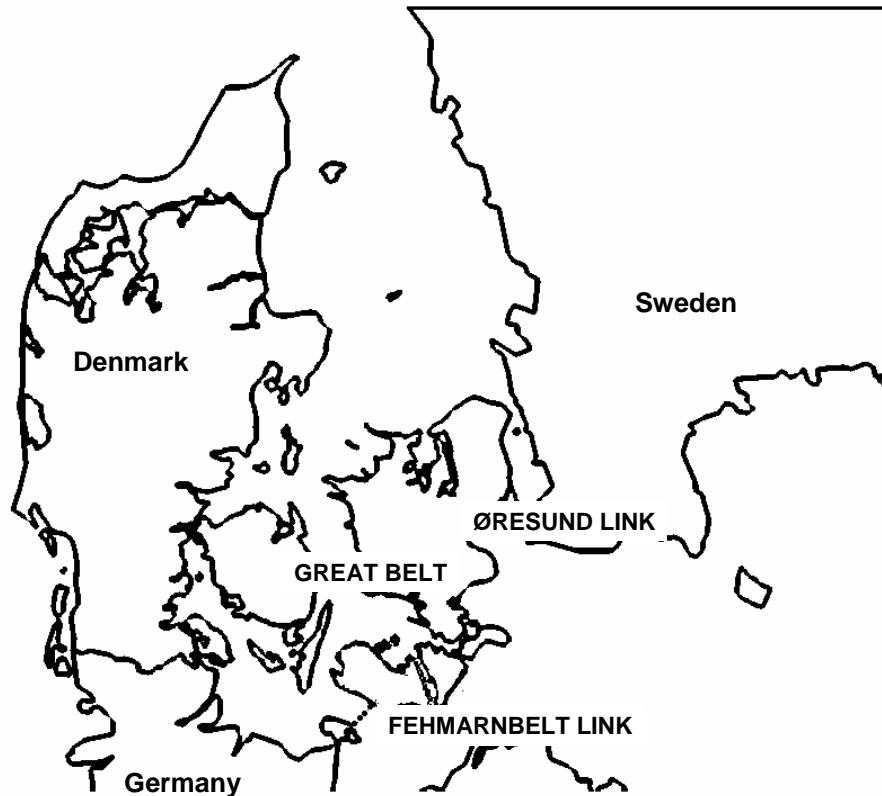


Bridge building in practice – mentally and physically

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BACKGROUND

A career spanning over first 20 years of contracting in heavy civil engineering and subsequently some 15 years as being 'The Owner' or 'The Client', and as such having been involved in the management of two of Europe's largest civil engineering projects, has highlighted the realisation that society needs a new breed of Owners.

True, we also need a new breed of Contractors, but as the contractor does not write the contract - this is the privilege of the Owner – then the process of changing the confrontational type of cooperation between the parties must naturally start at home – i.e. with the Owner.

My 21 years as a contractor around the World has made me realise that the most satisfying jobs were those carried out for Owners who knew what they wanted, who were clear and timely in their decisions.

However, they were very few and far between. For me they number in single digits.

For it to be a success the Øresund Fixed Link was from the outset destined to be a project where innovative solutions were required, - if nothing else, simply because it spanned a 16

km waterway with a national border in the middle, and watched over by some 3 million citizens in two countries.

This US \$ 3 billion project was completed on time (actually 9 months early) and on budget, while none of the 9 contracting joint-ventures made a loss, and no political or media scandals occurred during the execution period.

This was a remarkable achievement, in as much as no litigations or arbitrations were ever used or even contemplated by any of the parties.

Furthermore, all final payments had been made prior to the day the Danish Queen and the Swedish King officially opened the Fixed Link for traffic (July 1, 2000).

The reasons for this achievement are simple, - may be too simple, but real.

The Owner decided to be a believable Partner and lead the project. This meant managing the project, taking responsibility for co-operation not only with contractors but also authorities and share risks with the contractors in relation to their individual capabilities. Without entering into a formal partnership, it became a real partnership with significant benefits for all involved: The Owner, the Contractors and the Public.

