The co-ordinating committee — a project management tool for the Directorate of Water Affairs

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Synopsis
Sufficient detail of the internal organization structure of Water Affairs has been given for the role and operation of the co-ordinating committee to be defined and described. It has been pointed out that the innovation of the co-ordinating committee as adapted to suit the structure of Water Affairs has proved to be a success and is today a standard feature of the project control for every significant project handled by Water Affairs.

Samenvatting
Voldoende detail oor die interne organisasiestructuur van Waterwese word voorsien om die rol en werkmethode van die koördineringkomitee te definieer en beskryf. Daar word op gewys dat die invoering van die koördineringskomitee soos dit aangepas is om aan die struktuur van Waterwese te voldoen, suksesvol is en vandag in standaard verskynel is van die projekbeheer vir elke noemenswaardige projek wat deur Waterwese aangepak word.

Introduction
In our efforts to remain competitive and to provide an efficient service to the country, the spotlight has fallen in recent years on project management. This paper deals with the problems encountered in the past and benefits being derived from one aspect of our present project management style — the Project Co-ordinating Committee.

Project organization
Basic elements
Fundamentally organizations for most civil engineering projects consist of three basic elements:

1. The ‘client’ who required the project and who foots the bill.
2. The ‘engineer’ who conceives the detail of the project and ensures its successful completion.
3. The ‘constructor’ who executes the work.

Certain government departments and other public organizations have a significant technical capability and in certain cases execute all three of the basic functions of client, engineer and constructor.

The Directorate of Water Affairs is one such organization capable of fulfilling all three of the basic functions for most of its projects. However, in recent years growing use has been made of consulting services and a large portion of the construction budget is executed by the private sector. The organization chart of the Directorate of Water Affairs is shown in Fig 1.

Progress of a typical Water Affairs project
Broadly speaking, a project may be initiated in one of three ways:

1. As a request by the public
   (a) Referred directly to the Planning Division.
   (b) Referred to the Planning Division via the Irrigation and Engineering Services Division.
   (c) Referred to the Planning Division via the Minister.
2. As a request by another government agency, such as the Department of Co-operation and Development or the Department of Agriculture and Fisheries, again referred to the Planning Division as before.
3. Directly as a result of pre-planning on a national scale by the Planning Division of Water Affairs. The bulk of the work probably arises in this fashion, such as the continuous monitoring and planning for the augmentation of the bulk water supplies to the major metropolitan growth centres of the country.

During the planning stages, the main parameters of the project are determined and the economic viability proved. For these purposes

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most of the following tasks have to be carried out though not necessarily in the order given:

1. Geological investigations in two stages:
   (a) Reconnaissance studies. These involve visits by geologists and engineers to the alternative sites and a desk study of all available data to eliminate as many of the alternatives as possible.
   (b) Feasibility studies. These involve a full geological report on the remaining sites, based on core drilling adits, trenches, seismic surveys, etc, as the need arises. For this purpose also 1:10 000 scale plans are produced photogrammetrically from existing high level photography. Finally accurate 1:1 000 scale plans of the final site and 1:5 000 scale plans of the basin are drawn up, usually from new aerial photography.

2. Hydrological analysis as required, including flood frequency analyses.

3. Sediment deposition forecasts as required.

4. Optimization of various alternative proposals on an incremental cost basis to decide the final size and type of structure or aqueduct system. The final decision on the viability of the project is usually based on a benefit/cost study making use of discounted cash flow techniques with a range of discount rates to determine sensitivity, for the determination of the present values of both benefits (expressed as entrepreneur’s profit) and costs. For this purpose also, demand has to be determined and future growth of the demand forecast.

5. Determination of the unit cost of the water and the likely tariffs that would have to be levied. The unit cost is based on redeeming the full capital and running costs and accumulated interest at the ruling Treasury interest rate over the life of the project.

If the planning stages result in an economically viable project with acceptable tariff levels, then a White Paper is prepared and tabled in Parliament. This usually occurs during April each year.

If the White Paper survives Parliamentary criticism and if the budget for the necessary funds is approved by Parliament, then detailed civil designs are prepared by the Design Division and mechanical and electrical designs by the Mechanical Division. Full use is of course made of laboratory and model study techniques and computer aids.

The detailed budgets which are submitted for Parliamentary approval each year are prepared by the Construction and Cost Accounting Divisions and are often based on estimates provided by the other divisions of the Directorate.

Once both the designs and the funds are available, construction takes place. After completion of construction, the works are formally handed over to the original client.

