DECISION MAKING FOR CLOSING BRANCH OF BANK: A SIMULATION MODEL

Abstract: *The article deals with the method of simulation as a support for decision making. The two dimensional partial differential equations and fuzzy logic theory are used. At first the theory is mentioned, than the way of build up of a model and finally the case study deals with simulations leads to close of a branch of the bank to reduce the costs.*

Keywords: *judgmental forecasting, bank sector, simulation model, decision making process, closing the bank*

1. INTRODUCTION

The article deals with the build up of a model for judgmental forecasting in bank sector. It presents the model, explains the used variables and their interpretation in the competitive environment. The case study presents the application of the build up model. The results are discussed. The two dimensional partial differential equation of second order and fuzzy logic theory is used.

Banks must use their means carefully. Tasks for decision makers are to decrease the costs nowadays. The banks are surrounded not only by competitive banks, but they have branches and the competition in this case is undesirable. The decision makers must solve the problem which activities of branches will be reduced, changed (focus on corporations, persons; loans, mortgages etc.) or which one will be closed. They can be supported by designed program to optimize their decision.

The designed methodology implemented in a computer program enables to do the simulation. The program is very flexible for the set up of conditions, restrictions and obstacles. The two and three dimensional graphs together with polar graph and fuzzy outputs results in graphical ways are used.

3. BUILD OF THE MODEL

The meaning of used variables in competitive environment model in banks sector is as follows: The values of "cells" represents the bank utilization $D_{t,i,j}$ with index of time t and coordinates i, j. The bank utilization is in the range from *+100%* to *0%*, where *+100%* means the maximum bank utilization and *0%* means the zero utilization of bank. The various conditions of banks create the competitive environment. The value K is a simulation constant. The constants $Kx_{i,j}$ and $Ky_{i,j}$ present the rate of "influence" of competition environment in the direction of coordinates x, y of each cell. Each cell $\boldsymbol{O}_{i,j}$ is coded in the following manner:

a) any influence (except initial condition),
b) solid obstacle,
c) positive and constant influence,
d) positive and variable influence,
e) negative and constant influence,
f) negative and variable influence.

The program was designed for the simulation of the competitive environment. The input values are constants K , $Kx_{i,j}$ *(n* x *m),* $Ky_{i,j}$ *(n* x *m),* matrix $\boldsymbol{D}_{0,i,j}$*(1* x *n* x *m)* (initial conditions of hospital utilization in time $T_0 = 0$), matrix ***O****(n* x *m)* (code of each cell). The last item is the time T_{end}, the end time of calculation of competitive environment. The differential equation was used for the simulation in the form

$$D_{t+1,i,j} = D_{t,i,j} + K\left[Kx_{ij}\left(D_{t,i,j-1} - 2D_{t,i,j} + D_{t,i,j+1}\right) + Ky_{ij}\left(D_{t,i+1,j} - 2D_{t,i,j} + D_{t,i-1,j}\right)\right].$$

The parameters for simulation Kxij and Kyij are set up by means of fuzzy logic. The details of the program were described in [Dostál 2008] and applications in other branches in [Dostál et al. 2009] and [Dostál 2010].

4. REAL CASE

The real case presents the placement of branches of bank in town Brno (see fig.1).

