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FUZZY MODEL OF THE PHARMACEUTICAL ENTERPRISE'S BUSINESS SAFETY AND THE RESULTS OF IT'S COMPUTER REALIZATION

The fuzzy model for generalized losses definition during pharmaceutical enterprises activity on the basis of indistinct sets theory methodology has been developed. It's realization in MATLAB environment is executed. Common perspectivity for application of fuzzy-sets approaches for increase of the enterprises business safety level has been shown. The aim of the paper is to describe the method and computer's realization for estimations of pharmaceutical enterprises safety level on drugs market in Ukraine. The main methodology is to use the fuzzy methods and Matlab's fuzzy-tools for creation of multicriteria model for calculations of summary level of pharmaceutical wholesaler's busines safety with financial, time, information, ecological and other losses as parametrs. On the basis of the conceptual approaches to study of busines safety and the computer fuzzy modeling methodology for industrial-administrative solutions and the fuzzy model for pharmaceutical enterprises busines safety level estimation has been created. The finded output surfaces allow to carry out at verbal level the analysis of association of an integral common from a modification of separate losses. On the basis this surfaces it is possible to know areas in which minor alterations of data-ins essentially change safety level of pharmaceutical enterprices.

Keywords: *business safety level, computer model, fuzzy sets, pharmaceutical firms activity, Matlab fuzzy tools.*

Introduction

Formulation of the problem, publication's rewiew and the purposes of paper. Today the enterprises operation defines a level of development of the market and makes a basis of any economic system which builted on the competitive beginnings.

It, in turn, gives warranties of stability for society and supplies economic safety of the state as a whole.

Therefore the problem of economic safety support for enterprises with development of market relations gains a special sharpness and becomes one of key factors of its economic and social development [1].

Enterprises system of economic safety is intended for the creation and support of normal development of pharmaceutical enterprise and for preventing of possible damages and losses, which can take place as a results of implementation of various threats [2].

The first aim of system of economic safety for pharmaceutical firms is the preventing of bankruptcy threat for the enterprise.

System of economic safety can be realised as economic safety policy and represents assemblage (collection, complex) of measures, tools and resources which usage is regulated by appropriate legal acts (state, regional, own etc.) [3].

The main researches

Fuzzy Model Approach. On the basis of the conceptual model of system for enterprises economic safety, developed in [4], and the computer modeling-simulation methodology of adoption for industrial-administrative solutions, offered in [5], the original fuzzy model for the enterprises economic safety level's estimation with estimations from the making solution persons is created.

The major index of system of economic safety (index of functioning for economic safety system) is the enterprises economic safety level which appears from usage of the corporate operational resources.

This index is a complex, integral index and it can be certain by expression, which described in [4].

Tables of Parameters. The developed fuzzy-logic model of economic safety level estimation for pharmaceutical enterprise considers all metrics of offered conceptual model assemblage.

For an instance, we will reduce account of significances for some of indexes, metrics (see table 1).

Fuzzy functions, decision rules and results. Further, with using the Fuzzy-unit of simulation tool MatLab©[6], functions of entry and output parameters (figures 1 – 4) were builted.

Thus, the output parameter represents loss resultants (figure 5), evaluated on 100 ball scale with 4 levels (small, average, big, unacceptable).

With registration of a cross-coupling for all significances of indexes by means of the gated in conventional codes we will receive assemblage of the alternatives introduced into model.

Thus for improving of visualisation for submission of model we will merge 1.3 and 1.4; 2.1 and 2.2; 3.1 and 3.2; 4.1 and 4.2, that does not infringe a generality of the task's solution.

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Table 1

Significances for levels of the financial, temporal, information, ecological losses.

