17th WEDC Conference	Using microcomputers to monitor remote projects
Infrastructure, environment, water and people	Charles M. Balina and Ian Smout
Nairobi, Kenya 1991	

SUMMARY:

In the past decade or so, development aid has tended to shift from the big capital projects to small projects at times initiated by the local communities. This is especially true in the fields of water supply and sanitation, squatter up-grading, irrigation and housing infra-structure. In spite of the advantages this shift has brought about, however, it has tended to highlight the difficulty in effective monitoring of many mini-projects spread over wide areas. In many circumstances, these projects have to be coordinated from a central point either at the agency's headquarters or at regional offices. The problem is how to access, update and analyse information about the performance of these projects both individually and collectively with a degree of reliability and speed for planning purposes.

This paper looks at how the micro-computer can help in this task thereby enhancing the possibility of completing the projects on time, within budget and hopefully to the desired specifications.

INTRODUCTION:

Effective project management can be achieved by use of an integrated information system as shown in fig. 1 below. Four application softwares are required to perform the various tasks in project management:

i. word-processing e.g. word perfect, wordplus, macwrite, etc.
ii. data base management e.g. dBaseIII+, dBase IV, etc.
iii. spreadsheets e.g. Lotus 1-2-3, Quattro, Supercalc, etc.
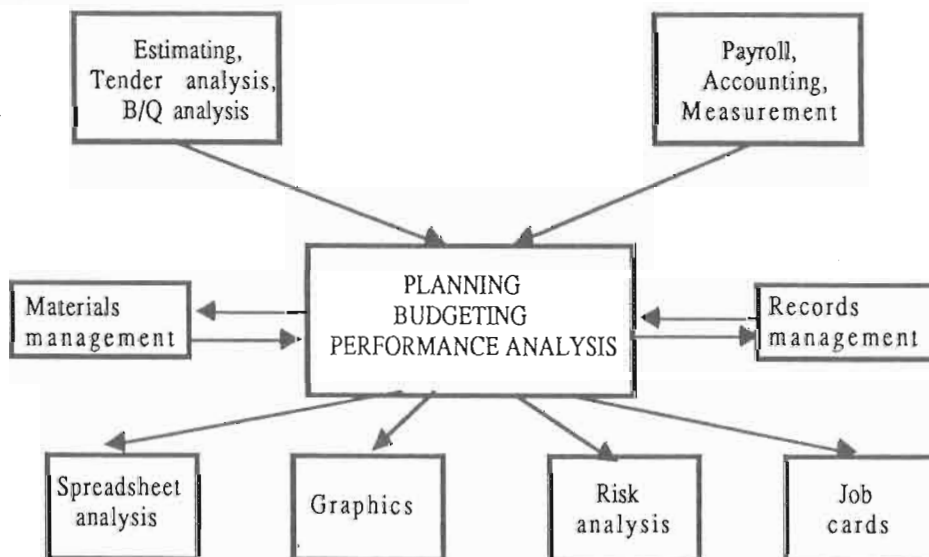iv. a package for schedule and resources management e.g. Timeline, Artemis, Openplan, Pertmaster advance, etc.

Figure 1   Integrated   project   management   information   system

Source: Harrison, (1985)

Whatever the packages used, the first stage of project management will be entry of the data. Depending on the package however, the number, layout and types of reports obtained after this data has been entered may be different.

Figures 2 below & 3 overleaf show sample printouts of reports using the Timeline package on different USAID-funded projects in Uganda.

PERFORMANCE ANALYSIS

Monitoring the performance of a project involves analysis of its cost and progress schedule. This will be based on bar/progress charts showing the duration of the various activities together with their individual costs. Using a schedule management package and, if need be, a spreadsheet, the following values of work may be obtained:-

i. Total budgeted value of work scheduled, BVWSTotal: This in essence is the total contract sum for the project.

ii. Budgeted value of work scheduled, BVWS: This consists of all the work that should be done by the date the review is being done. This value is obtained from the planned schedule.

iii. Actual value of work performed, AVWP: This is obtained from the site valuation reports and/or observations.

iv. Budgeted value of work performed, BVWP: In a number of project management packages, this figure is automatically obtained from the earned value analysis report. It may otherwise be obtained by determining the per cent of physical completion of each task multiplied by the task's budgeted value.

Monitoring project costs

The financial status of a project may be analysed using two parameters, the cost variance and the cost performance index.

Cost variance: This compares the budgeted value of work done to its actual worth i.e.

$$= BVWP - AVWP$$

A negative figure indicates a cost overrun while a positive figure signifies an underrun.