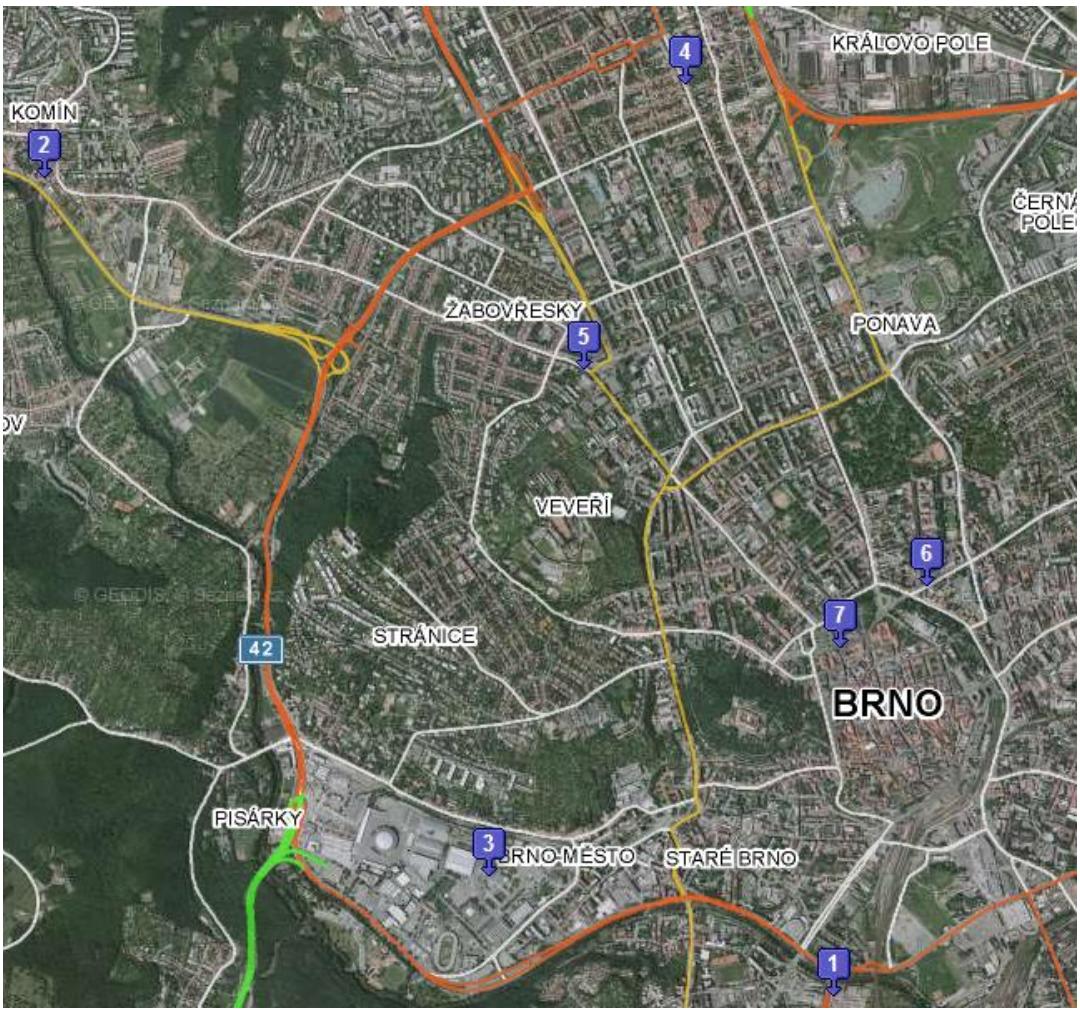

Fig.1 The placements of branches of bank

The branches of bank for judgmental forecasting are marked by number 1, 2, 3, 4, 5, 6, 7 and are presented in initial state graphically at fig.2 and numerically at fig.3.

