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APPLICATION OF SMALL SCALE COMPUTERS IN INDUSTRIAL MANAGEMENT

by

the Secretariat of UNIDO

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FOREWORD

This paper has been prepared for use by developing countries interested in reviewing, designing and implementing appropriate computer-based management systems. The objective is to enhance managerial capabilities and systematically increase operational effectiveness. It is primarily directed to policy and decision-making officials at the operational level, who are responsible for defining requirements for computer-based management systems. In addition it can aid those who are involved in making national policies towards the industrial and managerial application of small scale computers in developing countries.

Possible UNIDO inputs of technical assistance in this field are outlined in Annex I. Expression of interest in specific topics for future publications of similar nature and enquiries on UNIDO's assistance are also welcome. Please contact:

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1. Introduction

UNIDO initiated three years ago a programme of "Minicomputer Systems to Manage Industries" to build up UNIDO's capability to assist and advise developing countries regarding the selection and implementation of minicomputer based management information systems. This would include the usual inputs of TC assistance such as the sending of EDP experts, the provision of fellowships, equipment, etc...

Furthermore, UNIDO has been organizing and participating in meetings in this field. One of the recommendations put forward in these meetings is that UNIDO carry out basic studies to help industrial managers develop improved computer-based management systems. Accordingly, a UNIDO consulting service with a data bank for UNIDO member countries is being set up to supply them with information regarding the worldwide available expertise in minicomputer system hardware, software. A corresponding handbook is scheduled for publication in the latter part of 1979.

In practice, the utilization of minicomputers is becoming easier because they are more user-oriented than large computers. The introduction of micro-computers in the field of industrial management is expected to play an important role in the future either in lieu of minis or complementary to minicomputers or large systems. In the near future the entire classification of "minicomputers" is due to change because what is now considered to be a "large CPU memory" will be found installed in small scale systems. This shift in terminology is a result of the drastic technical innovation in the hardware of computers.

Apart from the semantic problem, UNIDO's major concern is that developing countries should avoid making similar mistakes in organization when using small scale computers as they made when large computers were introduced, i.e. inefficient utilization of hardware and software and unforeseen high costs of conversion and the necessary infrastructure.

2. End-users Problem Areas

The following is the summary of the investigation on the state of Electronic Data Processing (EDP) in one of the developing countries where UNIDO supplied technical assistance. The problem areas pointed out by the UNIDO consultant can be generalized as typical managerial bottlenecks in the application of small scale computers.

2.1 Lack of understanding among managers regarding the capability of EDP

A great number of managers have had no or very limited exposure so far to the capabilities of EDP. Therefore, they

- have limited interest in EDP assistance;
- have limited knowledge of what is required to develop and install a computer based system;
- have difficulties in expressing their wishes;
- have difficulty in evaluating the request to use or make greater use of computers and in judging the benefits and costs, and
- generally do not actively participate in the development of EDP applications.

2.2 Limited availability of experienced EDP personnel

In many cases the introduction of EDP within an enterprise is dependant on somebody's initiative at lower or middle management level. This person has to be able to "sell his idea" of introducing EDP to the relevant directors who can make decisions. Usually the initiator of the idea is capable of organising the work involved to establish the data processing function. It is normally difficult to find enough qualified EDP personnel to staff such an operation due to the fact that the commercial applications of EDP has a relatively short history in most of the developing countries.

2.3 Inefficient consequences

a) Most of the EDP applications in operation in the enterprises reviewed are manipulating data but not generating management type of information. Hence, systems which truly assist management in decision making, business control, planning, analysis, etc. are seldom to be found.

b) Some enterprises with a longstanding EDP practice have developed high skills and knowledge in such areas as standards and procedures in developing and documenting new EDP applications, in exploiting their computer resources, and in training their personnel. However, none of the enterprises reviewed covers all of these aspects at the same time. Other enterprises still have to significantly improve the effective management over their EDP facilities and related activities.

c) In most cases data rather than information is processed with the result that:

- the various computer applications are generally isolated - not integrated;
- the information is not structured for the usage of management at different organisational levels;
- the information generally pertains to the daily business transactions and is not of "higher value" for control and analysis, decision making, and planning activities, and
- more complete controls need to be applied over the input, processing and output.

d) In most categories it was noted that the initiative to develop an information system lies within the EDP department (organization) which acts too independent of the future users of their new systems concept. The joint project team approach of EDP personnel with user personnel is seldom followed in an effective manner. This, in turn, affects the value of the applications because they seldom fully meet the user's needs.

e) Most enterprises spend considerable time, money and effort preparing studies to determine their future computer hardware requirements. Enterprises with small scale hardware plan to introduce much more advanced and complex hardware and system software in the future, However, these studies generally lack a detailed plan covering a systematic approach to developing and installing application programs which are tantamount to an information system. A plan showing how they would train their available and required EDP personnel is often missing. It is clear that without these two plans the enterprises will not solve their problems but significantly increase them.

