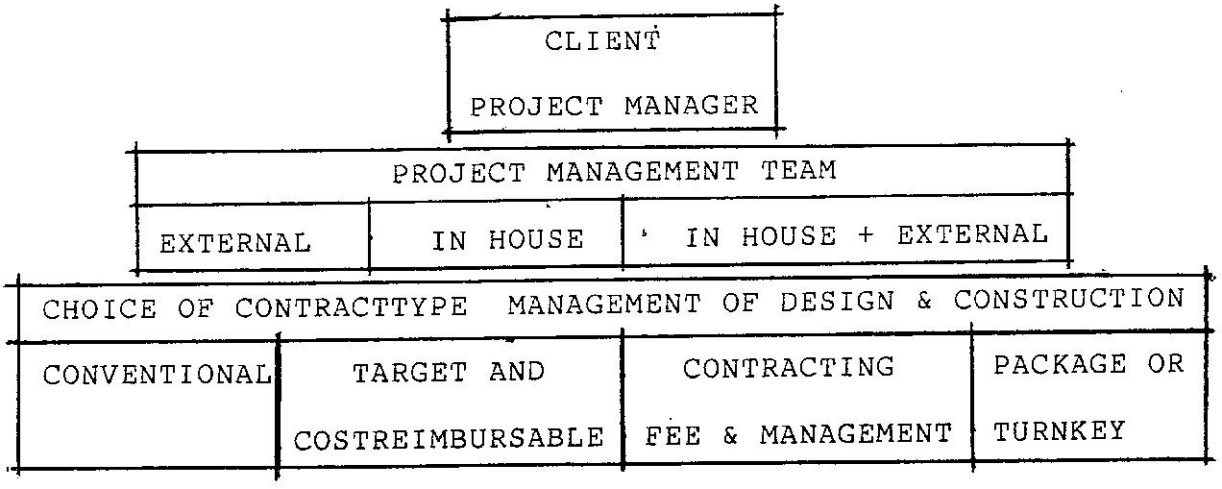
b) Building Industry; Client, Architect, Quantity Surveyor and Builder

they will all be assumed to have management responsibility in conventional roles. Ultimately, however, clients have responsibility for management of projects. The Client and his Project Manager must for any project take two major organisational decisions:

a) organization for overall project mangement

b) organization for design and construction.

Organizational choices available for formation of project and Construction Management Teams is illustrated below:



A single Project Manager from within the organization of clients should for each and every project be given necessary authority and responsibility to act on behalf of the client. Management teams can as shown be assembled in one of three main ways, while there are a number of choices of contract types available to a client and his project manager. This second decision will directly determine in what way management and organization of design and construction will be carried out.

4.2.1 Roles in MC

Because new roles of parties in MC are not yet well established, commonly duplication of effort is found between Client and Consultants (Engineer, Architect, Quantity Surveyor etc.) and Management Contractor. Some primary functions and responsibilities of parties in a project is listed below:

4.2.1.a Client; define the project and limiting or controlling conditions and thereafter provide decisions, approval and guidance in its development.

4.2.1.b Architect & Civil Engineering Consultant; to enable Management Contractors to make a sensible contribution to design, Designers must accept another party giving suggestions, recommend alterations and challenge concepts. Arrangements of quality control therefore, should be agreed and/or incorporated in an appropriate part of the terms of appointments between Designers and Management Contractors.

4.2.1.c Quantity Surveyor; on Building Projects his role is determined in early stages when he may be part of, or

adviser to client's management teams. Generally central matters are production, evaluation and reporting of information concerning tendering, contracts and finance. During the phases of design and construction detailed administration is added, and above all responsibilities between Q.S. and Management Contractor must be clearly allocated.

4.2.1.d Management Contractor; two principal roles of:

a) supervision of work on site, and

b) managing of design and construction always including programming and administration.

Allocation of more usual management functions and responsibilities in construction projects is schematically illustrated in Appendix 7, (3). In this table functions are allotted to the party most frequently responsible for them in typical conventional Civil and Building Construction Projects. Responsibilities can vary from project to project. but in all cases is a management team of the client recommended to exercise overall control and to have responsibilities for "strategic decisions".

Because of the Management Contractor working so closely with the client's management team, MC is said to be more related to a professional service than to a normal construction contract. In three areas this is reflected:

1. Emphasis on management considered as a separate and contractually well defined discipline within the project.

2. Payment mechanism, usually Cost Reimbursable Fee.

3. Allocation of risk between clients, management contractors and construction contractors as significantly different from conventional contracts.

4.2.2 Systems of Management Contracting.

a) Management Contract

b) Construction Management Contract

c) Design and Management Contract

d) Project Management Services Contract (Process Engineering and Offshore Industries)

4.2.2.a In a Management Contract, permanent works are constructed under series of construction contracts placed by a Management Contractor after approval by the Client. In UK this type is used in the Building Industry, but rarely in Civil Engineering. Contractual relationships are shown in Appendix 8, (3).

4.2.2.b In Construction Management Contracts, also often termed "Management Contracts", Construction Contracts are directly between clients and construction contractors with a Construction Manager acting as the Agent of the client. Extent of risk and liability carried by a construction manager can here vary considerably, and has so far been a matter of negotiation at the time of his appointment.

Especially in USA, large numbers of contractors and architect & engineering firms offer this service. Frequently up to one third of the turnover of US construction and engineering firms is quoted to be provided by CM. An apparent difference between UK and USA is not so much the extent of use of CM Contracts as described here in 4.2.2.b, but rather the emphasis which the client places on management of design and construction; CM is generally regarded as a professional service offered by agents with

all contracts directly placed with the client. British concepts of management contractors placing contracts and yet seeking to be considered as professional is unusual in the USA.

Services offered are a function of the type of organization and limits of liability possible to accept by a firm. Design and construction would appear less sharply categorised in the US, and primarily clients in the Building Industry consider CM beneficial to:

* overlap of design and construction (Fast Track)
* apply strong control of cost
* achieve completion in time.

In the Civil Engineering Industry, (power and transportation particularly), clients see benefits of CM as effective in:

* managing and controlling complex projects
* assisting clients to satisfy requirements of regulatory and environmental bodies
* budgetary control

4.2.2.c Management contractors in this form undertake both detailed design for projects and management of construction. Extra potential as opposed to a Management Contract is given for integration of design and construction, together with simpler administration and coordination.

4.2.2.d An approach evident on very large scale and complex projects associated with e.g. off shore construction.

CHAPTER 5

EVALUATION OF CONCEPTS

In this fifth chapter following, an attempt is made to evaluate the in this report rival concepts of SS and CM. As method is choosen the broad outline, more or less point by point an examination of benefits and disadvantages, sometimes even without certain underlying systems of logic. However will potential clients hopefully find use in understanding the view of the "seller", i.e. the Systems Seller and the Construction Management Firm. Not least when evaluating various arguments of sellers, is good to know what factors are affecting profit of consultants, perhaps the main purpose of this review.

5.1 CONCEPT OF TURNKEY & SYSTEMS SELLING

In first place, companies when considering whether to enter the business of selling systems or not, probably will consider factors of direct importance to prospects of profit. Before systematizing such factors, some often mentioned general arguments for and against SS will be examined;

5.1.1 Reasons for Systems Selling.

5.1.1.1 Arguments of Revenue.

For: selling of systems will;

* result in higher price for hardware components than if sold separately

* increase competitiveness based on superior know how

* Deepen involvement in business of clients, and result in opportunities to sales in future when time for maintenance and replacement of equipment and machinery

* mean adaption to actual conditions of markets and improve R & D in areas of relevance to clients - increased competitiveness in the long run will follow

Against: selling of systems will;

* make it more difficult to transfer gained know how into monetary revenue; certain systems may be used by competitors supplying them with components of their own

* result in less quantity sold as some consultants will become competitors and else would have suggested "our" components

* restrict the market because clients want to prevent their competitors from having access to systems used by themselves

* cause resistance of buying as clients not are ready or organized for buying whole systems

5.1.1.2 Arguments of Cost.

For: selling of systems will make necessary a thoroughly examination of whether authorization of certain products and functions are justified; control of internal relationships between hardware components will improve, as will suppositions w.r.t. introduction of standardization.

Against: by selling systems;

* big investments in general development will be required before expecting a reasonable level of sales as return

* costs of software will be hard to calculate and cause prolonged uncertainty

* cost of finance will increase as selling a system is much more time consuming than selling corresponding components

* advantages of large scale will be hard to achieve because every client has so different requirements.

5.1.2 Consequences of Revenue and Cost when Selling Systems.

In order to increase possibilities of to analyze systematically reasons for actions of the seller, some different types of consequences are identified. Characters as symbols (A, B, CO) are referring to the model in Chapter 4.1 of changed relationships when starting selling systems.

5.1.2.1 Consequences of Revenue.

Principally the company considering selling systems may regard one or more of the positive consequences as possible to realize: revenue will increase because;

* increased volume and/or price for hardware components, (A) - difficult for the seller to compare with competing products and for the client to distinguish certain prices of components among other

* hardware components, (B) added to sortiment - effects of synergy expected

* more software & know how, (CO) - already earlier existing know how will now be commersialized

* long term relationships, (A, B or/and CO) - aiming towards maintenance and development of systems sold

* long term R & D - orientation towards market and

relevant applicatons

* competitors will face more difficulties entering a market of system selling - level of prices are expected to remain high when fewer competitors

* innovative nature of systems - innovations are possible w.r.t. components, organization or the system as a whole.

Important is to be aware of reasons for aiming at revenue from systems selling when analyzing realism of attempts. Note how also negative consequences of revenue may occur:

1. In first place resources devoted to selling of systems might have given higher revenue when allocated to selling of components - productivity of salesmen is expected to be higher in the short perspective.

2. Heavy initial investments are required in periods of transitions between stages of development, (see Chapter 4.1.1), which result in later return on investments as compared to if resources used for investment in selling of components

3. As briefly mentioned above, the transformation of former suppliers or consultants into potential competitors, may cause less components sold.

5.1.2.2 Consequences of Cost.

Systematization of consequences of cost when selling systems, is preferably done on basis of division into soft and hardware components, and general systems vs those specific for certain clients.

Costs connected to general ability to sell systems:

* acquirement of know how, (CO), in areas of function, technology, markets etc to develop over all systems

* acquirement of resources for production of new hardware components, (B)

* investments in Public Relation Activities to ensure reputation of "Puzzle Solver"

Investments are to a certain extent possible to exchange for cooperation with other companies; e.g. must not B be produced through own resources.

Costs connected to individual projects:

* cost of software components, (CO), including e.g. service, education of operational personnel etc. - this cost is likely to decrease with increased experience and standardization of systems

* cost of software components, (CO), without any specific know how required by the seller - usually an expression of cost and risk as the responsibility of the systems seller as compared to sellers of components is hard to determine

* cost of production of hardware components, (A, B) - costs mainly affected by similarity of systems and size of production i.e. economies of scale w.r.t. aspects of coordination in time of different projects.

In conclusion, from the point of view of costs when selling systems, is need for heavy (software)investments, and as a result, uncertainty about required engagement in projects in terms of time and involvement. Selling of components means easy to define the product, and responsibilities is described in terms of technical norms and clauses of law. When selling systems the "product" and responsibility is hard to describe in terms of technology, economy and judicalities.

5.1.3 Client's Point of View.

By beeing aware of such reasons as mentioned above, clients are likely to be less susceptive to seducing arguments of systems sellers. In particular these reasons will serve as a back up to in the context, see and evaluate arguments for and against buying whole systems from purely the client's point of view, more closely examined in the following:

For: by buying a system;

* the know how gained from the seller will be superior to our own
* the responsibility of function is placed at the seller and hence, reducing the risk
* the experience of the seller is a guarantee for good performance
* is an over all solution for the long run obtained
* is the only alternative existing bought - the problem is to choose the seller
* is cost and functions more easy to estimate in advance for the whole system - factors of uncertainty are very much absorbed by the seller

Against: a systems seller will;

* have too little experience of significance
* cause uncertainty regarding his capacity of problem solving
* mean greater financial engagement and adaption of the function concerned as compared to buying components
* cause big dependence in the long run - risk of too small flexibility

* result in risk of specific solutions spread to competitors

* not be adaptable to existing organization with personell perhaps making much of the systems sellers services redundant.

5.2 CONCEPTS OF MANAGEMENT CONTRACTING

Most important for clients to recognise is how when MC used, contractual and organizational arrangements are different from those in conventional contracts. Without such an awareness, full benefit of the approach is unlikely to be achieved. In order to give a background, therefore the old, traditional approach of the process of building is briefly outlined;

In tne first phase of Decision, the owner establishes need for facilities and define requirements and budgetary constraints. An architect is hired for the next phase of Design. Since phases are sequential in nature with all the time new people involved, the owner has little direct control, but will nevertheless pay all bills. For example during the Design phase, owners have no sure procedure for evaluating cost implications of architechts proposals. Typically, if favourable alternative procedures becomes known after the third phase of Bidding, changes will necessitate major revisions and expenditures of time and effort. During the fourth phase; the very Construction, most of the work is sub contracted by the general contractor who mainly therefore manage flow of materials and men. For inspection of work, owners depend upon their

architects who seldom have the expertise necessary to question or reject details of schedules, or to determine if performances are to be improved. Above all, contractors usually have no incentive to reduce costs of building, but rather tends to side with their well known sub contractors against the owner. Finally the architect conduct a last inspection before buildings are handed over to the owner.