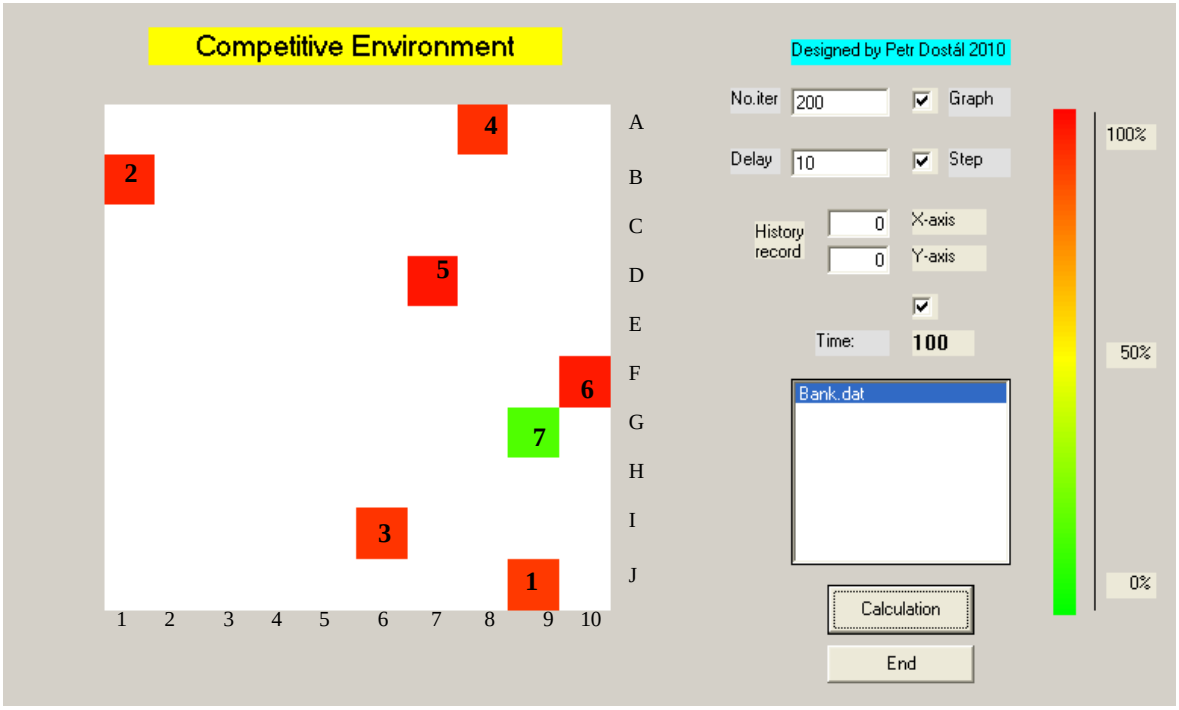

Fig.2 The initial situation of branches of bank

1	2	3	4	5	6	7	8	9	10	
000	000	-000	000	-000	000	000	086	000	000	A
088	000	000	000	000	000	000	000	000	-000	B
-000	-000	-000	-000	-000	000	000	000	000	-000	C
000	000	-000	-000	000	000	091	000	000	000	D
-000	-000	-000	-000	000	000	000	-000	000	000	E
-000	-000	000	000	-000	000	000	-000	000	090	F
000	-000	-000	000	-000	000	-000	000	073	000	G
000	000	000	000	000	000	000	000	000	000	H
000	000	-000	000	000	085	000	000	000	000	I
000	000	000	000	000	000	000	000	084	000	J

Fig.3 The initial situation of branches of bank

The bank No.7 has a problem with its utilization therefore the management has an idea to close this branch of a bank and strengthen the others. The simulation model was built up.

1	2	3	4	5	6	7	8	9	10	
000	000	000	000	000	000	000	089	000	000	A
093	000	000	000	000	000	000	000	000	000	B
000	000	000	000	000	000	000	000	000	000	C
000	000	000	000	000	000	098	000	000	000	D
000	000	000	000	000	000	000	000	000	000	E
000	000	000	000	000	000	000	000	000	094	F
000	000	000	000	000	000	000	000	000	000	G
000	000	000	000	000	000	000	000	000	000	H
000	000	000	000	000	088	000	000	000	000	I
000	000	000	000	000	000	000	000	091	000	J

Fig.4 The situation of branches of bank after 200 days of simulation

The fig.4 presents the situation after 200 days numerically. The close of bank No.7 increased the utilization of other branches. See fig.4 for more details. The simulation supports the decision making of managers to close the branch No.7 of the bank.

The results of calculations is possible to present by a spider graph, where the banks with number 1, 2, 3, 5, 6, 7 were drawn in time T_0 (full line), T_{100} (dashed line) and T_{200} (dotted line). See prog.1. The graph enables the search of dynamic change of utilization of branches of bank when bank No.7 was closed. The increase of utilization of branches of banks confirms the correct decision of management when branch No.7 was closed.

```
clear all;
P=(xlsread('Data','Polar'))';
n=P(1,1);
t = 0:pi/3:2*pi;
polar(t, P(n+1:2*n),'-rs')
hold on
polar(t, P(2*n+1:3*n),'--bs')
polar(t, P(3*n+1:4*n),':gs')
```

