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MODELLING OF THE OPERATIVE CONTROL OF PLANT CULTIVATION

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Abstract: In most farms the developments of the information systems or their elements are going on the basis of the demands of the accountancy and different reports to tax office and government. The demands of the operative managers are not taken into consideration on a suitable level. The recording of essential data on production, the making and feedback of essential reports, the influence of operative decisions are insufficient because they rely on the knowledge, experience and memory of operative managers.

Key words: information systems, operative control, plant cultivation, database, operative plan.

Introduction

Management of the business and production of agricultural enterprises is a very complex problem. As the division of labour is increasing in society, the number of factors and connections, which we have to consider in control and decision making, is also increasing. In addition, the dynamics of these factors is getting faster too. These causes have led to the fact that there is a great demand for modern information systems and decision-making (Kapronczai, 1994, 1999; Kertesz, 1994). In the field of accountancy, where requirements must meet regulations, the supply and demand of softwere developments are equal.There are developments to meet the demands of statistics, production councils, chambers, the government, and other institutions above enterprises (Szanyi, 1994; Poppe et al., 2000; Negy et al. 1994). For these targets support can be provided from state and other sources. However, there are unsolved problems in other fields. One of these fields is operative control.

Our task is to show a descriptive model of the operative control of plant cultivation, which can be the basis of further research work and the development of computer software if financial circumstances allow it.

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The definition of the problem and objectives of research

During our examinations we established that in the field of information systems differences can not only be seen between theoretical knowledge and practice. There is divergence between the possibilities of computer solutions and actual demands as well (Szabo, 2000). On the basis of this recognition, we established operative control of plant cultivation as a problem of research.

During the examination of the problem we established that the defined problem can not be converted. For example, we can not solve this problem with the solution of another information system.

At this level our aim is to solve the problem of the operative control of production by a theoretical, descriptive model.

The descriptive model of operative control of plant cultivation

Characteristic features of arable plant cultivation control

The characteristic features of arable crop cultivation are well known. For the purpose of our research, we highlight those that can somehow influence its control.

In plant cultivation the processes of production and work are not in accordance with each other. The work process is much shorter than the process of production. In arable plant cultivation the process of production does not end up with the work process because the biological process of plant grown continues (Somogyi, 1987).

In plant cultivation the investment of machinery and human labour is periodical and it takes place in periods restricted by agrotechnical processes. As a result of this, there are peaks of work, which would demand overtime, or shift work will be needed. Besides time limits, agrotechical work processes are influenced by natural forces, most of all weather. As a result of this, there could be significant divergence between planned and completed work.

The working process demands a certain order of activities forcing them into strict time limits. Therefore, the control of production must be organized so that the impact of these differences can be eliminated because the process of production cannot be stopped.

The allocation of the land is also a characteristic feature of arable plant cultivation. The land is divided into plots and each plot has particular physical and chemical features. In large-scale farms arable crops can be cultivated on a lot of plots, so it is very difficult of monitor the process of production.

In arable plant cultivation the control of production process concentrates on checking the results and doing the planned agrotechnical work. Information about

the quality and quantity of products at the end of the production process are useless for the control of production process which is taking place though the control of the planned work accomplishment. Among the factors that can influence control, a suitable system of data processing and information has an outstanding importance.

Information requirements of the operative control of arable plant cultivation

The different activities making up the control of arable plant cultivation have different information needs in practice. In order to work out the operative plan of production, the following information is needed (Somogyi, 1983):

- a list of activities not completed in the previous operative period,
- the activities to be done in the current period,
- a list of planned activities for the operative period according to the applied technology.

These items of information should contain the following elements:

- premises of work to be done,
- quantity of planned work,
- machines needed for work,
- quantity and types of materials needed for work.

Besides the listed data, the following items of information should be provided for operative planing:

- information on the size of supplies,
- information on the preparedness of machines,
- information for workers,
- information on technical-technological indices: work norms, norms of material consumption, norms of the use of tools.

In order to prepare and make controlling decisions, we need the following information:

- data of material consuption per plot and for common requirements,
- differences between the quantity of planned and used materials per plot and for common requirements,
- utilization of work force and machinery per plot and for common requirements,
- amount of accomplished work per plot and for common requirements.

The above listed items of information are based on the accurate registration of materials, work force, machinery and the accomplished amount of work per plot and for common requirements. On the basis of these data, the level of the accomplishment of planned work can be established, and it is possible to account for the expenses.