5.2.1 Strengths and weaknesses.

Particular strengths and weeknesses of MC when compared with more conventional arrangements, can be summarized as follows:

5.2.1.1 Strengths.

Time can be saved by a more extensive overlap of design and construction than is normal. Also the Management Contractor may have special experience applicable of how to plan construction.

MC can give flexibility to accommodate uncertainties where programme and design are ill defined and subject to change - projects can be splitted into series of suitable contract packages.

Savings of cost is achievable through:

* better control of design changes
* improved buildability and planning
* press upon prices due to increased competition
* packaging of work better coordinated and adapted to construction contractor's capabilities.

Emphasis is placed on needs for clients to make timely decisions to ensure availability of design information to meet needs of sequential construction.

5.2.1.2 Weaknesses.

When absence of direct contractual links, clients may be exposed to greater risk from Construction Contractors than in conventional approaches. Also uncertainty is due to absence of overall, stipulated price for completed works at start of construction.

No standard Conditions of Contract are established, and those offered by Management Contractors are very differing.

Roles and responsibilities of designers and Management Contractors for quality control, usually requires clarification.

There is a general tendency to produce additional administration and some duplication of supervisory staff. Additional direct costs to a client plus the fee charged, must be assesed against savings of cost and time.

Management Contractors sometimes lack specialized knowledge in areas of e.g. electricity and mechanical matters, important for projects with high contents in these areas.

Ultimate responsibility for methods of construction and risk of different opinion of design organizations, may limit the ability of the Management Contractor to ensure compatibility between design and construction methods.

5.2.2 Liabilities, risks and incentives. Risks must be acknowledged and clearly allocated between client and contractors. Preferably they are carried by the party best able to assess, evaluate and control them. Usual incentive mechanisms to ensure efficient performances of all parties

include: bonds, suitable insurances, retentions, bonus/incentives, liquidated damages, defect/maintenance periods, warranties etc.

Some difficulties have arisen in MC, because parties involved not fully have understood the roles of each other or changes introduced in contractual arrangements. Main factors to be appreciated are:

* except for proffessional negligence, MC is relatively risk free for a Management Contractor

* Reputation and need for future work are principial incentives for a Management Contractor, similar to those of a professional consultant

* construction risks, neither risk of default, nor incompetence on part of Construction contractors, are normally accepted by a Management Contractor.

Generally, if clients adopt MC, they re allocate risks of conventional contracts and therefore will have to accept somewhat increased exposure to risk. On the other hand however, while definition of liabilities and allocation of risk is vital, MC does not necessarily result in greater total risk; improved management of mainly design and construction phases, should be a significant factor in lowering risks of time in the long run and claims as well.

Management Contractors required to accept liability for liquidated damages, have a position similar to conventional contractors. Fees will have to cover additional risks - not recommended. Normally Management Contractors do not accept risk of poor workmanship by Construction Contractors or the use of inadequate materials. Consequently, if cost of repairing not is recovered from Construction Contractors,

it is borne by the client.

Factors to be considered when apportioning responsibility for defects normally include:

* point at which defect liability/maintenance period, (dl/mp), should commence for Construction Contractors

* extension of dl/mp for certain selected contract packages of projects

* balance of risk between imposing a dl/mp on Construction Contractors and cost of extension of dl/mp to achieve full maintenance cover until completion of the project - clients are recommended to have contingency funds to cover risks involved

* need to ensure remedial work carried out promptly by Construction Contractors.

Generally, in MC where a number of Construction Contractors are involved in projects, responsibility for any particular damages may not be possible to identify. Assessment of this kind of risk will therefore be similar to the one needed in conventional approaches of several contracts !

5.2.3 Management Contracting in Civil Engineering.

Generally, potential use of MC in Civil Engineering, (CE), is more limited than in the Building Industry, (BI). Some main reasons for this are:

* conventional CE admeasurement as compared with normal Building Contracts, can cope more readily with design change and overlap of construction with design

* CE industry is less fragmented than BI; fewer clients, larger projects and often experienced in house project

management expertise is available

* possibly, difficulties may occur when allocating responsibilities between a Management Contractor and Construction Contractors for methods of construction and design of temporary works. Such works can form a substantial part of work in CE projects, and a conventional contract places the responsibility with the contractor.

Nevertheless is a case for considering MC in CE because:

* an application appears to be on multi discipline projects, particularly those on congested sites, involving a number of contractors and sub contractors needing close control of interfaces and programme, and where suitable policies are required for industrial relations

* in developing countries, where lack of local management expertise, CM training for local engineers as counterpart staff have a potential.

In conclusion, use of CM does not guarantee successful management of projects, but is undoubtedly an attractive alternative to traditional procedures which all potential construction owners should be aware of.

CHAPTER 6

VIEW OF THE OWNER - METHODOLOGIES TO EVALUATE

In the end of Chapter 2, was arrived at a general method of deciding what strategy to use for projects. In the fourth chapter the concepts of Systems Selling, (SS), and Construction Management, (CM), or rather Management Contracting, (MC), was broadly described. In Chapter 5, SS and MC was valuated as an outline for and against. As a consequential next step, in this chapter will be described how to evaluate certain proposals based on SS and MC, in order to select a certain Systems Seller and Management Contractor respectively.

Finally will also as a further step be given suggestion on how to decide which concept to apply to a certain project, i.e. how to compare the appropriateness of the two concepts.

6.1 TENDER ANALYSIS

In Chapter 3.3.4, Tender Appraisal was one of many subsequent steps in the Process of Contracting. Now a way to systematise the approach to the assessment will be explained more in detail. The aim should be to make the appraisal as objective as possible, in order to both to establish uniformity and to reduce any bias which may exist towards or against any particular tenderer. The Purchaser's

overall objective should be to select that offer which he considers will prove to be most economic when assessed over a reasonable pay off period, provided always that capital costs of the offer currently can be afforded.

Appraisals must be treated as joint technical and commercial exercises, and on e.g. the financial side must embrace factors such as terms of payment, consequences of earlier or late completion and effect of purchaser's cash flow position of paying increases in capital cost to secure reductions in operating and maintenance cost etc.

One possible system to assess could be on the following lines:

1. Check arithmetical accuracy of all tenders.
2. Correct any arithmetical errors found, and obtain confirmation from the tenderer that he agrees corrections.
3. Consider initial capital costs, and eliminate from further consideration any offer more than a stipulated per cent over the average of the lowest two.
4. Examine tenders against a previously prepared technical and commercial checklist and eliminate as required. Adjust bids by a financial bonus or penalty according to whether bids are above or below called minimum standard, or whether bids would cause lesser or greater ancillary expense.
5. Reassess correct bids and select the two most favourable for discussion.
6. Call in these two selected bidders, raise a preselected list of questions and insist on submitted written confirmation when points can not be settled at the time.
7. Make final selection from adjusted and completed bids.

Recommended is to draw up checklists in tabular form

with e.g. the answer yes/no to be deleted, according to whether essential requirements have been fulfilled or not. In a second column would be noted adjustments to be made to the contract price according to whether the offer was financially more or less favourable than the norm.

With a major contract, in Stage one tenders might be examined only to check compliance with essential requirements. Stage two then, is assessment of overall financial merits of those offers which have satisfied Stsge one. By this a large number of tenders otherwise difficult to handle, can be considered.

If further sophistication to make a decision is required, a Points System can be applied which will weigh respective factors. In advance should be decided upon what weighting to be given to factors such as e.g. Price, Completion Period, Management and Q & R. For further comments; see 3.3.4.

6.2 SELECTION OF MANAGEMENT AND CONSTRUCTION CONTRACTORS

For a client is important to recognize different contractual and organizational situations created by use of MC, and to approach his selection of a Management Contractor with care. As a new member is added to the team, is particularly important to define his precise role. Sensible early design and procurement input can only occur in the pre construction period, hence requiring the Management Contractor to be brought in as early as possible.

6.2.1 Selection of a Management Contractor.

Following stages are of importance in selection of a Management Contractor by clients and advisers:

1. Compile a Preliminary List; 10 to 15 firms with a good record.

2. Short List; 4 to 6 firms acceptable both to the client and the design team. In particular attention should be given to the capability in specialist areas.

3. Briefing Meeting; presentation of a brief outline of the project to each tenderer to avoid later inconsistences.

4. Formal Enquiry; following information should be included:

* roles and responsibilities of all participants
* description of, and constraints upon the project
* specification and quantitative document from which the budget estimate, provided by the Management Contractor
* critical dates and duties required
* extent of design and Conditions of Contract

5. Submission; full respons to the brief required

6. Presentation; allowance of close questioning

7. Evaluation; for the very assessment, the interviewing panel of the client and his advisers should take into account both a) Financially Quantifiable, and b) Subjective Aspects.

a) Quantifiable Aspects should include:

* management and pre construction fee
* budget estimate of construction cost
* estimated cost of if required, to provide site facilities

* estimated cost of Management Contractor's staff

For bid assessment is the Project Manager recommended to make his own estimate of the number and types of management staff required.

b) Subjective Variables are normally appraised using a Points System. According to their importance in a particular project, items are weighted from a list including for instance the factors following:

* appreciation of projects
* role of Management Contractor
* management strategy (method)
* planning and programming
* procurement methods
* financial and cost control
* site supervision and quality control
* design w.r.t technical experience and resources.

Appraisal of Subjective Variables is recommended since success of Management Contracting is critically dependent on people employed on projects and the management procedures of the selected firm.

6.2.2 Selection of Construction Contractors.

In conventional contract arrangements clients and their advisors are normally not involved in the main contractor's selection of sub contractors. Management Contracting however, allows a client and his professional advisers to indeed be involved in selection of Construction Contractors, the degree of involvement usually determined by importance of the particular package.

6.3 CHOICE OF THE OWNER - HOW TO COMPARE CONCEPTS

A broad categorization as outlined in the second chapter, is mainly a tool to achieve general guidance as a hint of what structure of the organization would be appropriate. Most useful perhaps it is to develop a broad, generally applicable framework, in order to review possible alternatives and exclude those not feasible whatsoever. However, purely organizational matters per se are usually not in first place of importance to owners and sponsors. Instead the financial model used to calculate anticipated Return On Investment and Payback Period, is the main yardstick for evaluation and comparision of methods w.r.t. expected result.

Except from currency risk, lenders will seek protection against eight principal risks through:

1. Credit risk of project sponsor; adequate sophisticated financial management ability required.
2. Natural sources or raw material; confirmation of reserves w.r.t. quantity and quality.
3. Transportation; if the product beeing produced must be transported to market before it can be sold.
4. Market or commercial risk; specific provisions included.
5. Political; assessment e.g. on country by country basis.
6. Force majeure; assuring against delay or interruption.
7. Design and construction; sponsors sometimes include request for sufficient funds to complete construction. Because cash flow will be generated only by the operational

project, usually a completion guarantee is required by lenders from project sponsors - even if original capital costs are exceeded, the project facilities will be completed by a specific date. Especially if the project financed incorporates new technology, lenders may require an unconditional financial guarantee from sponsors until continous operation. Cost of consultants to give independent confirmation of technical and economic feasibility, would be for the account of sponsors.

8. Operating or management risk; among important questions to be answered and carefully evaluated are:

(a) Does the location of the project cause any unusual concern regarding remoteness, climate, work force and infrastructure availability ?

(b) Are there any environmental concerns regarding water and air pollution or reclamation ?

Eventhough financial matters are not within the scope of this report, especially the two last mentioned risks must be considered as related to questions of organization. Not least by what method activities will be carried out, may directly affect e.g. result of assesment by lenders.

Large capital cost or size imposes great risks on all concerned. Particularily the client, usually is much more exposed than consultants or managing cantractor who often can pre determine and limit financial exposure.

With many variations existing in terms and conditions for manufacturing or construction contracts, generally, the larger or more remote the project, the more the client must reliefe contractors of unfair exposure. Otherwise almost certain, over pricing of the project will be the result.

Terms and Conditions of Contract therefore, must be equitable to the contractor and the client with the risk residing in the appropriate quarter.

The two basic types of construction contracts are: first; Fixed Price Lump Sum (Turnkey system), and second; Reimbursable Costs plus Management Fee. With a flexible and modern type of contract, e.g. as described in Chapter 7.2 below, the client is allowed to carry out essential changes, and may tender without fear of risk of undue financial penalty. An other example of how to avoid conflicts is a new type of contract widely spread in the UK; by explicitly stipulate that all details of construction is a matter of tne contractor solely, arguing will never have to take place about responsibility for costs in the case of necessary redesign when cnanges made.

Hence is very much open to the question from which category of the two basic concepts of Turnkey and Management Contracting witn separated construction, the method to be used should be derived. Cnoice of metnod is hereby suggested to be made on the basis of the following criteria:

1. Proportion of the whole project represented by building and civil engineering work; Assuming this is X per cent on a plant project, then if the anticipated saving by separating out civil design from construction is Y per cent, this would represent a (X:100 * Y) per cent saving on the total project. Reduction in completion period likely to be achieved by a traditional Turnkey method, then should be assessed together with advantages of revenue and lower escalation cost. Both alternatives then are fed into the

Financial Model used as superior measurement.