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Basic elements – Water Affairs

From the description given above, the following may be deduced:

The 'Client' is the body which has to take responsibility for the project after completion. Generally, this may be an irrigation board, a water board, another government agency as mentioned before or the Superintending Branch of Water Affairs. The Superintending Branch will generally act as the Client on behalf of irrigation and water boards. The 'Engineer' is at present the Civil Design Division for all civil construction, Special Tasks Division for environmental matters and the Mechanical Division for all mechanical and electrical work. All these divisions may employ consultants to advise and aid them without, however, detracting from their responsibilities as Engineer. The consultant may in fact carry out all the duties of Engineer but he does this on behalf of the responsible division within Water Affairs. The 'Constructor' is generally the Construction or Mechanical Division of Water Affairs. Again, outside contractors may be employed to do the work but they do it literally as sub-contractors to the Construction or Mechanical Division who retain final responsibility for executing the work.

Responsibilities

The basic responsibilities of the Water Affairs organization may be set out as follows:

(a) Definition of requirements - Client and Planning Division together
(b) Feasibility and optimization - Planning Division
(c) Design and specification - The 'Engineer' as defined above
(d) Construction - Works Branch
(e) Project control
   financial control - Works Branch together with the Financial and Cost Accounting Branches of the Department
   programme control - Construction or Mechanical Division
   quality control - The 'Engineer' plus Construction or Mechanical Division
(f) Financing - Financial Branch together with the Treasury

Relative merits of the Water Affairs organization

The most important disadvantage of functional organizations such as that of Water Affairs has always been the lack of a single responsibility for the overall success of the project. In the Water Affairs situation each Division is responsible for the success of its own work only, with the result that overall co-ordination in the absence of specific steps to counter this effect tends to be weak, relatively speaking. People tend to 'pass the buck' when marginally defined activities are at issue and most try to clear themselves and their division of blame when things go wrong.

Another difficulty is decision making. Most decisions affect more than one division and the making of the relevant decision tends to fall between two stools to the frustration of those awaiting the decision.

Also, for the same reason that actions affect more than one division, control has proved to be difficult:

- Control over quality affecting the civil design, mechanical, construction and superintending divisions.
- Control over time affecting all divisions although Construction carry the nominal responsibility for it.

However, the major strength of the functional type of organization has always been, and is still in the case of Water Affairs, the advantage of specialization. Each division specializes in its own function and can and does maintain a high level of expertise and knowledge.

Project organization for Water Affairs

To overcome the weaknesses mentioned above, it is often suggested that Water Affairs should be organized along project lines for each of its projects. The resultant organization might look something like that depicted in Fig 2.

In this possible organization, functional branches have been retained for Scientific Services, National Planning, Superintending and Financial Control. However, each project has its own organization of the functions of Data Services, Planning, Design, Construction, Cost Accounting and Administrative Services.

The major advantage of this organizational structure is that there is no split responsibility for the success of each of the projects. For instance, the head of Project A is responsible for success. Equally, he is given strong control over all his special functions and is in a position to co-ordinate all activities effectively.

The major disadvantage, particularly in the South African context, would be the inefficient utilization of people with specialized skills. Our projects are simply not large enough to keep people like planning engineers, surveyors, engineering geologists, civil, mechanical and electrical engineering designers, and draughtsmen busy on a single project all the time.

The compromise

The Directorate of Water Affairs has chosen a compromise solution and found it to be a most effective solution under current circumstances.

The objective was to retain the strengths of the current functional organization, namely the availability to each project of a pool of people with specialized knowledge and skills in each Division, together with the advantages of the project oriented organization — single responsibility for success, good co-ordination and strong control.

This objective has largely been achieved through the creation of the so-called 'Project Co-ordinating Committee'.

Project Co-ordinating Committee

Responsibilities

These may be listed as follows:
**Programming.** A broad co-ordination programme is run by the Committee with sufficient detail to ensure that delays which might affect target dates are shown up. Detailed programming of each major activity remains the responsibility of the functional Division concerned with the activity.

**Activities.** Steps are taken by the Committee to ensure that every activity which has to be executed is accepted as a specific responsibility by a particular Division through its representative on the Committee.

**Monitoring.** Every significant activity is monitored by the Committee to ensure its successful completion. If problems are encountered, alternative solutions are sought and responsibility re-allocated within the Committee. Problems which cannot be solved by the Committee are referred in the first place to the relevant Chief Engineers or if necessary to Branch Manager level for decision.

