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"FACTORS AFFECTING THE PROCUREMENT OF CAPITAL WORKS FOR THE UNITED KINGDOM WATER INDUSTRY"

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INTRODUCTION

The structure of the UK water industry.

In England and Wales the responsibility for the provision and maintenance of water supply and sewerage facilities was transferred to the private sector with the sale (privatisation) of the government owned Regional Water Authorities to create nine English and one Welsh public limited companies (plc's). Prior to privatisation, the Regional Water Authorities held an agreement whereby the various English Local Authorities were responsible as agents to the Water Authorities for the provision and maintenance of sewerage facilities within their districts. These agency agreements were transferred to the plc's but these could be subject to far reaching review in the future. There are also 28 existing small private water supply companies with no involvement in sewerage matters.

In Scotland the provision and maintenance of water supply and drainage facilities rests with the 12 Scottish Regional Local Authorities who operate Departments of Water Services. In Northern Ireland the responsibility rests with UK Central Governments' Department of Environment for Northern Ireland.

Water industry capital works budgets.

It has long been recognised that there is a need for increased investment in the water and sewerage infrastructure in the UK. Existing or impending European Commission legislation will significantly increase the annual rate of this investment with the most significant being:
(i) the pollution of bathing water directive:
(ii) Directives concerning the pollution of rivers and estuaries by "red list" substances;
(iii) the drinking water quality directive.

The EC are enforcing legislation and the UK have been prosecuted for non-compliance with the timescale for improvements under (i) and (iii) above. The water companies have responded with significant increases in their projected capital budgets. Evidence of this response exists in the annual financial reports of five of the ten new water companies which were published recently as summarised in Table 1.

Water Company	Annual Capital Budget (Pounds)	
	Current	Future
Anglia	192M	400M per annum by 1995
Thames	240M	400M per annum
South West	52M	117M per annum
North West	264M	400M per annum by 1992
Wessex	95M	95M per annum

Table 1 Water Company Capital Budgets

The general situation is one of a need for rapidly increasing capital expenditure and this will have a significant effect on the procurement systems adopted by the water industry client bodies.

Procurement options available to the water industry client bodies.

The majority of Water Engineering projects have been developed using the "traditional" procurement system shown in Figure 1.

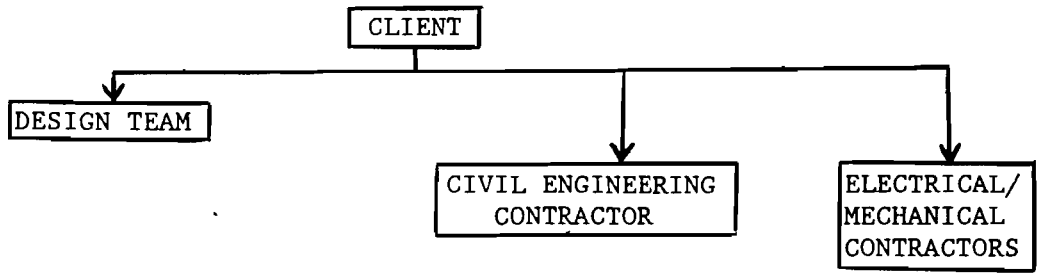

Figure 1 - Traditional Procurement System

The design team would be responsible for the conceptual and detailed design of the project, the preparation of contract documents and the issue of tender documents, and the supervision of the contractors involved in the construction of the works. The construction work would be let to contractors on the basis of competitive tenders from a preselected list of contractors using a contract based on the Conditions of Contract for Works of Engineering Construction, 5th edition (the ICE Conditions of contract). Since most water engineering projects would involve elements of mechanical and electrical control equipment separate contracts for these elements would be let, generally on the basis of design, installation and commission contracts. The design team would consist of either; the nomination of a direct employee of the water company or local authority as Engineer for the works assisted by a team of direct employees, this arrangement being commonly referred to as "in-house" design, or the appointment of an independent firm of consulting engineers. In the latter case the client bodies, because of their level of engineering expertise would have a member of their engineering staff acting in a capacity similar to that of a project manager.

Management Contracting and Construction Management arrangements would not generally be considered although design and construct schemes would be considered for projects that were largely process based.

This preference for traditional procurement systems with contractor selection based on competitive tender has been due in part to the need for public accountability when the water authorities were public bodies. Since privatisation this factor may not be as significant to the English and Welsh water companies and the balance between use of the various procurement systems is likely to change.

The future selection of procurement systems will therefore be more dependent upon the basic objectives of the water industry clients than on external influences.

CLIENTS OBJECTIVES.

Regardless of the nature of the client organisation, the principal aim in selecting project procurement methods is to obtain a finished project which will:

- be completed in the requisite timescale;
- perform to a satisfactory level;
- ensure that the most cost effective solution, on a life-cycle basis, is developed;
- ensure that the most appropriate allocation of risk between the various parties is achieved.