№	index title	code	significance	levels (months(1), hours(2), Mb(3), $(4))	
				max	min
1	financial losses level	1.1	p_1 = 0,9 if the firm has financial losses…	12	10
		1.2	p_1 = 0,7 if the firm has financial losses…	6	4
		1.3	p_1 = 0,5 if the firm has financial losses…	3	2
		1.4	p_1 = 0,1 if the firm has financial losses…	1	0
2	temporal losses level	2.1	p_2 = 0,9 if the firm loses on the average for a week …	6	3
		2.2	p_2 = 0,7 if loses is …	9	7
		2.3	p_2 = 0,5 if the firm loses on the average for a week …	13	10
		2.4	p_2 = 0,1 if loses is …	20	15
3	information losses level	3.1	p_3 = 0,9 if the firm loses on the average for a week…	10	7
		3.2	p_3 = 0,7 if loses is …	120	30
		3.3	p_3 = 0,5 if loses is …	1200	250
		3.4	p_3 = 0,1 if the firm loses on the average for a week…	14000	1300
4	ecological losses level	4.1	p_4 = 0,9 if the firm loses for a week (for example, fines)…	130	70
		4.2	p_4 = 0,7 firm loses for a week…	620	170
		4.3	p_4 = 0,5 if loses is for a week…	1200	750
		4.4	p_4 = 0,1 if the firm loses on the average for a week…	7000	1500

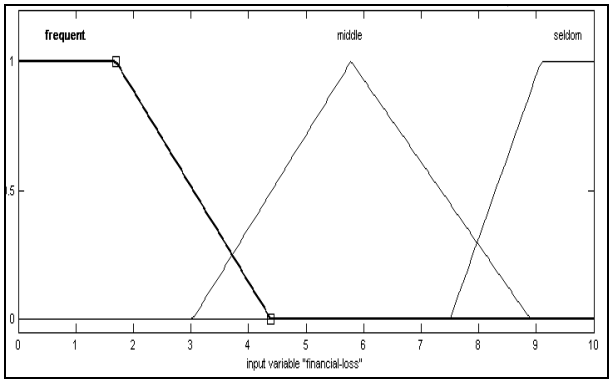

Figure 1. Function of parameter "financial losses"

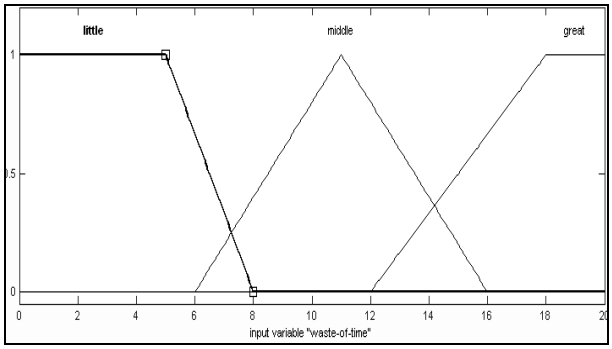

Figure 2. Function of parameter "temporal losses"

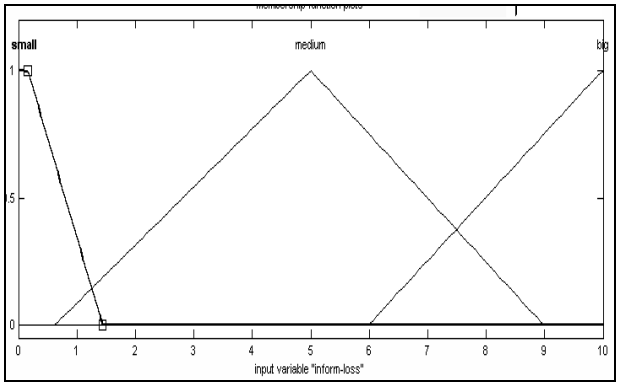

Figure 3. Function of parameter "information's losses"

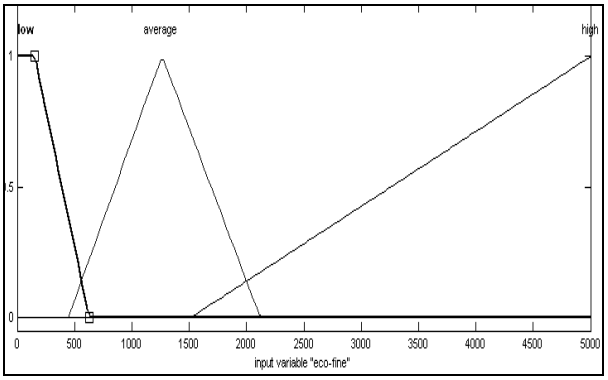

Figure 4. Function of parameter "ecological losses"

