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INFORMATION SYSTEMS IN DEVELOPING AGRICULTURE WITH SPECIAL REFERENCE TO PROJECT MANAGEMENT IN CISKEI

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Abstract

The purpose of this study was to establish how the fast-developing information technology could be used to assist management decision making in developing agriculture as this aspect was identified as one of the main constraints in a co-ordinated development approach. By means of a qualitative study it was established that information systems approaches were available that could be applied by management of agricultural development institutions to improve their managerial functions. In recent years, variations of the information systems approach have been developed. Each level of management has distinctive managerial requirements which should be met by these systems as the situation dictates. The critical success factor approach is highly recommended. Several caveats are identified and these should not be disregarded in the implementation of information systems. The study confirms that the innovative application of existing information system techniques, will enhance managerial decision making in developing agriculture.

Uittreksel

Inligtingstelsels in Ontwikkelende Landbou met besondere verwysing na projekbestuur in Ciskei.

Die studie het ten doel gehad om vas te stel hoe die snel ontwikkelende inligtingstechnologie aangewend kan word om bestuursbesluitneming in die ontwikkelende landbou te ondersteun. Die aspek is geïdentifiseer as een van die beperkende faktore om 'n gekoördineerde ontwikkelingsbenadering te bereik. Deur middel van 'n kwalitatiewe studie is vasgestel dat daar inligtingstelselbenaderings beskikbaar is wat deur die bestuur van landbou-ontwikkelingsorganisasies toegepas kan word om hul bestuursfunksies te verbeter. Verskeie variasies van die toepassing van inligtingstelselbenaderings is in onlangse jare ontwikkel. Elke bestuursvlak het eiesoortige inligtingsbehoefes wat gereedelik beskikbaar moet wees. Die kritiese suksesfaktorbenadering is benadruk. Verskeie voorvereistes vir die implementering van 'n inligtingstelsel is geïdentifiseer. Die studie bevestig dat deur die toepassing van bestaande inligtingstelseltegnieke besluitneming in ontwikkelende landbou bevorder kan word.

1. Introduction

The problem statement of this study is summarized as follows: Agricultural and rural development institutions and organizations are experiencing greater difficulty in achieving their own goals, and they have not been able to satisfy the high expectations of government or government agencies either (Bembridge, 1987:671). This has resulted in agriculture not playing the major role in economic development that it should, as has been explained by many authors, such as Brand (1988), Lewis (1981), Schultz (1960), and Van Rooyen (1989). Various reasons for this lack of performance by agricultural institutions can be identified, the lack of management being one of the most constraining factors.

The remarkable technological innovations in the electronic field have resulted in greater accessibility of the digital computer. The concomitant refinement of information theories within the decision making process of management has resulted in the development of computer-based information systems.

The purpose of this study was to determine whether the managerial skills of the decision makers in agriculture could be improved by using technological aids. The research method was non-experimental and followed a specific qualitative approach. The use of this method was justifiable and appropriate as the issues considered were not of a numerical nature.

Although the subject of the research was multi-disciplinary in nature, it was undertaken from an agricultural economic perspective with emphasis on organizational behaviour, managerial science and computer systems design.

2. The role of management in information systems (IS)

2.1 Definition

Over the years, management has been defined in many ways. Early definitions emphasized planning, organizing, directing and controlling, (Anthony, 1965:17). A comprehensive definition of management incorporates the process of achieving the organizational objectives:

The process of allocating an organizations' inputs (human and economic resources) by planning, organizing, directing and controlling for the purpose of producing outputs so that the organization's objectives are accomplished.

The process of management is illustrated in Figure 1 as an ongoing cycle.

Planning: The act of planning is the determining of short to long range plans - specific strategies, programmes and policies to meet organizational objectives.

Organizing: Once the plans are in place an organizational structure should facilitate their successful achievement. The structure relates people, tasks and technology to the objectives. The duties and responsibilities should be set forth clearly within this framework.