3. Small Scale Computer Applications by Industrial Managers

Small scale computers are foreseen to continue to change managerial activities by aiding the decision process and enhancement of operational efficiency.

The advantages of small scale computers are noted as follows: (1) user-oriented; (2) small size; ( ) powerful enough for many practical managerial applications; (4) relatively inexpensive; (5) good expansion capabilities; (6) capability to use most common computer languages; (7) minimal power consumption; (8) ease of using existing commercial software packages. All these features make small computers very attractive for management applications. One may consider that larger mainframes are often required for engineering, scientific and statistical applications where commercial problems like payroll, order control and general business accounting in the commercial area play a subordinate role.

The selection and implementation of appropriate small scale computer-based management systems depends on the size of the company, organisational structure, characteristics of the task, job requirements and other factors such as financial constraints of the company and external technological development. In general, however, it can be noted that small scale computers can be used only in a stand alone mode as autonomous units (e.g. in small organisations not dependant on costly data links) but also as part of distributed processing networks as well as intelligent terminals connected with larger mainframes.

The small scale computer of today has more memory and external storage capabilities than previously. It can be used not only for routine work but also to aid managers in their decision making process. Applications in the areas of:

a) sales analysis
b) market survey
c) production control
d) inventory control
e) evaluation of creditability of customers,

all lend themselves to helping managers plan their use of physical resources and manpower.

In addition to these applications the simplification of routine work by conversion to computer operations is also worthwhile, e.g. (1) payroll, (2) word processing, and (3) mailing list maintenance.

The key element to a successful small scale computer-based management system is good software. Most of the software at the initial stage of the introduction of large computers was supplied by manufacturers. Today, there are a number of small system design firms (often called "software house" or "system house") specializing in system analysis and software production. A turn key contract with thse firms enables end users of small scale computers to have a greater variety of packages which uniquely fit their operational requirement. It should be noted, however, that this option diminishss the advantage of low price of small scale computer systems. Some action should be taken as early as possible to develop self-supported capability for system development and maintenance. In fact, highly skilled end users at present write their own software, which tend to reduce the initial and running costs.

Thus, sample applications exclusively developed by system houses for end users are:

1) Financial Analysis (interal rate of return)
2) Loan Evaluation (creditability of customers)
3) Bid Estimate, etc.

Along with hardware and software problems, the first time user is in a predicament with a complex of problems stemming from organisational and economic pre-requisites and implications of applying a computer system. Too often old and outdated management methods are forced onto computer, while actually a computer as a management tool should be used to modernise management techniques and operations. The gap between the theory of management science on the one hand, and the way managers implement these concepts on the other, hampers improvement in industrial performance. Thus, the computer "orgware" problem has been recently highlighted. It is essential that a set of organisational pre-requisites supports the appropriate interaction between the technology and the applied system. Human and institutional elements, as well as technical factors should be carefully investigated in designing integrated management information systems.

4. UNIDO's Involvement: development aids for small scale computer applications in industry

UNIDO has extensive involvement in various types of technical assistance activities to support computer-based management systems. Examples:

Case 1: A recent request from the government of a developing country at the factory level pointed out once again the need to assist in implementing computer-based management systems. The national industrial development corporation of the country had acquired a computer system which they thought most appropriate to improve the management of a number of industries. UNIDO was asked to assist in installing the obtained equipment to achieve better performance. A UNIDO expert found out that the corporation had purchased a very small computer (now classified as "microcomputer") with very limited computing and memory capability, and no possibility of expansion. In addition, to operate it one had to use its own peculiar machine oriented programming language, yet the corporation had its own programmes written in a commonly used computer language. The purchase was obviously incorrect.

Case 2: UNIDO was asked to assist to improve the operational efficiency of a public corporation, which had not so far installed any type of computer. Here a key consideration is to implement a small scale computer system for their production and financial control. The detailed scope of the study is now under preparation.

Case 3: One of the large engineering and contracting firms in the Middle East asked UNIDO to review their existing MIS operation which employs reasonably large mainframes. A preparatory review mission was composed to evaluate the efficiency of existing system and elaborate future development scheme including "System Definition" and "Programme Implementation". This evaluation is now in progress.

4.1 Possible Development Aids at various support levels

A. Factory

At the factory level, managers generally require aid to evaluate existing data processing operations and define future requirements for its expansion. The initial step is the diagnosis of the

* general structure of the organization
* extent of computer support for management decisions
* long range systems development concept
* validity of the documentation methods
* clarity of operating procedures.

Where data processing does not yet exist, but a need is foreseen, it is imperative to review plans to install computers. This involves a survey of:

* organization plans
* potential applications areas
* financing
* kinds of training required
* personnel selection
* types of hardware and software which could be considered to best fit the needs.

