RELEVANCE AND BENEFITS OF EXPERT SYSTEM FOR MANAGEMENT DIAGNOSIS IN ROMANIAN AGRICULTURE

Cristina Antoaneta Ciungu

Colegiul Comercial "Virgil Madgearu", Tg – Jiu
e-mail: ciunguantoanetacristina@yahoo.com

Abstract

This paper describes the relevance and benefits of an expert system in management diagnosis of farm. The quality of diagnosis depends on the one hand on the transcription of human reasoning and on the other hand on information used to evaluate references. In this paper I will discuss about use and limitations of expert system in agriculture.

Key words: benefits, expert system, management diagnosis

INTRODUCTION

This is the age of information technology (IT) and the IT made tremendous impact in every dimension of human beings in the world. The world has changed into a global village. Information has become a powerful commodity and has become invaluable resource to people in both the developed and developing countries. With the operation of information super highway, the world has witnessed a significant economic growth owning to this development.

In this situation, agricultural production has evolved into a complex business requiring the accumulation and integration of knowledge and information from many diverse sources. In order to remain competitive, the modern farmer often relies on agricultural specialists and advisors to provide information for decision making. Unfortunately, agricultural specialist's assistance is not always availed when the farmer needs it. In order to alleviate this problem, expert systems were identified as a powerful tool with extensive potential in agriculture.

An Expert System (ES), are designed to represent human expertise I a domain (an area of expertise). The capture and preserve the Knowledge of experts in a specific domain and translate into computer software. It is a computer program designed to simulate the problem-solving behavior of an expert in a narrow domain or discipline. In agriculture, expert systems unite the accumulated expertise of individual disciplines, e.g., plant pathology, entomology, horticulture and agricultural meteorology, into a framework that best addresses the specific, on site needs of farmers. Experts systems combine the experimental and experiential knowledge with the intuitive reasoning skills of a multitude of specialists to aid farmers in making the best decisions for their crops.

THE USE OF AN EXPERT SYSTEM IN MANAGEMENT DIAGNOSIS OF FARM

The diagnosis, it is, in fact, an evaluation of the farm's situation, requires the collection and treatment of several kinds of economic data. The analysis reifies, indeed, on technical data as well as on financial data. Based on existing information, the goal of the analysis is to provide the farmer with results which can help him to take his decisions.

Faced with increasing uncertainty as to the future, many farmers now apprehend their role in the world as real businessmen. They need, in order to make optimum choices, a regular evaluation of their farm's performances. Nowadays, uncertainty prevails: in order to manage a farm successfully, the farmer must be able to adapt

very quickly to changes in the economic environment. He must continually modify his choices concerning: investments, production, personal expenses.

In short, to cope with a more and more uncertain environment, the farmer needs to evaluate the economic situation of his farm regularly, i.e. set up an economic diagnosis, so that he can take the best decisions at the best moment.

Even if the use of computers has become usual in agriculture! Management, classic software in agriculture is not adapted to systematizing human reasoning. It is necessary to apply new methodology: the use of artificial intelligence, and more particularly, the expert system. Though the expert system, it *is possible to atomize the management diagnosis on a farm and, therefore, to provide the farmer with a more evolved Information System.

An expert system can provide an improved level of decision support in a timely and integrated fashion whenever and wherever a farmer requires it. It gives the farmer the Information necessary to reduce some purchased inputs by substituting high-quality, integrated, information derived from many sources (e.g. farm level data; weather records).

The user may query system about specific problems of pest management, soil fertility, and orchard planning. They may also request in-depth supplementary information (including pictures) about an individual insect, disease, or weed. Recommendations are usually given with a range of alternatives, (where alternatives exist) thus allowing the farmer to combine his own preferences and experiences with the recommendation being offered by the system. This combined "package of information" is then used to support the decision-making process of the farmer in planning a pest management or other strategy.

C. A. Ciungu is with the *Assoc. Assistant Ph. Drd. at "Constantin Brâncusi" University of Tg-Jiu*, Romania (phone: 40/253/214307; fax: 40/253/215794).
P. Ciungu, *Assoc. Lecturer Ph. D. at Free International University of Moldavia* (e-mail: petrica1951@k.ro).

Three advantages can be identified by using an Expert System: the commentary is quite short (5-6 pages). Like businessmen, farmers want and need to have condensed information: the length of the commentary seems, therefore, well adapted to their needs. The graphs add extra value to the commentary. Even if they are merely a presentation of the results, they are easily comprehended by the farmer.

The farmer is interested in the link between technical and economic results. Because the farmer is above all a technician: the approach used by the expert. System is, therefore, suited to his way of thinking.

A primary emphasis of the expert system must decrease the detrimental environmental impacts associated with pesticide and fertilizer use as well as input costs, thereby improving farm profitability and reducing economic risk. The expert system must view the farm from an ecological perspective, as a complex and highly interdependent system where the altering of one component results in changes in the entire system. The system mimics the way in which a farmer must approach problem-solving in his farm. The goal is to consider the farm as a whole organism, and to make management recommendations in a holistic fashion, rather than making individual recommendations based upon independent components.

Limits:

>Firstly, the expert system is an Information technology that is intrinsically different from most Information technologies previously utilized by farmer. The kinds of practical and educational experience a farmer/user has, may effect how well the system is understood and thus, adopted.

>Secondly, the expert system is a technology inherently connected to microcomputers. In order to make use of the decision support capabilities farmers must: have access to a microcomputer capable of running the system; be able to operate the computer proficiently.