Project timescales

The major factor affecting the capital budgets of the water companies is the impact of EC legislation on pollution and water quality. The privatisation of the water companies, whilst not affecting the need for capital investment, has placed the water companies in a position where they are more able to raise sufficient finance to adequately fund this investment. The water companies, under the 1989 Water Act, are permitted to raise prices above the level of inflation to fund necessary increases in capital expenditure. The nett effect will be a rapid increase in capital expenditure with a corresponding increase in the necessary design work associated with this expenditure.

It is unlikely that the client bodies will be able to increase their in house design capacity to meet this demand. Whilst the water companies and local authorities have the expertise and the staff to design these projects in-house they will be unable to deal with the increased design work without widespread recruitment of suitably qualified additional staff. This recruitment would have to be initiated well in advance of the required completion dates of the projects. There is however no evidence of a recruitment campaign by any of these bodies.

The local authorities are further constrained by having a fixed number of posts available in their staff establishments and therefore recruitment of design staff at short notice is difficult. Consequently large projects with a relatively short period between initial conception and final completion will tend to involve private sector design organisations, either directly as design consultants or indirectly through design and construct contracts. In addition, they are unable to respond quickly to private sector changes in salary levels during a period where the demand for engineers at all levels exceeds the available supply and are therefore experiencing increasing difficulty in the recruitment and retention suitably qualified staff to their existing establishments. This imbalance between supply and demand will intensify, particularly in public health engineering, as increases in expenditure resulting from recent EEC directives coincide with a fall in the number of engineering graduates.

The use of private organisations may be self-perpetuating since the increased requirements of the private sector for qualified staff may be met through a corresponding decrease in staffing levels in the local authorities, thereby further reducing their capacity for in-house design. In England and Wales the privatised water companies will be more able to complete for staff with the private sector. Nevertheless, the problem of availability of qualified staff will remain.

Project performance and cost.

The choice of procurement system can significantly effect the clients' degree of control of the detailed outcome of the finished project. This degree of control is likely to be maximised with a project designed in-house, and minimised with a design and construct package based on an end product specification.

There are a number of reasons why client bodies would wish to retain such a degree of control. Firstly, the operation of any new project would have to be compatible with the operation of the clients existing facilities. This may place constraints on the use of particular processes or on the choice of mechanical and electrical equipment. Secondly, they will possess significant local knowledge and may have recent experience of projects of a similar nature and this can lead to the development of design solutions which are more appropriate to a particular project.

Clients control can be effectively exercised through their input to the design process. Figure 2 shows a model of the design process proposed by French (1) which illustrates the stages at which this input could be made.

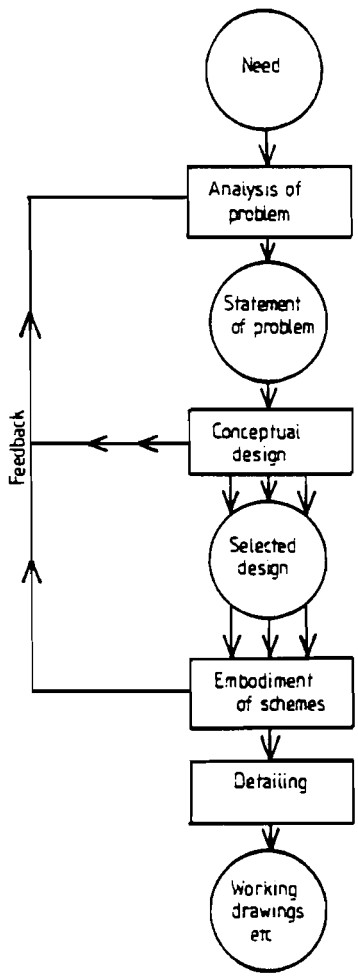

Figure 2. French's model of the design process.

At the very minimum the water industry client would be responsible for:
identifying the need;
analysing the problem; and
preparing a statement of the problem.

The statement of the problem is analogous with the preparation of a end product specification for a design and construct project or perhaps a brief for a consulting engineer. In either case the level of clients input will depend on the degree of detail in the specification or brief. At one extreme this could consist simply of the water or sewerage quality parameters required from the facilities and at the other extreme this could consist of a detailed specification of the clients preferred processes, plant, and facility layout requirements. In the latter case the client will have proceeded beyond the statement of the problem into the conceptual design, selection of design and embodiment of design stages. In fact it would perhaps be more accurate to describe a scheme developed in this way as a "detail and construct" scheme rather than a "design and construct" scheme with the design of the project being divided between the client and an external organisation.

It is conceivable that this would be the best way forward for water industry clients in reconciling their conflicting demands of;

(a) desirable levels of control of the project;
(b) the staffing levels required to adequately maintain that degree of control.