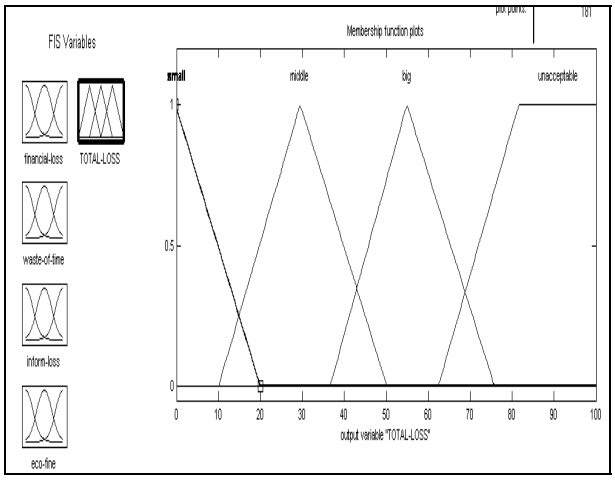

Figure 5. Function of "Loss resultants"

Thus for improving of visualisation for submission of model we will merge 1.3 and 1.4; 2.1 and 2.2; 3.1 and 3.2; 4.1 and 4.2, that does not infringe a generality of the task's solution.

For an instance we will reduce one of logic output rules: combination type «1.1 and 2.1 and 3.1 and 4.1»; exposition «IF financial losses (2.1) are small AND working hours firm loses (2.1) are small AND informa-

tion loss (3.1) is small AND ecological fines (4.1) are low»; outcome effect is «common losses are small (1)». At usage of the modeling-simulation environment MatLab© [6] the assemblage of the received rules will look like, shown on figure 6. On the basis of this rules and functions common loss (figures 7 – 9) is conducted.

1. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is small) and (eco-fine is low) then (TOTAL-LOSS is small) (1)
2. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is small) and (eco-fine is average) then (TOTAL-LOSS is small) (1)
3. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is small) and (eco-fine is high) then (TOTAL-LOSS is middle) (1)
4. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is medium) and (eco-fine is low) then (TOTAL-LOSS is small) (1)
5. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is medium) and (eco-fine is average) then (TOTAL-LOSS is small) (1)
6. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is medium) and (eco-fine is high) then (TOTAL-LOSS is middle) (1)
7. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is big) and (eco-fine is low) then (TOTAL-LOSS is middle) (1)
8. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is big) and (eco-fine is average) then (TOTAL-LOSS is middle) (1)
9. If (financial-loss is frequent) and (waste-of-time is little) and (inform-loss is big) and (eco-fine is high) then (TOTAL-LOSS is middle) (1)
10. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is small) and (eco-fine is low) then (TOTAL-LOSS is small) (1)
11. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is small) and (eco-fine is average) then (TOTAL-LOSS is small) (1)
12. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is small) and (eco-fine is high) then (TOTAL-LOSS is middle) (1)
13. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is medium) and (eco-fine is low) then (TOTAL-LOSS is small) (1)
14. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is medium) and (eco-fine is average) then (TOTAL-LOSS is small) (1)
15. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is medium) and (eco-fine is high) then (TOTAL-LOSS is middle) (1)
16. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is big) and (eco-fine is low) then (TOTAL-LOSS is middle) (1)
17. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is big) and (eco-fine is average) then (TOTAL-LOSS is middle) (1)
18. If (financial-loss is frequent) and (waste-of-time is middle) and (inform-loss is big) and (eco-fine is high) then (TOTAL-LOSS is big) (1)