Provision for specialized training for deserving personnel (EDP specialists as well as line managers who are users of EDP) is also crucial. EDP specialists must develop the software programming capability and maintain the management systems installed. Managers who use EDP should stay abreast of the advantages and problem areas of EDP. These skill development activities are often carried out by management institutes or universities in developing countries or "in-plant" training programmes undertaken in industrialised countries. Sometimes regional co-operation co-ordinates such training.

B. Government-owned Financial Institutions

It is foreseen that government-owned financial institutions and holding companies in industrial sectors will need more advanced financial control systems. The operational efficiency of this type of organization depends to a great extent on how effectively government funds are utilized. Governments often subsidise their initial investment and runing costs in various ways: provision of easy loans, holding substantial percentage of the stocks, etc. Thus, financial control and loan evaluation constitute their prime activities. The installation of relevant software packages is most important for these purposes. Accordingly a total operating concept needs to be carefully designed and implemented. The software packages, either those purchased or developed, have to be maintained at highly operative level.

C. Regional Co-operation among Developing Countries

There is a wide spread recognition nowadays that one of the practical means of accelerating industrial development is regional co-operation among developing countries. Technical assistance must be geared to the development goals of the region. It is therefore essential that regional focal points be identified to develop self-supported capabilities among developing countries in software development, system maintenance, and consultancy service related to computer-based management systems. Obviously a programme of training opportunities needs to be deliberately formulated in the regions to accomplish this purpose.

The skill development within certain segments of industry can be standardized, e.g. one basic cost accounting system can be agreed upon by all users so that a regional or national standardised system can be used; scarse manpower can be exchanged and given wider experience by a "job rotation" programme between given regional computer centers, software packages can be pooled, training can be co-ordinated, etc.

Another important activity of such regional centers is the consulting service, which provides the following:

* a short-term advisory service team composed of local staff members of the center and international experts, visiting factories in the countries in the region to evaluate the efficiency of computer-based management systems;
* development of specific software at the center which can be used on a royalty-free basis in any other factories not only within the region but in others through the co-operation scheme among the regions.

The initial action by UNIDO to achieve the goal of establishing regional centers is now underway.

The nature of technical assistance varies with the type of counterpart organizations and the state of their computer-based operation (small or large scale computer users or non-computer users). Some models of co-operation with UNIDO are attached in Annex I.

Subject to financial and timing arrangements, technical co-operation service along the lines of the above mentioned development aid is available through local representatives or from the directory prepared by the Factory Establishment and Management Section of UNIDO.

5. ANNEX 1: MODPT. PROJECTS

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- The Application of Computer Technology for Development, Second Report of the Secretary General, UN, ST/ECA/176, New York
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- Minicomputer and Small Business Systems, 1976, published by Online Conference Ltd. Brunel Univ., England.

I. **Project Title:** Packaged assistance in the implementation of small scale computer-based management systems at factory level*.

Objectives:

- To assist in the implementation of a small scale computer-based management system in the factory concerned.
- To strengthen the capacity of responsible staff members and managers in system design, software development and maintenance of the system.

Project Output:

- Implementation of small scale computer-based management systems.

Project Activities:

- Diagnosis of managerial operations
  (a) identify crucial management problems
  (b) analyse the cause of problems
- System design
- Selection of an appropriate small scale computer system
  (a) evaluation of existing hardware and software and maintenance service
  (b) cost-benefit analysis for practical use
- Development of the factory's own computer software
- Provision of fellowships to the EDP staff members and non EDP managers to receive more advanced training opportunities: 2-3 months.

Duration: 2 years

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* including public enterprises.

II. Project Title: Short-term review of Management Systems at factory level*.

Objectives:

- To diagnose the effectiveness of existing management systems and formulate future development schemes

Project Activities and Output:

The main objective of the project exucution is to hold interviews with relevant managers and engineers regarding the major types of business and their views on problems and opportunities of appropriate MIS. A written report summarizing the following will be submitted:

1) evaluation of the current state of management information and related activities;
2) outline of the type of management information and controls including related data processing aspects;
3) identification of the recommended logical and high priority actions to be taken, considering potential short-term benefit as well as the step-by-step approach;
4) recommendation on actions and timing estimated for the next phase of development.

Duration: 2 weeks

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* including public enterprises.

III. **Project Title:** Assistance in implementing appropriate small scale computer-based management systems at State financial institution level

Objectives:

- To strengthen managerial capability, especially in financial control and loan evaluation.

Project Activities and Output:

- Evaluation of existing operation
  a) reporting system
  b) job classification
  c) accounting control system
  d) volume of loan commitment, capital and other operational variables
  e) source of funds
  f) sectorial classification of clients
- Selection of an appropriate small scale computer-based management system
- Software development for feasibility study and loan evaluation and accounting control
- Implementation of the development system
- Provision of fellowships

Duration: 2 years

IV. **Project Title:** Strengthening regional co-operation in the field of small scale computer-based management systems.