Prog.1 Program for drawing the polar graph

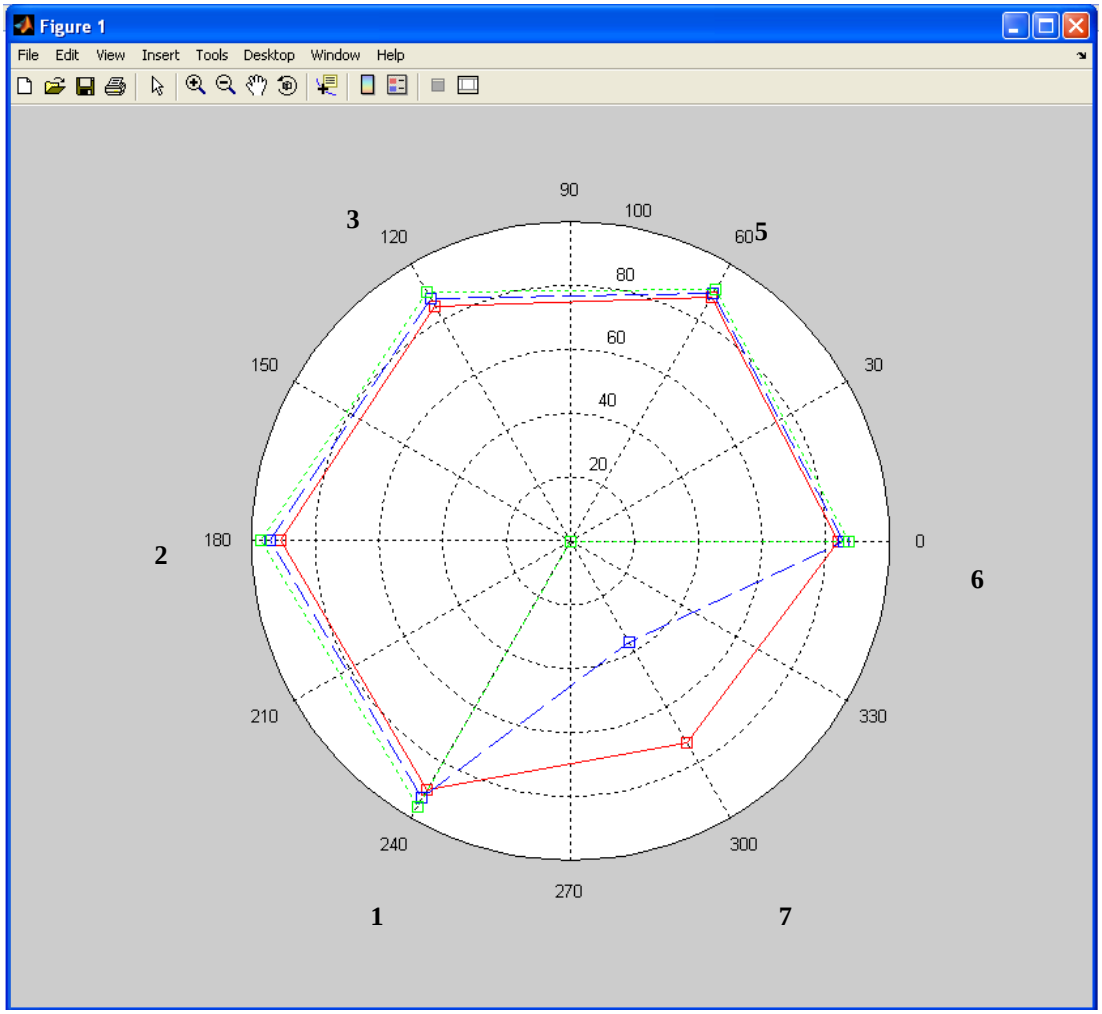

Fig.5 Utilization of branches of banks

The parameters for simulation Kx_{ij} and Ky_{ij} is suitable to set up by means of fuzzy logic. The inputs are represented by evaluation of variables such as staff quality, used equipments, productivity, service quality, placement, operation costs and pricing. The fuzzy model was build up for the set up of parameters. The fuzzy model has the seven inputs characterised by *Staff quality*, *Equipment*, *Productivity*, *Service quality*, *Placement*, *Costs* and *Pricing*. The

output is the value of parameter with attributes such as *Very Low*, *Low*, *Medium*, *High* and *Very High*. See fig.6 and fig.7.

