

P.E.R.T. and how P.E.R.T. techniques can be used in modern mine management

by E. T. Boome and A. C. Schmidt

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DISCUSSION

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In making this contribution to the authors paper, I should first like to congratulate them on the clear and yet detailed way in which they have illustrated their subject. I should also like this contribution to be linked with Mr Hazell's paper "Mine Management by Objectives".

I am very glad that Messrs. Boome and Schmidt have described the theoretical differences between I.J. and Precedence networks, since it has been my experience that Pert users are confused by these techniques. It is important that their differences be fully appreciated, with particular reference to their effect on updating procedures, where updating is done Bi-Monthly as against Daily. Similarly much more thought should be given to the final output requirements, prior to mounting the network on a computer. This is important in view of the number of varied Pert type computer packages that are available to the user. The Computer Department, be it "In House" or one of the many Computer Bureaux, should be called in whilst the network is still on the drawing board, and allowed to discuss the requirements of the system with all the personnel involved in its conception and use.

There is a tendency, to exclude Junior and Production Management from playing an active part in a Pert system. Various reasons are given, varying from, "They cannot understand", to "It will make the network more complex". It is my contention that Pert can be used for more varied reasons than those normally given. I have listed my uses as follows:

- (i) The planning of activities and labour resources.
- (ii) Control of operations whilst they are being carried out.
- (iii) Historical reference as an aid to future estimates of similar projects.

(iv) As a job relations aid via "management by objectives".

The first two points in my list have been more than adequately handled by the authors. Let us take the last two, in turn.

Historical reference as an aid to future estimates

Let us consider an incline shaft being put down by a producing gold mine. If updating is carried out strictly, i.e. altering estimated durations to actual durations as the project is carried out, we have at the end of the project very realistic durations for various activities, which can be utilised in future projects. However if we run concurrently a sophisticated stores and labour program, using as job numbers the same numbers as those of the activities making up the Pert Network, we can achieve two further results. That is to say we can now compare and control actual expenditure for any activity with estimated expenditure, and the actual expenditure can be also utilised for future estimating. In our incline shaft therefore we have used an estimated duration, gotten by "thumbsucking" as the Authors so rightly point out, for the cutting of a station, and an estimated expenditure for that station. At the completion of that station we shall have arrived at a much more accurate duration and the exact cost in terms of labour and stores; invaluable information for future planning. I do not think I need say more, except to point out that far from being a pipe dream, this method is at present being used by a gold mine here in South Africa.

As a job relations aid via management by objectives

As has already been pointed out by Mr Hazell this morning in his excellent paper, we must ensure that all levels of management are utilised

to the full. It is all too easy to use Pert as a pure reporting system, an error which occurs frequently and in my opinion negates the whole Pert concept. How much better to incorporate the people who will not only use the System, but will provide the information necessary for accurate updating. In the case of my incline shaft these will be the Mine Overseers, Shift Bosses, Electrical and Engineering Foremen, Storekeepers, Surveyors etc. If we use Pert as a report facility these people will be inundated with mounds of print-out from "that confounded computer", and the system will be doomed to failure.

I do not advocate, at this stage, calling all these people in during all stages of the initial set-up. However once the network is set up on the computer, the benefits to them and to the Company as a whole should be explained at an inaugural meeting. Their opinions should be listened to and their queries answered. The network will have been mounted using the Planning Departments' ideas on "Realistic Durations", "Activity Descriptions" etc. Let the Junior Management involved alter these if they have good reason to. Activity Descriptions which are readily understood by the Planning Department, may be unintelligible to the man who will be responsible for that activity. Let him give his own description, it will help to convince him that he is running the show, and not the computer or some Head Office "Boffin".

I have mentioned "Realistic Durations"; unlike Messrs Boome and Schmidt, I have had no difficulty in getting "Durations", but I am given only one, this so called "Realistic Duration", estimated by the Planning Department. It is at this stage that we can incorporate "Management by Objectives". In our same

incline shaft we have a cross-cut, say some 70 m long. The "Realistic Duration" given by the Planning Department will be based on a daily rate of advance, say 2 m/day, giving a duration of 35 days. At the update meeting the Mine Overseer or Shift Boss in charge may state that he is 10 days into this activity and that he has advanced 18 m. His rate of advance per day is now only 1,8 m and our "Realistic Duration" is incorrect. If, based on his experience and judgment he feels that his rate of advance will be only 1,5 m/day, the "Realistic Duration" is even more incorrect. He will have thus made the following simple calculation:

10 days @ 1,8 m/day = 18 m 52 m to complete

52 m @ 1,5 m/day = 34,5 days say 34 days

New realistic duration = 10 + 34 = 44 Days

At the next update meeting, in say 14 days time if his rate of advance has again altered, then he can again alter the duration. The important fact is that his objective is altered, and that it is altered by facts or estimates based on his knowledge and experience. It follows that at update meetings, due credit should be given where it is due.