Schedule Name: AID OFFICE BUILDING EXTENSIONS -NEW UPPER GROUND FLOOR
Project Manager: STEVE RYNER,   ASST. PROJECT MANAGER: TONY COCKAYNE
As of date: 20-Apr-91 3:27pm   Schedule File: B:NUGF

PROJECT ENGINEERS: FRANCIS DDUMBA & CHARLES BALINA
CONTRACTOR: KAPKWATA SAW-MILLS LTD.

```
                              91
                              Apr May              Jun            Jul              Aug
                       Status 29  6    13   20   27   3   10   17   24   1    8    15   22   29   5

      1 ELECTRO-MECHANICAL 1ST FIX    C +++++++++++++++++++++++++++++++++++++++++   .    .    .    .    .    .    .
      2 PLUMBING PIPEWORK (1ST FIX)       .   2 ++++++++++++++++++++++++++++++.    .    .    .    .    .    .    .
      3 DOORS & WINDOWS MANUFACTURE       .   3 ================================.   .    .    .    .    .    .
      4 ELECTRO-MECHANICAL 2ND FIX   p    .    .    .    .   4,=========================-------------    .
      5 PLUMBING FITTINGS (2ND FIX)   p    .    .    .    .    . 5 =============-------------------    .
      6 DOOR & WINDOW FIXING          p    .    .    .    .    . 6 ==============---------------    .
      7 WALL & FLOOR FINISHES         C >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>===================================   .
      8 COMPLETION OF UPPER GRD FLOOR C    .    .    .    .    .    .    .    .    .    .    .    8.M    .
```

```
-------------------------------------------------------------------------------------------------------
D Done              === Task          - Slack time (==---), or
C Critical          +++ Started task    Resource delay (----==)
R Resource conflict M Milestone       > Conflict
p Partial dependency
Scale: Each character equals 1 day
-------------------------------------------------------------------------------------------------------
```

Fig 1: TIME LINE Gantt Chart Report   Strip I

Schedule Name: COMPLETION & RENOVATION OF BUILDING FOR F.A.O. OFFICE
Project Manager: C. M. BALINA
As of date: 1-Aug-89 7:28am   Schedule File: D:KAWANDA2

PROJECT FUNDED BY A.I.D. UNDER THE MANPOWER FOR AGRICULTURAL DEVELOPMENT
PROGRAMME (USAID PROJECT No. 617 - 0104)

TASK	1-Jun-89 30-Jun-89	3-Jul-89 31-Jul-89	1-Aug-89 31-Aug-89
DEMOLITIONS & ALTERATIONS	123.45	0.00	0.00
R.C. SUPERSTRUCTURE	471.32	0.00	0.00
ROOFING	1,471.53	1,681.75	0.00
WINDOWS & DOORS	6,374.23	7,284.84	0.00
INTERNAL WALLS & PARTITIONS	624.17	4,057.14	0.00
ELECTRICAL INSTALLATION	0.00	8,464.91	6,046.36
FITTINGS & PLUMBING	0.00	1,015.53	2,466.30
INTERNAL FINISHINGS	0.00	495.29	5,695.89
EXTERNAL FINISHINGS	0.00	0.00	371.03
EXTERNAL WORKS	0.00	0.00	0.00
TOTALS	9,064.71	22,999.46	14,579.58

Fig 3 :   TIME LINE   Cost Report by Period vs Task   Page 1 of 3.

Cost Performance Index, CPI: The CPI is the ratio of BVWP/AVWP Like the variance, it indicates whether project costs are within budget or not. i.e.

CPI < 1 shows a cost overrun
CPI = 1 shows costs per plan
CPI > 1 shows a cost underrun.

The CPI is however more useful than the variance in that it may be used to project the final cost of the project as per current performance. In this case the cost is:

$$\frac{\text{Planned cost of remaining work}}{\text{Cost Performance Index}}$$

$$+ \ AVWP$$

$$= \frac{(BVWSTotal - BVWP)}{CPI} + AVWP$$

Monitoring Project Duration

How long the project lasts can be monitored using the schedule variance and the schedule performance index.

Schedule variance: This compares the planned duration of whatever work has been done with its actual duration i.e.

$$= BVWP - BVWS$$

Again a negative figure indicates the project is lagging while a positive figure shows a project running ahead of schedule.
Note that financial costs are being used for calculating work duration.

Schedule Performance Index, SPI: This is the ratio of BVWP/BVWS Like the variance, it indicates whether the project duration is within plan or not i.e.