**Authority.** As a complete contradiction of all standard theory on the subject, the Committee per se has no executive authority to carry out its responsibilities. Executive authority remains with the Divisional Chiefs. However, the Committee indirectly wields all the authority of all the Divisions represented since each representative on the Committee carries the delegated authority of his Divisional Chief to act in his name.

Specifically in this context, the Committee has no authority to make any decisions at all — it can only recommend. However, again because of Divisional representation on the committee, committee recommendations generally have the power of decisions.

**Financial Control.** Currently, the Project Co-ordinating Committee has no responsibility for financial control other than to recommend action to counter the effects on particular projects of financial restrictions not originally anticipated. Financial control remains the direct responsibility of the Construction Division together with the Financial Branch of the Directorate of Administration of the Department.

**Operation.** Project Co-ordinating Committees for major projects are appointed by Management whilst the Chief Engineer's Co-ordinating Committee might decide to form Project Committees for certain of the more important of the remaining projects.

Current policy is to appoint the Project Co-ordinating Committee as soon as possible. In the case of the Usutu-Vaal Project, the Committee was formally constituted just before the first excavations were started, although an informal committee was active before this. In the case of the more recent White Moffozi Government Water Scheme (Klipfontein Dam), the Committee was appointed prior to the tabling of the White Paper so that all Divisions concerned could make a direct contribution to the final conceptual planning for the scheme.

The chairman is appointed directly by either Management or the Chief Engineer's Co-ordinating Committee and he then invites divisional chiefs to nominate their representatives. As far as possible, this constitution of the Committee remains unaltered through all phases of progress of the project to completion in order to ensure effective continuity and a clear acceptance of responsibility for the success of the project. However, the chair should rotate according to the Division most concerned at the time and as preferred by the Project Committee.

When the appointment of the Project Committee is made, its specific objectives will be defined by Management or by the Chief Engineer's Co-ordinating Committee as the case may be. Meetings are convened by the chairman as frequently as circumstances dictate — usually monthly.

Three types of report are prepared and circulated:
1. Programme — an updated critical path network computer print-out or a manually prepared bar chart as the case may be. This is distributed to committee members only.
2. Minutes of meetings. These are distributed to members and to those Divisional Chiefs mainly concerned in the action at the time.
3. Exception reports either to Management and the Chief Engineers or only to the Chief Engineers according to the constitution of the particular committee, regarding matters for special decision or on a regular basis for the more important projects.

**Responsibilities of members of the Project Co-ordinating Committee Planning.**

Generally the broad target dates for new projects are determined by the Planning Division and form the basis of the co-ordinating programme. Where the Committee exists before tabling of the relevant White Paper in Parliament, the Planning representative reports on progress of the work being done to prepare the White Paper. This work comprises mainly the following:

- Surveys — site and basin topographical surveys, soil survey (Department of Agriculture) and materials survey (laboratory)
- Engineering geology
- Hydrology
- Demand determination
- Consultations and negotiations with other interested bodies
- Preliminary designs
- White Paper report

Subsequent to the tabling of the White Paper, generally during April/May of each year, the Planning Division is concerned with any deviations of the work being executed from that described in the White Paper. In fact no work whatever may be done or money spent on anything at all not covered by the White Paper. The Planning representative must also ensure that the full intentions of the planning work done, which might not have been fully documented in the White Paper, are carried through.

**Design.**

The work done involves mainly:

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Hydraulic studies including the use of models
Structural studies including the use of models
Materials analyses and testing
Designs and design optimization studies for minimum cost
Preparation of working drawings, specifications and contract documents when required.
Preparation of purchase and servitude plans
Instrumentation for behaviour monitoring of the structure.
Control over quality of the execution of the work in relation to the specifications. However, the Design Division at present has no authority to enforce its decisions in this respect. In cases of dispute the matter would be referred to Management for decision. In this respect, too, the Design Division therefore does not enjoy the normal authority of the 'Engineer'.

The Design representative, just as is the case with all the other representatives, does not report on detailed progress. He merely reports problem areas and task completion dates.

Mechanical electrical design

With the exception of the preparation of purchase and servitude drawings, the work involved in mechanical and electrical design has the same elements as for civil design. The major difference lies in the fact that the Mechanical Division generally is itself responsible for mechanical and electrical installations and the problem of split responsibility for quality control does not arise.