2. Whether design is carried out by the clients own engineering department, or if consultants are required to be engaged; If the latter, then Fees need to be taken into account when comparing costs.

3. Character and complexity of the project; The choice of contractors is wide, and important is therefore to choose the one most suited to the particular project in hand. Both size and type must be considered. Very large contracts can be handled only by a large contractor, in the office of which, conversely, a very small contract can get lost.

If it is feasible for one firm of consultants to design the whole project and to put construction out to several firms on construct only basis, and works are not so closely inter related that each is dependent on the other to an extent which it would be difficult for the consultant to coordinate, then separation of design and construction might be most cost effective. Alternatively, the less civil engineering / building contents in relation to mechanical / electrical / process work, then the Turnkey method would be more likely to be favourable. Note however in this context the occurrence of specialists within certain sectors of construction or plants. In some cases the number of companies able to provide a particular facility is extremely limited, and hence, the choice of supplier very easy.

In terms of complexity, the determining factor for type of contractual conditions is the State of Knowledge that the client has for the particular job in mind. If requirements can be precisely defined, e.g. in t/d, then

several capable contractors could give a firm, fixed price offer. At the other end of the scale, where for instance a new process cause requirements for development and scale up to a certain production capacity, then a fully reimbursable contract may be equitable to both parties.

4. Anticipated level of profit or cost savings to be generated by the project, critical dates these would arise and anticipated rate of escalation over the period of construction. All and each of these factors are significant in respect of benefits to be gained by early completion, in some instances the over riding factor; in order to catch a seasonal trade, e.g. a facility must be operational by a specific date.

Once more we here notice the importance of over all look upon the project in the context. For instance, the total number of projects actually planned, might be of importance. If shortage of work, clients are very much in a favourable position to choose between proposals characterized by hard competition. On a more practical level well established relationships to e.g. a management firm might be the crucial factor of choice. In particular good advisers are important. In order to obtain an objective estimation of reasonable cost for a project, a consultant is useful. To this category belong except from Project Managers, also Quantity Surveyors and Design Companies without construction capacity of their own. Contractors and Construction Managers are likely to trying to persuade clients to adopt alternatives of design and organization, which will be suitable for in first place their own way of working. In other words, very important is

to know the organizations supposed to be involved, i.e. to be familiar with the people who are to do the job.

In Appendix 9 are summarized some aspects of relevance for the owner, when regarding a project in its entirety. Note in this collocation how many of the characteristical parameters that are human oriented. In principle, production processes can be controlled by two means: formalized, pre programmed action or ad hoc action based more on collaboration, intuition, creative and resolute behaviour than on planned procedures. However, they are interchangeable as effects of inadequate planning can be neutralized by ad hoc action, and lack of ad hoc resolution be remedied by extra planning.

Crucial to feasibility of a given strategy is amount of uncertainty. Generally are situations characterized by low degree of uncertainty accepted to most efficiently be handled with a high degree of planning, (long horizon and many details), by an organization with a Mechanistic, centralized structure.

On the other hand, it is normally taken for granted that situations with high degree of uncertainty are handled most efficiently with ad hoc decisions guided by plans with a short horizon and few details, by an Organic, decentralized organization.

A picture of the environment of the construction company should at any rate include the following details:

* high degree of managerial and technological uncertainty
* complex and changing technology
* many intra- and interorganizational interfaces
* a stream of unique projects with many changes.

Undobtedly this picture, compared with e.g. the manufacturing industry, indicate occurence of organic organizations, having a relatively high level of uncertainty. In such a case good ad hoc decisions are far more essential to success than any amount of formalized planning. Regardless of the structure, capital is one most important mean of production in an organic organization. On the otner hand, fixed assets such as equipment, management systems etc, are not regarded as critical whereas people are. Hence, an appreciation of rationality of order of priorities would be: people first, money second and technique third. Applied on the situation of the client in the situation of having to make a choice, it is most important to get an idea of how the organizations considered to be engaged actually are working w.r.t. inter personal relationsnips. Even to if possible have a look upon how the practical construction work on site will be carried out, mignt be of importance. Experience and studies indicate big advantages when for instance the men on site are asked to syntnesise effective methods of construction work themselves. Teams may base plans of work on heuristic scheduling rules, appoint a specialist director to coordinate operations or place emphasis on each worker's ability to anticipate events. In some cases groups allowed merely to watch another group attempt a task, were able to by mere intellectual activity alone, reduce their first attempt time to approximately 40 per cent of the original group time.

Conclusions to draw therefore would result in comments upon engaging organizations with production capacity of

their own. By this, advantages of tradition and feed back of experience from practice are more likely to be utilized. Also when the working men more or less constantly belong to the same organization, union conflicts and problems with allocation of workforce easier are avoided, all resulting in the owner less exposed to financial risk.

Furthermore, comparative studies of different methods of practical work indicate that anyone of technical procedures used, would have been optimal under certain conditions. This implies that there is no singular best way of doing a job, and that prescription of methods of project management by analogy are fundamentally misguided. It is assumed that optimum strategies cannot in any way be worked out in advance, and must be custom tailored to the particular situation. However, where the current problem bears a close resemblance to previously solved problems, the previous solution may be transferred across. Merits of the solution in this instance will depend on closeness of the analogy. In summary, choice of method to apply must be worked out from first principles. In this view then, Project Management is in fact a process applied to a situation, rather than a mere execution of a sophisticated technique or procedure.

CHAPTER 7

SUMMARY OF QUALITATIVE EVALUATION

7.1 CONCLUSIONS

Management Contracting is possible to apply on many different projects including factories, offices, airport building, refurbishment etc. Circumstances in particular favouring its use throughout the process are:

* when need for early start to the construction phase required for e.g. political reasons, budgeting or procurement policy
* need for early completion, but design is not sufficiently defined prior to construction
* particular construction methods must be considered during the design phase
* in high technology, complex projects, is provided for flexibility for design change
* organizationally complex projects due to e.g. many contractors or design organizations involved
* insufficient in house management resources.

These circumstances do not, individually, demand the use of MC as the only feasible alternative. When a combination occur however, they are likely to lead the client to adopt the concept of MC.

Undoubtedly, different methods within MC have saved substantial amounts for construction sponsors, and promises

to revolutionize the process of building have to a certain amount been fulfilled too. Impressive results have made individuals and corporations, local agencies and governments too, to turn to it in increasing numbers all over the world. What role will then the traditional contractors play in the future ? Are they deemed to more and more becoming just one of many sub organizations, coordinated by Construction Managers on their different projects ? At least that is the impression you get when studying the information obtainable from several management firms. Generally, descriptions of benefits and disadvantages of methods are very simplified indeed. For instance are all contractors assumed to solely use the Traditional Method featuring purely successive stages of e.g. programming, design, procurement and construction. Often is overlooked how contractors with resources of their own can undertake much more on a site than just building works, and not very many contractors nowadays still are devoted to traditional concepts. As a matter of fact, many arguments of management firms are the same as those frequently used by contractors. Furthermore, actually everything of what a management firm normally is undertaking to do, contractors very well could have the capability for, or are already doing !

When asking a Management Contractor what services provided by him, not possible for clients to obtain from a contractor, usually is emphasised the close advisory relationship to clients in very early stages of a project. However, as contractors always are trying to industrialize the process of building to make it still more effective,

cooperation with all other other participants is a necessity. Therefore the contractor usually is naturally participating already during early stages of programming and design. Certain advantages are e.g. possibility to adapt the design to planning of procurement and phases of construction, make use of the often superior know how of constructors concerning building materials to put pressure on costs, give tne contractor more responsibility through increased involvement etc. Note also tne fact that the contractor is competing with price and product as well !

In particular is more and more noticed the importance of planning for the whole of the lifecycle of a building, with regard to operation, maintenance, growth and replacement. These aspects, possible to take into account already in phases of programming and design, will directly affect annual costs later on. Except from the fact that very few pure management firms have experience of phases of post construction, the appropriateness of breaking the continuity of the process, by handing over physical construction work to other organizations involved is questionable indeed. In business in practice, objective prices are not relevant. All estimations and bids include provisions and guarding against risks, special features of the project etc. Therefore, responsibility for price if construction is delegated to other parties should not be economically feasible, referring to management firms as well. Good relationships to clients is what management firms usually bring forward as main reason for looking after the interest of clients. To claim responsibility for costs of the construction of other parties, must be to put

your reputation at stake. Clients claiming that Turnkey will not give value for money, should instead check the appropriateness of their specifications as stated in inquiry documents. This is relevant irrespective of procuration through negotiation or competitive bidding procedure. In order to be informed of what ne will get for a certain price, the client is recommended to ask for price for different alternatives. Still the choice is possible to make at a very early stage.

Below is listed an array of arguments often mentioned by contractors to defend their position against advancing Management Contractors: "The Turnkey Contractor has";

* more experienced personnel of all categories
* social responsibility for directly employed personnel at site, and is well suited to take it
* internal training courses for all levels of personnel to improve rationality of construction processes
* possibility to offer the client special equipment and machines and methods adapted to the project concerned
* press on prices of equipment and materials through centralised agreement of procurement in large scale
* continously ongoing Research & Development concerning both technologies and administration
* management systems of their own based upon long tradition and experience
* excluded an extra level of the administrative organization required by management firms to coordinate sub contractors as the contractor is always represented at the site anyway
* local knowlege through local firms supported by the

resources of the whole of the concern

* possibility to take total responsibility against clients which thereby will avoid risks of default or incompetence on part of Construction Contractors, (see Chapter 5.2.2)

* resources for all and every stage of contracting; consulting, manageing, construction and operation / maintenance.

So, since obviously all parties concerned have incentive to adapt programming and design to production and operation of the object, should the client not have as much confidence in a Turnkey Contractor involved at a early stage of the process, as in a Management Contractor ?

Usually the apprehension of cooperation in conventional (Turnkey) contracting systems is the owner and the contractor as adversaries; "contractors want to squeeze as much money as possible out of contracts, while owners want to get as much building as possible for their money. The owner is tied to the contract, but since he has to make all decisions very early, there will be many changes as the project advances. The owner has only one party to turn to - his contractor. And changes will be made without competitive bidding, so extra costs for work not included in the contract are likely to be high. Furthermore, the owner often has only a vague idea of what is going on inside the project, rarely knows what is paid for or what he is really getting for his money ".

7.2 RECOMMENDATIONS

In this part of the chapter, first an attempt is made to present a solution to the problem sometimes expressed as the client regarded as helplessly resting in the hands of his engaged Turnkey Contractor.

For projects where attributes and functions are more easy to define, e.g. bridges and other standard constructions, the type of contract used is of less importance. In particular traditional Turnkey Contracts however, are most suitable. With regard to big projects, having complicated functions hard to define, fixed prices are not realistic. Changes and development of functions are not possible to avoid during the process of construction. In this case only agreements of continous cost monitoring, combined with incitation of time and cost, are feasible.

When a project is first awarded to the contractor on Target Agreement Basis, the conflict risks between parties are few and generally of limited importance. This facilitates for the staff to concentrate on progress and economy of works, resulting in a cheaper job. Note also that within ageements of incitation / target, the parties are cooperating over costs, not prices. Clients are by this favoured as savings through developed methods of construction, in first place will gain the client, not always the case in more traditional agreements. Furthermore, projects with a Target Agreement are very likely to be completed in time as client and contractor

together will define a plan of completion. The fulfillment is then the concern of the contractor. Based on the plan of completion as next step, the parties together will estimate quantities and work out preliminary costs, in the same time a budget for actually incurred costs to be compared with. Note in this context, the inflexible traditional Bills of Quantities with provisions for risks are avoided. To sum up, in a Target Agreement, the client and the contractor more than otherwise share the same technical and economical interests.

In the following, a possible type of Target Agreement is described more in detail. As a basic concept, certain bonuses and penalties are directly connected to the agreement. Savings or extra costs will be split up between client and contractor according to fixed agreements in advance. This will gain both, and such an agreement is furthermore suitable to relate to modern, computer based, administrative management systems.

A numerical example of effects of a Target Agreement is now penetrated, where indications are referring to Appendix 10. Assume Preliminary, Budgeted, Cost of a project is 200, (monetary units), and the Fee of the contractor is 10, provided the final cost will actually be precisely 200 ! According to the agreement, costs and savings are divided between client and contractor as 80 / 20 (%).

Figure A examplify what will happen if final costs are only 170, i.e. 30 less than expected. The Fee then will be: (10 + (20 % of 30)) = 16, while the price of the client will be (170 + 16) = 186. If Preliminary Cost exceeded by

30, the Fee will be (10 - (20 % of 30)) = 4, while Final Cost paid by the owner will amount to (230 + 4) = 234.

In practice the fee would be a percentage of calculated preliminary total cost, including all costs on site and administration, i.e. management services. Note especially how in this model decreased preliminary cost will not render the contractor any increase in fee. Not until final cost of the project is certain to actually be less than what is shown in adjusted budgets, the final fee will exceed the preliminary ! During construction as mentioned earlier, cost affecting changes will inevitably take place. Hence preliminary costs must be adjusted, and by this, the agreement in this model is consequently altered too. In figures C and D, (Appendix 10), is graphically shown what will happen in case of increased and decreased preliminary cost respectively.

As mentioned previously, Target Agreements can be connected to flexible, computer based, Management Information Systems, (MIS), closely integrated in the process, as both preliminary budget as well as the final one will affect the agreement.

