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A FUZZY MODEL FOR DETERMINING THE JUSTIFIABILITY OF INVESTING IN A ROAD FREIGHT VEHICLE FLEET

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Abstract: *A road freight vehicle fleet represents the basic means of work of a transport company which makes it the most important element of its business activities. Namely, it has a direct influence on the transport company's volume of income as well as costs of its business operations. The correct sizing and the management of the road freight vehicle fleet are both of essential significance for cost-effectiveness of the company and satisfaction of transporting demands. Both the defining of the road freight vehicle fleet and the selection of the vehicles that it will comprise are a complex problem, which should be approached from several aspects. In the paper, a fuzzy model for determining the justifiability of investing in the renewal of a truck road freight vehicle fleet is presented and so is assessment of the time period needed for the return on such investment. The forecasts of the expected volume of transport, i.e. income from transport, have been made on the routes with constant flows of freight for realistic, pessimistic and optimistic variants for the recommended period of the vehicle's exploitation.*

Key Words: *Fuzzy Logic, Road Freight Transport, Vehicle Fleet, Fleet Sizing, Investments*

1 Introduction

A successful transport company is recognized by constant monitoring, planning and management of its road freight vehicle fleet. The road freight vehicle fleet planning is a complex process, which directly influences efficiency and effectiveness of both freight transport, and, at the same time, its economy. On the one hand, an insufficient and inadequate road freight vehicle fleet may influence the choice of another form of traffic or, ultimately, inefficiency of the economy. On the other hand, an excessive and improperly structured road freight vehicle fleet has an influence on efficiency and effectiveness of the transport company (a loss of transport and income, costs of "tied up" capital, costs of maintenance, etc.).

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In other words, the sizing of the road freight vehicle fleet and the selection of the vehicles that it will comprise are a complex problem that should be approached from several aspects.

The road freight vehicle fleet of the road transport means consists of road and trailers, whose exploitation-technical characteristics are different and the technical conditions unequal. The exploitation-technical characteristics imply the overall dimensions of a vehicle – its length, width and height; the distance between the pivots (wheelbase), the distance between the wheels, the length of the front and rear overhangs, the semi-diameters of longitudinal and transverse maneuvering capability, the turning radius, the dynamic characteristics of a vehicle, the empty vehicle mass, the engine efficiency, a suitability for technical maintenance, the vehicle's capacity – the useful cargo load capacity, the specific area and volume capacity in t/m2, and so on.

If the road freight vehicle fleet consists of the vehicles of the same brand and type, then it is regarded as homogenous. Yet, the structure of the road freight vehicle fleet is, as a rule, rarely homogenous, which causes the need for its homogenization to the greatest possible extent. This step facilitates, to a great extent, the purchase of spare parts, while, at the same time, lowering the vehicles'' maintenance costs.

The assets of the road freight vehicle fleet have a greater value and account for the biggest portion of the capital of a transport company. Accordingly, when the vehicles are not used, or when they are used in an inappropriate manner, they may be implicative of an unrealized profit and high opportunity costs.

In the case of investing in a road freight vehicle fleet, the purchase of newer vehicles, or brand new vehicles, which are going to replace the existing ones in the company, is what we primarily have in mind. The selection of the vehicles which are being invested in, as well as the type, or the price of new vehicles, directly dictate the amount of the investment, and pursuant to that – the repayment period, i.e. the period of return on investment.

In the literature, there are a significant number of the papers dealing with fleet sizing. One of the first papers concerning the sizing of the fleet but in the maritime sector is published by Dantzig & Fulkerson (1954). They presented the problem of determining the minimum number of tankers to carry out the timetable, while Kirby (1959) made one of the first attempts concerning optimization of the fleet of the railways. He dealt with the problem of increasing the degree of utilization of wagons owned by the small rail system and of reducing the level of rental cars by determining the relative cost of the system's own and leased cars per day.

