Research Paper Agriculture

The Decision Making Process in SMES

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ABSTRACT

The decision process, seen as a sequence of stages through which the management decision is prepared, adopted, applied and evaluated is specific to some complex decision situations requiring the gathering and analyzing of a large number of pieces of information, which is time consuming. The decision-making process is most often conducted in situations of uncertainty and risk, which means that besides a rational approach, the experience, intuition and imagination play a certain role in obtaining the best results. The importance of production for economic units arises from the large share of resources that operate this function. It is estimated that 70% of the labor force, wages paid and assets of companies is taken by those working in the production function (sector). In addition, technological transformation operations are the reason for the existence of any productive enterprise.

KEYWORDS decision-making, decision management, decision-making context, rational approach, experience, intuition, imagination

MATERIAL AND METHODS

The production potential of agricultural exploitations is similar to the result which can be achieved through the modification of resource potential technologically balanced, conditioned by the functioning of the production process at standard technique-economic level.

Regarding the mathematical shaping, the satisfactory results are obtained through the models elaborated in the limits of living programming. Thus, as part of a model of optimizing the production structure, through the purpose function centred on maximizing the value of the rate of sales, of income or profit, founds its representation through the direct proportionally, relation between the level of development of different branches and the result of production activity, which characterizes the size of production potential.

The restrictions of the model colligate the consumption of material, financial and human means, on categories of resources. Thus, the discrepancies which exist in the specific consumption of resources expressed in technical-economic terms of model, conjugated with the difference of relative efficiency of different activities, had to their dimensioning, and on this basis, to the structuring of the system of agricultural exploitation production in such a way so that it would be able to ensure the maximization of the result which can be obtained, in other words, to establishment of the maximum production potential.

INTRODUCTION

The decision is the result of conscious activity, particular to man, which unreels in the personal life as well as in his professional career. This activity consists in the accumulation and creation of knowledge in the process of solving a problem of choice from many alternatives identified or designed in order to perform actions that involve utilizing some resources with the purpose of achieving some objectives of an SME.

In the development and adoption of good decisions, which create the premises for achieving the goals, intuition and human reason play an essential role. Sometimes, these are not sufficient and it is desirable that the decision-maker (individual or collective) is to be assisted by specific methods and techniques and specialized computer systems.

In recent years, numerous works have approached the subject of decision assistance from different perspectives, the main emphasis being on the characteristics of the decisional processes, either to elaborate the methods for decision assistance or to develop support systems for decisions.

Human activity, particularly the leadership, regardless of the domain or hierarchical level in the SME, actually involves solving decision problems, therefore choosing a path of action. If in the case of individual decisions taken at a personal level the social risk is relatively low, in the case of small or large communities leadership, a series of hardships arise, all generated by the evaluation of the cause-effect ratio.

CASE STUDY

The initiative for this paper started from the analysis of the present states to the past ones, from where we returned to the present and looked into perspective as far as the times allowed us, regarding the future decisions.

At the core of the documentation we find many works of decision-taking management in the grapevine and wine-making domain within a vineyard called Cotnari.

From the information processing, which is a complex process that cannot be let left solely to the computer, however refined the technique used, some solutions result that can be decisions, ideas or attitudes.

From what is known, in many cases, the cause is not only a cause, but the effect of a previous cause, and the effect is not only effect, but also a cause for one or some future effects.

The increased extent of risk is qualitative and quantitative. Hence the importance of a rigorous analysis of the decision mechanism has, uncovering essential and nonessential, deterministic and random connections in the cause-effect ratio.

In the management scheme it was observed that the effects from the led subsystem are generated by the leading subsystem, part of the analyzed system, or by the disruptions that

come from its interior or exterior, both components leading to a new system state, giving rise to new information, cementing new decisions and reevaluating strategies and/or objectives.