SPI < 1 shows a lagging project,
SPI = 1 indicates progress as per plan,
SPI > 1 shows a project running ahead of schedule.

Again, like the CPI, the SPI can be used to get an estimate of the final completion date of the project as per current performance. In this case the new date is given as:

$$\frac{\text{Remaining estimated time}}{CPI}$$

$$+ \text{ time already spent.}$$

Corrective action:

The computer is of immense help in the search for corrective action on the project. By inputting various options on the schedules, it is possible to find out what repercussions each decision may have on project costs and duration (the WHAT IF? analysis).

MONITORING MULTIPLE PROJECTS

Monitoring many projects is based on two concepts: the work breakdown structure and the hierarchy of plans. These concepts are discussed in adequate detail in references 1 & 2.
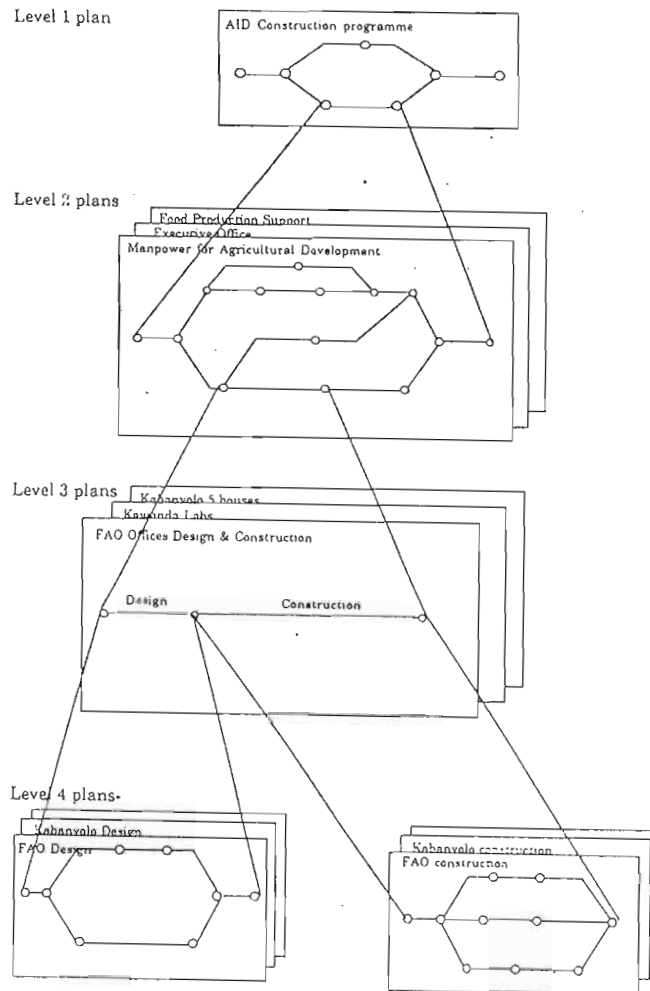
Level 1 plan

AID Construction programme

Level 2 plans

Food Production Support
Executive Office
Manpower for Agricultural Development

Level 3 plans

Kabanyolo 5 houses
Kawanda Labs
FAO Offices Design & Construction

Design   Construction

Level 4 plans.

Kabanyolo Design
FAO Design

Kabanyolo construction
FAO construction

figure 4:   Hierarchy of network plans for USAID construction

Whatever the size or number of projects, the first step is to draw up the work plan for each individual project. By building upwards it is then possible to draw up a hierarchy of plans covering all the projects. Figure 4 above shows a hierarchy of plans for some USAID-financed projects that the author has been involved with.

If the computer package being used performs work breakdown structure and hierarchial planning, information for the projects need only be updated at the lowest level (level 4 in this case) and all the changes will be automatically carried through to the highest level.

Preparing of project reports is also greatly facilitated when management packages are used. It only takes a few minutes to prepare reports that give different details to different people depending on where they are placed in the management structure.

CONCLUSION

Using the micro-computer should be a cost-effective way of monitoring the performance of scattered remote projects from one central location. Project costs and duration are easily determined and monitored regularly at all stages of implementation thus ensuring proper control. Performance can be compared with the original schedule and the software can be used to produce summary reports which identify problem areas.

REFERENCES:

1. Balina, Charles M, 1990: The application of micro-computers in the monitoring and control of low-cost projects. M Sc dissertation, Loughborough University

2. Harrison, F. L., 1985: Advanced Project Management, Gower Publishing Co. Ltd, Aldershot, England.