Etezadi & Beasley (1983) studied the problem of determining the fleet's optimal structure and size. Assuming that the decisions made concerning the given task are long-term ones, they presented a model that is based on integer linear programming. In the same paper, the authors suggested that the problem may more accurately be solved by using simulation. Bojovic (2002) addressed the problem of optimizing the size of the fleet through meeting demand and minimizing the total cost. Lima et al. (2004) described a mathematical algorithm for problem-solving. This algorithm is a hybrid of genetic algorithm and local search based on GENIUS algorithm. Wu et al. (2005) addressed the problem of the dimensioning fleet in road traffic. Operational and tactical decisions for heterogeneous fleet were explicitly

designed by the model of linear programming in order to determine the optimal size and mix of the fleet. Demand is assumed as known, while travel time is a stochastic parameter. Choi & Tcha (2007) presented an approach based on generating columns for problem resolution. The authors proposed an integer programming model whose LP relaxation is dealt with by the method of generating columns.

Models of optimization based on the behavior of swarms (colonies) "swarm intelligence" are partly inspired by the behavior of ants and bees in nature (Teodorovic, 2008). They solve the problems of combinatorial organization. It is a problem that occurs in the dimensioning of capacity of railway transport.

Bojovic et al. (2010) worked out the problem of determining the optimal composition of the freight wagon fleet. The problem is divided into two parts, namely, into determination of an optimal mix and that of an optimal size of the freight wagon fleet.

Sayarshad et al. (2010) proposed formulation and procedure for solving optimization size of the freight wagon fleet and allocation of wagons for the case of stochastic demand. The authors proposed a two-phase procedure based on the algorithm of simulated problem solving.

Loxston et al. (2012) considered the problem of forming a heterogeneous fleet with the presence of stochastic demand. The problem is based on determining the number of vehicles to be purchased for each type of vehicle specifically so that the total expected cost of the fleet would be set to minimum. These authors developed an algorithm that combines the dynamic programming method and the golden section to resolve the problem.

Milenković and Bojović (2013) proposed a fuzzy random model for the rail freight road freight vehicle fleet sizing problem. The problem is formulated as that of finding an optimal fuzzy regulator for a fuzzy linear system with a fuzzy quadratic performance index and fuzzy random initial conditions.

For a fleet size with environmental aspects, Sawik et al. (2017) used multi-criteria optimization.

Costa-Salas et al. (2017) presented the fleet size optimization in the discarded tire collection process.

In their study, Valmikia et al. (2018) presented a simulation model for the evaluation of an AGV fleet size in a flexible manufacturing system.

Telleza et al. (2018) introduced the fleet size and the mix dial-a-ride problem with multiple passenger types and a heterogeneous fleet of reconfigurable vehicles.

In the foregoing papers, different fleet-sizing aspects are observed. The basic goal of this paper is the development of the model that will give answers to the following questions:

1.   When should vehicles be bought?

2.   How many vehicles should be bought for the observed period?

3.   What is the value of investment per single vehicle? and so on.

The model should be able to include more factors, commonly with different sizes and values. Avoiding mixing of different sizes and values or linguistic variables as the most appropriate method that can measure and compare differences represents the method of artificial intelligence - "Fuzzy logics" (fuzzy logic). This method allows measuring, comparing and synthesizing different variables that are hard to be quantified to carry more qualitative features, as well as simplifying the uncertainty regarding the input data and parameters regarding uncertainty, subjectivity, inaccuracy and ambiguity.

2 The Prognostic Model of the Volume of Business Operations

In this paper, our observation focuses on the "M" Company, which realizes its most significant transport services through five different activities with approximately constant cargo flows at the level of the whole of the fiscal year. In those activities, the three scenarios of business operations are forecast, namely pessimistic, optimistic and real scenarios. Each combination is attributed a certain financial value for each of the next 10 fiscal years, which is the length of the exploitation period.

The prognostic model provides input data for the development of the fuzzy model. The growth rate method is used for the prognostic model. In order to define the growth rate according to different forecast scenarios, eight experts did the surveying. By applying the Delphi method, the sublimation of their answers regarding the expected growth rate is performed (Table 1).