Directing: This function is concerned with motivating and stimulating personnel to achieve organizational objectives. Whatever action results from the directing function forms the basis of information for the control function. Because the outcome of directing is crucial to the achievement of organizational goals, the manner of executing the directional function is extremely important.

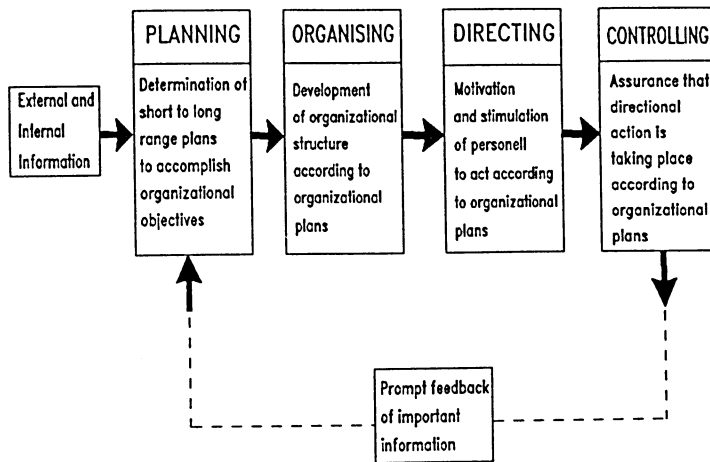


Figure 1: Management functions.
Source: Thierauf (1987:8)

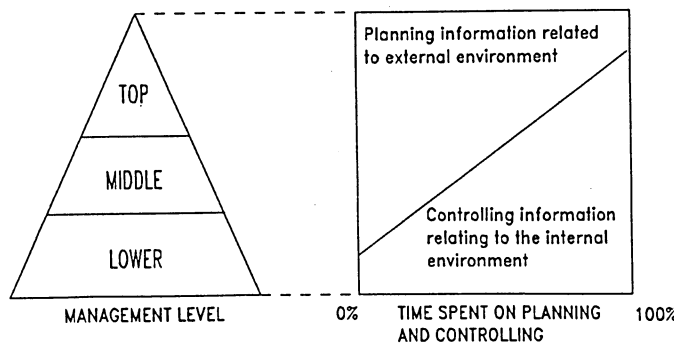


Figure 2: The relationship of managerial levels to time spent on information with regard to planning and controlling.
Source: Thierauf (1987:13)

Controlling: Control consists mainly of overseeing and comparing actual results with those originally forecasted; it assures that directed action is taking place according to organizational plans within the confines of the organizational structure. Management control is defined by Anthony *et al* (1984:4) as methods, procedures, and devices, including control systems, used by management to assure compliance with organizational policies and strategies.

2.2 Integration of management

Within a typical organization the time spent on planning, organizing, directing and controlling is proportional to the level of management (Thierauf, 1987:9). This is illustrated in Figure 2.

At higher management levels, planning is the major task, organizing is next and directing and controlling are the least important. At the lower levels, the major management emphasis is on directing and controlling; planning is of a short-term nature and organizing is limited. At the middle levels of management, there is a mixture of all the basic managerial functions.

2.3 Management and decision making

An integral element of the managerial task is organization decision making - choosing an overall strategy, setting specific objectives, designing structures and processes, selecting people,

delegating responsibility, evaluating results and initiating changes (Kast and Rosenzweig, 1979:344). More broadly construed decision making also involves all the actions that should take place before a final choice can be made. Probably the most important of these is to determine whether something needs to be done.

The distinction between programmed decisions and non-programmed decisions is stressed by Ross (1970:202). Decisions lend themselves to programming techniques if they are repetitive and routine and if a procedure can be worked out for handling them so that each is not an *ad hoc* decision needing to be treated as a new situation each time it arises. The problems that lend themselves to computer programming are those that tend to be repetitive and occur frequently. Decisions that are unstructured, new, of high consequence, involve major commitments, and are elusive or complex, are not suitable for computer programming.