The story of this remarkable step, - an Owner, who is a true Partner and willing to take responsibility and share risks - is told below as an inspiration to those Owners, who want more results and less confrontation.

THE BEGINNING

The Øresund Fixed Link (Coast to Coast) is a combined high-speed rail and motorway link, extending 16 km across the Øresund between Copenhagen on the Danish side to Malmö on the Swedish side, valued at some US\$ 3 billion (1990).

The decision to build the Øresund Fixed Link was taken by the Danish and Swedish Governments in 1991, when they agreed to establish a state-owned limited company for the purpose of forming a consortium – Øresundskonsortiet (in the following named The Owner) - that was to be responsible for designing, financing and constructing the Øresund Fixed Link.

In addition, the Government Agreement assigned to The Owner the task of operating and maintaining the Fixed Link following the planned opening for traffic in the year 2000 – mainly by levying toll fees on the link's users, both road and rail.

The Government Agreement stipulated the Owner should be responsible for the execution of the project taking into account what would be

- ecologically motivated,
- technically possible and
- financially reasonable.

The Consortium Agreement further stipulated, that the Consortium should be managed

- according the sound financial principles

The latter implied that - although state-owned, the Board was selected by the Governments from Private Sector individuals. The Board in turn selected the management in a similar manner.

The Owner's management (The Management) consisted therefore of a small number of experienced people. Therefore, the basis was created for a Management that was prepared for and capable of taking on risks in a financially responsible manner.

The Fixed Link project attracted enormous interest in both countries from political circles, from the authorities, from future users and from the local residents:

Where exactly should the link be sited?

What should it look like?

How would it affect the environment?

What distinguish this project from many other projects, however, are its surrounding community and the many factors that needed to be taken into account:

- The project is politically sensitive and has been highly affected by the political decision processes relating to other infrastructure projects (the associated land works near Copenhagen, the new City Tunnel through Malmö, etc.
- In view of the attention given to local as well as global environmental issues, the environmental impact of the construction process, as well as that of the completed traffic facility, had to be considered very carefully.

The dual-nationality of the project necessitated a detailed examination of the different legislation in the two countries. In fact, for each decision concerning the Link's design and construction, The Owner had to examine the legislation of both countries – a task that was not made any easier by the fact that at this point in time Sweden had not yet become a member of the EU.

It was also clear that as far as standards were concerned, a number of problems were bound to arise. Since Denmark and Sweden in a considerable number of cases have incompatible regulations and standards, The Owner was faced with the choice of either co-ordinating the existing standards of the two countries or providing alternative solutions.

Following an international tender process, Management selected two consultant groups (house consultants) to prepare proposals for the Fixed Link's design, i.e. for the tunnel part and for the bridge part respectively. This employed their relative strength in the optimum way. The results from their proposals formed part of the ongoing planning of the project for the environmental requirements concerning the Fixed Link's blocking effect on the water flow. As a result of the environmental process the originally 2 km long immersed tunnel needed to be increased to 4 km.

Management decided for commercial reasons to split the coast-to-coast section into five (relatively) large contracts (US\$ 400 million – 1000 million), suitable for international competitive tendering:

- Dredging & reclamation work
- The 4 km immersed tunnel under the Drogden Navigation Channel
- The 7 km long approach bridges
- The 1 km long cable stayed high bridge across the Flinte Navigation Channel
- The 16 km long dual track railway systems and installations

However, the main management problem for a one-time Owner – apart from the obvious ones of starting up a new dual nationality company - is that it has no track record, i.e. to its business partners it may be a Difficult Client or an Easy Mark, nobody knows, and this is normally reflected in attitudes as well as tender prices.

These problems, however, did not deter the Management.

For a small group of the Owner's new management staff, with sufficient previous experience, the first 3 months were spent preparing a complete strategy – how best to proceed from start to finish – in principle.

This proved to be a wise way to spend the time, and the strategy - and the possibilities of adjusting it - held up right to the opening, some 8 years later.

MANAGEMENT PRINCIPLES

The Owner's management principles were not static, but changed systematically as the project's phases were completed.