Table 1 The growth rates for different forecasts as per each year in the next 10 years of the exploitation period

Years of exploit. period	Growth rate prognosis					
	Pessimistic		Real		Optimistic	
	relative	cumulative	relative	cumulative	relative	cumulative
1	0%	0%	1%	1%	2%	2%
2	0%	0%	1%	2%	2%	4%
3	0%	0%	1%	3%	2%	6%
4	0%	0%	1%	4%	2%	8,2%
5	0%	0%	1%	5,1%	2%	10,4%
6	-1%	-1%	3%	8.2%	5%	15,9%
7	-2%	-3%-	3%	11,3%	6%	22.8%
8	-3%	-6%	3%	14,6	7%	31,4%
9	-4%	-10,3%	3%	18%	9%	43.2%
10	-5%	-15,8%	3%	21,5%	10%	57,5%

3 The Development of a Fuzzy Model for Determining the Justifiability of Investing in a Road Freight Vehicle Fleet

3.1 Fuzzy sets and fuzzy logic

Fuzzy sets are sets whose elements have degrees of membership. In the classical set theory, the membership of elements in a set is assessed in binary terms according to a bivalent condition - an element either belongs or does not belong to the set. By contrast, the fuzzy set theory permits the gradual assessment of the membership of elements in a set; this is described with the aid of a membership function valued in the real unit interval [0,1].

Fuzzy logic is the base of fuzzy system. It enables making decisions based on incomplete information, while the models based on fuzzy logic consist of the so-called "if-then" rules. "If-then" rules are interconnected with "else" or "and".

Fuzzy logic is defined using algorithms for approximate reasoning. When we assume that x =[x_1, x_2, . . . , x_n] is a vector of features describing any object or state and y = [y_1, y_2, . . . , y_m] is the vector of output values of a system, the rules are represented in the form, See Eq. (1).

$$R^r : IF\ x_1\ is\ A_1^r\ AND\ x_2\ is\ A_2^r\ AND\ldots AND\ x_n\ is\ A_n^r$$
$$THEN\ y_1\ is\ B_1^r, y_2\ is\ B_2^r, \ldots, y_m\ is\ B_m^r \tag{1}$$

where $x \in X = X_1 \times X_2 \times \cdots \times X_n$, $y \in Y = Y_1 \times Y_2 \times \cdots \times Y_m$ and

$A^r = A_1^r \times A_2^r \times \cdots \times A_n^r \subseteq X$, $B^r = B_1^r \times B_2^r \times \cdots \times B_n^r \subseteq Y$ are the fuzzy sets.

The special significance of fuzzy logic is in the possibility of its application for modeling complex systems in which it is very difficult to determine the correlation of certain variables that exist in the model. Possible and logical rules are with weight 1, less possible 0.5.

The fuzzy rules are a manner of processing the numerical or information data obtained from the input interface. In the fuzzy model scheme, the rules are contained in the "processing" segment. Therefore, by means of the fuzzy rules, certain combinations of fuzzy numbers that will later be interpreted in the form of results, or fuzzy conclusions, are singled out.

There are several different forms of the fuzzy model use, whereas the model using numeric results, besides generating numeric results in the form of fuzzy sets, is the most important for this research study.

The characteristics of this type of the fuzzy model are as follows:

- the model reflects a broad modeling spectrum,

- numeric data are used and numeric results are generated, and,

- after its development, the model is applied for purely numeric purposes, while simultaneously accepting numbers and using them to obtain numbers in the form of a nonlinear input/output mirroring.

The scheme of this model is shown in Fig. 1 and consists of: the input interface, the processing module, and the output interface. The input interface stands for a

fuzzy set, whereas the output interface is a set of outcomes, i.e. conclusions (Pedrycz & Gomide, 2007).
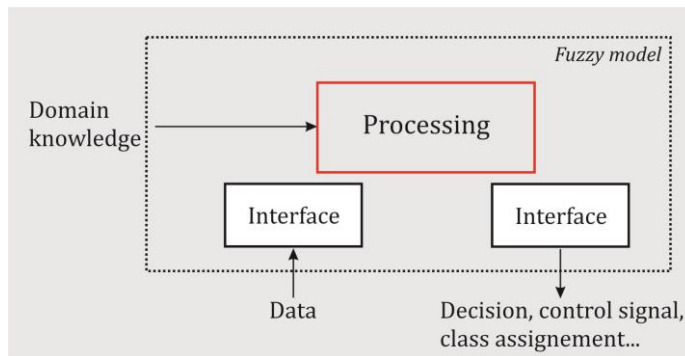

Fig. 1 General architecture of fuzzy model (Pedrycz & Gomide, 2007)

Fuzzy numbers, or the fuzzy sets consisting of such fuzzy numbers, represent the numeric data that create an input to the fuzzy model. So, the input interface uses fuzzy numbers or fuzzy sets, depending on how they are organized, and after processing data in the model, it comes to output data, i.e. conclusions.