The information available to the decision-maker, how complete and up to date it is, plays an important role in knowing and achieving the state of equilibrium. Thus the success of an activity and the quality of management depend greatly on the way information is collected and processed, the efficiency of the action which is undertaken on the basis of this information.

From the information processing, which is a complex process that cannot be let left solely to the computer, however refined the technique used, some solutions result that can be decisions, ideas or attitudes. Also, human intervention renders possible the flexible evaluation of the existing connections in the information -decision -action cycle, which must take into account the natural and conventional restrictions that occur. Moving from decision to action may impose making a decision in advance as a set of instructions created to specify the "spirit" of the decision itself, to eliminate uncertainty and to direct correctly the action.

In order to optimize the managerial decisions the decision support systems (DSS) are used, also called decision support systems in SMES, being computer interactive systems through decisions models and specialized databases that offer information to assist managers in adopting unstructured or semi-structured decisions.

The main objective of the DSS consists of enhancing the way a decision is taken or creating a preparatory study regarding the adoption of the decision, in case that all the activities that are to be unfurled for this purpose are not programmable.

The spectrum of the systems reunited under the name of DSS is very wide: from mundane DSS's endorsing repetitive decisions based on predefined procedures and formats to general DSS based on spreadsheets calculus, SGBD's and packs of graphic applications, all the way to complex systems, which target clearly defined domains and are based on simulations, optimization models, online analytical processing and data warehouses.

So we proceeded to develop an economic-mathematical model to optimize the management decisions that involve several successive stages, namely: collection and classification of data, determining the unknowns, the restrictions, the objective function, building a matrix, configuration itself.

The main limitations of the economic-mathematical model, in this case, refer to: the average grape yield, the number of works per row, the concentration of sugars in the unfermented wine or selling price, labor consumption, diesel consumption / tons of grapes, direct expenditure per hectare direct expenditure per tons of grapes, tillage expenses, income per unit area, production costs per kilogram of grapes, profit and return.

The economic-mathematical model of linear programming includes the so-called free term or constant term bi that reflects the restrictions content. The values of these elements are determined, in general, outside of the model and represent the minimum, maximum or equal values that have to be achieved.

In actual terms of the economic-mathematical model for optimizing tillage in vineyards, free terms are represented by the set of elements expressed in natural or value units and express the minimum or maximum level of some indicators.

The restrictions and free terms are presented in Table 1:
TABLE – 1 ECONOMIC AND MATHEMATICAL MODEL RESTRICTIONS

No. ctr.	Content restrictions	≥, ≤	bi	U.M.
1	Average yield of grapes	≥	9830	Kg
2	The number of papers on all	≤	6	%
3	The concentration in sugars	≥	175	G/l
4	Power consumption related work	≤	1277	hours/ha
5	Consumption of diesel per ton of grapes	≤	11	Liters
6	Direct expenditure per hectare	≤	2700	$
7	Direct expenditure per ton of grapes	≤	148,3	$
8	Tillage expenses	≤	800	$
9	Income per hectare	≥	4915	$
10	Cost of production per kilogram of grapes	≤	400	$
11	Profit / ha	≥	1484	$
12	Return	≥	2,6	%

Source: Own calculation

Were considered as objective functions:
- maximizing the average production;
- maximizing the selling price of;
- minimizing h / ha;
- minimizing direct costs expenditure;
- maximizing profit;
- Minimizing production costs.

To maximize the average production function, the following data was used:
F (ON) = 9610X1 + 12500X2 + 13290X3 + 13650X4 + 13750X5 + 13300X6 + 13870X7 → MAX

To solve the economic-mathematical model we used the MANAGER SCIENTIST optimization program in Basic language used by the chair of the University of Applied Life Sciences and Veterinary Medicine of Iasi. Mathematical formulas were written as equations in the table called matrix model.

The results obtained by applying the mathematical model reflect an optimum set with certain limits and conditions set by the restrictions envisioned.

Therefore we can state that the assessment of the remembered mathematical optimum will only be done regarding the context of the conditions, restrictions and objective, as they were presented previously.

