Formation of identifying parameters reference values of information and psychological impact

Vladyslav Griga, Andriy Gizun, Illia Lanovyi

Academic Department of IT-Security, National aviation university, UKRAINE, prosp. Komarova, 1,
E-mail: gsmgrey1@gmail.com

Abstract –The paper defines and describes the identifying parameters of information and psychological impact. There are formed reference values that are necessary for revealing the information and psychologic influence.

Informational and psychological influence, information war, benchmarks, identifying parameters, fuzzy logic .

I. Information and psychological influence identifying parameters determination

Identification of information and psychological influence allows to implement countermeasures effectively and win during the information confrontation. Therefore, arises the question about its implementation. During the research, the following basic characteristics of the IPI were identified:

- «duration of implementation of IPI» – LT,
- «stage of manifestation» – DM,
- «economic losses level» – EL;
- «percentage of the population that watches foreign TV» – PP;
- «percentage of the population that reads the foreign press» – PN;
- «level of trust in government» – CG;
- «the level of protest attitudes of the population» – PM;
- «information infrastructure development degree» – II;
- «external factors influence degree» – IF.

So, we present the set of identifying parameters for the number of investigated situations as follows:

$$IPF = \left\{ \bigcup_{I=1}^{9} IPF_I \right\} = \{IPF_1, IPF_2, IPF_3, IPF_4, IPF_5, IPF_6, IPF_7, IPF_8\} =$$
$$= \{LT, DM, EL,, PP, PN, CG, PM, II, IF\}$$

II. Formation of reference values for identifying parameters

Reference values are formed according to [1] and [2].

The parameter LT is characterized by the following linguistic assessments: {short (К), medium (С), long (Д)}. Intervals for reference values determination = {[0-25], [26-50], [51-75]} days. Creating assessments summary table and basic frequencies matrix that are presented in table 1.

TABLE 1

	0-25	26-50	51-75
К	24	9	5
С	14	29	21
Д	12	19	30

Defining ν= | 50; 57; 56 | i Max = 57

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 27,36;9;5,09 \\ 15,96;29;21,38 \\ 13,68;19;30,54 \end{vmatrix}$$

and maximums vector = ||27,36 29 30,54||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,3;0,1 \\ 0,6;1;0,7 \\ 0,5;0,7;1 \end{vmatrix}$$

Supports: $T_{log11} = T_{log21} = T_{log31} = 25 / 100 = 0,25$, $T_{log12} = T_{log22} = T_{log32} = 50 / 100 = 0,5$, $T_{log13} = T_{log23} = T_{log33} = 75 / 100 = 0,75$. After making the transformation, obtain a set of parameter reference values LT = T_{log} = {short (К), medium (С), long (Д)} and the terms of the linguistic variables for this parameter:

К = {0/0,25; 1/0,25, 0,3/0,5; 0,1/0,75; 0/0,75},
С = {0/0,25; 0,6/0,25; 1/0,5; 0,7/0,75; 0/0,75},
Д= {0/0,25; 0,5/0,25; 0,7/0,5; 1/0,75; 0/0,75}.

Graph of the membership function of the terms of the linguistic variable “The aims of IPI implementation” is shown in fig. 1:

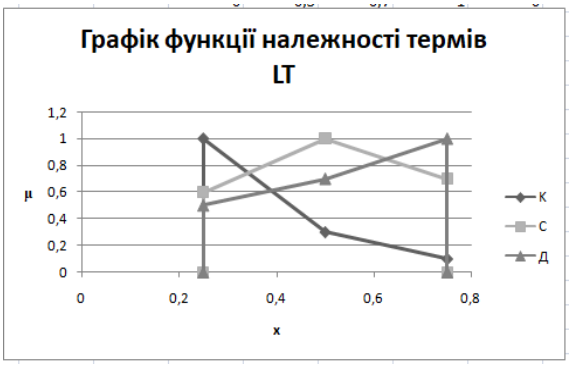

Fig. 1. Graph of terms affiliation «The aim of IPI implementation»

The parameter DM is characterized by the following linguistic assessment: {primary (П), deployed (Р), final (З)}. Intervals for reference values determination = {[0-10], [11-20], [21-30]} IPI events per year. Creating assessments summary table and basic frequencies matrix that are presented in table 2.

TABLE 2

	0-10	11-20	21-30
П	14	9	4
Р	12	15	10
З	7	14	17

Define ν= | 33; 38; 31 | and Max = 38

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 16,12;9;4,9 \\ 13,82;15;12,26 \\ 8,06;14;20,84 \end{vmatrix}$$

and maximums vector = ||16,12 15 20,84 ||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,6;0,24 \\ 0,86;1;0,59 \\ 0,5;0,93;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=10/30=0,33$, $T_{log12}=T_{log22}=T_{log32}=20/30=0,67$, $T_{log13}=T_{log23}=T_{log33}=30/30=1$. After making the transformation, obtain a set of parameter reference values $DM=T_{log}$ = { primary (П), deployed (Р), final (З)} and the terms of the linguistic variables for this parameter:

П = {0/0,33; 1/0,33, 0,6/0,67; 0,24/1; 0/1},

Р = {0/0,33; 0,86/0,33; 1/0,67; 0,59/1; 0/1},

З = {0/0,33; 0,5/0,33; 0,93/0,67; 1/1; 0/1}.