It is important to have decision rules to cover specific situations. If not, the manager is obliged to fall back on general problem-solving methodology, which will depend on human judgement. One of the goals of IS design is to devise decision rules for those problems that lend themselves to solution by means of such decision rules and the computer programmed approach.

3. The role of information and its role in information systems (IS)

The terms data and information are often used interchangeably, but they refer to two distinct concepts. According to Burch *et al* (1979:4), data are language and mathematical, or other symbolic surrogates which are generally agreed upon to represent people, objects, events and concepts. Information is the result of modelling, formatting, organizing or converting data in a way that increases the level of knowledge for the recipient (user). Given these definitions, data are viewed as being by nature objective, whereas information is subjective and is only relevant to the recipient.

A variety of devices that can be utilized to perform these data processing operations much more efficiently and effectively than the basic pen and paper have been made by advances in technology. Based on the level of technology involved, four broad categories of data processing can be identified:- (i) manual; (ii) electromechanical; (iii) punched card equipment; and (iv) electronic computer (Burch *et al*, 1979:8). The preference for one method of data processing rather than another, depends on economic considerations, the processing requirement for producing the needed information and the performance factors related to each data processing method.

Thierauf (1987:4), points out that information has recently been recognized as a sixth corporate resource, and should assume a value equal to the other resources - money; materials; machines and facilities; men (people), and management. From their perspective, information supplied by the information system (IS) can assist managers at all levels in performing their managerial functions of planning, organizing, directing and controlling available components of resources.

In terms of an economic perspective which recognizes information as a valuable resource, the processing of data into information costs money. As such, information may be judged with the "value added" concept in the same manner as any new material being processed further. Information can thus be seen as a value-added component that is useful to managerial and other personnel in an organization for planning, organizing, directing and controlling activities at a specific cost. Information is required for:-

- strategic planning - defining long-term financial and other objectives and allocating resources across units, departments and divisions;
- management planning and control, capacity planning, securing of funds, implementation and management of an inventory management system;
- operating control, standard cost control, production and stock control, and
- transaction processing, work order processing, invoicing, debtors' processing, and processing of salaries and wages.

It is clear that the information required for decision making will differ for the various organizations. Should the application of briefer and more focussed planning techniques be implemented, the Key Performance Areas and Key Result Areas will be emphasized.

4. Preconditions for the development of an IS

The development of an IS for any agricultural organization is subject to its top management's acceptance of the following:

- The achievement of an organizations' predetermined goal depends on the ability of top-management to make sound decisions.
- It is essential that an awareness be created throughout the organization that effective managerial decision making hinges on accurate clear and readily available information.

- Information has become one of the key resources of an organization and the capture, maintenance, manipulation and reproduction of the information should be recognized as a main task within an organization.
- A strong awareness of the information needs of the different managerial levels within the organization is necessary.
- These perceived information needs should be related to Key Performance Areas (KPA's) to ensure that only essential information is processed in the IS.
- A thorough cost benefit analysis of alternative information systems should be undertaken to ensure that the IS system chosen is the most appropriate, and specific assessment should be made of available (internal or external) human resources to plan, implement and maintain the IS.

5. Choice of a specific IS planning approach

Any planning action can be based on various approaches with each of the approaches possibly producing the same end result. Some of the approaches could, however, be more costly and time-consuming than others. The same applies to IS planning, irrespective of the type of business environment. It is therefore important to have a sound framework to guide the IS planning process. McNurlin and Sprague (1989:95) propose six planning frameworks that have been used by IS planners. These are:

- Stages of growth,
- Critical Success Factors (CSFs'),
- Business Systems Planning,
- Investment Strategy Analysis,
- Scenario Approach to Planning, and
- The Architecture Building Approach.