In practice, throughout the main stages it would be organized as follows;

a) Programming & Design: Best possible relationship between price and quality is wanted. Importance of different alternatives w.r.t. cost and consequences for the project as a whole is emphasised.

b) Budgeting: Budget of production is basis for Cost Monitoring to facilitate updating of the budget. Many

possible levels of detail are possible. For instance might total over all cost of a project be splitted up into e.g. cost of:

1. Resources; e.g. total cost of machines used.

2. Type of work / Activity; e.g. cost of machines used to excavate.

3. Result / Part of the object; e.g. cost of machines used to excavate a certain yard.

Generally, cost monitoring for practical reasons will be at a not very detailed level.

c) Production; basically, just series of cost reporting as comparisions between estimated and actual costs.

In conclusion, an agreement as outlined here would give clients opportunity to consider costs for different alternatives of design as the project is proceeding. Through more specified agreements taken subsequently, the work can commence earlier, and by this also the owner can start using his object much earlier. Above all, the client all the time has access to the Monitoring Documents of the contractor, and both parties have the same interest of improving matters of technology and economy.

Since abowe is shown how Management Contractors not at all rightly in their public relation activities can monopolize favourableness of early involvement, flexibility of parallel design and construction, client related cost monitoring etc, then their very existence should not be justified ? Of course such a statement would not be adequate. For instance, particularly in the case of good, long term, well established relationships between client

and management firm, an extended integration of common functional interests might render both advantages of synergy. In terms of the appropriate authority of the Management Contractor, he is recommended to be the principal motivator of contracts, and encouraged to speed up decision making and accelerate design processes. Also he is recommended to have managerial authority over all those involved in the project's design and construction.

Defining and achievement of quality as task of the designer, is the basis of most MC. Ensuring of all works built to this defined standard, is recommended as the task of the Management Contractor. He also must have unquestioned authority to approve work in order to maintain the discipline exercised over Construction Contractors.

As a somewhat theoretical method to check the status of prevailing conditions of relationships between participants of the process, a Control Graph and Sociomatrix as shown in Appendix 11 can be useful. According to Prof. VK Handa and Prof. McLaughlin, University of Waterloo, Ontario, Canada, (4), the optimal, idealized allocation of control and flow of information is here graphically expressed. Assumptions are the project as an ideal candidate for CM, the Project Manager employed as representative of the owner and the Construction Manager beeing a member of the general expatriate construction staff. Together they are responsible for development of on site management organization.

Finally some general recommendations concerning MC:

a) In case of standard documents not available, clients should undertake preparation of Conditions of Contract with

professional assistance.

b) Consider preparation of tender documentation with guidance notes.

c) State clearly allocation of risk, in particular liabilities of the client.

d) Meanwhile preparing guidance notes of parties in MC, clients should pay particular attention to division of responsibility for quality control, issue of certificates, claims assessment and design and management authority.

7.3 PROVISO

Some reservations however, must be made in order to not give the impression of suggestions as above once and for all unquestionable given.

To start with MC, is clear that the term "Construction Management" includes neither actual design, nor actual construction tasks, but does involve all or some of processes included in concepts of management.

What is not clear is the extent to which CM involves various elements of the management process, and the extent to which these elements overlap with either or both of the design and construction activities themselves.

Spectrums of opinion are very broad regarding the scope of CM services. At one extreme some see the services extending over all phases of a project, from pre design to handing over. The Construction Manager, often referred to as a Project Manager by those advocating this approach, is the lead professional with responsibility of the project as a whole.

At the other end of the spectrum, CM is regerded as a far more restricted service. Focus in this view centers on procurement and construction phases, the Construction Manager beeing responsible only for conveying instructions to, and coordinating participating enterprises which he also monitors the output of. During the design phase, advice only is provided on technology and cost consequences of alternatives.

In the same way as briefly mentioned in Chapter 3.2.8, also different degrees exist of Turnkey commitment. Principial advantages of traditional total Turnkey applied on easily defined projects, are completion of project in shortest possible time to lowest cost. But to obtain these advantages, sufficiently specified details are a necessity which above all not must be due to changes requested of the owner.

Also the "Partial Turnkey" procedure cause consideration over the coordination between process facilities and construction elements. If e.g. machinery not possible to install when the Turnkey section completed, advantages of speed with Turnkey are lost. Such a situation might for instance be the case when overseas firm employed on Turnkey basis for design and construction, and local contractors in charge for ancillary facilities.

However the relevance of Turnkey projects in the international perspective is during recent years very much influenced by an appearance called CEDO, (Consulting and Engineering Design Organization). These are locally based consultancy organizations, notably favoured by very much adapted legislation and polices by e.g. India, Brazil,

Korea and Argentina. Support is also provided by development agencies such as:

* Inter American Development Bank / The World Bank
* International Development Research Centre
* Organization for Economic Cooperation and Development
* UNIDO Development Programme

Among many advantages to the countries concerned, are local benefits with more local suppliers involved in Joint Venture contracts aiming to reduce the outflow of foreign excnange and improve local skills. Conclusively as increasingly more of the former "Development Countries" will turn into NIC, the industrialized Western World will have to learn how to still more on equal terms deal with trading partners and clients from the "Third World".

Not least is this situation likely to occur, since the determination to make it a reality is so strong in the countries concerned. Very clearly examplified this is for instance in the Korean Presidential Instruction shown in Appendix 12, from a date as early as 1969.

SECTION THREE

CHAPTER 8

CASE STUDY

Theories and methods of how to organise the construction of objects in general, might be interesting to study and compare. As purpose descriptions and conclusions of this kind always must have to in some way be useful. Hence the aim should be to develop methods possible to apply on specific projects. An owner in the situation of having to decide in what way to transform his resources to invest, into a prosperous plant or some other facility, is likely to show interest in certain characteristics of details in the project he is planning for. In other words; after the stage of structuring of broad, over all matters for instance as described in earlier chapters, he will try to make use of specific features of the project in order to even more by these be sure of chosing the most suitable concept. One way of doing this is to make use of earlier experiences, hence devoting his time to Case Study in practice. The owner is in this text assumed to having access to facts and figures from other projects, similar to the actual one, and therefore possible to use for comparisions. This might be the case if the owner for instance during recent years himself has built many plants or other buildings of the same kind. A first question of relevance in such a situation will be by what methodology to draw conclusions from previous experiences.

8.1 HOW TO COMPARE DIFFERENT PROJECTS

A factor of utmost importance to comparability of certain objects is the complexity, or degree of highly advanced structures built in. Very complex construction objects are characterised by an obvious difference between two objects from the same category (process plant, electricity plant etc). Objects to compare will in this case be either existing plants or simply the preliminary or first layout of the project beeing planned. In the case of less complexity and when differences between objects from the same category are supposed to be small, collected data as reference are statistically transformed into a "neutral" comparision object. Examples of such buildings are: standard houses, offices and hotels.

8.1.1 Structuring of Characteristics of Projects.

The way statistical facts of costs usually is recorded and all the problems with their interpretation due to e.g. spread of costs, changing quality from case to case and how differences of costs are analysed, cause much too approximate and not regularly enough cost monitoring during the period a project is carried out. By this, knowledge about economical consequences will not at all increase with the same speed or as continously as all other successively collected data about the actual project. In particular, a basis of facts is of big importance in early stages when the amount of money so far spended is small, and the allocation of resources in the future yet controlable.

Construction projects are as a result of the nature of the process of erecting objects, very much related to and expressed in terms of quantities. Work usually is measured in areas or volumes to be done during a certain period. Hence a natural basis of a system for comparision of projects would be:

* Area of walls on a certain floor as related to the area of the same floor (m^2/m^2 floor area); by expressing how complicated the plan of a certain part is, this relationship will be a measure of complexity.
* Cost per quantity; for instance cost per m^2.
* Cost of the site as expressed in per cent of material and work. Site cost is affected mainly by:
  - gegraphical location of the object
  - extra costs due to winter conditions
  - transportation to the site
  - length of period of construction
  - resources to mobilise
  - social costs; taxes, certain funds for pensions
  - cost of capital.

Finally on the most detailed level, data can be categorised in terms of certain parts only; e.g. foundation, walls, roof, supporting structures; cost of mobilisation, machines, administration, management of work and fees. By collecting data concerning the items mentioned above, owners have possibility to in for organizational matters appropriate ways, categorise and structure characteristical facts of certain projects.

8.1.2 Methodology of Comparision.

In order to make comparision possible between similar, although not identical objects, an approach as described in the following is recommended. Objects to be compared are civided into parts or components in the most appropriate way, depending upon what category the objects belong to. If machinery for instance is a substantial part, this must be a certain item. Then the three parameters described in Chapter 8.1.1 are used to reduce the size of the larger object to the size of the smaller for each and every item. By in the same time proportionally reduce costs for each item, will be shown for which project the item in question the price was most favourable. Next step naturally will be to add all comparable parts or items to obtain an estimation of which object as a whole that was cheapest to construct. Of course effects of constructing in different years must be taken into account, and provisions made for e.g. effects of inflation.

To further explain, in the case of walls as a comparable item, the area of walls per area of floor on each floor (m^2/m^2), would be used as measure to reduce proportionally. If costs (C) are measured as costing per unit or quantity (Q), and L is denoting the larger object and S the smaller, the difference in cost as related to both quantity and costs would be expressed as:

$C_L (Q_L - Q_S) + Q_S (C_L - C_S)$. Not least to matters of understanding and controlling cost during construction of similar objects in the future, this division matters.

8.2 APPLICATION ON DOCUMENTS OF CONSTRUCTION

As reports of how projects are proceeding, clients usually are given very compressed records of costs and quantities of work done. In most cases costs are the over all measure of importance as quantities of work often are expressed in terms of monetary value related to estimations of reasonable cost per unit of work. Below is given recommendations upon how to structure such cost reports and how to use them to analyse performances during construction and also how to afterwards compare e.g. appropriateness of applying certain methods.

8.2.1 Estimations, Budgets and Cost Reports.

Regardless of kind of company issuing them, documents to estimate or monitor costs usually have the same main headings. At first, initially budgeted figures are shown, followed by modifications due to changes leading to updated budgets. Then will follow how much work is done as compared to actual resources spended. The difference of course will show the result, and furthermore can be used to forecast results as expected in the future. The objective of all activities is trying to use up less money to do a certain work than required according to the budget. Hence, very clearly is expressed and efficiently made use of the crucial point of the whole construction process.

How, and by what accounts the allocation of resources is shown however, very much depend on the kind of company.

While a General Contractor emphasise allocation to certain works and parts of an object, the Management Firm also include matters as e.g. Site Costs, Design, Construction Management as opposed to over all Project Management, Owners Cost and Price Inflation etc. In more traditional procedures, for instance when using a Quantity Surveyor as consultant to coordinate, very much of the monitoring is devoted to costs of Architect's Variations, both omitted and added. Important for the client therefore is to if possible persuade the engaged company to adapt their system of monitoring to the method of estimation and comparing used by himself. Such a basic thing as organize monitoring reports after for the actual project appropriate items or parts of the building, would be crucial to usefulness of reports to analyse later on.

8.2.2 Relationship of Parameters as Related to Concept of Construction Applied for Certain Projects.

A General Contractor usually do not show additions for management services and administration as separated accounts, while a Construction Manager commonly do so. Hence conclusions are difficult to draw upon such costs as compared to each other, unless drastical changes in the way of presenting facts and figures can be achived. Also once more complexity of projects must be taken into account. If design and other features of the projects concerned from the very beginning was quite well specified, not very many changes would occur and hence making comparision between

different concepts of less interest. If work proceeded precisely as planned all the period of the construction process through, comparision between total cost of almost equal projects would be not very difficult. For this reason cost of similar, certain separated changes would give more significant hints of to what extent the engaged companies are looking after the interest of their clients. So, by concentrating on extra costs and savings in first place possible to directly relate to the concept applied, owners should be able to estimate the reliability and sense of responsibility of hired companies.

Still we face the problem of separating and allocating cost of administration to the right accounts, but by using the part or item beeing changed as basis and by asking for extra work to be monitored as a lump sum for building in required quantities of material and working hours, comparisions are possible. The owner then simply use the suggested procedure of equalization through reduction of physical quantities. Especially reliable results are likely to occur if for some reason e.g. due to the kind of projects built, approximately the same changes frequently are necessary during construction of different objects. Above all is of utmost importance to very well know all characteristic features of the systems used by different companies to present cost and results. Without this knowledge, neither reliable methods of comparing, nor interpretation of their results will be of much use.

CHAPTER 9

FEASIBILITY OF COMPARING PROJECTS

9.1 FACTORS OF UNCERTAINTY

Diversity is perhaps the most characteristic feature of the Construction Industry. The business is dynamic with frequently occurring changes of conditions, for the single company as well as in the market as a whole. Not least this is reflected in all the difficulties likely to show up when trying to compare two different objects as like with like.

9.1.1 Accurateness of Estimations.

As in allsciences, estimations are not of much relevance unless the user is given some measure of accurateness. The text in the two last chapters, number eight and nine, is deliberately made very brief, because of the impossibility to take all relevant provisions into account and give recommendations of how to handle them. By this an flexibility is reached at, making allowance to readers to develop methods tailor suited for their own organizations and experience. For same reasons is in the following given an outline only, of how owners should calculate approximate figures, showing the reliability of their method of comparing projects.

