# *THE DECISION OF INVESTMENT USING THE DECISIONAL TREE*

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*Abstract: The present economic context sees the decision as an act of a great responsibility, with direct and complex consequences on the company present and future. The importance of the decision consists in the fact that it is present with all the functions or attributes of the managerial process. The multitude of the decisional criteria that takes into consideration the investments expresses the manager decision regarding the dominant aspects of the socio – economic reality, such as: the investment expenses, the actual net value, the cash-flow, the residual value, the updating rate, the lifetime rate of the investment project, the retrieve deadline etc.*
*The decision tree represents a performing managerial tool that puts together the impact of the risk factors on the whole process and their feedback.*
*The present paper is a case study that proposes to describe a decision action using the instrument depicted above, namely the decisional tree. So, we use the analysis technique and also the technique of optimizing the potential results of the complex, strategic decisions in risk situations. We show all the stages, the components, the specific points and the effects of a decision of investment by using this method.*

*Keywords: investors, managerial decision, project for investment, working equipment, managerial process*

The decision represents, mainly, a deliberate act, an act of authority, bearing a compulsory character for the organisational structures and for the persons under the ferule, in order to fulfil the common objectives. Decisional speaking, this intercession cover all the imperative and conscious actions met with the leading issues; these are disposed on three panels: *organisational* (data preparing and analysis; identifying and elaboration of the action alternative; explaining, adopting and choosing the optimal variant), *informational* (data and valuable ideas picking, stocking, processing and evaluating) and *methodological* (homogenous activities, logical procedures, algorithmic, heuristic and logistic operations).

Within the managerial theory and practice, the decision can be defined as the conscious act that establishes the future objectives to be fulfilled, the directions of action and their ways and the necessary resources capable to assure the economic – financial auto regulation of the company and a high level of profitability.

The clear formulation of the problem and the building of the descriptive model represent the main working tool when evaluating the consequences of the decision alternatives. It is a logic and rational approach that has to answer some requests, such as: coherence, correctness, consistency, completion, efficiency, the model conception with minimal human and material efforts [1].

The role of the modern methods in sustaining the decisional act at the level of the strategic management is greater and greater. In order to obtain performing and consistent results of the real foresights, one has to correctly dimension the following parameters: the total sum of the investments initial expense; the life span; the cash-flow; the residual value; the discount rate. These initial elements processing and combining lead to determining the resulted parameters of the net present value, the recovery period, the profitability, the risks etc. Any investment project needs an analysis of the forecast performances, depending on the application background: certain, with risks, uncertain one.

The uncertain conditions are met when one cannot dispose of the necessary pieces of information in order to establish the probabilities of manifesting the objective conditions and when the variables are partially out of control. Those projects of investments with associated uncertain conditions have to take into account the following analysis techniques: the decision tree and the sensitivity analysis.

The decisional tree represents a managerial tool that takes into account both the impact of the risk factors on the investment project and the response reactions to them [2]. It has to be used for complex, strategic decisions, those decisions referring directly to the investments optimization.

In order to apply this technique, one has to follow the next stages:

- ***defining the decisional issue*** that is to be optimized; here also one identifies the main events that are supposed to influence the decisional consequences;
- ***graphic representation of the tree***; the tree structure details periods of decision and of risk;
- ***determining the decisional consequences corresponding to every forecast alternative***; here one can take care of probabilities that events should appear and manifest. The probabilities can be calculated with three types of reasoning: statistic, analytic and empiric. The main consequences can be: profit, cost, productivity, stocks, selling level, working capacity and so on.
- Choosing the optimal variant, by calculating the mathematic hope for every consequence and decisional alternative. It will result the optimal variant offered by the mathematic hope bearing the highest value.

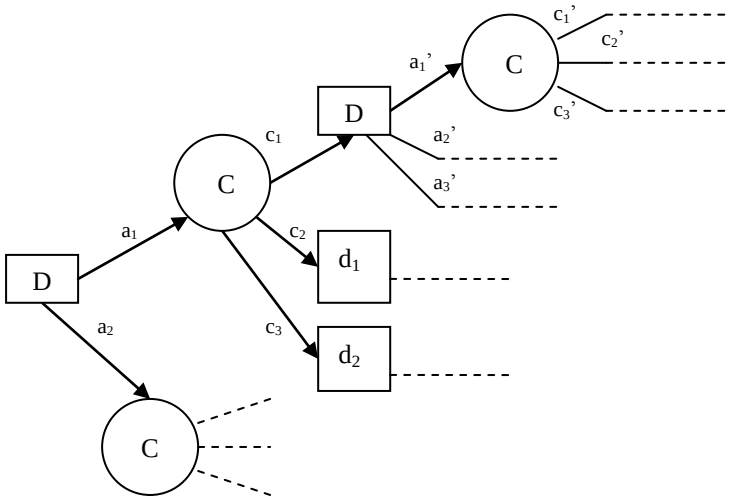

Figure no. 1 *Graphic representation of the decisional tree*

Where:

- **a** expresses actions, **c** – consequences, **d** – decisional alternatives,
- geometrical forms **o** - nodes of consequences and decisional nodes.