The above authors are of the opinion that none of these planning frameworks are better nor more popular than any of the others. There are, however, two essential ingredients. Firstly, the plans should be future oriented and secondly, IS plans should be linked to the business plans. For the purpose of this analysis, the Critical Success Factors planning approach is selected as this approach is best suited to a citrus project. By using this approach in the citrus project the two essential ingredients, i.e. future orientation and the linking of an IS plan with the business plan can be achieved.

6. Suggested application of the Critical Success Factor planning approach applied to a Citrus project managed by a development corporation in Ciskei

The four sources of crucial factors suggested by Rockart (1979) are utilized to identify Critical Success Factors (CSFs) applicable to the citrus project: the industry; the company itself; the environment, and temporal organizational factors. Although the CSFs do not necessarily have to represent all four of the sources, the procedure to select CSFs from each of the sources as would be the case in this project, will be outlined.

6.1 The citrus industry as a source of Critical Success Factors (CSFs)

The southern African citrus industry has specific features that are critical to the continued economic viability of the industry. Ferreira (1991) identified three critical factors which strongly influence Net Farm Income (NFI). In order of influence, these are: change in the export price of citrus; yield per citrus tree, and the percentage of the total citrus production exported, termed the export percentage. Although the export price is recognized to have a major effect on NFI, it is beyond the control of the individual citrus producer. Export price is therefore ruled out as a CSF. For the purpose of this exercise, yield per citrus tree and export percentage are identified as CSFs (as sourced from the industry).

6.2 The development corporation as a source of Critical Success Factors (CSF's)

In order to identify CSF's for the corporation, it is essential that the mission or objective of development corporation, as well as the development objective of the citrus project be critically analyzed. In the absence of a workshop to compile a shortlist of CSF's, the following phrases, as extracted from the above are considered to be important:

- From the project's development objective: economically viable citrus project, and the establishment of viable citrus farmers.
- From the mission of the Development Corporation: optimum utilization; develop human element; privatize viable agricultural projects, and provide farmer support.

The above phrases could be combined into: establishment of privatized farming units; economic maintenance of the balance of the production units, and development of the human element. Should the above be considered as critical elements to ensure the sustainability of the corporation, the following CSF's could be deducted: The number of viable privatized farming units (or in the case of the citrus project, number of viable privatized citrus farming units), and the best contribution by the corporation towards economic development.

6.3 The environment as a source of Critical Success Factors (CSF's)

McNurlin and Sprague (1989:97) cite examples of factors such as consumer trends, the economy, and political factors of the country in which the company operates as important environmental factors influencing performance. In order to identify possible CSF's it is again prudent to ask which factors related to the environment should be considered essential to the future sustainability of the corporation. These should also be related to the business plan, and be future oriented. Ideally, a workshop should be held by a number of middle and top managers to elicit their ideas. A workshop would be valuable as the managers would suggest factors based on their day-by-day decision making problems. In the changing environment, both from a political and an economic point of view, environmental factors could be regarded as being of concern to these managers. Various factors impinging on the sustainability of the organization could be listed. From these, CSF's could be derived, such as:

- to maintain a favourable image as a development corporation, and
- to maintain sound relations with the immediate community surrounding the projects.

6.4 Temporal organizational factors as a source of Critical Success Factors (CSF's)

According to Rockart (1979) these are areas of company activity that normally do not warrant concern but that are currently unacceptable and require attention. Unacceptable stay-aways of the labour force could be used as an example.

6.5 The screening process of the Critical Success Factors (CSF's)

The screening process of the list of CSF's is done with the aid of the list of corporate objectives and goals for the year. These are then used to determine which factors are critical to the accomplishment of the objectives.

Based on the above, the following list of CSF's could be included as the main matters demanding attention in the citrus project in future: Yield per citrus tree; export percentages of citrus; number of successfully privatized citrus farmers; maintenance of sound relations with the surrounding community, and enhancing the image of the development corporation. Al-

though the other factors are important, for the purpose of this exercise only these five CSF's are viewed to comply with all the requirements.