Owners are assumed to keep extensive records from projects of their own as well as others. Testing of methods

therefore can be performed on basis of statistics. The standard deviation (s), as a percentage of the mean of the cost of a certain quantity ($\bar{m}$), is possible to use. For instance, by calculating s as per cent of $\bar{m}$ of cost per area of floors for all objects known, first without and then with reduction to the physical size of the smallest, the latter figure should be the smaller one if reduction is done in a realistic way. Also the maximum difference between figures is worthwhile taking into account. Further more, a more reliable average value of cost per quantity is by this obtainable in order to use it for future estimations.

Alternatively, in the very first stages of a project, final costs can be estimated using traditional methods and procedures of reduction as well. Differences in actual final costs will also show the accurateness of estimation based on records of statistics from earlier projects as compared to when starting from scratch for each new project.

9.1.2 Pecularities of Projects.

Diversity of the industry as a whole as well as between separate projects, cause troble when statistical records of facts are to be interpreted. In particular this is a common situation in the case of using systems of cost monitoring to explain economical consequences of changes made. For changes of design during construction and for other work, the basis of measure usually is cost per quantity. Interpretation of records of cost per area or volume expressed as average or some other measure of statistics, is difficult

because of:

* Substantial spread of total cost of different objects.
* Demand of design and by this cost of project's change.
* Contents of cost of certain items of different projects is seldom the same. As mentioned above, projects can be structured in many best ways, and definitions of what substructures that belong to certain parts of buildings are not once and for all given.
* General difficulties to explain differences in costs - too many variables to take into account.

9.2 PRACTICAL ASPECTS OF COMPARISION

Theories are possible to develop into most sophisticated systems. However they must always be related to reality. Of this reason most companies in the construction industry using comprehensive records of previous projects are relying upon very simple measures as basis. Even the biggest companies often do not use more complicated measures than m, m^2, m^3, number of flats etc. Classification and collection of data hence is done on a rough level. Note also in this context the importance of the nature of the business in question. Usually the ruling factor of importance is the overall state of the market; Do we have many jobs to choose between or is it a market of the buyers ? Hence sometimes the problem will more be a question of how to get any job to do, instead of to apply highly developed methods of operational research. Further more, as the process of workers on all levels wanting to have insight in internal matters of their

companies, systems of monitoring are likely to more and more be used to provide information requested by for instance unions.

9.2.1 Different Types of Projects.

When an object is structured, it might be useful to in first place know how to classify it. Depending upon category, different methods to structure are likely to be most appropriate. A general division of types of projects as related to the activity concerned, is outlined below:

Houses, hotels; education; health care; trade, service and offices; leisure and public halls; food industry, farming ; work shops; metal plants; wood and pulp industry; chemical industry; pits and quarries; rock industry; fashion industry; stores; communication; roads, bridges etc; energy production; military installations.

Of these, the following are most likely to be possible to use for comparision based upon figures worked out by help of theories of statistics:

Small houses; hotels: offices; police houses; laboratories; health care institutions; schools; dining halls; skate halls; storing houses; swimming halls and heating plants.

9.2.2 Phases of the Construction Process.

This report has as main purpose the guidance of the owner to enable him making good decisions of what kind of organization to use. Nevertheless must be emphasised the promising possibility to in early stages of a project use the

methodology of comparing projects as outlined above, to directly control costs occurring later on. By relating the actual project to an other known or a statistical mean of many, significant abnormal differences are possible to indicate, and hence necessary corrections can be done in time not to exceed the budget. Not least for the purpose of continously monitoring, is important to split costs up in differences of quantities and costs themselves. In particular, monitoring of differences is valuable if related to what would be "normal" amounts to expect, calculated by for instance implementation of the method suggested in Chapter 8.1.2

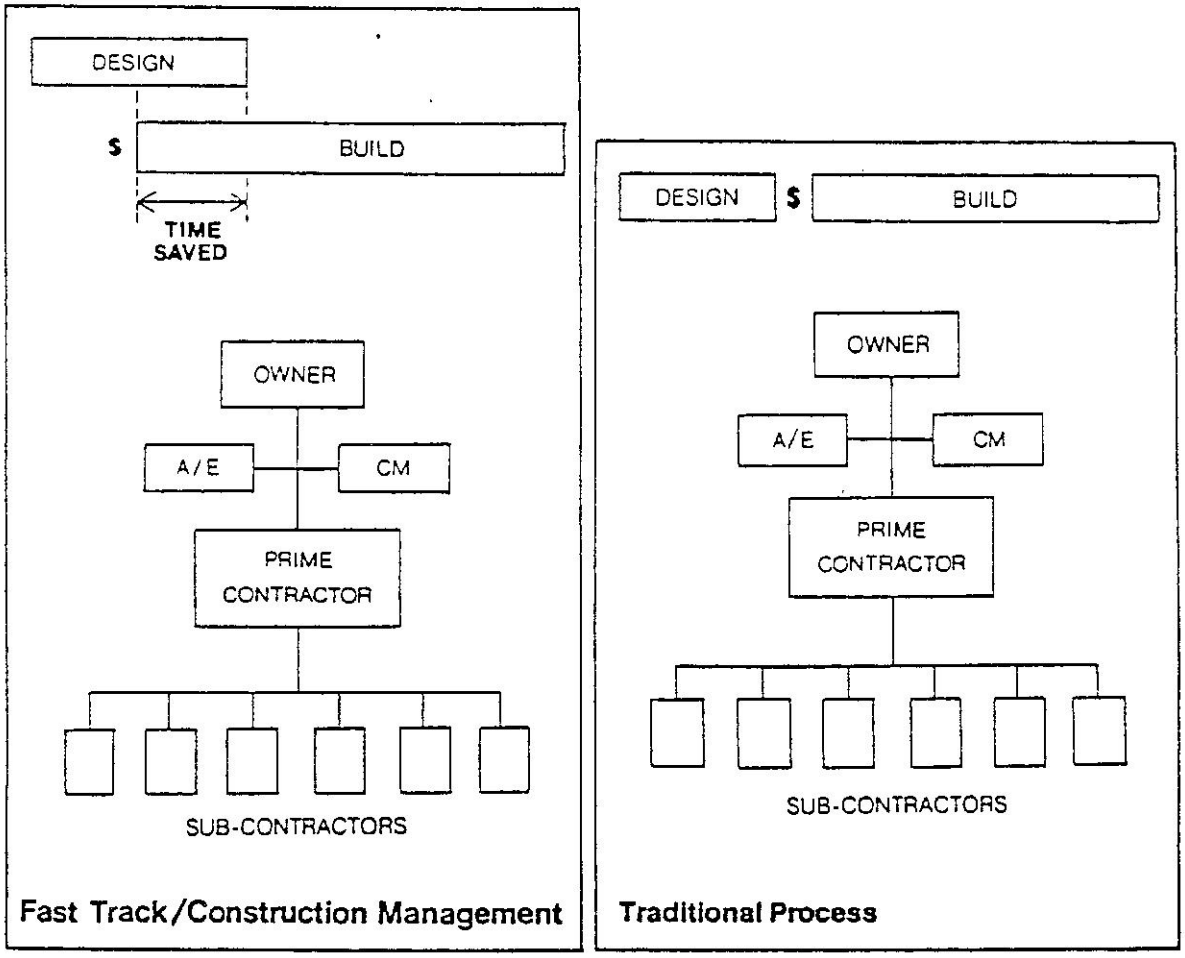
Also the question rise of feasibility of comparing just solely, parts of the whole construction process only. As many Management Firms are concerned with administrative matters of the phase of parallel design and construction only, is not at all given how included costs of management services should be extracted. Undoubtedly methodologies based on quantities should be most useful in early stages of certain projects to estimate what would be reasonable costs to expect. From a practical point of view, results of comparision between objects already built by implementation of concepts of MC and Turnkey respectively, are because of too many variables not very likely to be scientifically reliable. For instance, how should the value of education of operational staff, maintenance and financial help often provided by companies having Turnkey capacity, be discounted or taken into account when comparing with more limited, however very effective Construction Managers ?

As mentioned in Chapter 8.2.2, analysis w r t necessary changes during phases of construction probably is most likely to be useful as mean of comparision to obtain significant results. In conclusion, here as in all other cases must be emphasised the importance of looking upon certain phases of construction as well as other phenomena as related to their context, very much a question of experience and common sense.

OWNER CHOICES
SOME STANDARD PROJECT STRATEGIES

HOW TO BUY
DESIGN AND CONSTRUCTION

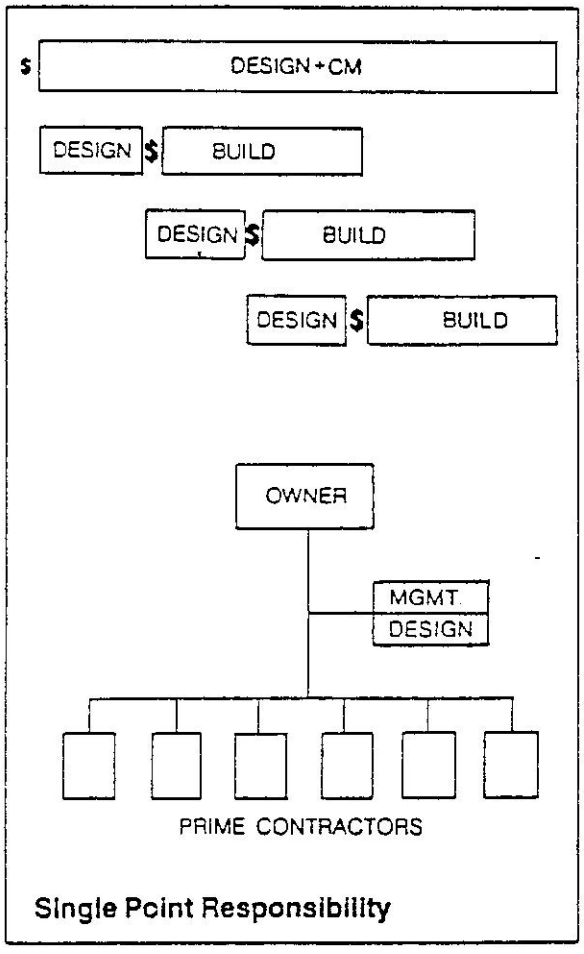
Organizational structure is the traditional definition of positions and reporting relations often shown in an organization chart. Basically the two extremes of structure are Hierarchical and Judgemental, the latter found in smaller professional organizations. Except from Organizational Structure, the five other elements of structure are: Defined Task, Definition of Responsibility, Control, Defined Procedures and Communication. Structure then, finally, together with Participation and Consideration are the basic conditions of a effectively functioning team.

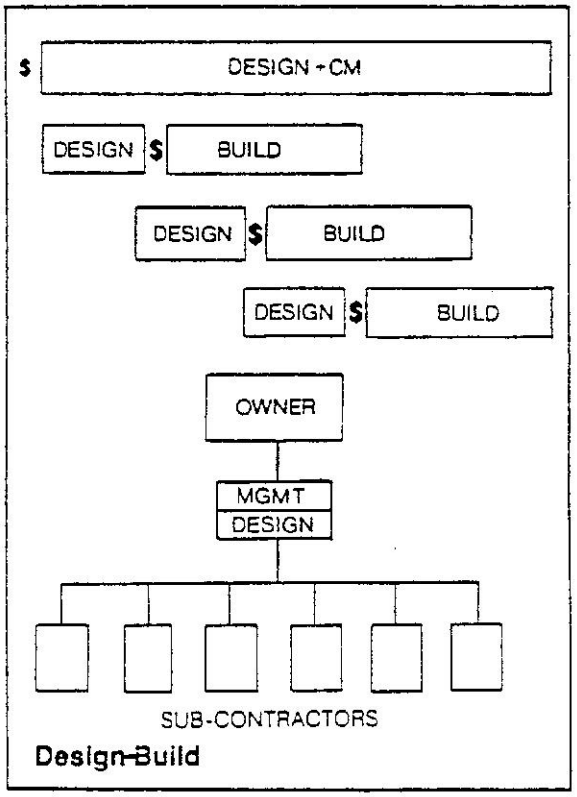


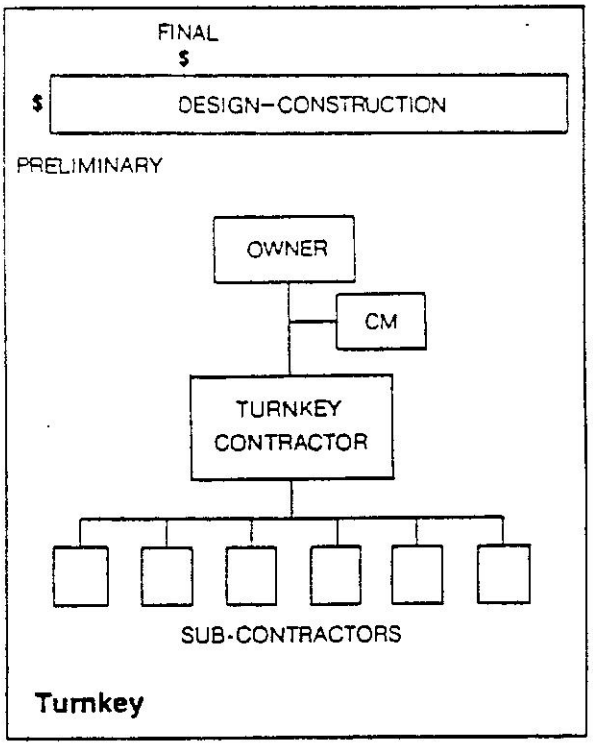
OWNER CHOICES
SOME STANDARD PROJECT STRATEGIES