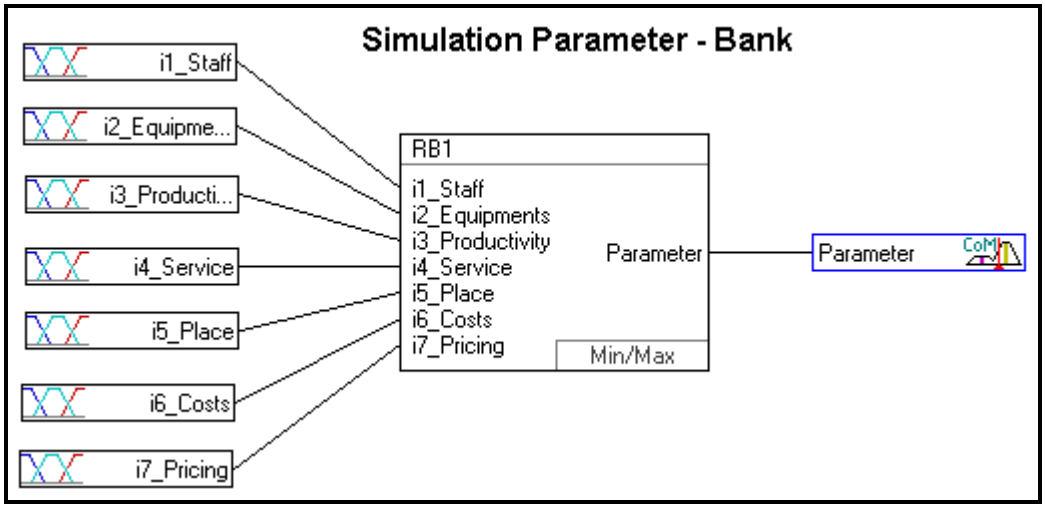

Fig.6 Fuzzy model

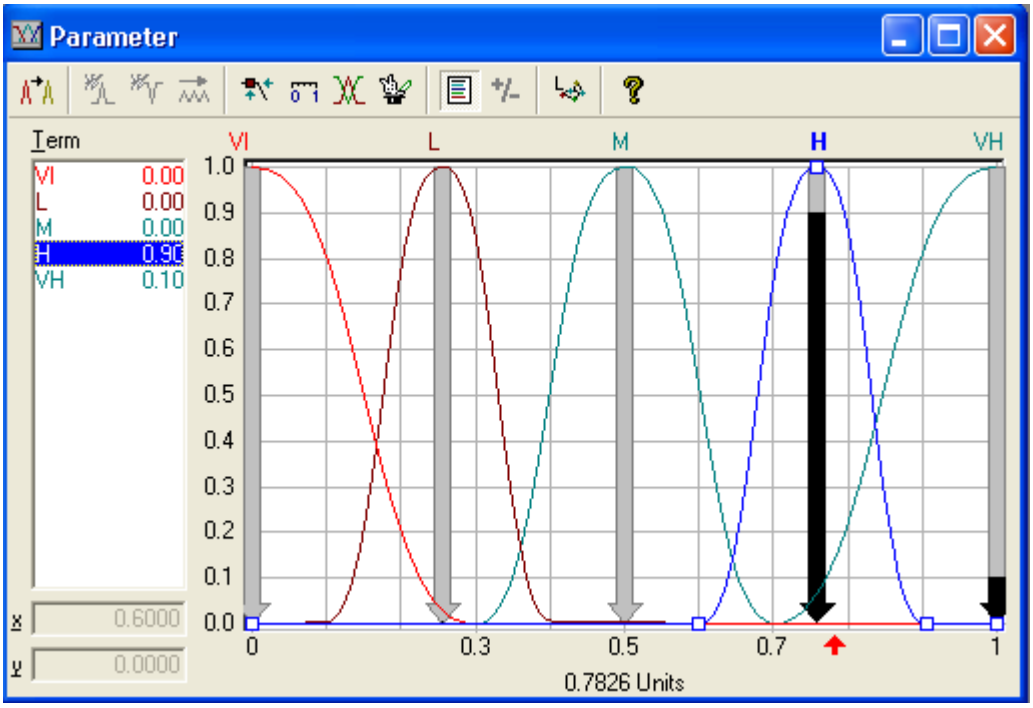

Fig.7 Set up a parameter for simulation

5. CONCLUSION

The result of simulation is clear. The evaluation of the closure of branch No.7 of the bank confirms the correct way of management. The designed model is usable in practice for decision making processes. The designed model is focused on the field of "no" competition among branches of bank. The described method of the build up of a model and its realization enables the search for strategy of bank that are very important for the decision makers. The simulation can help to prevent or reduce the costs of bank. The designed method can be used not only for bank competitive environment by also for example for hospitals, hotels, markets, firms, suppliers or customers relations etc.