Construction

This Division executes the work either through own resources or on public contract. In the latter case tender documents would be prepared by the Civil, Mechanical or Electrical Design sections. As far as the Project Co-ordinating Committee is concerned, this Division has three important functions:

1. Reporting on progress, generally by exception together with comment on action taken or proposed to correct non-achievement of targets. The date of actual achievement of each target should always be reported and recorded.
2. Preparation of those portions of the Co-ordination Programme with which they are concerned.
3. Information regarding any activities which might affect construction progress and which either have not yet been allocated for execution or which should be monitored by the programme. In the former case it is one of the Committee's most important tasks to ensure that a specific member of the Committee accepts responsibility for timely execution of the activity. Should the Divisional Chief disagree with his representative on the Committee, the matter would again be discussed. If at Chief Engineer level responsibility cannot be decided, the Chairman of the Committee would refer the matter to Management for decision.

This third function, of course, applies to any activity no matter which Division discovers the need for it.

Superintending

Because it generally acts as the client's representative, Superintending's chief role on the Committee is therefore to ensure that their requirements are in fact met. In addition they must ensure that facilities such as permanent housing are available in good time for their operatives to take over the operation of the scheme in an effective way whilst Construction are still on site.

Other ad hoc members

The relevant representatives would attend meetings only as required by the progress of the work and would report as follows:

Surveys: Progress of site and basin surveys, canal and pipeline routes, borehole levels and any other special survey tasks.

Engineering geology: Progress of core drilling work, any other geological investigations and the preparation of the relevant reports.

Hydrology: Progress on the preparation of any special reports, the needs for hydrological measurement such as water level recording, stream flow measurement, dam discharge measurements and the like.

Special tasks: Design and control of environmental factors and associated reports on progress of studies or construction resituation.

Land matters: Progress on the acquisition of the required land, servitudes or other rights. This Division fulfills an important co-ordinating role in this case since the actual purchasing of property and servitudes and the payment of compensation is done by the Land Affairs Branch of the Department of Community Development. Nevertheless the right of access and occupation must vest in Water Affairs by the time Construction has to take action and it is the Division of Land Matters who have the responsibility for ensuring timely acquisitions.

The co-ordination programme

The Chairman of the Project Co-ordinating Committee is responsible for the drawing up and maintenance of the co-ordination programme. This programme does not in any way reduce the importance of the detailed programmes which are drawn up and maintained for internal use by each executive Division.

So, for instance, Construction will maintain detailed programmes for each major task to be carried out. This would be used for daily control, purchasing, resources scheduling and general pre-planning. Thus, too, in the cases of the Design, Mechanical and Planning Divisions. By virtue of their nature these programmes will vary in complexity but it is seldom necessary to use a programming technique more complex than the normal bar chart.

However, the Project Committee has to ensure that all these individual programmes are combined into one master co-ordination programme to ensure the co-ordination of all the activities concerned. Again the normal bar chart usually suffices. However, for larger projects where the number of activities to be monitored by the Committee exceeds about 300, use must be made of a computer based critical path network programme. Such programmes would normally be run by the Construction Division's programming section.

The number of activities incorporated into the programme depends almost entirely on the definition of the concept of an 'activity' adopted for the particular programme. If this definition leads too much detail in the programme then it will become too clumsy to operate effectively, it will duplicate detailed functional programming within the divisions and will run the risk of not being used because of the mass of detail not required for co-ordinating purposes. If the definition is too broad then insufficient information will be available to meet co-ordination objectives. The following definition has proved effective:

1. Activities should be defined as broadly as possible, not the converse, whilst providing sufficient detail for every activity which should be monitored by the Committee to be identified separately.
2. Activities should always be broken where changes of responsibility take place.

An example will illustrate this point. 'Build pumping station' would generally be too broad a description since several responsibilities are usually involved, such as civil construction, mechanical installations, electrical equipment, structural steel work, electrical power and the like. However, if the concrete work involves only concrete construction activities, these could all be lumped together as, say, 'concrete work to ground level', even if this is a six-month activity. On the other hand, if mechanical parts are to be built into the concrete, such as, say, steel pipes, then the concrete work should be subdivided to enable the delivery and installation of the pipes to be scheduled to match the progress of the concrete work at that point.

Conclusion

There can be no doubt that the adoption of co-ordinating committees by Water Affairs has filled a long felt need in the Department and is fulfilling a most useful function. It would be interesting indeed to receive constructive comment from the private sector on project control within the public sector as they see it, with specific reference to Water Affairs. Further improvements or innovations could well result.

Acknowledgement

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