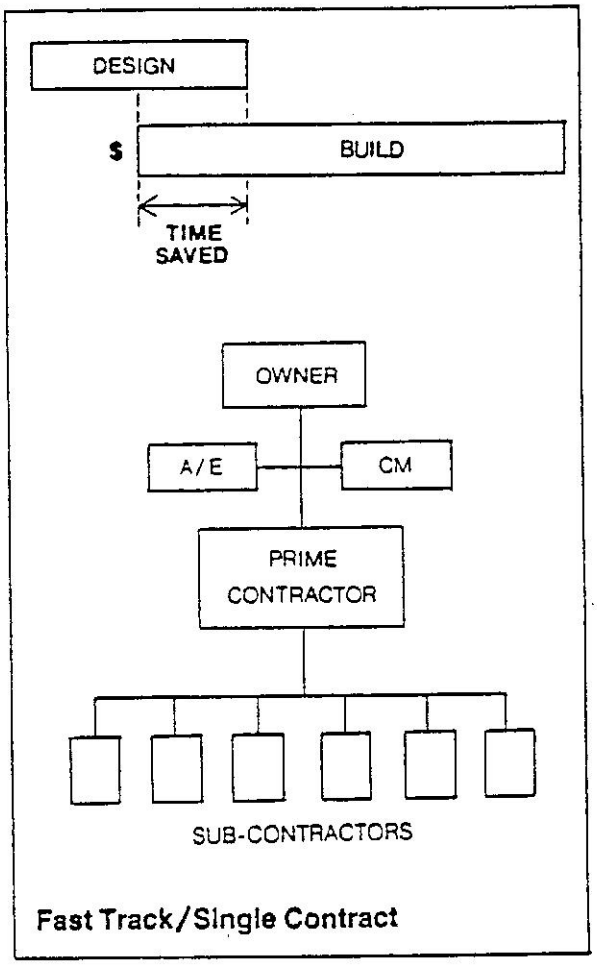
HOW TO BUY
DESIGN AND CONSTRUCTION

DESIGN-BUILD, TURNKEY AND SINGLE POINT RESPONSIBILITY CONTRACTS

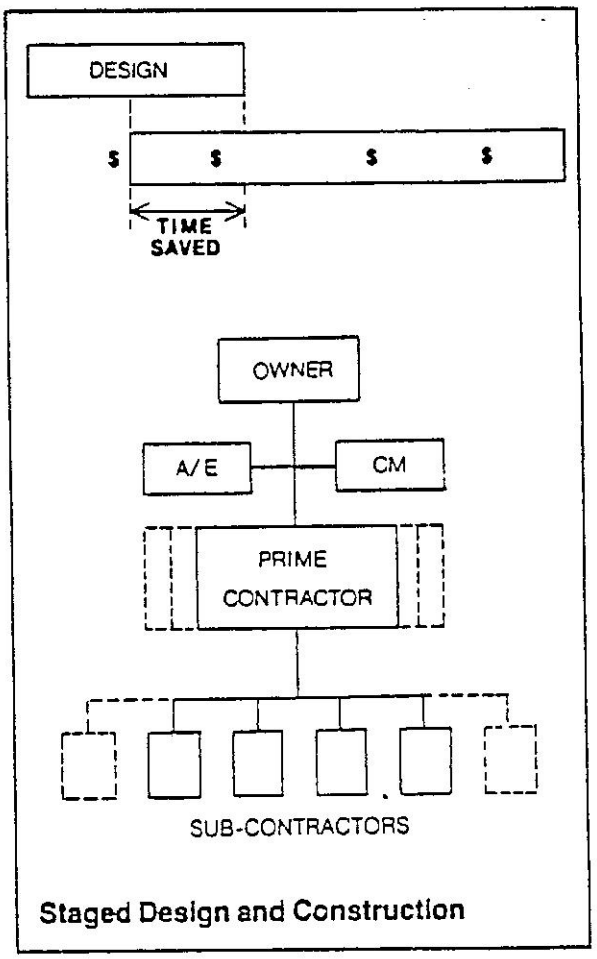




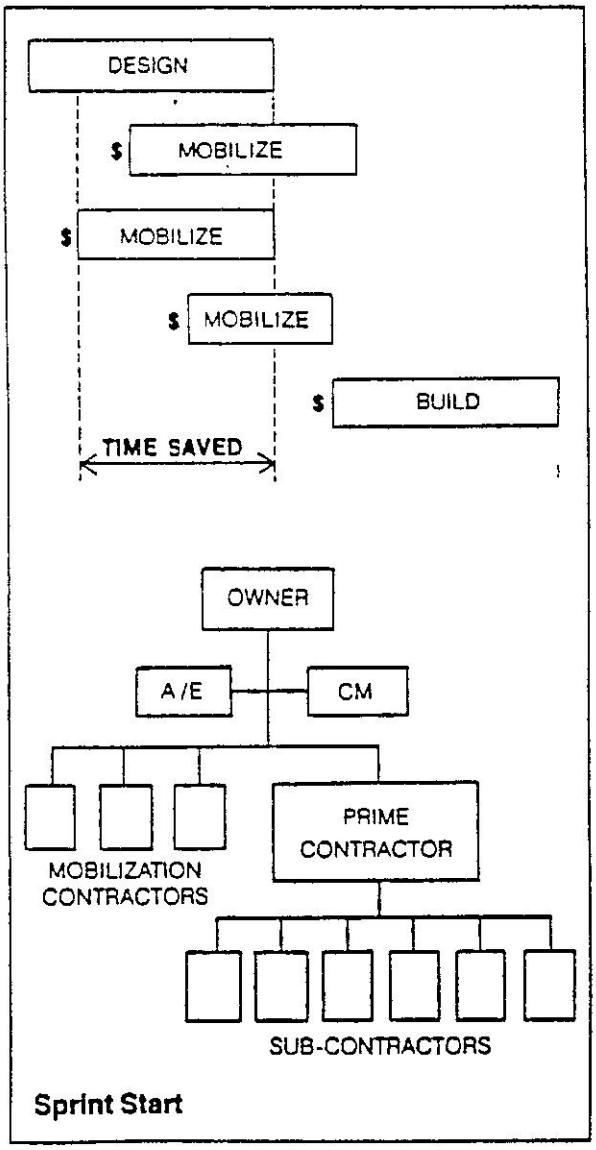




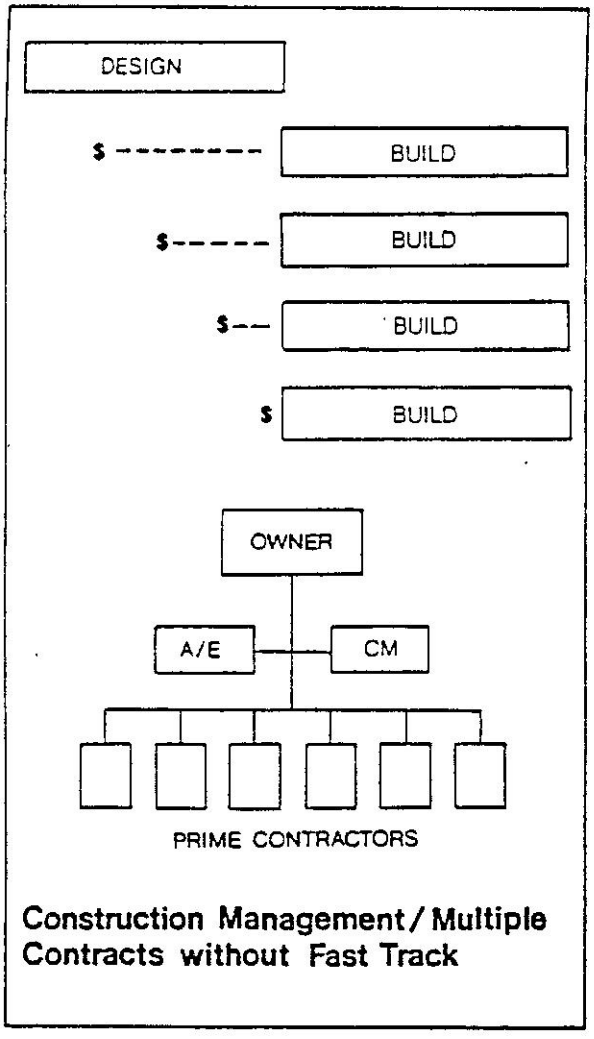
Fast Track/Single Contract



Staged Design and Construction



Sprint Start



Construction Management/Multiple Contracts without Fast Track

APPENDIX 2

Owner's Viewpoint - Relationship

		Quality	Low Price	Speed of Work	Accurate Estimate
1.	Owner/Designer/ Constructor	average	average	poor	good
2.	Owner + Designer/ Constructor	average	average	average	good
3.	Owner + Designer + Constructor	good	good	good	good
4.	Owner/Designer + Constructor	average to good	excel-lent	excel-lent	good
5.	Owner + Constructor/ Designer	good	good	average	good
6.	Design by owner with Contractor participating	good to average	good	good	average
7.	Design by Consultant with Constructor participating	good to average	good	good	average
8.	Partial Design-Build	good	excel-lent	excel-lent	average
9.	Project Management	average	good	average	average
10.	Construction Management	good	average	average	average

Ratings based on following grades - excellent, good, average, poor and ineffective.

(All following tables based on same grades.)

Designer's Viewpoints - Relationship

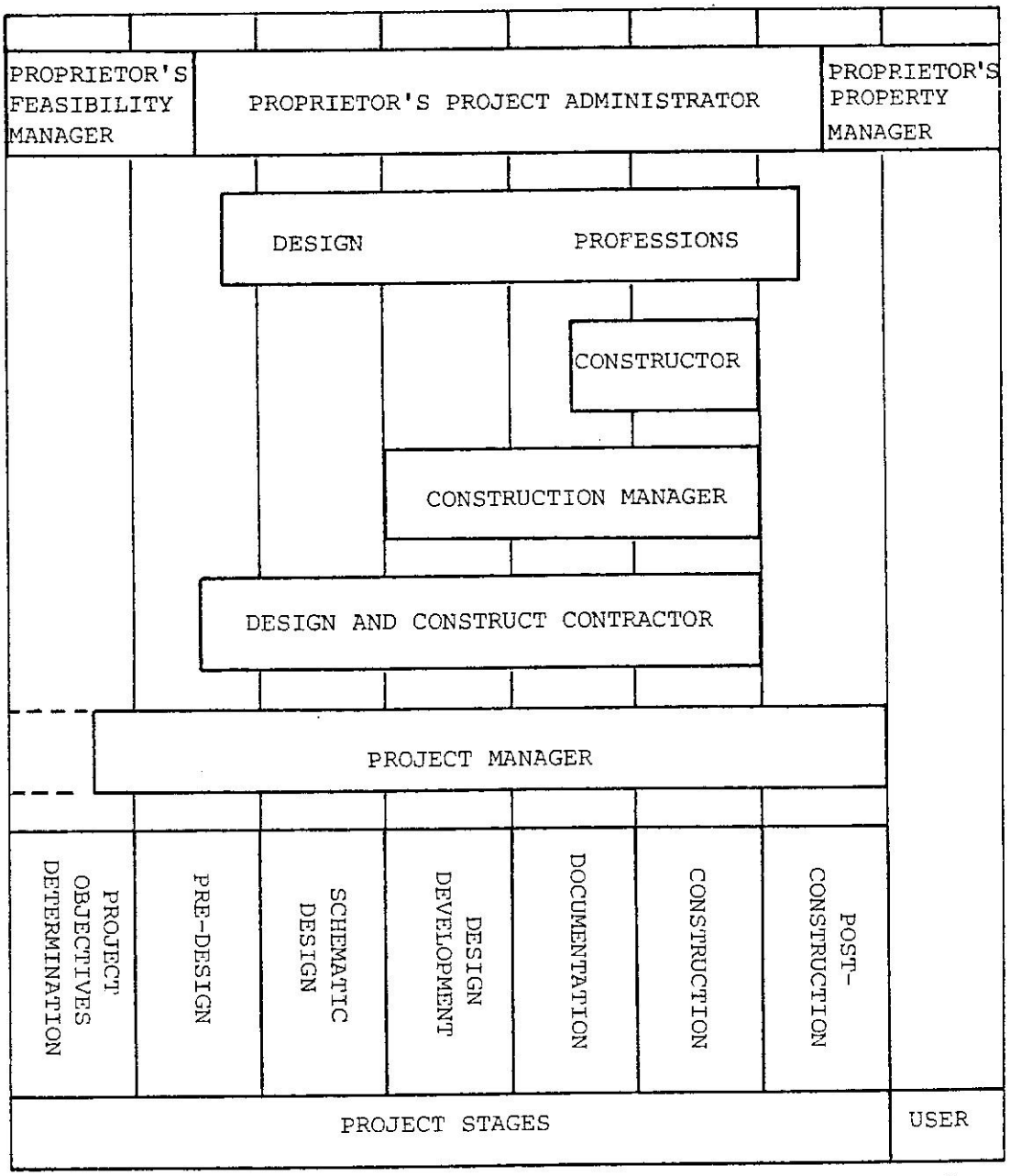
	(1) Owner/ Designer Constructor	Owner + Constructor/ Designer (5)	Design by Consultant with Contractor (7)	Project Management (9)	Construction Management (10)
Design					
Independence of action	excellent	poor	average	poor	average
Capability of controlling his design costs	excellent	average	average	average	good
Desirable relationship with owner	excellent	average	average	average	good
Engineer's financing requirements	excellent (designer doesn't need funds)	excellent	good	excellent	excellent (no funds required)
Construction Services					
Freedom of action on substitutions proposed by contractor	excellent	poor	excellent	ineffective	poor
Freedom of action in evaluation contractor's claims	excellent	poor	excellent	ineffective	ineffective
Time of assignment defined	excellent	average	good	excellent	excellent
Liability due to Contractor's action	excellent (none)	average	good (very little)	excellent (none)	excellent (none)
Resident Inspection					
Quality control, freedom of action	excellent	poor	good	poor	poor
Overall					
Degree of risk involved	excellent (no risk)	good (some risk)	good (some risk)	excellent (no risk)	excellent (no risk)