The following items of information are necessary for clearing the accounts, which happens at the end of the accounting period and to analyse planned and real calculations:

- amount of wages per plot and common requirements,
- account of working days of machinery per type,
- overhead cost of crop production,
- part of the overhead cost of the company,
- other expenses connected with arable plant cultivation,
- positive and negative differences between the plan and the accomplishment per plot.

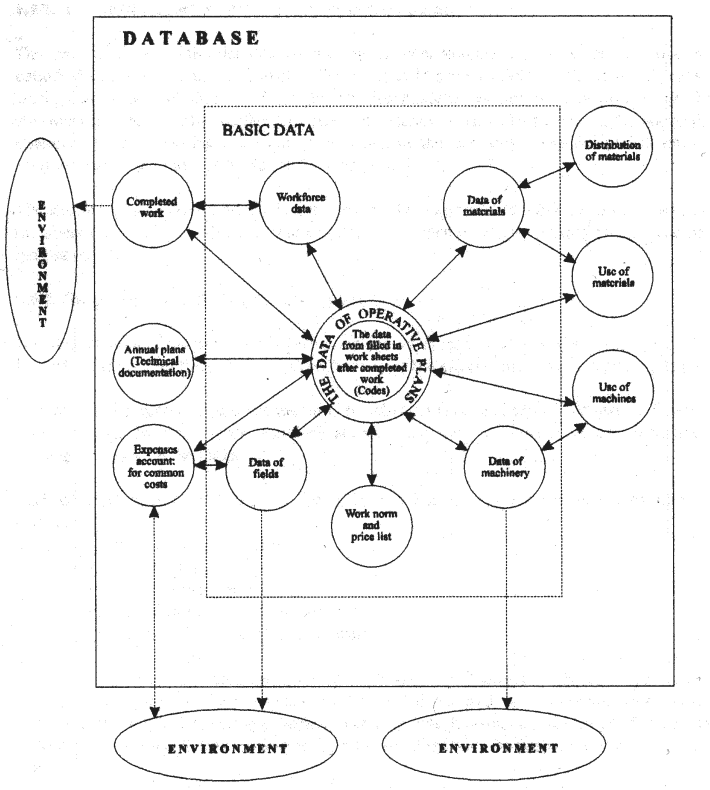

Fig. 1. – The database needed for the control of plant cultivation and its connections with the environment of the enterprise

At the end of the year the following information must be provided:

- accomplished and accounted unfinished production per plot,
- acount of production value and financial results,
- account of accomplished production per plant and the whole accomplished results.

Content of database

The database partly contains common data collected for the needs of different management functions. At the same time, however, it also contains specific data groups that belong to the production function exclusively, or to its information subsystem (Celikovic, 1987). Therefore, it is understandable to use a modulated, and integrated, database. The database, which is structured in this way, can be seen in Figure 1.

Determination of stock data

Stock data includes the permanent or seldom changing data of the farm, which are used by several management functions.

Stock data included in the model:

- data of the plots of the farm,
- data of the employees,
- data of the materials to be used,
- data of the machinery,
- work norms and price lists,
- data of the work sheets,
- characteristic features of work sheets.

Possible content of the modules of the database

The modules of the database are suitable to collect, process and store data that change more frequently. Data necessary for preparing the production processes and for following their operation can be stored in this model.

The database organized by types of common costs and cost bearers must include the following data:

- code of common costs,
- utilization of basic and subsidiary materials,
- utilization of machinery,
- employee costs.

The aim of accounts of costs not only gives data about the different costs, but facilitates or provides comparison of actual and planned costs and give information on the reasons for these deviations. The registration of natural quantities on the cost places makes this possible, showing the differences between real and planned quantities.

Operative planning and analysis

As arable plant cultivation is continuous and its length is predetermined, the production process can only be influenced by the constant control of the planned

work process. The aim of control is not keep the quantity and quality of output within given limits but to accomplish the planned work process completely and on time. These work processes influence production to utilise production factors as much as possible.

For the efficient control of work processes, information is needed on the difference between planned and real results in time. Operative planning and operative analysis of plans are useful tools in this respect, which make the following analysis possible:

- analysis of operative periods,
- analysis of various parts of the business year,
- analysis of the whole year.