Once the list is agreed upon, two to three prime measures are determined for each factor. Rockart (1979) is of the opinion that the identification of these prime measures is the most time-consuming part of the exercise - as some are hard factual data and others are 'softer' measures such as opinions, perceptions and hunches. The identification of measures should be of such a nature that this would enable the manager to exercise his managerial role as already outlined.

6.6 The development of systems priorities

According to Rockart and Crescenzi (1983), the objective of this phase is to identify the required systems and establish a priority scheme for their development. The authors propose that this activity should also be done in a workshop session. This will also have the added advantage that in the process the managers will develop the confidence that the system will accomplish the intended objectives. It is important to bear in mind that the normal reporting and accounting and managerial system being used in the company at the time should be intact.

The purpose of developing the additional systems is to assist decision-makers in paying specific attention to the selected CSF's. A workshop is usually held by the managers to decide on the required systems to support the CSF's. A system will be required to measure the first two CSF's, i.e. yield per citrus tree and export percentages of citrus. The system should be devised to measure and report on activities and results which are essential for the successful achievement of these CSF's. Such a system could for example, be called a citrus production system. Regarding the privatized farmers and their success, another system will be required, e.g. a privatized farmer's performance system. The last two CSF's could be combined as the nature and assessment do not only depend on hard factual data, but also on opinions and impressions. Such a system could be called a public relations system. Based on the above, three systems have been identified, i.e.:

- a citrus production system,
- the privatized farmers performance system, and
- a public relations system.

6.7 The development of decision scenarios

The key technique for this phase is the use of decision scenarios. Recurring questions and decisions that the managers are confronted with are identified. It is proposed by Rockart and Crescenzi (1983) that consultants be invited to develop decision scenarios for a number of these decisions and questions, indicating which items of information could be provided by the proposed new IS and which could not. In the case of the citrus production system, the citrus section managers and citrus exchange extension staff would be able to provide technically and financially-oriented "what if" questions, essential to the development of a citrus production system. Information and questions related to the development of the privatized farmer's performance system could be sourced from the farmers themselves, the privatization manager and organizations with experience of privatization. In order to develop a public relations system, use should be made of experts in the particular field as this is a specialist field. Field staff on projects, as well as senior managers that have been confronted with difficult situations related to public relations, would also be of assistance.

6.8 Finalization of the Feasibility Stage

Based on the planning framework the project manager responsible for the Information Systems (IS) development should be able to quantify the costs of setting up and running the IS. Once these costs have been calculated, an assessment of expected future costs should be made. The expected benefit of

the IS to the citrus project should then be calculated. As there are hardly any published guidelines available (Marrao, 1990), an innovative approach will have to be followed to quantify the benefits from such an IS. Due to the fact that the planning approach is based on CSFs, the achievement of these objectives should ensure and justify the existence of the project, and even the corporation. A high monetary value could therefore be awarded to these intangible benefits. A cost-benefit analysis should be undertaken and submitted to top management for final approval leading to the further implementation of the IS.

7. Conclusion and recommendations

The basic components required to implement IS in developing agriculture are available as well as the theoretical background required as a basis for the development of an IS. There is a lack of awareness that information systems could assist efficient decision making amongst top management of organizations involved in agricultural development. In addition, this decision making process, based on an IS, is dependent on well-trained supporting staff. Lack of the required staff could delay the implementation of such a system. It is therefore essential that a well-structured training programme should be developed. Such a programme should include in-house training, vocational training and specific training courses at tertiary level. Top management in developing agriculture should be actively involved in creating an awareness of the advantages of effective managerial processes and decision making. Such a process is based on sound information obtained through an IS. Information systems should only be implemented after a thorough needs assessment as well as a cost-benefit analysis have been undertaken. Should all the conditions outlined above be adhered to, it is possible to devise an IS in developing agriculture to assist the managerial process.

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