Flexibility was therefore an important component in the whole process.

It was a conscious effort by Management to always be responsible for initiating and motivating changes within its own organisation, as well as its partners.

For this to occur, all staff must absorb two principles:

- To know the common objectives
- To understand the means of achieving them

The essence of these matters was clearly communicated to all our partners.

However, those messages were not initially understood by all, but repeated messages succeeded.

MANAGEMENT STRATEGY

The Owner's basic management principles can be summarised as

- management by objectives,
- delegation and
- pro-activity.

Consequently, right from the earliest stage, Øresundskonsortiet defined clear goals, both within

- its visions, and
- its business concept.

Such goals should be measurable.

A strategy for their achievement was then developed.

Only when the goals and strategy were in place, could the Management determine the organisational structure and the associated staffing, which should eventually realise the visions and business concepts.

At regular intervals (every six months, as it turned out), the objectives and strategies were reviewed. Management then adjusted the organisation, wherever necessary, to ensure that sufficient resources were available for the tasks in hand – and that those in charge of individual tasks had the authority to act accordingly.

This "controlled process" served to emphasise the concept of pro-activity – that Management was ready to act before events forced it to and that any change of direction had been carefully considered in advance.

The successful implementation of a cross border project the size of the Øresund Fixed Link – i.e. some US \$ 3 billion with a monthly turnover over some US \$ 75 million, and within such a short time span – i.e. 4½ years construction time, right from scratch, requires the immediate establishment of a company culture which continually leads the process and naturally adapts to new demands and requirements, internally as well as externally.

No less importantly, it also requires with the new organisation an acceptance of openness, a willingness to listen to suggestions and to adapt to ideas from partners as well as from the world at large. Only in this way will an Owner organisation be able to bring the project to its successful conclusion within time and budget.

CALLING FOR TENDERS

In 1994, Øresundskonsortiet invited tenders for the Fixed Link's main contracts – the tunnel, the dredging works, the high bridge and the approach bridges - based on the principles in the EU Directive 93/37/EEC concerning public agreements. This was despite the fact that the directive did not yet apply to the Øresund Link.

However, it was the first signal of the Owner's intention of engaging in a transparent and fair tender and construction process.

CONSTRUCTION CONTRACT PRINCIPLES

The tender process itself did not follow traditional methods either.

The Owner was able to lay down his own tendering strategy.

In a traditional tendering process, the Client delegates the detailed planning and design to consultants and then invites tenders on, in practice, somebody else's documents.

In the background, the Client pays for the entire process, somewhat reluctantly, without being quite clear on the risks involved and how they were actually handled in the design process or priced by the Contractor during the tender process.

The Management wished to handle the process differently.

First of all, the Management wanted to avoid the ritual discussions, confrontations and arbitrations, which are generally well known and inherent in conventional client-contractor relationships. The aim, of course, was not only to try to build the Fixed Link at the agreed price and at the agreed time, but to actually do it – and also to create a working relationship, which ensured fair, transparent and constructive collaboration between the many parties involved.

The obvious solution to this was to write clear construction contracts that could be read without the assistance of lawyers.

The basic concept for the construction contracts was a de facto "Partnership".

An initial survey of the Fixed Link's "stakeholders" revealed that no fewer than some 150 organisations were involved in the project, all of which had to, wanted to or claimed a right to exercise some degree of influence.

Unless this was tackled in a new way, it could easily lead to many confrontations that clearly would delay and/or increase the cost of the project.