The results from the application of the mathematical model are denoted by R1, unlike the results obtained by testing denoted by R0. The results were presented as a minimum (R0 MIN) and maximum (R0 MAX) within each system for the following indicators: average price recovery, hours / ha consumption, direct expenses, cost of production and profit.

In table 2 the results of optimization are presented with (R_1) compared to the average production of the experimental results (R_{0MIN} and R_{0MAX}).

TABLE – 2 THE RESULTS OF OPTIMIZING AVERAGE GRAPE PRODUCTION (Kg. / Ha)

No. ctr.	The system	Average production (Kg. / Ha)			
		R_0		R_1	Variants close R_{0MAX}
		Var.	Min. Max.	Optim.	
1	ON	3P E+1P	12500 13870	14557	6P=13750 5P=13650
2	ID	3P 6P	9830 10860	10742	5P=10560 E+1P=10220
3	E	3P 5P	12180 13680	13877	6P=13500 E+1P=13350
4	ON/ID	3P 6P	11070 11970	12682	E+1P=11880 5P=11720
5	ON/E	E 6P	11550 13270	13173	5P=13120 4P=12370
6	ID/E	3P 6P	10960 12750	13152	E+1P=12420 5P=12130

Source: Own calculation

Where P = hoeing; E = herbicide application

In the case of the ON system, the optimum production is 14557 kg / ha, and through experimenting R0MIN = 12500 kg / ha for the 3P variant and R0MAX = 13870 kg / ha for the E +1 P variant. The 5P and 6P variants get close to R0MAX. This optimum was imposed by correlation with other indicators which present high values: direct costs / ha, workforce consumption, being necessary to maximize production to get maximum profits, which are otherwise optimization criteria.

Similar situations were also recorded with the E, ON/ID and ID/E systems. With the other two systems ID and ON/E the optimum production level is below the maximum recorded production in experimental conditions. Thus, in the case of the ID system, the optimum is 10742 kg / ha with the maximum value obtained being 10680 kg / ha.

In table 3 the results of the optimization selling price are presented:

TABLE – 3 THE RESULTS OF OPTIMIZE THE RECOVERY PRICE ($ / tons)

No. ctr.	The system	Recovery price			
		R_0		R_1	Variants close R_{0MAX}
		Var.	Min. Max.	Optim.	
1	ON	6P 3P	4900 5200	5179	4P=5100
2	ID	6P 3-4P	5300 5600	5518	5P=5500
3	E	6P 3P	5000 5300	5463	4P=5200
4	ON/ID	6P,E+1P 3P,E	5000 5300	5427	4-5P=5200
5	ON/E	5-6P E	5000 5300	5417	3P,4P,E+1P=5200
6	ID/E	6P 3P	5100 5400	5492	4P, E=5300

Source: Own calculation

It was observed that with the ON and ID systems, the optimal price is set within experimental price limits. If in the case of ON the only variant (3P) has R0MAX higher than R1 and the 4P variant closes in to R1, with the ID system, two variants (3P and 4P) have R0MAX higher than R1 and the 5P variant is practically equal to R1. The other four systems: E, ON / ID, ON / E and ID / E have a higher than the optimal price than R0MAX with 3.7 to 6.6, urging an increase in production quality.

In table 4 are the results of the optimization of direct expenditure per hectare, having as objective their minimization.