Graph of the membership function of the terms of the linguistic variable Stage of manifestation shown in fig. 2:

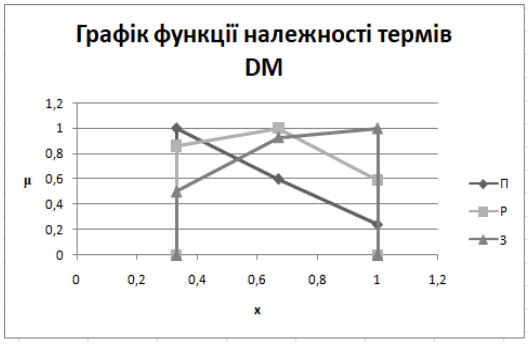

Fig. 2. Graph of terms affiliation «Stage of manifestation»

The parameter EL is characterized by the following linguistic assessment: {small (M), middle (C), high (B)}. Intervals for reference values determination = {[0-20], [21-50], [51-80]} thousands of dollars per year. Creating assessments summary table and basic frequencies matrix that are presented in table 3.

TABLE 3

	0-20	21-50	51-80
M	16	8	1
C	7	12	3
B	1	5	8

Define ν= | 24; 25; 12 | i Max = 25

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 16,67;8;2,08 \\ 7,29;12;6,25 \\ 1,04;5;16,77 \end{vmatrix}$$

and maximums vector = ||16,67 12 16,67||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,67;0,13 \\ 0,44;1;0,38 \\ 0,06;0,42;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=20/80=0,25$, $T_{log12}=T_{log22}=T_{log32}=50/80=0,63$, $T_{log13}=T_{log23}=T_{log33}=80/80=1$. After making the transformation, obtain a set of parameter reference values $EL=T_{log}$ = {small (M), middle (C), high (B)} and the terms of the linguistic variables for this parameter:

M = {0/0,25; 1/0,25; 0,67/0,63, 0,13/1,0/1},

C = {0/0,25; 0,44/0,25; 1/0,63; 0,38/1; 0/1},

B = {0/0,25; 0,06/0,25; 0,42/0,63; 0,1/1; 0/1}.

Graph of the membership function of the terms of the linguistic variable “Economic losses level” shown in fig. 3:

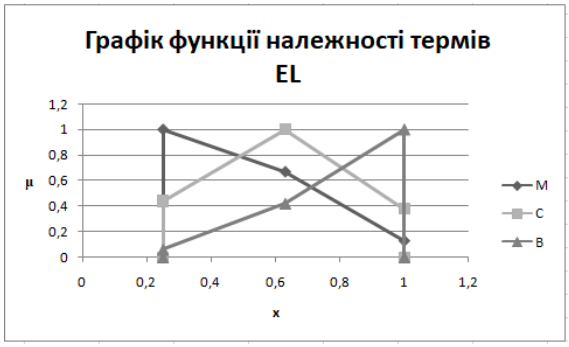

Fig. 3. Graph of terms affiliation «Economic losses level»

The parameter PP is characterized by the following linguistic assessment: {small (M), medium (C), high (B)}. Intervals for reference values determination = {[0-33], [34-66], [67-100]} percent. Creating assessments summary table and basic frequencies matrix that are presented in table 4.

TABLE 4

	0-33	34-66	67-100
M	20	14	6
C	7	13	1
B	2	7	15

Define ν= | 29; 32; 22 | i Max = 32

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 24,83;16;9,82 \\ 8,69;13;1,64 \\ 2,48;7;24,55 \end{vmatrix}$$

and maximums vector = ||24,83 16 24,55 ||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,92;0,4 \\ 0,4;1;0,07 \\ 0,1;0,54;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=33/100=0,33, T_{log12}=T_{log22}=T_{log32}=66/100=0,66$, $T_{log13}=T_{log23}=T_{log33}=100/100=1$. After making the transformation, obtain a set of parameter reference values $PP=T_{log}$ = {small (M), medium (C), high (B)} and the terms of the linguistic variables for this parameter:

M = {0/0,33; 1/0,33; 0,92/1; 0,4/1; 0/1},

C = {0/0,33; 0,4/0,33; 0,8/0,67; 0,07/1; 0/1},

B = {0/0,33; 0,1/0,33; 0,44/0,66; 1/1; 0/1}.