For resolving this type of problem, one starts with the consequences of every possible decision alternatives, with the help of mathematic hope [3]. The set of decisions for the future investment project is analyzed as a succession of decisions appeared as responses to different evaluative scenarios of the phenomena [4].

How to make a decision by using the technique of the decisional tree for an investment project – a case study

We suppose that a company proposes to consolidate its position on the open market and wants to make an investment in a new and more performing piece of equipment. The activity is cutting and woodworking; in this case sawmill is the most important tool that affects the production. The company already owns working equipment, but its productivity is low and its physical and moral depreciation is high. The alternative is acquisition of a new equipment, with the investment value of 200000 euro; the old one is now valued at 20000 euro; the productivity of the new one is of 120 square meters/day, of the latter is only 20 square meters/day. The decider has to make a strategic decision, starting from the next two hypotheses:

- gives up the old equipment in the favour of the new expensive but performing investment;
- making repairs to the old equipment, thus investing 30000 euro.

The market is variable too, as it depends on the periods when wood can be cut and processed; the domestic and foreign request; the rate exchange and so on. The average selling price is of 150 euro/square meter.

Here we meet two production scenarios:

- with the new working equipment, the production price for a square meter of timber is of about 100 euro and the daily productivity of 84 square meters of timber, obtained from 120 cubic meter of wood.
- with the old equipment the production price of a square meter of timber is of 113 euro, the daily productivity is only of 14 square meters obtained from 20 cubic meter of wood.

Under these circumstances, the investors have to choose in order to establish the new direction of action for developing the business. If they choose the major investment for the new equipment, they will have the advantage of a six times greater productivity, high quality products and a greater volume of finite products. Otherwise, the productivity is less, the quality is medium and there is also the risk to lose new contracts as the equipment has limitations of any kinds.

By applying the technique of the decisional tree, one can choose the optimal variant. Taking into account the two mentioned alternatives: the new equipment and a great investment or the old equipment and a small investment, we applied all the possibilities and got the first variant of the decisional tree, as one can see in the figure no. 1.

The arch calculation was done under these scenarios:

A-1: we own new equipment and sell 80 square meters with 150 euro => R = 12000 transposed as R=12

A-2: we own new equipment and sell 80 square meters (sm) with less than 145 euro => R = 11600 transposed as R=11.6

B-3: with the old equipment we sell 15 sm with 150 euro => R = 2250 transposed as R=2,25

B-4: with the old equipment we sell 15 sm with 145 euro => R = 2175 transposed as R=2,175

1-C: sell 80 sm with 150 euro => R = 12000 transposed as R=12
1-D: sell 80 sm with 145 euro => R = 11600 transposed as R=11,6
1-E: sell 75 sm with 145 euro => R = 10875 transposed as R=10,875
2-F: sell 80 sm with 145 euro => R = 11600 transposed as R=11,6
2-G: sell 75 sm with 145 euro => R = 10875 transposed as R=10,875
3-H: sell 15 sm with 150 euro => R = 2250 transposed as R=2,25
3-I: sell 15 sm with 145 euro => R = 1800 transposed as R=1,8
4-J: sell 12 sm with 150 euro => R = 2250 transposed as R=2,25
4-K: sell 12 mc with 145 euro => R = 1740 transposed as R=1,74
C-5: sell 80 mc with 150 euro => R = 12000 transposed as R=12
C-6: sell 80 mc with 145 euro => R = 11600 transposed as R=11,6
D-7: sell 80 mc with 150 euro => R = 12000 transposed as R=12
D-8: sell 75 mc with 145 euro => R = 10875 transposed as R=10,875
E-9: sell 75 mc with 150 euro => R = 11250 transposed as R=11,25
E-10: sell 75 mc with 145 euro => R = 10875 transposed as R=10,875
F-11: sell 80 mc with 145 euro => R = 11600 transposed as R=11,6
F-12: sell 75 mc with 145 euro => R = 10875 transposed as R=10,875
G-13: sell 75 mc with 145 euro => R = 10875 transposed as R=10,875
G-14: sell 70 mc with 145 euro => R = 10150 transposed as R=10,150
H-15: sell 15 mc with 150 euro => R = 2250 transposed as R=2,25
H-16: sell 15 mc with 145 euro => R = 1800 transposed as R=2,175
I-17: sell 12 mc with 150 euro => R = 2250 transposed as R=1,8
I-18: sell 12 mc with 145 euro => R = 1740 transposed as R=1,74
I-19: sell 15 mc with 145 euro => R = 1800 transposed as R=2,175
I-20: sell 12 mc with 145 euro => R = 1740 transposed as R=1,74
K-21: sell 12 mc with 145 euro => R = 1740 transposed as R=1,74
K-21: sell 12 mc with 140 euro => R = 1680 transposed as R=1,68