TABLE – 4 THE RESULTS OF OPTIMIZATION OF DIRECT COSTS ($/ HA)

No. ctr.	The system	Direct costs			
		R_0		R_1	Variants close R_{0MIN}
		Var.	Min. Max.	Optim.	
1	ON	E 6P	2568,6 2676,1	2467,4	3P=2586,6 E+1P=2599,9
2	ID	E 6P	2501,3 2611,1	2354,1	E+1P=2524,9 3P=2529,9
3	E	E 6P	2608,9 2714,6	2420,3	3P=2624,3 E+1P=2634,8
4	ON/ID	E 6P	2528,0 2641,2	2407,1	3P=2555,5 E+1P=2560,1
5	ON/E	E 6P	2571,7 2690,8	2432,8	E+1P=2598,5 3P=2603,5
6	ID/E	E 6P	2554,5 2665,1	2378,6	3P=2575,6 E+1P=2604,3 4P=2604,6

Source: Own calculation

In the result table it is shown that in all systems the optimum (R_1) is less than R_{0MIN} by up to 13.3%. The variant with the lowest expenses was E, with all systems having values close to the E+1P and 3P variants.

The most important indicator, profit, is presented in table 5 in the optimized version (R_1) and the minimum and maximum variations (R_{0MIN}, R_{0MAX}) within each system.

TABLE – 5 THE RESULTS OF OPTIMIZE PROFIT ($ / HA)

No. ctr.	The system	Profit			
		R_0		R_1	Variants close R_{0MAX}
		Var.	Min. Max.	Optim.	
1	ON	6P E+1P	1517,4 1774,2	1810,6	3P=1766,8 4P=1764,7
2	ID	6P 4P	1484,0 1696,2	1674,3	5P=1661,5 3P=643,2
3	E	6P 4P	1556,8 1785,5	1807,3	3P=1771,8 E+1P=1760,0
4	ON/ID	6P E+1P	1342,5 1691,3	1635,2	3P=1601,8
5	ON/E	6P E	1540,5 1691,9	1733,0	E+1P=1690,3 4P=1685,4
6	ID/E	4P E	1595,6 1828,4	1767,2	E+1P=1727,1

Source: Own calculation

Although a maximisation of profit was envisioned it turned out that in the case of the ID, ON / ID and ID / E systems, the optimized profit is below the limits of the achieved maximum (R_{0MAX}), and with the other three systems ON, E and ON / E it is higher than R_{0MAX}: Variants with the lowest profit were those with 6P within the five systems and the variants with the highest profit were the E+1P ones present in the ON and ON / ID systems, the E variant in the ON / E and ID / E systems and the 4P variant for the ID and E systems.

It turns out that the variants with five to six hoeings, even if they present some better indicators, they have the lowest overall profit. For example, if the system ON / ID records minimum profit (R_{0MIN}) the accomplished 6P variant represents under 50% of the maximum profit (R_{0MAX}) obtained in the E+1P variant.

The fact that stands there is an established correlation be-

tween experimental results and the optimized ones which shows that both pathways lead to close results, highlighting the most efficient or the optimal ones, as presented before.

Regarding the system of soil maintenance, choosing the most effective one will depends on the region.

So we tried a multifactorial analysis of five soil maintenance systems, each with seven variants, that lets us provide sufficient data to those interested in choosing which the one that corresponds best to the target area and the pursued objective.

CONCLUSIONS

The conclusion is that the alternatives with five and six weeding, even if they present some better indicators, they have the lowest profit overall.

An example is the case of system ON/ID where the minimum profit (RoMIN) obtained in alternative 6P is less than 50% out of the maximum profit (RoMAX) obtained in alternative E + 1P.

It is noticed the fact that there exists a correlation between the results established experimentally and the optimized results which prove that both ways of analysis led to close results, underlining the most efficient or most favorable ones.

Regarding the maintenance of the soil, the choice of the most efficient system depends on the conditions specific to the region.

Thus, a multifactorial analysis of five soil maintenance systems was attempted, each variant having seven alternatives that could offer to those interested sufficient information in choosing the one which corresponds best to the conditions in the region and the pursued objective.

REFERENCES

[1] Alecu, I. (2001), "Management of agricultural exploitations", Ceres Publisher House, Bucharest. | [2] Axenciuc, A (1999), "The economic evolution on Romania", Publisher House Romanian Academy, Bucharest. | [2] Ungureanu, G (2011), "Management of agricultural production", Publisher TipoMoldova Iasi. |