3.2 The Idealized Fuzzy Tree Representing the Basis of the Fuzzy Investment Model

The fuzzy model type used in this paper is based on the fuzzy tree rule (Fig. 2).
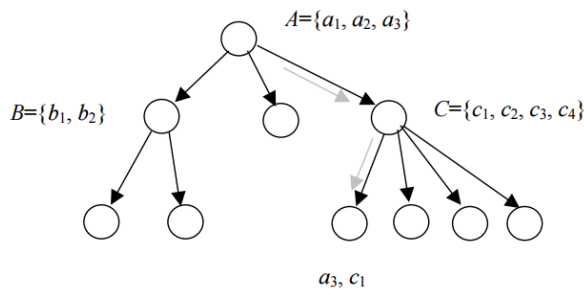

Fig. 2 Simple fuzzy tree (Pedrycz & Gomide, 2007)

This fuzzy tree contains three fuzzy sets: A, B, and C, which are differently organized and generate results, i.e. conclusions, by performing a defined algorithm. It is clear that B and C elements cannot intersect, and that only two elements from fuzzy sets, i.e. A and B elements, as well as A and C elements, can intersect.

3.3 The Input and Output Data of the Model

The input data in this model are financial parameters. They are presented in the form of the company's income from business operations.

Table 2 accounts for the income as per activities obtained with cargo permanent flows. They represent the input data for the development of the model. In the observed example of the "M" Company, as already mentioned, income with constant income is realized on five relations, i.e. five activities (Business).

Table 2 The total forecast (discounted) income of the company according to the pessimistic, real and optimistic forecasts for the period of 10 years

Business	Forecast income - P [10^3 €/10 god]		
	Pessimistic	Real	Optimistic
Business 1	1458.33	4416.67	5833.33
Business 2	437.50	1271.67	1675.00
Business 3	187.50	530.00	700.00
Business 4	46.67	141.67	186.67
Business 5	163.33	495.00	653.33
Total	2293.33	6855.00	9048.33

The input data are divided into fuzzy elements and fuzzy sets.

The fuzzy elements are grouped into fuzzy sets and are marked by colored circles, and represent the total financial income from one activity in a single year on the observed relation with constant income. It may have three forms, depending on the forecast: the red – pessimistic (A_1, A_2,…,A_5), the yellow – real (B_1, B_2,…,B_5), and the green – optimistic (C_1, C_2,…,C_5). By combining these elements, of which five combinations with different indices are chosen, a model for the assessment of the company's income is generated, while, at the same time, the model can be formed for each year, even on a quarterly basis, all depending on the needs of the company's management (Fig. 3).
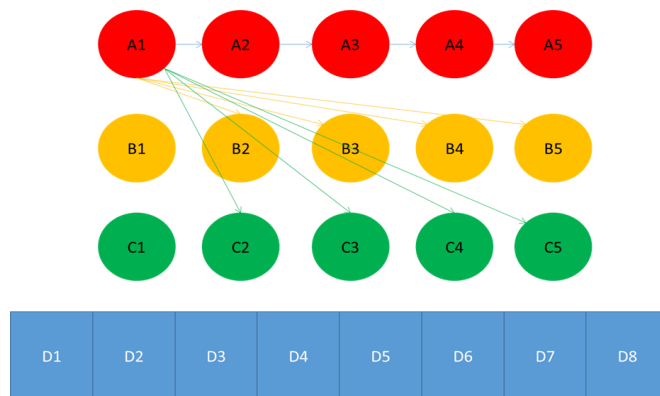

Fig. 3 Fuzzy tree used as the basis for model formation

Fig. 3 shows an idealized fuzzy tree generated based on the assumption that the maximum of eight vehicles are to be bought, according to the three possible prognostic scenarios for each activity with approximately constant commodity flows.

