SECTION I, ENGINEERING SCIENCE

The "Cube Concept" Approach to Management Information Systems

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INTRODUCTION:

An effective management information system is a tool (among other management tools) to improve the manager's decision-making ability.

A meaningful definition of management is: "Management is the function of establishing the objectives of the enterprise, allocating resources according to a predetermined plan and schedule, and reacting to deviations between predicted and actual results, to forestall the development of an unfavorable situation."

Of course the effectiveness of management is measured by the results achieved. The objectives of an enterprise will vary according to its type. In business, the primary objective is to maximize return on investment, i.e. to make profit. To accomplish this objective, management must be able to react instantly to varying sets of conditions and have a set of alternatives to consider in order to select the best course of action.

This is effective management, and any system that helps management to do this is an effective Management Information System (M.I.S.).

OBJECTIVES OF THE M.I.S.

The objectives of the M.I.S. are twofold: (1) To provide management with all the information necessary to create an operating plan; (2) To produce operating statistics for immediate correlation to the plan of the deviations between the initial plan and actual performance.

The information produced should be complete, useful, timely, accurate, and always economical. The cost of compiling information, in relation to its ultimate value to management, must be measured and understood. Also the feasibility of gathering and processing information, in view of equipment capabilities and limitations, must be determined.

Finally, it should satisfy all levels of management. Information needs of the various levels of management will differ, with greater reliance on detailed operating reports, for lower levels, and a lesser dependence on quantitative evaluation of operating reports at higher levels. Decision making at the lower levels tends to become somewhat repetitive and routine. Decision making at higher levels, however, is influenced by many factors that unfortunately do not easily lend themselves to quantification.

TOTAL SYSTEMS CONCEPT

The "total systems" approach implies that all subsystems in an organization should be integrated in a single information system. This total-systems approach is considered a "Dream" and can be translated to a computer-minded manager as follows: To have *ALL* the information, stored on *RANDOM ACCESS* equipment, in *ONE* location, continuously *UP-DATED*, and immediately available *ON REQUEST*. This is the concept of *Total Management Information Systems*.

This dream is not practical today for the following two main reasons:

1. Manpower limitations—we do not have the qualified people to develop M.I.S.'s, even with our present, less-demanding equipment and techniques.

2. Economic considerations—the cost of compiling information, processing and retrieval is still high, in view of the present equipment capabilities and limitations.

There is no doubt that, at some time in the future, the concept of Total Management Information Systems will be possible and practicable. The fourth generation of computers, due in the early 1970's, promises hardware that is likely to be more advanced technically and separate from software. There will be improved cost/performance, larger high-speed memories, lower-cost random-access devices, greater multiprogramming and multiprocessing capability, more sophisticated on-line terminals, graphics—etc., increased use of operating systems, and improvements in the file management systems.

These improvements in computer technology will help overcome the economic and manpower limitations mentioned before. However, it may take a long time for the dream to materialize. Until such time, we should organize in a realistic manner to achieve real gains. The system's effectiveness depends on management ability in planning ahead of time for the needs not only of today, but of the future as well. It is of vital importance at the outset to organize all the pertinent data within the planned parameters.

The "Cube Concept" of M.I.S.

The "cube concept" of M.I.S.'s is presented here as an approach to pre-planning the parameters of the total system and recognizing the subsystems under two categories; those that should wait for future developments of computer technology, and those that can be handled immediately with the presently available capabilities of the computer applications.

The "cube concept" approach to M.I.S.'s will be illustrated by a brief description of a case study from the petroleum industry.

Case Study—In an international petroleum company, interest was expressed in developing and implementing tools to plan and control all elements falling within a major segment of the company. This segment was defined as that of manufacturing and distributing of lubricating oils (lube oils). A system was designed to provide information for decision-making at all organizational, physical, and functional levels of the company concerned with this segment of the business.

The parameters needed for a total lube-oils system were defined as follows:

1. Physical facilities level (i): These include the facilities required for the manufacture and distribution in the lube operations; refineries, blending plants, and warehouses.

2. Decision and control level (j); Functional decision-making is performed at levels involving investment and facilities planning, allocation of resources, operational planning, and scheduling control of daily operations.

3. Organizational level (k): Decisions are made at affiliate, division, and component levels.

These complex activities were assembled to produce a 3-dimensional cube shown in Figure 1.

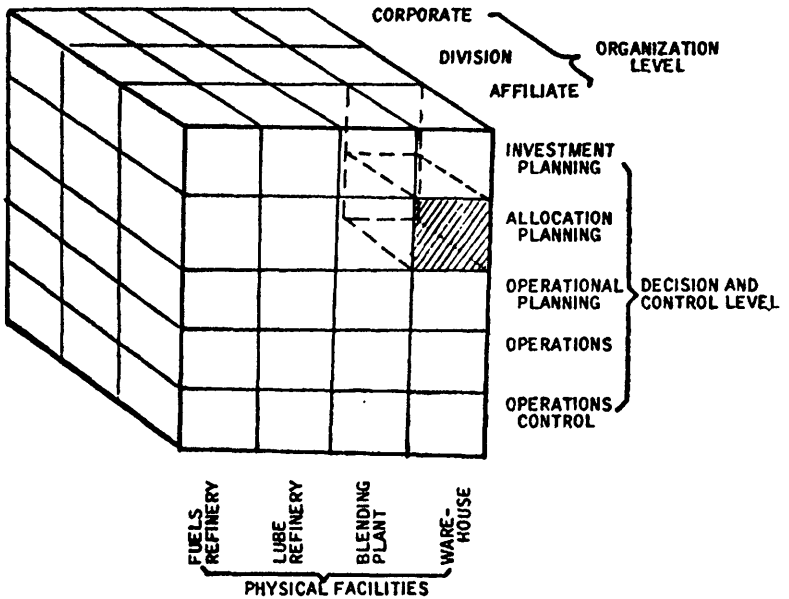

Figure 1. The "Cube Concept" approach to Management Information Systems.

Every cell (ijk) represents the subsystem for decision-making within the three levels. For example, the shaded cell represents the allocation planning for warehouses in an affiliate.

It may be explained here that this cell was the first subsystem completed. This is because it is the product demand at the warehouse that sets in motion the whole chain of demands all the way up to the demand for reduced crude, and thus triggers the corresponding inventories to meet these demands.

Needless to say that, as of today, many cells have been completed and the ultimate objective is to cover all the cells of the cube. The more cells covered, the closer we are to a total system for lube oils. The case study, briefly explained here, illustrates a system that can be described as "total" as one can get for the lube-oils segment of the petroleum industry.

The same cube concept can be applied as well to other segments of the petroleum industry. To that extent, it can be also used for other industries.

Conclusion

It will take a long time to materialize the dream of total M.I.S. Let us not wait—let us organize our data and plan our parameters. We can achieve real gains from the present computer applications. We will continue to accomplish more cells of the cube as the improvement of computer technology permits, then the dream will materialize.