Development Objectives:

- To assist and support developing countries to become self-sufficient in selecting, designing, implementing and maintaining small scale computer-based management systems.

Immediate Objectives:

- To strengthen the integral part of the services of the regional center and make available such services to the countries of the region in the field of industrial application of small scale computer-based management systems.

Project Output and Activities:

- Provision of the following services to developing countries through the identified center:
  a) Information regarding the application of small scale computers in industrial enterprises.
  b) Consultation activities in selecting, designing and implementing, as well as in the diagnosis of SSLC computer-based management systems within the region.
  c) EDP skill development opportunities for the managers of manufacturing industries in the developing countries.
- Software development for new areas of industrial application
- Pilot application of the developed software in public enterprises or government corporations.

Duration: 2 years or more.

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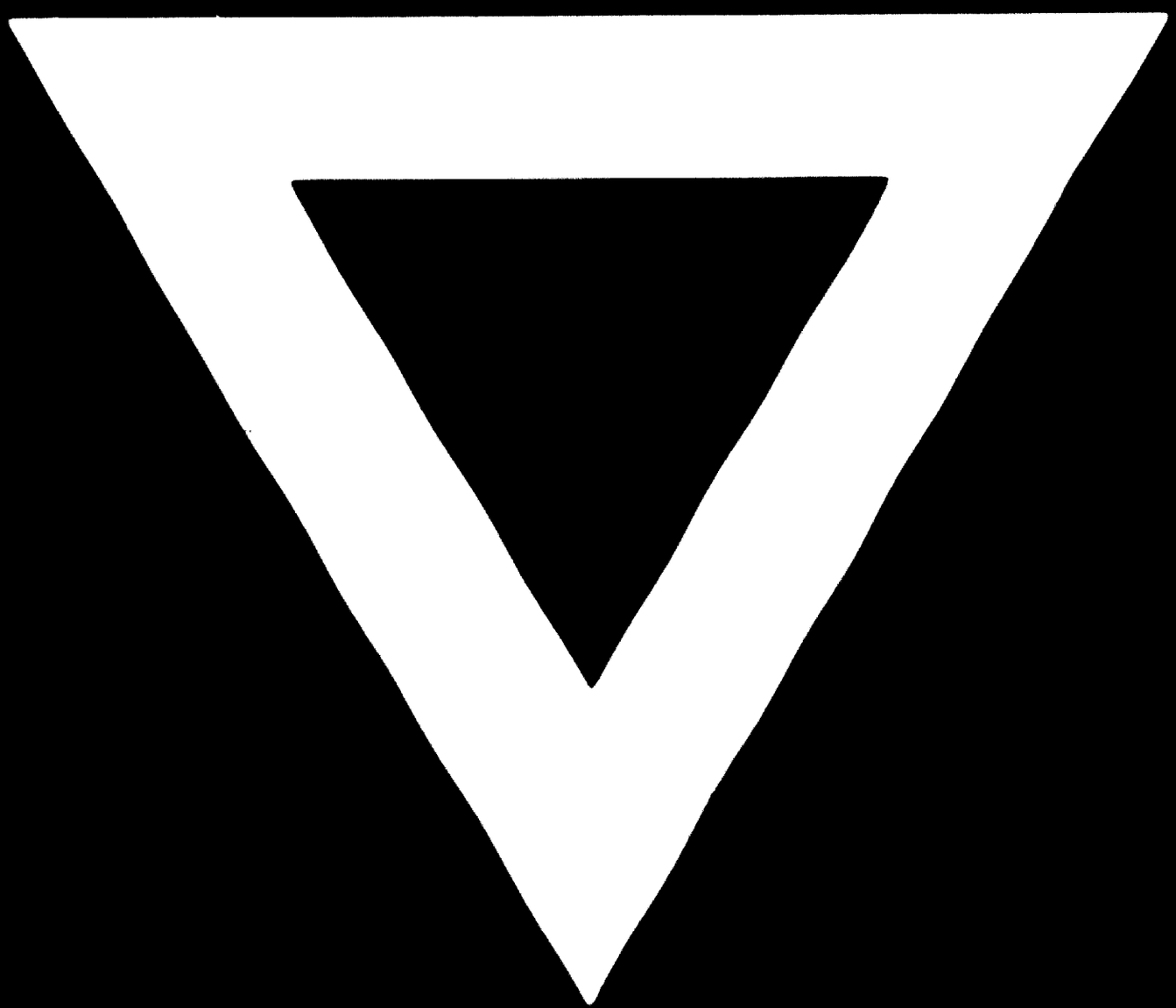

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