The quantity of timber for sale in each situation based on the productivity of the pieces of equipment and its correlation with the inflexions timber suffers on the open market. The more branches the decisional tree will have, the more varied action states the forecast scenarios will determine.

Thus, in order to obtain the optimal variant, one has to follow a longer route, a variety of more and more complex situations where variables such: price, sold quantity, open market usually change their values. All these forecasts together with certain probabilities operate with statistical values obtained by different companies along the time.

The figure below presents the first variant of the decisional tree:

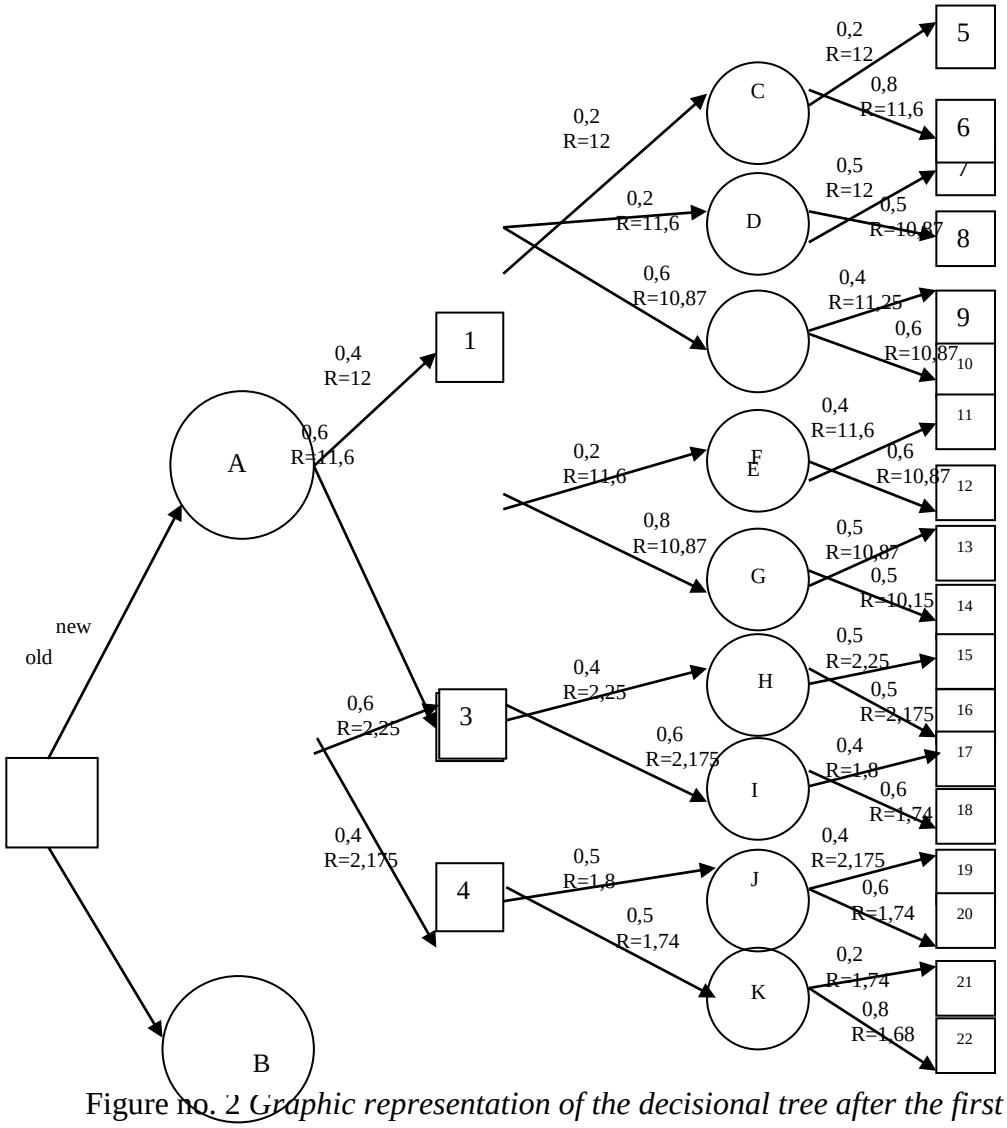


Figure no. 2 *Graphic representation of the decisional tree after the first step*

On the basis of the exposed data, one can make a decision. We have to count value of every line that leads to the initial decision. According to each stage, we count the hope for earning (E), going backward.

