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RISK MANAGEMENT IN AGRICULTURAL INVESTMENTS

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INTRODUCTION

Investments could be defined as postponed consumption or a trade-off between present and future consumption. In order to get a higher level of future consumption, we prefer to give up a better living today and decide to invest our savings. An investment decision assumes that an immediate and certain satisfaction is changed for the future expectation based upon the new capital goods, but awarded by obtained higher benefits. In other words an investment could be defined as a present spending of money in order to get during a time period future returns that will pay the investor for the time he postponed his consumption, for the estimated rate of inflation as well as for the risk he is taking (Caracota Dimitriu, 2000).

In a world of rapid changes and risky environment, business risks are manifold and not easy to recognize. If an investor decides to postpone his present consumption in order to earn higher benefit in the future, he can not be certain of making profit out of his invested savings, i.e. his return is becoming uncertain. As longer the projected period of investment returns, as higher degree of uncertainty.

In economic literature there is usually made a difference between risk and uncertainty. That difference is based upon possibility to be assessed a distribution of probability for expected revenues coming from the project exploitation. Risk is linked with situations whereas probability distribution could be estimated, while uncertainty is linked with ones whereas there is no sufficient relevant information for its reliable assessment. However, most of the authors do not realize mentioned difference as important one, so they most frequently use the terms risk and uncertainty as the synonyms. A risk can be defined as an uncertainty of a future outcome. A risk implies a spectrum of uncertain future outcomes regardless of

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whether or not such outcomes are positive or negative for the risk bearer. Risk is more or less predictable and manageable, but uncertainty represents the impossibility of accurate foreseeing of an outcome in the future (Umihanic, 2003). In economic terminology word 'risk' is used to describe the types of situations where distribution of variables is known but the conditions for their implementation are not. Word 'uncertainty' is used when it is not possible to predict the frequency of events, i.e. outcomes of planned or undertaken activities (Kalanovic et al., 1996).

Although agriculture is economic branch that is facing with numerous risks, until relatively recent time phenomenon of risk and uncertainty got little or no attention in the farm management research and advisory work. There are many reasons for that, among which some of them are the following: a prevailing culture of pretended certainty, no well-developed and widely-accepted methods of risk analysis, lack of specialist softwares and training for such kind of analysis (Hardaker, 2006).

**MATERIAL AND METHODS**

Evaluation of expected investment economic effectiveness is established on previously determined numerous different initial parameters, whose level and dynamics' projection in period of investment exploitation are not easy to determine with same certainty degree. The reasons for that are both objective and subjective ones.

Reasons and forms of risks and uncertainty in agriculture are numerous but they all could be classified on the basis of their appearance as follows:

- **Production and technical risks** – due to changing of natural and environmental conditions (e.g. climatic conditions), influences of plant diseases and pests, production yields could significantly vary in spite of applied appropriate production technology.

- **Market risks and changes of economic policy measures** – could influence changing of input and output prices, output sales possibilities, level of interest rates and taxes, utilization of governmental supporting measures in production etc.

In management of investments as well as in making investment projects and feasibility studies as an important tool of project management it always appears an important question how to evaluate expected risk and uncertainty in order to get the most realistic indicators of investment economic effectiveness, i.e. to minimize the risk as much as possible.
In agricultural investments, particularly in those with long exploitation period, certain expectations of obtained results can not be supposed (especially in the years and countries characterized by uncertain economic conditions). Making investment decisions in such circumstances have been realized as ones with uncertain expectations, i.e. decisions with ambiguous expectations.

Assessments in investments projects are usually done with supposition of certain expectations concerning the initial parameters (yields, input and output prices, financing conditions etc.). In other words, it is supposed that projected expectations will be realized in the exploitation period of investment with high probability. But if investor or investment decision maker likes to get much more realistic results concerning possible risks, it is necessary to introduce aspects of risk analysis into investment effectiveness analysis and that will change obtained results, but could help to decision maker to minimize expected investment risk.

In investment theory and methodology there have been elaborated numerous methods for risk evaluation, less ore more sophisticated. Those methods can be classified into two groups as the following:

- **Methods for risk and uncertainty important for practice.** In this group of methods the most important are: *selection of the most probable values, correction procedures, shortening of the invested capital amortization period* and *sensitivity analysis*.

- **Theoretical methods for risk and uncertainty.** In this group of methods the most important are: *risk analysis* (procedures based on subjective probability distribution for initial variables) with *simulation method* and *Hillier-Heebink method* as the most important ones and *methods for flexible investment planning*, whereas the *decision tree method* should be mentioned as one of the well known and usually used.

**RESULTS AND DISCUSSION**

One of the most utilized methods in practice of risk evaluation in the case of real investments is *sensitivity analysis*. Sensitivity analysis includes the following methodological variants:

- **Triple (parallel) calculation.** Calculating of the investment economic effectiveness indicators (net present value etc.) for three different future assumptions, for the optimistic one, for the probable one and for pessimistic one;

- **Measuring of change in the investment profitability degree** if some of initial parameters differ by some percent from expected (the most certain) value;
Calculating of the critical value i.e. the break-even-point for particular input values, i.e. initial parameters. The maximal critical values could be: calculative interest rate, investment costs, variable and fixed costs. Minimal critical values could be: quantity of output, output prices, the investment exploitation period and salvage value of investment.