The output data are given in the D fuzzy set. The D fuzzy set will refer to the set of the conclusions, i.e. how many cargo vehicles, and of which type, to buy. In the model, eight groups are created: D_1, D_2,...,D_8. For example, the set marked as D_1 represents a decision to buy only one vehicle. This is important in the case the model is observed on a temporal basis, i.e. if we are interested in the number of the vehicles we will be able to pay off in a particular year. So, for example, at the end of the third year, it is necessary to determine the potentially available amount of income to be invested. Each of these groups will receive one combination generated from the three conditions, which means that the number of the vehicles to be bought annually will depend on the future business operations. In this manner, we are enabled to gradually observe investments in the model, from one year to another, depending on income.

Depending on the desired degree of the model's sophistication, every such tree can represent one business year, while the investment potential of each business year, i.e. the degree of return on investment, could simultaneously be determined.

The "M" Company's current road freight vehicle fleet consists of the vehicles older than 10 years; hence, all the vehicles should be replaced with newer ones (second-hand or new vehicles).

4 The Fuzzy Model Testing and the Results Analysis

While testing the fuzzy model, the fuzzy sets are formed with the forecast income, from which conclusions are derived. The fuzzy sets, i.e. the pessimistic, real and optimistic assessments of business operations will be the conditions, and investment in certain vehicles will be the conclusions. In other words, the three sets of conditions will be formed with one of them derived as the set of conclusions.

The basic assumption used in the paper is that the period of return on investment can be observed as the ratio between the *costs and income of the annual forecast in any observed year or period*. At the same time, taking into consideration the prescribed amortization rate for transport means in road traffic and the exploitation period, it is determined that 9.8% of income needs to be designated for the amortization of vehicles (p_a=9.8%).

For the sake of the unification of the "M" Company's road freight vehicle fleet, experience, need and ecological parameters, the MAN TGX vehicle model is selected. In order to purchase one new vehicle, an investment of and exceeding EUR105000 needs to be earmarked, depending on the vehicle equipment.

As the forecast volumes of the scope of transport of the "M" Company required a larger number of vehicles in the road freight vehicle fleet, also taking into consideration the age of the existing vehicles, a possibility of purchasing second-hand vehicles of the MAN TGX brand, whose residual exploitation cycle can be fitted into the observed one, was the subject matter of consideration. The average purchase price of one such vehicle is EUR18480. The potential investment groups are formed in Table 4.

Table 4 Investment groups of the MAN TGX vehicle, depending on the number of the vehicles to be bought

	Investment group – Number of the vehicles to be purchased (10^3 €)							
	1	2	3	4	5	6	7	8
Value of investment (I)	39.1	78.2	108.3	144.3	180.3	218.3	254.0	292.0

There are several combinations related to the possible variants of business operations in the future, namely only for business operations on the five relations with constant flows. In the paper, only several such combinations are presented.

Based on the input parameters, the fuzzy model schematically shown in Fig. 4 is formed. As can be seen in Fig. 4, the fuzzy numbers are organized in the three fuzzy sets, whereas the fuzzy rules are organized within the processing segment. One of the rules reads as follows:

"If the sum of any five fuzzy numbers is equal to or greater than $254 \cdot 10^3$ € , and less than $292 \cdot 10^3$ €, i.e. if the forecasts indicate that the enterprise's income in the year to come will be within the alleged range, then the D_7 Option, namely the purchase of seven vehicles, will be opted for."

In this case, the income (P_i) according to the realistic scenario can be generated from Equation (2).