The most important characteristics of the operative plan

The operative plan is the detailed description of technological processes for the next operative period. As in arable plant cultivation work is done in several plots, at the time of peaks of work, control is very difficult if we do not use modern systems of data processing. This statement is confirmed by the fact that time for decision is very short between the succeeding operative periods. During this short time, work in the previous operative period must be analysed and a plan must be made for the next period.

The length of the operative period is not constant. During peaks of work the optimal length of the operative period is 7-10 days, whereas in periods with less work, its length can be as long as one month.

The process of making operative plans

Detailed analysis of the process of operative planning shows us that a heuristic approach can be applied, which copies the decision-making activity of the expert, but done faster by a computer.

The data of the operative plan are the basis for tasks schedule and results analysis. Operative planning helps to make work vouchers automatically and to remit materials necessary to accomplish work on the plots.

Technological sheets must contain the following information for the needs of operative planning:

- the order of work schedule,
- work timing,
- types of necessary machinery,
- number of workers to accomplish work,
- the amount of work to be accomplished.

In order to work out the operative plan, apart from technological sheets, reports about unaccomplished work in the previous operative period are used. As

a consequence of weather conditions, the whole production process can change, which results in the change of techological sheeds content. This work must be done together with the preparation of the opertive plan.

We must emphasise the role of experts, who take part in the planning process. The task of agricultural engineers here is to inspect the fields and the condition of the crop, and on the basis of this, to make operative decisions if necessary. Therefore, operative planning can never be automatised completely.

Computerised data processing allows us to make operative plans in several versions. Agricultural engineers can choose the most suitable one, after a quick visual check, and storing it in the computer database antil the end of the operative period it can be used for operative analysis later. If it is needed, all operative plans of the year can be stored separately.

Operative analysis

The complete operative plan, its implementation and registration are the preconditions of the analysis. In the course of analysis the planned and accomplished work processes of the given operative period are compared. If there are divergences between them, they must be shown and analysed separately (Figure 2).

The operative analysis can be quantitative or qualitative.

Quantitative analysis does not deal with the causes of divergence. Its basic task is to establish the level of accomplishment of planned work and to make a list of tasks not accomplished in the given operative period.

The aim of qualitative analysis is to reveal the causes of divergence. A systematic registration and regular inspection of the causes that result in divergence from the plan make it possible to establish and distinguish the objective and subjective causes of divergence.

Objective factors are difficult to be influenced on. However, subjective factors have to be identified and eliminated as much as possible.

The point of analysis is to examine the quantity and quality of the accomplishment of work processes. As only short time is provided to complete an operative analysis, first the quantitative analysis is made, determining the quality of divergence. Qualitative analysis is the next step with the aim of establishing the causes of divergence. The results of this analysis do not depend on time so much, and are generally used for the development of the methodology of operative planning and to reveal various objective and subjective causes that have led to divergence.

The amount of accomplished work is usually less than planned work, which can have several reasons, such as bad weather, shortage of raw materials, failure of machinery.