Within this step, we have:

E(C) = 0,2 x 12000 + 0,8 x 11600 = 11680

E(D) = 0,5 x 12000 + 0,5 x 10875 = 11437,5

E(E) = 0,4 x 1125 + 0,6 x 10875 = 6975

E(F) = 0,4 x 11600 + 0,6 x 10875 = 11165

E(G) = 0,5 x 10875 + 0,5 x 10150 = 10512,5

E(H) = 0,5 x 2250 + 0,5 x 2175 = 2212,5

E(I) = 0,4 x 1800 + 0,6 x 1740 = 1764

E(J) = 0,4 x 2175 + 0,6 x 1740 = 1914

E(K) = 0,2 x 1740 + 0,8 x 1680 = 1689

After making calculations, we can remove some lines, taking into account maths hope. Under these circumstances, in point 1 between E(C), E(D) and E(E) we choose E(C) as it has the biggest value – 11680 and eliminate the other two. Applying similar procedures, we get a simplified tree, as the one in the figure no. 3:

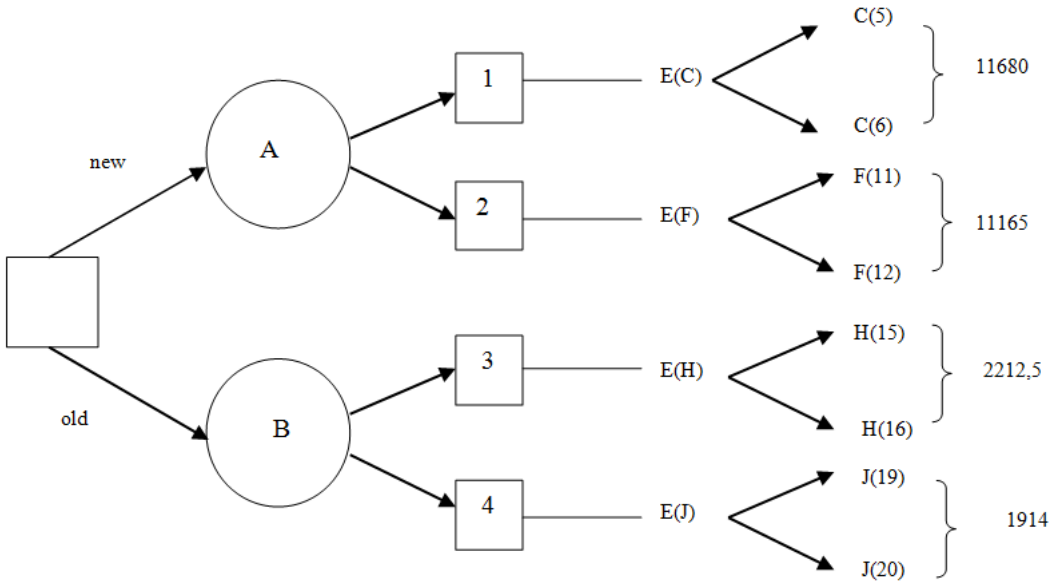


Figure no. 3 *Graphic representation of the decisional tree after eliminations*

Successively, we eliminate outperforming lines, until we get two situations from which we have to choose the optimal one – as in figure no.4:

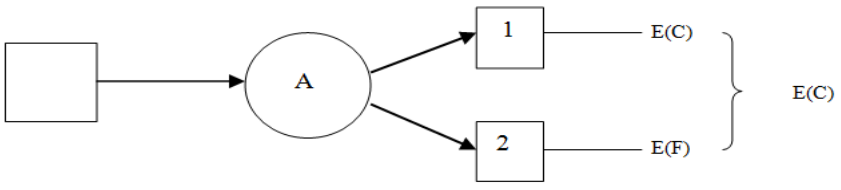


Figure no. 4. *Identifying the optimal variant*

In conclusion, the decisional tree allows us establish the optimal decision; that is a company has to make the investment and buy the new working equipment, as the calculated earning hope shows clearly the superiority of the new machine against the old one, even having it repaired.

The economic context oblige the investors be extremely prudent when thinking of updating or developing, this fact makes the assisted decision be sustained by scientific bases and mathematically modelled.

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