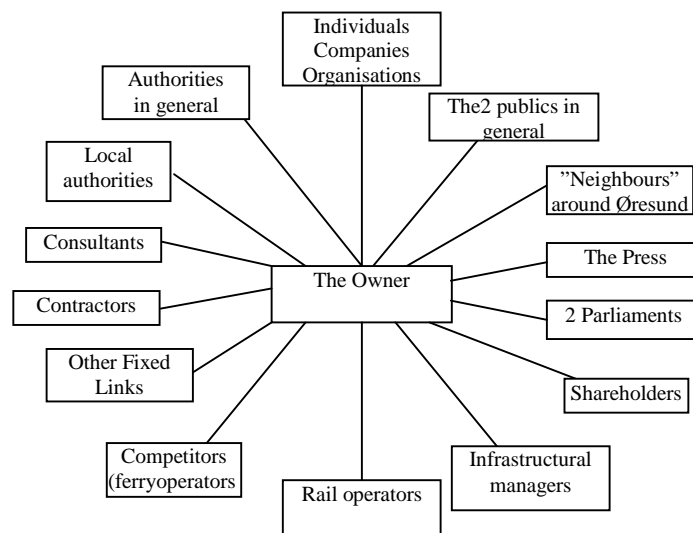


Figure 1: Stakeholder diagram

The Management's basic concept, therefore, was to be an Owner/Client that knew what he wanted, but valued a constructive partnership with all parties involved, including the authorities and, of course, the contractors.

In contrast to the conventional methods in many infrastructure projects, the Management wanted to manage the process. It did not wish to manage the details, but understood the

details and was aware of their existence, and delegated the necessary responsibility and authority to those best equipped to handle them, while, at the same time, maintaining a constant and firm overall view of the project and its risks.

THE DESIGN & CONSTRUCT PHILOSOPHY

It was a natural consequence of the strategy to implement a Design + Construct philosophy, which provided firstly the tenderers with the House Consultants' strong draft proposals (the Owner's Illustrative Design) – and secondly and not least a free hand to use their expertise to improve the design, if they could.

The thinking behind this Illustrative Design is that the responsibility for the final detailed planning and execution should be clearly assigned to the contractor, but by issuing a strong tendering basis the Owner has done his "homework", avoiding surprises later.

This process limits the conventional potential for both errors and confrontation, it improves cooperation and it provides the individual contractor with a greater opportunity for solving his task efficiently. This again creates committed contractors, who become involved in the detailed planning and makes fast improvements and who feel a responsibility for the final product.

The Owner must be committed to support. It is, after all, his concept and his project. The concept provides considerable freedom for the contractor – a freedom that the Management must be continually aware of and respect.

The basic premise for a Design + Construct contract was an Illustrative Design where the Owner had developed one or more designs, which met all the Owner's own specifications and requirement, set out by, for instance the authorities and himself.

One could describe the Illustrative Design that it is the client's "homework" that tells the contractor "this is how I, the Owner, would build it, having adhered to all my own specifications".

This provides the contractor with most of the parameters for the execution of the project but since the contractor possess considerable knowledge, the project will inevitably be improved once the tenderers have examined it for tendering purposes.

With his Illustrative Designs, the Owner has provided a constructive groundwork, made available to the bidding contractors, guiding them in the right directions while not tying them down.

With the Illustrative Design the Owner was also able to get principle decisions from the Authorities, like requirements to location and worksites as well as a series of obvious practical questions related to the execution.

Therefore, a number of major obstacles to a timely completion, which always crop up at the detailed planning stage, had found solutions in principle by the Owner at an early stage, making time schedules and construction methods in the tenders realistic. Without, however, unduly tying the tenderers down.

ENSURING QUALITY

All the construction contracts comprise descriptions of the fundamental quality management philosophy of "own control".

This means that the contractors were assigned the responsibility for the design and administration of the quality management systems and the quality control of their own work. However, paper is not the real objective.

The objective is to first create a construction plan that describes step by step how to achieve and fulfil the contract's requirements for the final product, by describing the methods for temporary as well as permanent works, and as a consequence integrate into the description both the protection of the external environment and the working environment (health & safety).

Believe me, it proved an enormous help for a contractor with such a package in his back pocket to proceed quickly from the start of the construction. Needless to say, only documentation of the prescribed quality released a payment.

ENSURING REALISTIC DIVISION OF RISKS

A natural consequence of this partnering model is that the contractor has full responsibility for risks over which he has control, i.e. detailed planning, the workforce, and permits issued by the authorities concerning construction aspects.

On his part, the Owner is responsible for other risks, where an element of gambling is predominant: currencies, political aspects, the overall granting of approvals by the authorities, i.e. areas in which contractors traditionally calculate a high risk premium and which often become subject to dispute if the risks in fact occur.