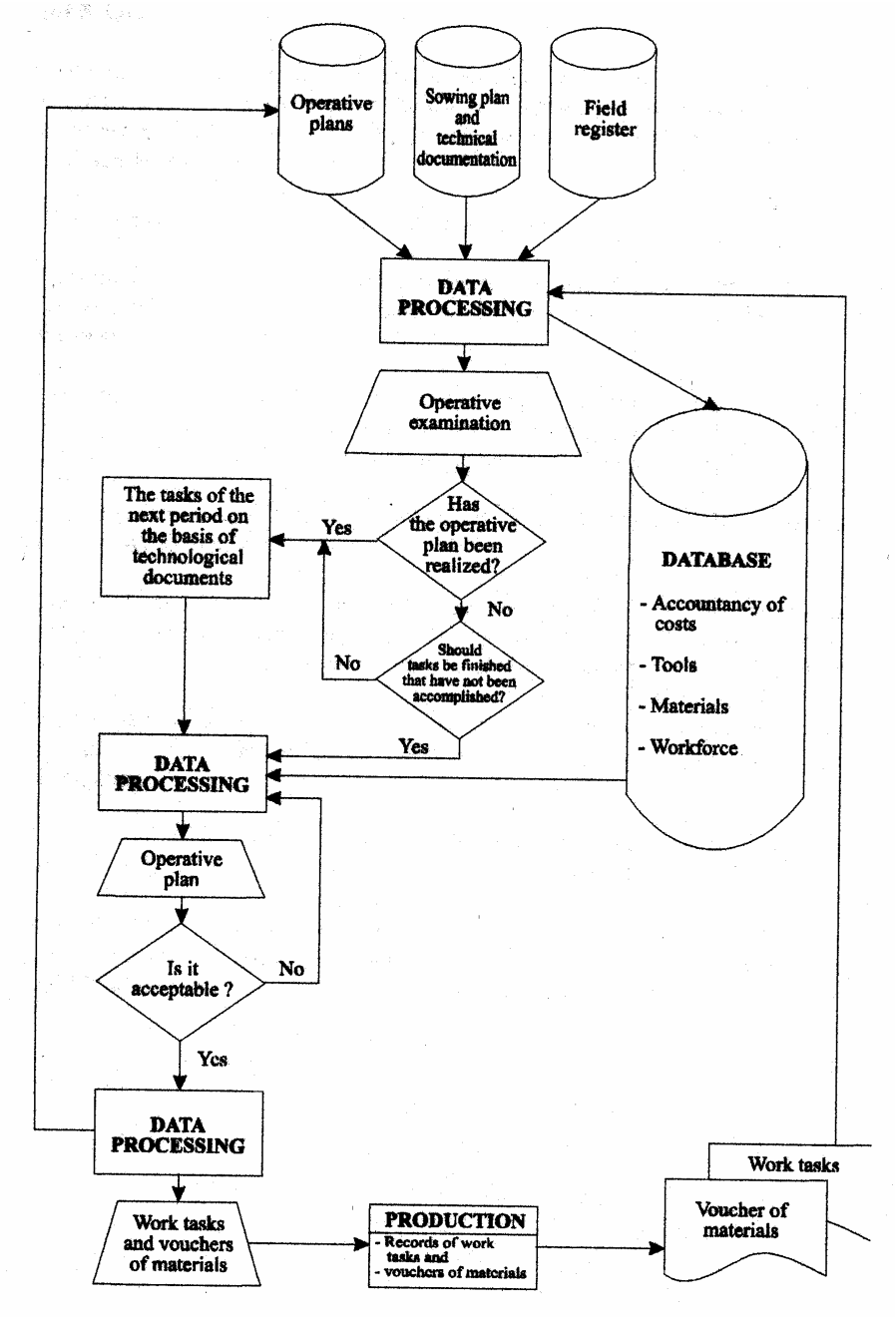

Fig. 2. – A model of the accomplishment of operative examinations

The list of unaccomplished work must be controlled so that divergence can be prevented in time. Computerised data processing can provide great help in this case, because it can show quickly where and how much work was not accomplished in the previous operative period.

Concluding remarks

The basis of this model of control is a general model of arable plant cultivation and a database of the relevant technological date.

In practice, when the control of the production of an arable enterprise is put on computer, the system must start wiht outlining a yearly plan. These plans are the basis of an operative plan and the control of its accomplishment, which facilitates the necessary interventions.

The question arises on, whether integrated systems can be efficiently used by smaller enterprises?

The market can create conditions necessary for integrated systems. Integrated systems will not mean the concentration of ownership but organised production in the fields of a lot of owners, creating economics of scale possible at both the input and the output size of production.

During the implementation of such an integrated system the opportunity to provide automatic data collection must be to created and, at a certain level, it is also advisable to automatise the filling in of work sheets to provide easy input for the programmes.

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MODEL OPERATIVNOG UPRAVLJANJA BILJNOM PROIZVODNJOM

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R e z i m e

Na najvećem broju farmi razvoj informaciong sistema ili delova informacionog sistema je funkcija potreba računovodstvenih propisa i obaveza izveštavanja poreskih organa i državnih organa. Potrebe operativnih rukovodilaca proizvodnje se ne uzimaju u obzir na celishodnom nivou. Obuhvatanje veoma značajnih podataka o proizvodnji, izrada potrebnih izveštaja, njihovo povratno dejstvo je nezadovoljavajuće. Operativno donošenje odluka koja se zasniva na znanju, iskustvu operativnih rukovodilaca i memorisanih podataka ne može da zadovoljava potrebe.

U jednom širem istraživačkom projektu je razradjena koncepcija operativnog planiranja, operativne analize i pogonskog knjigovodstva koja može prebroditi ove probleme. U ovom radu se prezentiraju osnovne ideje rešenja.

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