There are other external developments which may make a "detail and construct" option attractive to clients; namely the increase in fee competition amongst consulting engineers and a current interest in quality assurance in the design process.

The advent of fee competition, as described by Rowdon & Mansfield (2), will place consulting engineers involved in traditional projects under similar financial pressures to those involved in design and construct projects and there will be an increased need to accurately estimate and rigorously control the costs of design work. Referring to French's model of the design process the stages up to and including conceptual design would be the most difficult to estimate. However Ferry & Brandon (3) suggest that some 80% of the total costs of a project will have been committed by decisions made during this stage. It is therefore conceivable that the environment created for design in design and construct projects and in design work let to consultants on the basis of price may not lead to the most satisfactory conceptual designs. In view of the difficulties in estimating the costs of conceptual design work, it is possible that working to preset estimates of design costs at the conceptual stage is detrimental to both the quality and life-cycle costs of the completed project. It would however be possible to more accurately assess the costs of detailed design once the conceptual design has been developed.

It may be necessary for clients to require organisations on select lists of contractors for design and construct projects or consultants for design work to operate some form of design office Quality Assurance (QA) system in accordance with the British Standard BS 5750 or the International Standard ISO 9000. In this way both design and

construction cost estimates and the effectiveness of the organisations design management systems could be assessed at the selection stage. As is the case with cost estimates, QA procedures could be readily produced for detailed design but the intangible nature of conceptual design would limit the effectiveness of the QA system at the earlier stage of design.

Considering the potential conflicts between cost and quality and in view of the uncertain and complex nature of conceptual design work, it is likely that the most effective stage at which clients should invite external organisations would be on completion of the conceptual design. It could be argued that a major benefit of design and construct projects is that it removes the separation between designers and contractors which should lead to a more cost effective design and that this benefit may be lost if the flexibility of the turnkey designers is compromised. However, the conceptual design would only extend to elements of the project which are considered to be essential and therefore clients would be prepared to meet any additional costs of this nature.

Allocation of risk.

Client bodies, when considering the alternative procurement systems, must also consider carefully the choice of the most suitable standard form of contract to operate within the procurement system. The selected form of contract must ensure the most appropriate allocation of risk between the various parties. The Institution of Civil Engineers (ICE) Conditions of Contract for Works of Engineering Construction, 5th Edition has been utilised for most water engineering projects. The ICE conditions are generally intended for use on traditional contracts where the contractor would have no control of the design of a project and hence the risk is distributed generally on the basis that the contractor is responsible only for risks which could have been foreseen at the tender stage. The contractor is entitled to claim for additional costs associated with unforeseen circumstances under clause 12 of the conditions of contract. With design and construct projects the contractor would be able to consider at the design stage the effect of any changes in their design assumptions and it would be therefore reasonable to shift the balance of risk towards the contractors. This has been achieved in some contracts by the deletion in its entirety of clause 12 and risk allocation in this way would be broadly in line with the principle of allocating risk to the party best able to control that risk. This may lead to conservative design but most clients would accept this in return for greater certainty on the project completion costs. The shift of risk would also encourage design and construct contractors to give greater emphasis to quality and quality assurance of design work and this would reduce the potential problems associated with design work let by fee competition.

The applicability of the ICE conditions of contract may be further limited for process dominated projects which will be required as a result of the EEC directives. These conditions are concerned specifically with the construction of the process units rather than the adequacy of the performance of the actual process. Alternative forms of contract have been considered and Greenhalgh et al (4) suggest that the Model Form of Contract issued by the Institution of Chemical Engineers might be more appropriate. These conditions contain specific provision for testing that performance specifications have been met and contain remedies in the event of failure. If a modified ICE form of contract

were to be adopted then some form of performance bond may be required to safeguard against unsatisfactory performance of the completed works. The need for such a bond is questionable. In traditional procurement systems bonds are not required from consulting engineers designing the works nor is insurance against non-performance taken out on projects designed in house. The cost of any bond on any project would have to be passed to the client, who would have redress through the courts for non-compliance in any case. However some clients may consider that a bond would give a more certain and more readily attainable form of guarantee.

CONCLUSIONS

The advent of privatisation of the water industry in England and Wales will significantly affect the procurement systems adopted by the industry The rapid increase in capital budgets and the reduction in the need for public accountability is likely to lead to a shift from the traditional procurement system to greater use of the design and construct system. Water industry clients will however require a high degree of control of the outcome of the projects and this can be best achieved by an adjustment to the design interface between clients and design and construct contractors. The necessary degree of control can be most effectively maintained by the direct involvement of the client in the design process up to and including the conceptual design of the project.

Having evolved the conceptual design the client would be able to issue definitive briefs to designers either through traditional procurement systems or more likely by a system which could be described as a "detail and construct" system. This system would be more compatible with current trends toward fee competition amongst designers and the implementation of formal quality assurance systems for the design process.

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