As to Job Relations, allow me to quote from an elderly Shift Boss. At a recent update meeting he commented that he was very pleased that Management were using the computer. He now had ample warning of when he should plan to start a job, and why, which was in direct contrast to the age old system of being told "today" that he should get a blast *there* "tomorrow".

This same Shift Boss was shown the histograms of labour resources. These histograms had been produced, mainly for planning requirements, labour allocation and training school etc. They were by development crews and geographical areas. The Shift Boss commented that he could now plan when he should take a day off, in order that it co-incide with a period of low labour utilisation. Quite a different use of resource histograms from that of the Planning Department.

Finally, let me leave you with two thoughts for the future use of Pert. The National Coal Board in the

United Kingdom run several collieries, totally on Pert systems. In direct contrast a large South African base metal mine, which has been using Pert for some years now, via its own "On Mine" computer installation, recently decided to run Pert, as an exercise, for a small project. This project was a routine mill maintenance, a procedure carried out twice yearly and involving the co-operation of several mine departments. As a result the total duration was reduced from 14 days including overtime and Sunday work to 10 days.

AUTHOR'S REPLY

We thank the contributor for his comments on our paper, and confirm our finding that users can and do experience confusion between I.J. and Precedence networks, and this despite the fact that either type of network for the same job has exactly the same meaning. We also agree that it is our experience that when there is involvement by the users in constructing the network, they make far more use of the printouts where the project is computerised as well as showing considerable interest in the relationships between the various activities, especially when other concerns are also involved.

Under the heading "Historical Reference as an Aid to Future Estimates", the contributor has covered a very valid subject, in that exact costs in terms of labour and stores can be established, as well as actual durations taken for the various tasks. This is of course, no problem when only one concern or mine is involved, and where the work itself is repetitive, but when outside contractors are involved, such as Civil and Engineering concerns, *with particular reference* to a project which is unique and may not occur again, it must be borne in mind that probably the most difficult thing to establish until the particular job is completed is the exact cost; this may only be possible when a final invoice is submitted for payment.

The contributor has also covered his subject very well under the heading "As a Job Relations aid via Management by Objectives", covering the subject of involvement of people in the planning, so that they

feel they are running the show. It is not unusual, in our experience, for a meeting chairman to tell a sub-contractor that "the Computer says you are two weeks behind". This sort of statement does prove embarrassing for the planner, and could easily be obviated by the chairman making a more careful choice of words, for, after all, even sub-contractors try to do their jobs as expeditiously as possible.

As he so rightly says, the contributor has a confirmed ally in his Shift Boss. Within an organisation, where people must work together, praise of a system is usually passed on by word of mouth, and even shift bosses talk to one-another.

The contributor mentions a Pert program run as an exercise for mill maintenance, with time reduced from 14 to 10 days. At a well known chemical concern in South Africa, the use of Pert on boiler maintenance achieved a more beneficial reduction. Heretofore it had never been done in less than 10 weeks, this time being reduced to 4 weeks when programmed with the aid of Pert.

NOTICES

The Institution of Mining and Metallurgy

The Institution is to hold a one-day meeting entitled "Sampling in the mineral and metallurgical processing industries" at Imperial College, London, on 2nd July, 1973.

Particulars may be obtained from the Secretary of the Institution at 44 Portland Place, London, WIN 4BR.

International Conference on Air Pollution

This Conference is organised by the Department of Health and the National Association for clean air. It will be held at the University of Pretoria from 26th to 28th March, 1973.

Particulars may be obtained from Department of Health, Private Bag X88, Pretoria.

Consas 74

The Fifth Conference of Southern African Surveyors will be held in Salisbury, Rhodesia, from 3rd to 9th February, 1974. Particulars may be obtained from Consas 74, P.O. Box 3869, Salisbury, Rhodesia.