$$IF\ x_1\ is\ B_1\ AND\ x_2\ is\ B_2\ AND\ldots AND\ x_5\ is\ B_5\,,$$

$$THEN \begin{pmatrix} P_1^r = B_1 + B_2 + B_3 + B_4 + B_5 = 4416.67 + 1271.67 + \\ 530.00 + 141.67 + 495.00 = 6855.00 \cdot 10^3\ € \end{pmatrix} \tag{2}$$

where x_i is the expected income according to the forecast B_i for $i=1, 2, 3, 4$ and 5 for the observed case of the realistic scenario (Table 2).
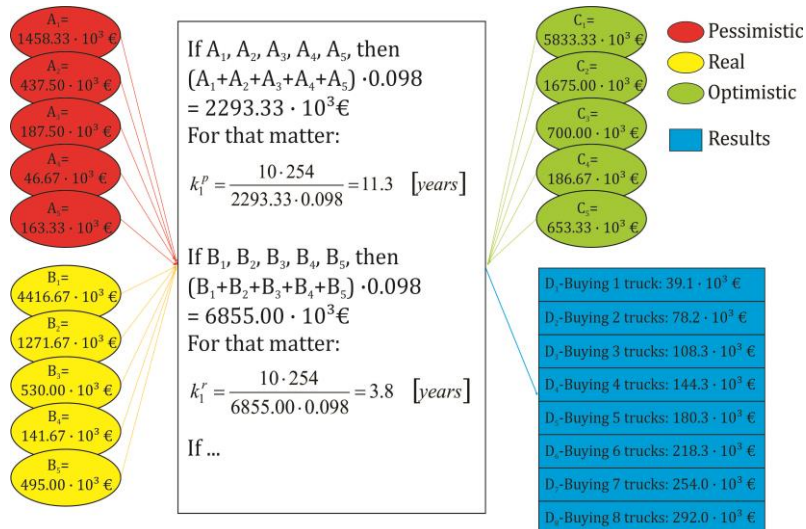

Fig. 4 Illustration of the investment fuzzy model

The total expected income from all business activities according to the realistic forecast amounts to $6855.00 \cdot 10^3$ €. According to the assumption about the proportionality of income and the costs of investment that was mentioned earlier, the investment repayment period (k) for the observed exploitation period (n) in the case of the seven vehicles (D_1 variant) can be obtained by applying the following equation:

$$k_1^r = \frac{n \cdot I}{P_1^r \cdot p_a} = \frac{10 \cdot 39.1}{6855.00 \cdot 0.098} = 0.6 \qquad [years] \tag{3}$$

If all incomes of all businesses would be realized according to the real scenario, then the expected period for repayment of the investment for the D_8 variant is:

$$k_8^r = \frac{n \cdot I}{P_1^r \cdot p_a} = \frac{10 \cdot 292}{6855.00 \cdot 0.098} = 4.4 \qquad [years] \tag{4}$$

Analyzing all possible cases of realization of the relay scenario, it is possible to get periods of vehicle repayment for the cases of realization of variant D_i for *i = 1, 2, 3, ..., 7.* The test results are shown in Fig. 5.
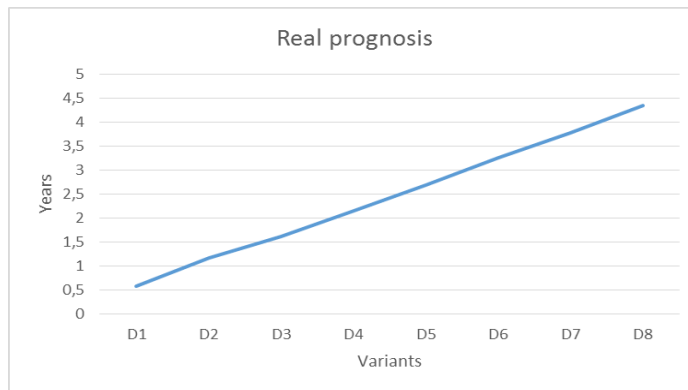

Fig. 5 *Investment repayment period according to the forecast realistic scenario*

As can be seen in Fig. 5, the model shows that the company "M" can obtain and replace all (eight) second-hand vehicles of the existing fleet in the first year of observation because the ratio of revenues and expenses is favorable and allows the return of invested funds within a reasonable period. This indicates that in the observation period, the company can once again renew the fleet with second-hand vehicles. Practical experience also points to such a conclusion. Depending on the condition of the used vehicle and the planned volume of exploitation, the remaining period of exploitation is usually up to 5 years. The model can also be tested for different exploitation periods, different allocations from company income for investment repayment (e.g. by reducing the other costs of business operations in favor of greater amounts for repayment), as well as for the cases of the purchase of only new vehicles (the values in Table 4 change).