Sensitivity analysis done in an investment project represents complementary procedure to the evaluation of real investment economic effectiveness and it serves to give information to the investor how much sensitive are indicators of investment profitability (net present value, internal rate of rate etc.) onto possible changes of variable initial parameters, production volume, operating costs, investments etc. In other words, sensitivity analysis enables determination of "safety borders" for particular initial parameters realized as critical, i.e. uncertain in the occasion of investment effectiveness evaluation. In fact, sensitivity analysis could be done by determination of critical values or by giving alternative calculations. Having in mind relatively simple calculative procedure on one side and provision of very important information about allowed degree of variation for particular input parameters within the borders of project profitability on the other, elaborated sensitivity analysis procedures have very wide application in practice.

By application of the critical value method it has been analyzed investment sensitivity on an example of agricultural investment project, i.e. fruit production (blackberry). As insufficiently certain input values in the initial model, there could be chosen the following ones: achieved yields and output quantity, output prices, investments, average annual costs (variable and fixed ones) etc.

Critical values of cited inputs could be calculated on the basis of the following formula for net present value:

\[
C_0 = \sum_{k=1}^{n} \left[ x_k (c_k - a_{vk}) - a_{fk} \right] (1 + i)^{-k} + B (1 + i)^{-n} - A_0
\]

where
- \( x_k \) is quantity of output
- \( c_k \) selling price
- \( a_{vk} \) average annual variable costs
- \( a_{fk} \) average annual fixed costs (without depreciation)

Critical values of particular input parameters have been calculated for net present value equal zero, and then they have been calculated based on each particular variable value. Obtained critical values and their differences compared to initial parameters in the blackberry plantation model are given in Table 1.
In the case of calculating the investment economic effectiveness in agriculture, very important initial parameters are projected yields in the course of investment exploitation period. Having in mind possibility of yields variation in some years of exploitation, calculated critical values of mentioned parameter (yields) could represent important information for investor on sensibility, i.e. stability of projected investment onto variation of the mentioned parameter. In other words, the projected (most probable) average blackberry yield of 10.6 t/ha could be decreased onto 4.19 t/ha or by 60.3% \( (ceteris paribus) \) and that analyzed investment should still be evaluated as the profitable one (on the lower border of economic effectiveness).

Critical values of the output selling prices determine possible interval for price fluctuations – 1.2 – 0.897 d/kg for blackberry fruits.

Although efficiency of the investment sensitivity analysis is limited by isolated observation of particular initial parameters (under condition that all other parameters stay unchanged), it however creates possibility for further detailed analysis as well as giving answers very important for investors in the investment decision making process.

<table>
<thead>
<tr>
<th>Investments/indicators</th>
<th>Initial value in an investment model</th>
<th>Critical value</th>
<th>Difference compared to initial value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackberry plantation, 10 ha</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net present value</td>
<td>273,425</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Internal rate of return</td>
<td>28.6 %</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Average production volume (kg)</td>
<td>105,558</td>
<td>41,924</td>
<td>- 63,634 (-60.3%)</td>
</tr>
<tr>
<td>Average selling price (d/kg)</td>
<td>1.2</td>
<td>0.897</td>
<td>- 0.303 (-25.3%)</td>
</tr>
<tr>
<td>Investment exploitation period (years)</td>
<td>15</td>
<td>jun.33</td>
<td>- 8.67 (-57.8%)</td>
</tr>
<tr>
<td>Investments (d)</td>
<td>181,94</td>
<td>455,365</td>
<td>+ 273,425 (+150.3%)</td>
</tr>
<tr>
<td>Capital costs (d)</td>
<td>21,256</td>
<td>53,2</td>
<td>+ 31,944 (+150.3%)</td>
</tr>
<tr>
<td>Average annual costs (d/kg)</td>
<td>0.696</td>
<td>1.0</td>
<td>+ 0.304 (+43.7%)</td>
</tr>
<tr>
<td>Calculative interest rate</td>
<td>0.08</td>
<td>0.286</td>
<td>+ 0.206 (+257.5%)</td>
</tr>
</tbody>
</table>
Very important information for an investor also represents the critical value of investments (capitalized investment value), which shows the highest amount of money that could be invested and that investment still stays economically justified under condition of other unchanged parameters. In analyzed case, capitalized investment value for blackberry plantation amounts to 45,536 dinars per hectare.

CONCLUSION

Sensitivity analysis by utilization of critical values represents appropriate methodological procedure for determination of risk and uncertainty influence onto the investment economic effectiveness in practice. However, it has to be stressed that by utilization of the critical value method it is not possible to solve completely a problem of investment decision making in the risky and uncertain conditions. Utilization domain of this method is limited on introduction of only one uncertain value in calculation. By introduction of two or more values we should get uncertain results and this methodological procedure becomes unacceptable for application. In favor of the mentioned methodological procedure utilization it could be emphasized the fact that in practice it is frequently one or small number of initial parameters evaluated as uncertain, whose differences from the projected values could be important for investment economic justification (in the analyzed blackberry model those are projected yields, selling output price etc.).

In any case, it can be concluded that results obtained by application of elaborated or some other more sophisticated method for the investment risk and uncertainty analysis, could contribute to the more realistic recognition of investment economic effectiveness.

REFERENCES

2. Caracota-Dimitriu, Maria (2000): Investments and Risk, Editura Margaritar, Bucharest


10. Kalanovic, Branka, Vasiljevic, Zorica., Dimitrijevic, B., Trmcic, Snezana (2007): Business Risk And Uncertainty of Investments into the Grape Production, Proceeding of the International Symposium "Trends in the Development of European Agriculture", The Faculty of Agriculture, Agricultural and Veterinary University of the Banat, Timisoara (Romania) and The Faculty of Agriculture, University of Novi Sad (Serbia)