Figure 6. The fragment of rules assemblage for logic output system

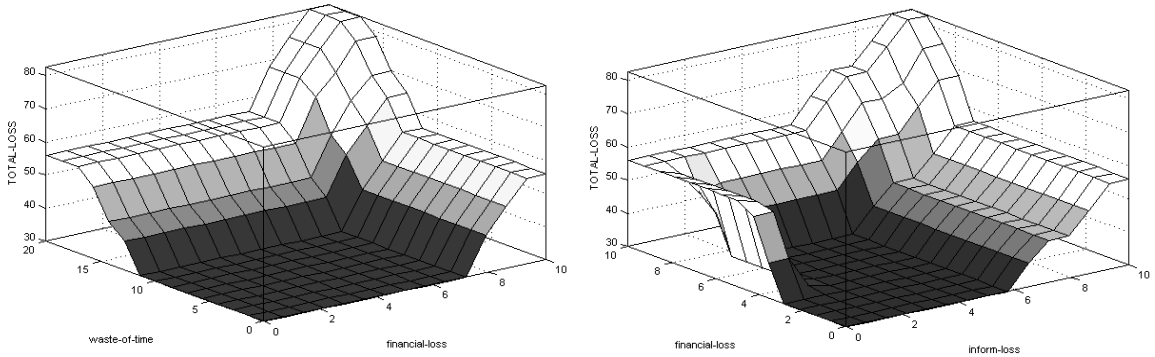

Figure 7. The output surface on parameters "Financial losses" and "Information losses"

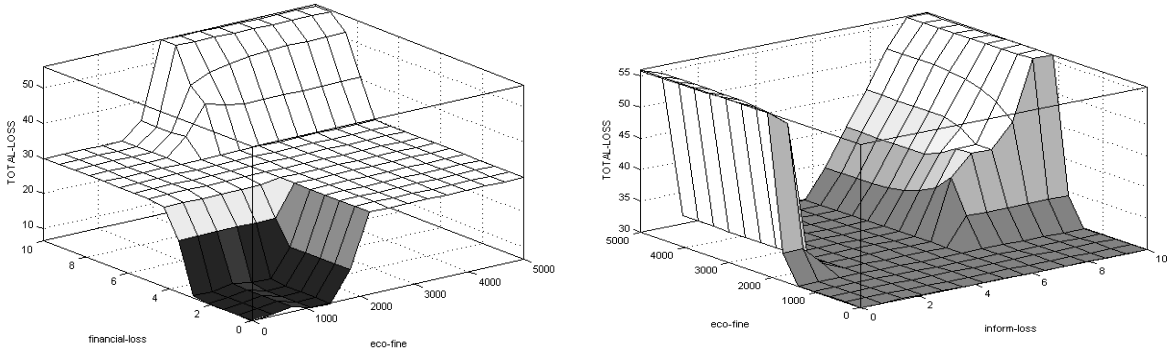

Figure 8. The output surface on parameters "Ecological losses" and "Information losses"

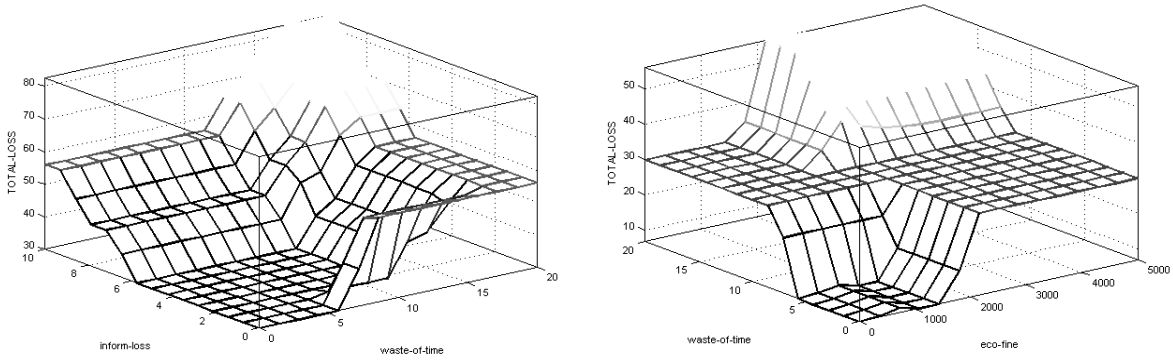

Figure 9. The output surface for parameters "Temporal losses" and "Ecological losses"

This output surfaces allow to carry out at verbal level the analysis of association of an integral common from a modification of separate losses.

On the basis of received output surfaces it is possible to know areas in which minor alterations of data-ins essentially change common economic safety level of enterprise.