When it comes to purchasing of new vehicles, whose value is estimated at $120 \cdot 10^3$ €, for the period of observation (fifteen years), only three new vehicles can be purchased, if the procurement is carried out in the first year, see Eq. 5.

$$k_{new}^r = \frac{n \cdot I}{P_1^r \cdot p_a} = \frac{15 \cdot 3 \cdot 120}{6855.00 \cdot 0.098} = 8 \qquad [years] \tag{5}$$

If the expected period of exploitation will decrease to 10 years then only two new vehicles can be repaid, under condition to be purchased in the first year of observation.

4 Sensitivity Analysis

During the model's testing, the questions to arise are always the following: what happens with the results if the expected revenues will not be realized in the observed period, if operating costs will be higher than expected, if the market conditions will change... Therefore, the model is tested in the cases of realization of pessimistic and optimistic scenarios. According to the pessimistic scenario incomes (P_i) of all businesses can be obtained from the formula (6).

$$IF \; x_1 \, is \, A_1 \; AND \, x_2 \, is \, A_2 \; AND \ldots AND \, x_5 \, is \, A_5,$$

$$THEN \begin{pmatrix} P_1^p = A_1 + A_2 + A_3 + A_4 + A_5 = 1458.33 + 437.50 + \\ 187.50 + 46.67 + 163.33 = 2293.33 \cdot 10^3 \; € \end{pmatrix} \tag{6}$$

where x_i is the expected income according to the forecast A_i for $i=1, 2, 3, 4$ and 5 for the observed case of the pessimistic scenario (Table 2).

According to the optimistic scenario, incomes of all businesses can be obtained from the formula (7).

$$IF \; x_1 \, is \, C_1 \; AND \, x_2 \, is \, C_2 \; AND \ldots AND \, x_5 \, is \, C_5,$$

$$THEN \begin{pmatrix} P_1^o = C_1 + C_2 + C_3 + C_4 + C_5 = 5833.33 + 1675.00 + \\ 700.00 + 186.67 + 653.33 = 9048.33 \cdot 10^3 \; € \end{pmatrix} \tag{7}$$

Should all income according to all business activities be only realized according to the pessimistic, or only according to the optimistic scenario, the expected investment repayment period (k) according to different variants is shown in Fig. 6.
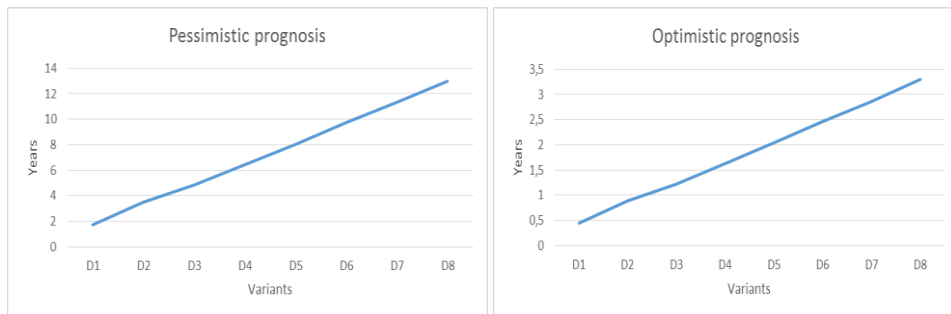

Fig. 6 Investment repayment period according to the different scenarios forecast

The model can also be tested for a combined forecasting revenue scenarios. So, for example, if we consider the combined revenue realization: real for business 1, 3 and 5, pessimistic for business 2 and optimistic for business 4, we get the expected revenue from $6065.83 \cdot 10^3 \text{€}$, see Eq. 8.

$$IF\ x_1\ is\ B_1\ AND\ x_2\ is\ A_2\ AND\ x_3\ is\ B_3\ AND\ x_4\ is\ C_4\ AND\ x_5\ is\ B_5,$$

$$THEN \begin{pmatrix} P_i^{com} = B_1 + A_2 + B_3 + C_4 + B_5 = 4416.67+ \\ +437.50 + 530 + 186.67 + 495 = 6065.83 \cdot 10^3 \quad \text{€} \end{pmatrix} \tag{8}$$

In this case, for example, for the purchase of eight vehicles, the repayment period of the investment is:

$$k_i^{com} = \frac{n \cdot I}{P_i^{com} \cdot p_a} = \frac{10 \cdot 292}{6065.83 \cdot 0.098} = 4.9 \qquad [years] \tag{9}$$

For this variant of revenue realization, eight vehicles can be purchased in the first year of observation and after five years, if the state of the vehicle requires, it is possible to purchase another eight used vehicles.