APPENDIX 4

Constructor's Viewpoints - Relationship

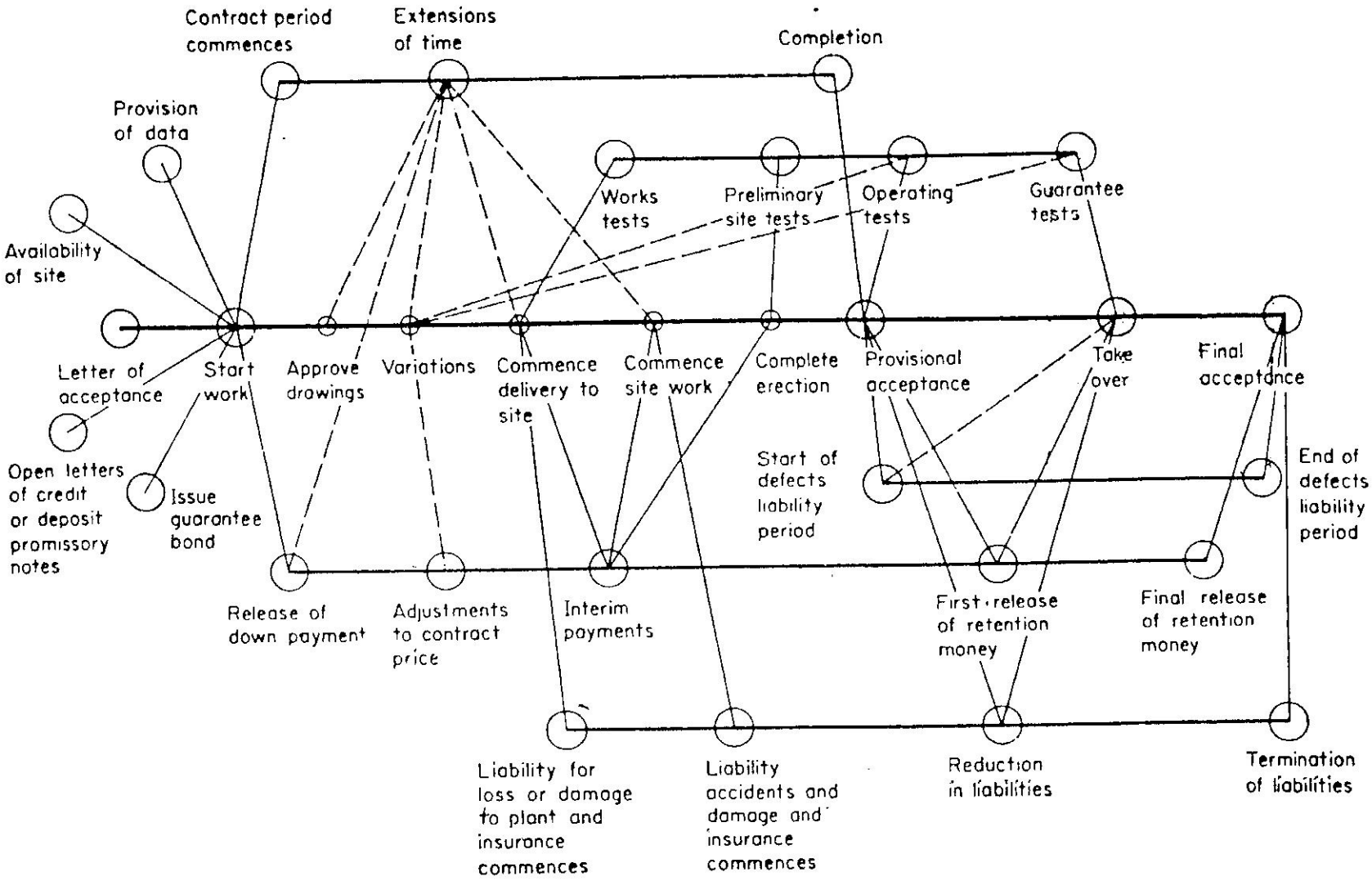
		Profit
1.	Owner/ Designer/ Constructor	Average
2.	Owner + Designer/ Constructor	Good
3.	Owner + Designer + Constructor	N/A
4.	Owner/ Designer + Constructor	Excellent
5.	Owner + Constructor/ Designer	N/A
6.	Design by Owner with Contractor Participating	Good
7.	Design by Consultant with Constructor participating	Poor
8.	Partial-Design Build	Good
9.	Project Management	Poor
10.	Construction Management	Average

APPENDIX 5



Common Spans of Work Scope in Project Control.

Scope of duties for the project manager is compared to duties of individuals in other organizational forms. By comparision with other methods, in which design and management roles are simoultaneously taken by one person, or in which the management responsibility is passed from one functional group to an other during the project, the Project Management method provides an integrated approach, more likely to result in a balanced achievement of all client objectives.


Contract period commences
Extensions of time
Completion
Provision of data
Works tests
Preliminary site tests
Operating tests
Guarantee tests
Availability of site
Letter of acceptance
Start work
Approve drawings
Variations
Commence delivery to site
Commence site work
Complete erection
Provisional acceptance
Take over
Final acceptance
Open letters of credit or deposit promissory notes
Issue guarantee bond
Start of defects liability period
End of defects liability period
Release of down payment
Adjustments to contract price
Interim payments
First release of retention money
Final release of retention money
Liability for loss or damage to plant and insurance commences
Liability accidents and damage and insurance commences
Reduction in liabilities
Termination of liabilities

Management Functions and Responsibilities in Construction Projects

Function	Typical conventional building contract				Typical conventional civil contract			Typical building Management Contract				
	PM team	Architect	Q.S.	Contractor	PM team	Consultant	Contractor	PM team	Architect	Q.S.	Management Contractor	Construction Contractor
Project Management												
Project appraisal	★				★			★				
Project definition	★				★			★				
Contract strategy and approvals	★				★			★				
Appointment of professional services	★				★			★				
Financial strategy	★				★			★				
Initial budget estimate	★				★			★				
Programme	★				★			★				
Commissioning	★				★			★				
Production/Operation	★				★			★				
Design												
Concept design		★				★			★			
Drawings		★				★			★			
Specification		★				★			★			
Quality definition		★				★			★			
Detailed design		★				★			★			
'Buildability'		★				★			★		★	
Bill of Quantities			★			★				★		
Design programme		★				★			★		★	
Monitoring design progress		★				★			★		★	
Drawing production		★				★			★			
Appointment of Management Contractor												
Preparation of Brief								★		(★)		
Enquiry								★		(★)		
Evaluation								★		(★)		
Recommendation								★		(★)		
Appointment of Construction Contractors												
Prequalification	★	★	★		★	★			(★)	(★)	★	
Tender Documents	★	★	★		★	★			(★)	(★)	★	
Evaluation	★	★	★		★	★			(★)	(★)	★	
Recommendation	★	★	★		★	★			(★)	(★)	★	
Contract supervision and administration												
Detailed design		★				★			★		(★)	
Advance procurement		★	(★)			★			★	★	★	
Quality control		★				★			★		★	
Financial control			★			★				★	★	
Variation orders			★			★				★	★	
Planning and co-ordination			★			★			★		★	
Measurement			★			★				★	★	
Certification			★			★				★	★	
Claims - assessment			★			★				★	★	
Construction												
Programming/Planning				★			★				★	★
Methods of working				★			★				★	★
Design of temporary works				★			★				★	★
Industrial relations				★			★				★	★
Safety				★			★				★	★
Sub-Contractors - selection				★			★					★
Execution of construction				★			★					

Note:
Project Management (PM) Team can consist of a number of people.

(★) Alternative.

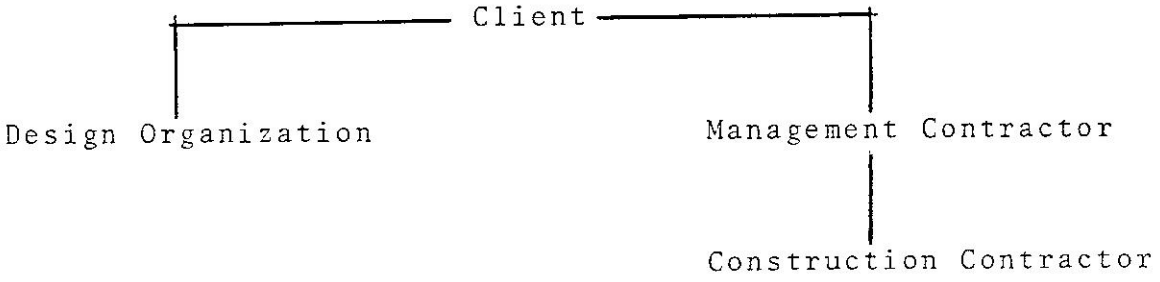
APPENDIX 7

APPENDIX 8

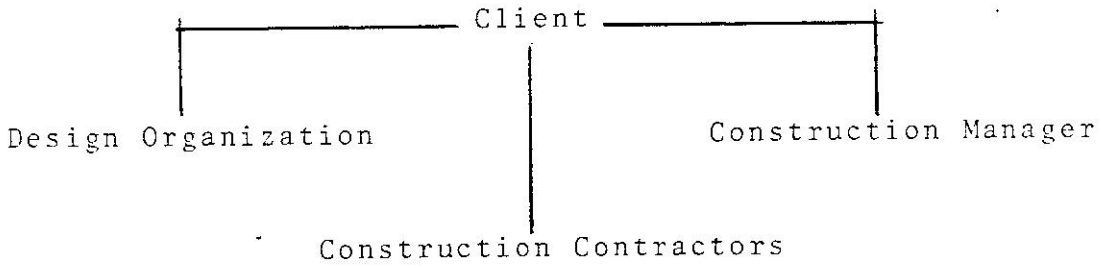
SYSTEMS OF MANAGEMENT CONTRACTING

CONTRACTUAL RELATIONSHIPS

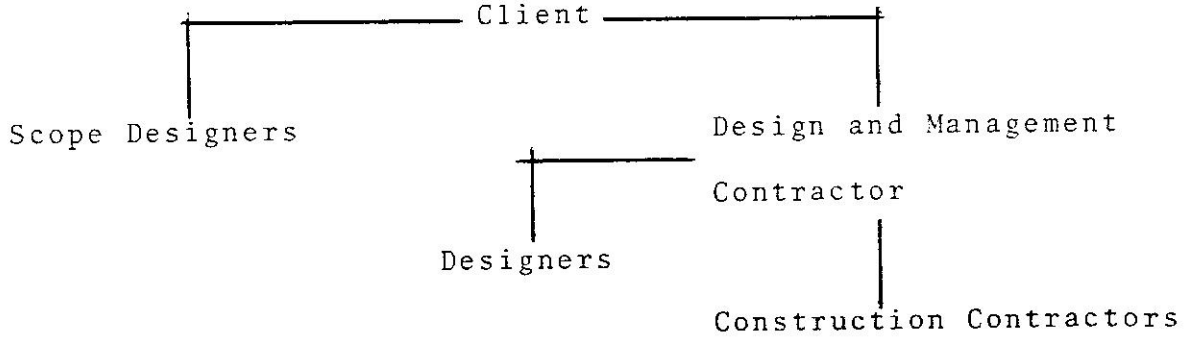
(a) The Management Contract.



(b) The Construction Management Contract.



(c) The Design and Management Contract.