The offered model can be effectively used at solution of following tasks: development and implementation of common economic safety concept at enterprise; creation of the strategic plane of enterprise activity with allowance for requests of the modern business market; creation of rigorous and functional economic safety service for the enterprise working together with organs of police and local authorities; creation of all premises for preventing of smashup threat for a business, cumulative successful development, evolution and stability in all locale; solution of economic problems with rational using of all enterprises operational resources and reaching of a competitive state level in the market of any scale; preventing of economic crimes e.g.

Conclusions

The obtained results are usible for all types of enterprises in conditions of right determination of assemblies of input parameters and its numerical levels.

Future researches should include development of multi-parameter models in tree-view with more factors and design correspondent software for usage in pharmaceutical business and drugs market conditions.

The practical implications showed, that the offered model help to solution for development and implementation of safety concept at enterprise; creation of the strategy of activity for the enterprise; solution of economic problems with rational using of all enterprises operational resources; preventing of economic losses.

Described approach is the new, original, eazy, efficient and effective way to exeminate and calculate common safety level for pharmacy enterprises.

The proposed and realised model is clear for understanding and using, as well as it give corect and true results.

References

1.Kavun S. Informational safety in business. The scientific edition / S. Kavun. – Kharkov: Publishing house Kharkov National University of Economics, 2007. – 408 p.

2.Kavun S. Estimation of a damage of enterprise owing to network attacks to her resources / S. Kavun // Scientific journal "Economy of Development". – 2007. – № 1 (41). – P. 83-85.

3. Kavun S. The methodic of construction of a policy of safety of the enterprise / S. Kavun, G. Shubina // Business Inform. – 2005. – № 1-2. – P. 96-102.

4.Kavun S. Conceptual model of system of economic safety of enterprise / S. Kavun // Scientific journal "Economy of Development". Kharkov, Publishing house Kharkov National University of Economics. – 2007. – № 3 (43). – P. 97-101.

5.Dorokhov O. Application of decision-making methods under uncertainly conditions for transport service management / O. Dorokhov // Bulletin of East-Ukranian National University named Volodimir Dal: Scientific journal. – Lugansk, 2004. – № 7 (77). – Vol. 1. – P. 202-209.

6.Duane C. Hanselman. Mastering MATLAB / Duane C. Hanselman, Bruce L. Littlefield. – Prentice Hall, London. – 1 edition. – 2004. – 864 p.

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ФАЗІ-МОДЕЛЬ ДЛЯ ОЦІНКИ БІЗНЕС-БЕЗПЕКИ ФАРМАЦЕВТИЧНОГО ПІДПРИЄМСТВА ТА РЕЗУЛЬТАТИ ЇЇ КОМП'ЮТЕРНОЇ РЕАЛІЗАЦІЇ

О.В. Дорохов, І.О. Золотарьова, Л.П. Дорохова

Представлено постановку завдання та методологію нечіткого моделювання багатокритерійної оцінки рівня комерційної безпеки фармацевтичного підприємства. Наведено приклад практичних розрахунків, а також графічні результати моделювання в середовищі Matlab. Визначено напрямки практичного використання розробленої комп'ютерної моделі для посилення комерційної безпеки фармацевтичних підприємств та організацій.

Ключові слова: *нечітке моделювання, комерційна безпека, фармацевтичне підприємство.*

ФАЗЗИ-МОДЕЛЬ ДЛЯ ОЦЕНКИ БИЗНЕС-БЕЗОПАСНОСТИ ФАРМАЦЕВТИЧЕСКОГО ПРЕДПРИЯТИЯ И РЕЗУЛЬТАТЫ ЕЕ КОМПЬЮТЕРНОЙ РЕАЛИЗАЦИИ

А.В. Дорохов, И.А. Золотарева, Л.П. Дорохова

Представлена постановка задачи и методология нечеткого моделирования многокритериальной оценки уровня коммерческой безопасности фармацевтического предприятия. Приведен пример практических расчетов, а также графические результаты моделирования в среде Matlab. Определены направления практического использования разработанной компьютерной модели для усиления коммерческой безопасности фармацевтических предприятий и организаций.

Ключевые слова: *нечеткое моделирование, коммерческая безопасность, фармацевтическое предприятие.*