The sensitivity analysis of the model was also carried out for the cases of the purchase of new vehicles (Fig. 6).
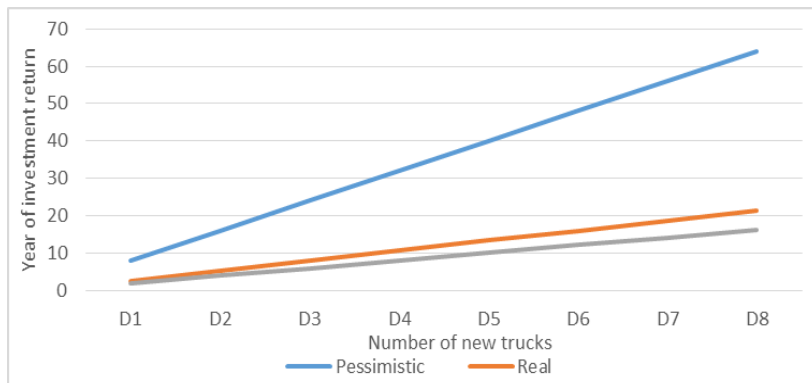

Fig. 6 Period of the repayment of investment in new trucks according to the different scenarios forecast

As can be seen from Fig. 6, the observed company "M" in the case of a pessimistic business scenario can return investments for only one truck in the observed period (15 years), in the case of the real scenario five, and in the case of the optimistic scenario, seven trucks.

Further testing of the model shows that the model is extremely sensitive to the height of the investments (type and number of vehicles) and the amount of realized revenues, primarily business 1, 2 and 3. The model is least sensitive to the realization of revenues of business 4.

5 Conclusions

In order for a transport company to successfully operate, it is extremely important that it should have an appropriate road freight vehicle fleet, with respect to both the quantity and the structure. Besides, the road freight vehicle fleet ages during the exploitation period, so it is extremely important to plan investments in its renewal. Investing in the renewal of the road freight vehicle fleet is a complex process, simultaneously taking different aspects into account. It is very important that vehicles should be chosen in accordance with future income. For that reason, it is very important to make a good forecast. In the paper, the pessimistic, real and optimistic forecasts are subjected to observation. The assessments of income, as well as the return-on-investment period, were performed for all of the three forecasts. In all of the three cases, the results were acceptable, and the conclusion is that the road freight vehicle fleet should be renewed irrespective of which forecast will come up to expectations, since it is very important that the emission standards should be followed due to the announcement of raising the minimum emission standard in the EU from EURO 3 to EURO 5 in the forthcoming period (3 years have been planned in that regard). That would mean that a large majority of transport means in Serbia do not meet the conditions and have to be replaced; in order to avoid problems related to that, the road freight vehicle fleet should be adapted as soon as possible to the conditions existent on the European transportation market, especially in the EU region. Although the economic business market, and simultaneously the market of transport companies as well, has its regularities, it also contains certain uncertainties, such as, for example, demand, competition development, the transport policy, the fuel price, etc. In the majority of cases, the known fleet management analytical models do not take into consideration that uncertainty. For that reason, this paper suggests the use of fuzzy logic for the development of the fleet management model that can provide answers to the following questions: should the road freight vehicle fleet be invested in? How many vehicles are cost-effective to buy? When to buy them? and how long is the return-on-investment period? Apart from that, the model can also be used for the variant of investing in the road freight vehicle fleet by purchasing new or second-hand vehicles. The deficiency of this model is its sensitivity to more significant changes in the volume of business operations (a decrease or increase in income). In that case, the reconfiguration of certain segments of the fuzzy model is required.

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