APPENDIX 9

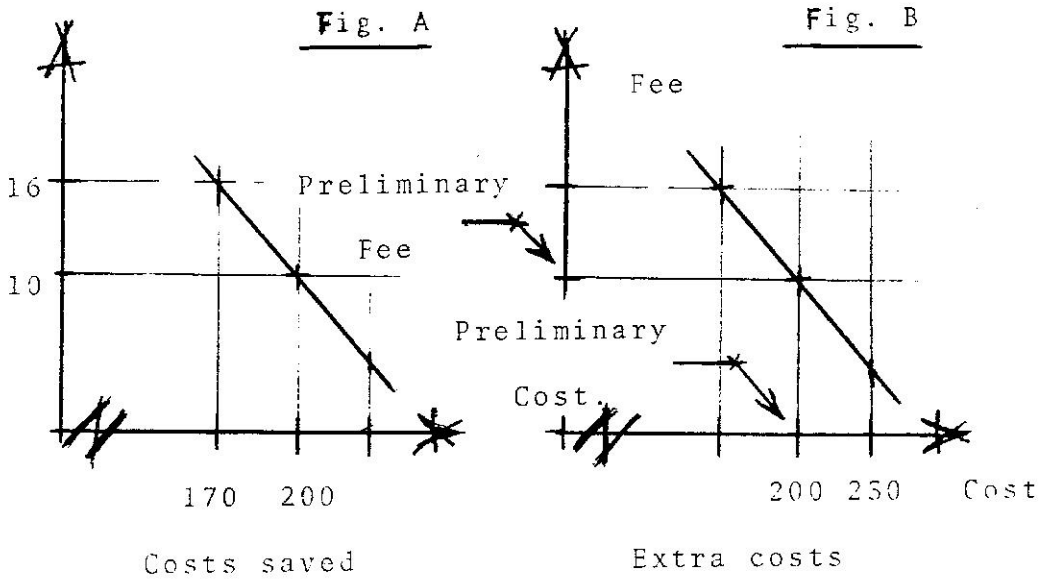
Characteristics of Organisations

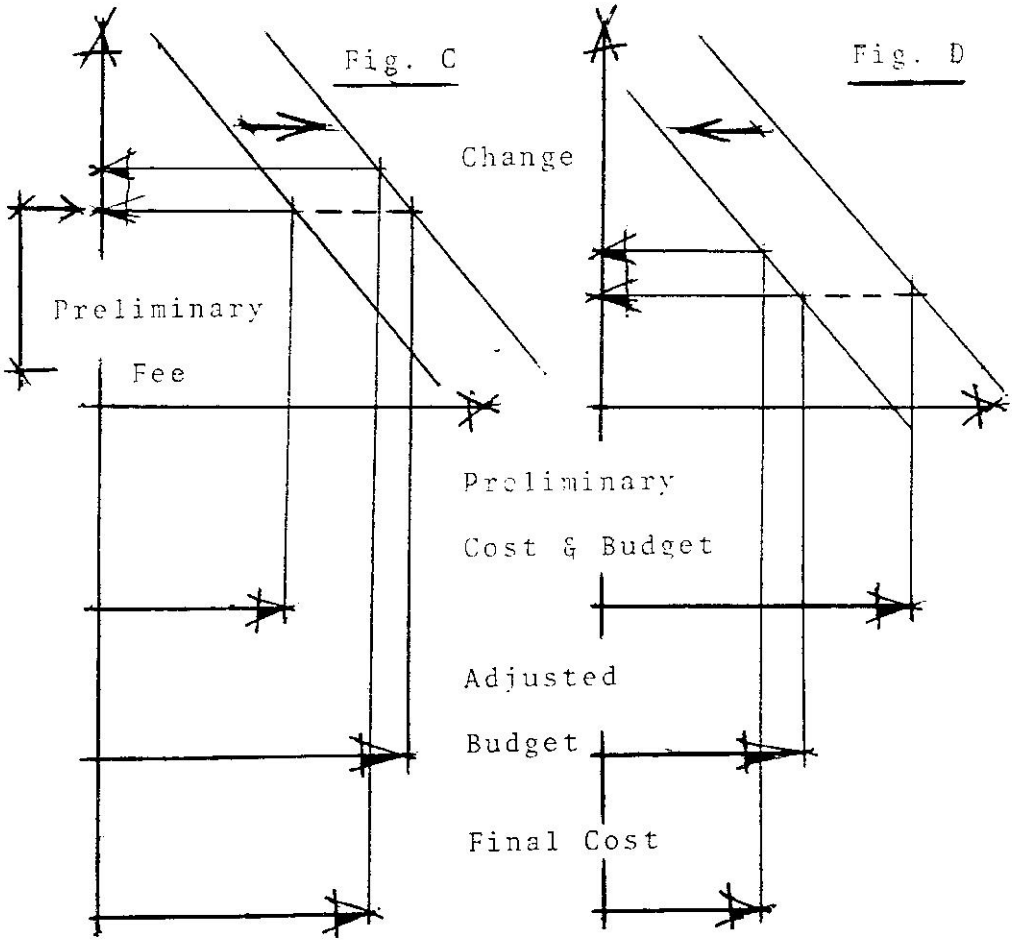
Characteristic	Description
Organisation Structure	
- Control	the extent to which the activities of individuals are laid down by higher authority and prescribed by procedural rules or are left mainly to the discretion of the individual.
- Integration	the extent to which the activities of individuals are closely co-ordinated in relation to the firm's objectives.
- Boundary Regulation	the extent to which the activities of the management system are concerned with managing its relationship with the environment or controlling the internal affairs of the organisation.
Management Style	
- Production Orientation	the level of concern of managers for efficiency, productivity and systems of management control.
- People Orientation	the extent to which managers give priority to the welfare, development and involvement of staff as compared to enhancing their own personal standing in the organisation (i.e. employee centred v self centred).
- Corporate Orientation	the extent to which managers are concerned with medium and long term market related organisational goals as compared to satisfying immediate relationships with existing clients and markets.
Problem Solving Expertise	
- Technical Skill	the level of expertise available for the solving of technical and general management problems.
- Organisational Skill	the level of expertise available for the solution of organisational problems.

APPENDIX 10

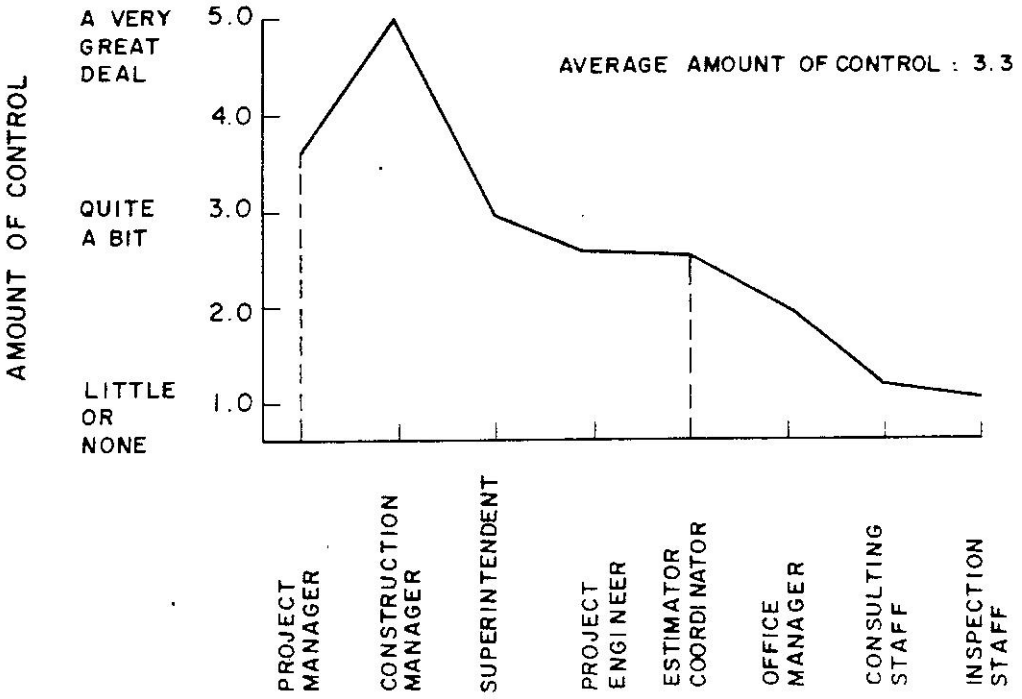
TARGET PRICE AGREEMENT

EXAMPLIFIED AND IN PRACTICE





APPENDIX 11



(a) CONTROL GRAPH

INITIATOR		RECEIVER 1	2	3	4	5	SUM	RELATIVE FREQUENCY
PROJECT MANAGER	1	0	6	4	2	4	16	0.14
CONSTRUCTION MANAGER	2	8	0	10	6	6	30	0.26
SUPERINTENDENT	3	4	10	0	6	5	25	0.22
PROJECT ENGINEER	4	1	6	8	0	5	20	0.18
ESTIMATOR–COORDINATOR	5	3	8	6	5	0	22	0.19
SUM		16	30	28	19	20	113	
FREQUENCY		0.14	0.26	0.24	0.17	0.18		

(b) SOCIOMATRIX

Idealized Sociomatrix and Control Graph

APPENDIX

PRESIDENTIAL INSTRUCTION ON THE CREATION OF ENGINEERING SERVICE COMPANIES IN KOREA, 15 MAY 1969

The majority of major industrial plants, into which a vast amount of foreign and domestic capital investments has been channeled, have been built with foreign capital, foreign technology, and foreign services in all phases of their construction: from basic design to test operation. Therefore, the participation of the Korean engineers in, and the use of domestically available materials for, the construction of these plants has been impossible, while the lack of our technical know-how and the shortage of adequately trained Korean engineers have made it difficult for us to ask foreign countries for our greater participation in these projects. As a result, the drain on our foreign exchange reserves has been considerable. Should this situation be allowed to continue, the loss of foreign exchange will certainly increase as the amount of investments goes up.

To deal with the situation, the government will henceforth do away with the turnkey job principle to make newly emerging Korean engineering service companies and homemade products take a greater share in these projects. For this purpose, the establishment of joint-venture service companies will be encouraged between foreign engineering service firms of high standing and able engineers at home who have been pooled by industries, and thus to form a combination of foreign capital and domestic skills.

By so doing, the government encourages the use of homemade equipment and materials fully in the construction of plants and promotes a learning process through the participation of local engineers in all phases of plant construction, from basic design to final operation.

At the present stage, the most important problem is how to increase the degree of participation of Korean engineers in, and the quantity of homemade materials to be used for, such plant construction. In particular, the government is striving for the construction of petrochemical plants, for which an investment of about $200 million will be required. In the implementation of these projects, conventional methods will be boldly discarded in favour of the utilization of the aforementioned joint-venture engineering service companies so that any further drain on the country's foreign exchange may be curbed. In addition, the government will encourage the integration of Korean manufacturing industries with an eye to raising the standards of domestic products, and all efforts will be made to search for able brains and excellent engineers hitherto untapped.

REFERENCES

(1) Araoz, A, (editor): Consulting and Engineering Design in Developing Countries.
p 67, 140. International Development Research Centre (IDRC), Ottawa, Canada.

(2) The Institution of Civil Engineers, London, (1978). Management of Large Capital Projects. Proceedings of the Conference held in London, 17-18 May, 1978. Appendix.

(3) Systems Theory for the Civil Engineer, (1979). Canadian seminar on systems theory for the civ. eng. Calgary, Alberta 18-19 Oct. 1979.

(4) Proceedings of The CIB W-65 Third Symposium on Organization & Management of Construction, Dublin, Ireland, 6 - 8 Juli 1981. An Foras Forbartha; The National Institute for Physical Planning and Construction Research.

BIBLIOGRAPHY

Bergstroem, E, (1979): Marknadsfoering av komplexa anlaeggningar, Foeretagsekonomiska Institutionen, Stockholms Universitet.

Bhagauan, MR, (1980). Technological Transformation of Developing Countries. Resarch Paper.

Clifton, DS and Fyffe, DE: Project Feasibility Analysis - A Guide to Profitable New Ventures.

Export Credits Guarantee Department, (1984): ECGD Services. HMSO.

Exportkreditnaemden (EKN), (1983): EKN Garanti. EKN, Stockholm, Sweden.

Financial Times. International Construction. Financial Times Surveys, 1976 - 1984.

Healy, NJ, (1981): Risk Management in Giant Civil Engineering Projects. Univ. of Manchester Inst. of Sci. and Tech. (UMIST).

Heffman, S, (1983): Country Risk Analysis; Demand and Supply of Sovereign Loans. City University Business School

IMF, (1983). Annual Report 1983, International Monetary Fund (IMF), Wash. DC.

National Economic Development Office, (June 1983): Construction Forecast 1983-84-85. HMSO.

Mattsson, LG, (1977). Cooperation between firms in international systems selling. Paper, University of Uppsala.

NEDO, (1983): Selling Process Plant to Overseas Energy Industries. NEDO Process Plant EDC.

Nevitt, PK, (1980). Project Financing. Euromoney Publications.

Sasson, D, (editor), (1982): Bidding for Projects Financed by International Lending Agencies (ILA). Gower Publishing Co. Ltd.

Skylark, C, (1979): Strukturering av Aemnesomraadet Project Management, IMIT, Chalmers Institute of Technology, Gothenburg.

Swedish Export Council, (1979). Turnkey Offers from Sweden, Export Council, Stockholm, Sweden.

SKANSKA AB. Turnkey = Nyckelfaerdigt; Komplicerade Aataganden paa Utlandsmarknaden. SKANSKA AB Journal.

C. von Schirach-Szmigiel and L. Otterbeck (editors), (1978): Oeststatsaffaerer. Institutet foer Internationellt Foeretagande, Studentlitteratur.

UNIDO, (1982): Financial Resources for Industrial Projects in Development Countries. UNIDO International Centre, Vienna. Jnl. third ed, vol. 3.

The World Bank, (1982). The World Bank Annual Report 1982. Wasn. DC.