>Even if the expert system is appreciated, it is still incomplete in transcribing human reasoning. It has two main limits, whose consequence is the simplification of human reasoning: the modification of the reasoning and the information used.

First of all, to atomize the diagnosis with an expert system, it is necessary to make a model of that diagnosis. That means to describe and to formalize it in order to create a model. Unfortunately, the formalization of the diagnosis unavoidably simplifies human reasoning. The structure of the diagnosis, and its atomization method (If... then...) have, indeed, simplifying effects. The second limit concerns information used in the expert system. As the entire information cart not be introduced, the system is necessarily somewhat imprecise. To achieve a common basis used in the diagnosis, it is impossible to consider all information existing in reality. Therefore, the more the field of information was limited, the poorer the transcription of human reasoning.

The expert system uses technical, economic and financial information. It is now interesting to describe more precisely what information is. In fact, the term, which is ambiguous, can be broken down into two aspects:

- *Material part*, the "signifier", which is the "visible" and transferable part of information (words, codes, symbols...).
- *Conceptual part*, the "signified", which represents what, is understood from the information (we use the terms of sense, semantic content, idea...).

It must solve two central problems:

- The standardization of the material part of information;
- The necessary information in the expert system is either numerical (value, ratio...) or symbolic (a string such as the name of the farm, the production system ...). This information must be defined in a determined order and format so that the expert system can read them. Thereafter, once its signification has been defined (the homogenization) the information must be standardized in its presentation;
- The homogenization of the conceptual part of Information. The analysis determines which kind of information must be used but a selection of Information is nevertheless necessary. Indeed, several types of information of the same nature can be used to present or explain a result. For example, the current profit can be used to explain the performance of a farm for one accounting period as can the net profit or the global margin. Moreover, one term can have several significations. So a choice must be made and this depends on three factors: the unanimity of expert's opinions, the availability of information, and its immediate utility;
- The expert system uses technical, economic and financial information (Essentially from accounting) and some references (technical information on the farm and its environment: the legal status of the property, land distribution, the annual weather pattern). References have the same characteristics as information: they have a material and a conceptual part but they also play a special role in so far as they allow for an explanation and an interpretation of the results. Two main characteristics of references should be noted.

Firstly, as opposed to "internal information" (technical, accountable or financial data), stemming from the farm itself, references are "external information".

Secondly, the use of a reference depends not only on its semantic content but also on its value.

Therefore, references are technical, economic or financial information whose value is used as a measure of comparison in order to explain the results. To interpret a result, most of the commentary comes from a comparison with references. This phase is often wrongly compared with intelligence because the software appears to be quite similar to human reasoning, that is to say nuances are introduced. In fact, the commentary includes expressions such as quite good, rather bad ... In the commentary, references are essential because they are used to assess the results: they are the basis of the evaluation produced.

As it is true with the other information, references used in the expert system require a common definition of their material part. But this is not sufficient: references imply a specific problem relating to the choice of their value (their conceptual part). The use of references is based on the comparison between their value and farm indicators. The

relevance of the commentary depends on this comparison: this explains why the conceptual part of references is essential.

Two kinds of references can be distinguished:

- *Standard references'*. they represent indicators from the average of a set of farms (for example: the average profit margin for all corn farms whose to mover is more than l million.)

- *Normative references:* they are the result of the reasoning and the experience of the experts and are not necessarily the result of a sample average. These references can, moreover, be produced from new indicators which are not used at the farm level. (For example, to assess the current profits of a farm, the average of all current profits is not used but rather two new ratios: current profits/gross profits and production/gross profits which represent the material part of the reference. Thereafter, each ratio is attributed a specific value which is the conceptual part of the reference and, at that point, it is possible to say whether the current profits figure is good, quite good, quite bad or bad.

For normative references, the conceptual part is defined by the experts. It is a result of human reasoning divisible into two parts:

- The objective part. The value is determined by the experts relying on their experience and their knowledge of the problem. Even if this value does not precisely correspond to a statistical calculation, the result is quite similar.

- The subjective reasoning. The expert actually gives his opinion about the value of the normative reference. They establish the value more on a feeling than on a calculation.

For standard references, the conceptual part is given by a statistical treatment; the value is the result of a calculation: it is determined by means of a statistical tool which provides the average of an indicator for comparable farms. The standards refines can vary from one farm to another. For example, the wheat yields standard comes from an average of data collected in wheat-cultivating farms. But this average is different for each geographic area, so this disparity reappears in the values of standards. Standard references appear to be more reliable than normative references, which are partially subjective. However, the representatively of the calculated average may itself pose a problem. The representatively of standard references determines the relevance of the comparison with the farm indicator.

CONCLUSIONS

The use of references is based on comparisons. From the comparison between the value of the reference and the value of the farm indicator there results an explanation (increase or decrease) or an assessment (good, quit good, quite bad...). That is why the value of the reference determines the relevance of the commentary. Nevertheless, a relevant value obtained for a reference does not necessarily mean a relevant diagnosis: the use of references also plays a great role.

The two parts (material and conceptual parts) of the reference must be clearly distinguished. Unfortunately, a universal reference is impossible. The heterogeneity of the agricultural World requires differentiating references area to area, size to size etc... Therefore, to work at a collective level, it is first necessary to get a specifically approach for references.

In the long term, expert systems and other tools like them will provide the framework for the information revolution in agriculture.

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