ENSURING QUICK SETTLEMENT OF DISPUTES

The professional role separation in clearly written construction contracts combined with a sound working relationship reduces the number of potential conflicts compared to conventional methods.

By also establishing a Dispute Review Board (DRB) already at the tender stage the Management further reduced the likelihood of a dispute.

In the event of a dispute, the DRB shall function as chief arbiter.

The principle is that at the contract signing stage a panel of three experienced, independent and internationally respected engineers, chosen in common - the DRB - is established for each construction contract and named into the contract.

Contractually, the Board's decisions may be referred by an unhappy party to arbitration, but only after completion. The contracts stipulate, namely, that the two parties have agreed to implement the DRB's decisions until the construction process has been completed.

The aim of this stipulation is to ensure frictionless day - to - day co-operation.

The procedure chosen for the Fixed Link implied that each Board convened every second month on the Site, where both the Owner and the Contractor gave a briefing on the status of the construction contract and brought up possible problems.

The aim was to solve problems as quickly as possible – hopefully before they could affect the running of the construction sites.

The experience with the Dispute Review Board showed that problems were never allowed to come beyond the briefing stage.

In the first place, there were few potential areas for conflict, because these were carefully described in the clear text of the construction contracts.

In the second place, with such short periods between the Board's meetings the actual problems were identified very early - generally already in the planning phase - thus before money were spent, which enabled the parties to resolve any problem fairly easily, - i.e. before the matter was brought before a Dispute Review Board.

The factual success can be demonstrated in that during the construction of the Fixed Link no decisions were ever required by any party from any of the individual DRBs. Thus no arbitration was ever considered by any party.

Therefore, all payments were effected before the official opening of the Fixed Link took place.

ENSURING COMPLETION ON TIME AND BUDGET

The management goal was that – regardless of the length of the bi-national approvals phase - The Øresund Fixed Link must be ready by the summer of the year 2000.

This became the overall common objective, which the Owner and the contractors were working towards. The secret behind the very effective time schedule during the last two years was a "parallel works" approach on all sections of the project initiated by the Owner.

The purpose of "parallel works" was improved utilization of time. Thus, any surplus time on one section of the project should be transferable to another contractor, who might in practice be in need of more time. That means non-used buffer time on one contract should be utilised on other contracts. It is obvious, for instance, that a bridge must be welded together before the rail tracks are laid. But – was it not for the obvious inherent contractual restrictions - the rail contractor could, of course, begin his preparations on the bridge long before the bridge is ready.

Implementing this thinking contractually is, therefore, rather tricky, because a contractor's buffer time is the contractor's property.

The Owner could not have implemented his Parallel Works strategy over those last two years unless the individual construction contracts (there were 9 Nos.) had foreseen the need for and permitted such planning and co-operation procedures across the interphases between the construction contracts.

Conventionally, sub-optimisation occurs to the detriment of the whole project.

That is, each contractor completes the task assigned to him as quickly as possible – irrespective of whether his neighbour (and the project) might benefit from using - for example - some of his scaffolding overnight in order to finish more quickly.

Basing his parallel works method on the actual progress in the first 2 years, the Owner managed with mirrors, smoke, song, dancing as well as plain planning homework and convincing dialogue to create a common understanding of the project's optimum time schedule, which made it possible for every contractor not to have unused buffer time, i.e. “to pull in the same direction” during the final 48 months to finish ahead of all individual time schedules, ahead of the budget and with a corresponding profit for the individual contractors.

This partnership result was achieved through cleverly repaying time with time, and without cash involved.

Not a common occurrence on such large and prestigious undertakings.

CONCLUSION

When the management philosophy is redefined to not just finding a winner and a loser, but to create a win - win partnership (and meaning it), new creative forces take over to provide a better and more profitable environment for all the actors involved in the process.

Actually, it becomes a win – win – win situation: The Owner, the Contractors and Society benefits.

It might sound as a fairy tale written by H.C. Andersen.

It is a true story.