Graph of the membership function of the terms of the linguistic variable "Percentage of the population that watches foreign TV" shown in fig. 4:

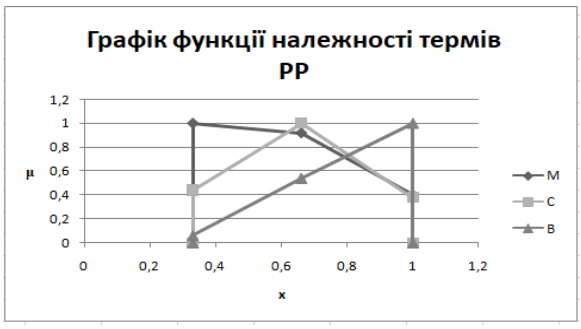

Fig. 4. Graph of terms affiliation «Percentage of the population that sees foreign TV»

The parameter PN is characterized by the following linguistic assessment: {small (M), medium (C), high (B)}. Intervals for reference values determination = {[0-33], [34-66], [67-100]} percent. Creating assessments summary table and basic frequencies matrix that are presented in table 5.

TABLE 5

	0-33	34-66	67-100
M	18	11	4
C	8	12	0
B	0	7	9

Define ν= | 26; 30; 13 | i Max = 30

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 22,85;14;10,15 \\ 10,15;12;0 \\ 0;7;22,85 \end{vmatrix}$$

and maximums vector = ||22,85 14 22,85 ||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,92;0,44 \\ 0,4;1;0 \\ 0;0,58;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=33/100=0,33$, $T_{log12}=T_{log22}=T_{log32}=66/100=0,66$, $T_{log13}=T_{log23}=T_{log33}=100/100=1$. After making the transformation, obtain a set of parameter reference values $PN=T_{log}$ = {small (M), medium (C), high (B)} and the terms of the linguistic variables for this parameter:

M = {0/0,33; 1/0,33; 0,92/0,66; 0,44/1; 0/1},

C = {0/0,33; 0,4/0,33; 1/0,67; 0/1},

B = {0/0,33; 0,58/0,67; 1/1; 0/1}.

Graph of the membership function of the terms of the linguistic variable "Percentage of the population that reads the foreign press" shown in fig. 5:

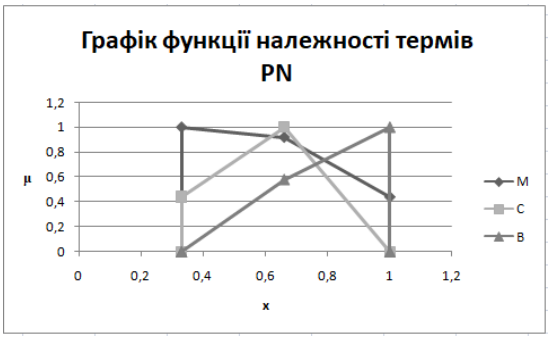

Fig. 5. Graph of terms affiliation «Percentage of the population that reads the foreign press»

The parameter CG characterized by the following linguistic assessment: {distrust (Н), partial trust (Ч), full confidence (П)}. Intervals for reference values determination = {[0-33], [34-66], [67-100]} percent. Creating assessments summary table and basic frequencies matrix that are presented in table 6.

TABLE 6

	0-33	34-66	67-100
Н	29	15	6
Ч	20	25	18
П	0	5	22

Define ν= | 49; 45; 46 | i Max = 49

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 29;16,33;6,39 \\ 20;27,22;19,17 \\ 0;9;5,44;23,43 \end{vmatrix}$$

and maximums vector = ||29 27,22 23,43 ||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,6;0,27 \\ 0,69;1;0,82 \\ 0;0,2;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=33/100=0,33$, $T_{log12}=T_{log22}=T_{log32}=66/100=0,66$, $T_{log13}=T_{log23}=T_{log33}=100/100=1$. After making the transformation, obtain a set of parameter reference values CG=T_{log} = { distrust (H), partial trust (Ч), full confidence (П)} and the terms of the linguistic variables for this parameter:

H = {0/0,33; 1/0,33; 0,6/0,66; 0,27/1; 0/1},
Ч = {0/0,33; 0,69/0,33; 1/0,66; 0,82/1; 0/1},
П = {0/0,33; 0,2/0,66; 1/1, 0/1}.

Graph of the membership function of the terms of the linguistic variable "The level of trust in government" shown in fig. 6:

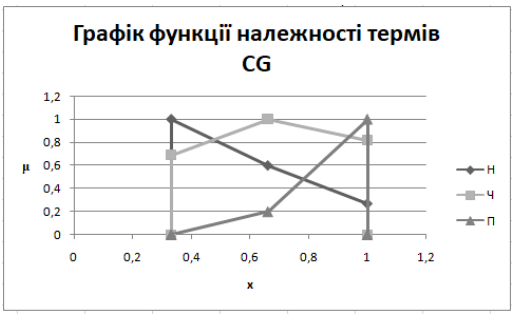

Fig. 6. Graph of terms affiliation «The level of trust in government shown»

The parameter PM characterized by the following linguistic assessment: {low (H), middle (C), high (B)}. Intervals for reference values determination = {[0-33], [34-66], [67-100]} percent. Creating assessments summary table and basic frequencies matrix that are presented in table 7.

TABLE 7

	0-33	34-66	67-100
Н	24	12	8
С	10	20	7
В	3	8	18

Define ν= | 37; 40; 33 | i Max = 40

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 25,95;12;9,7 \\ 10,81;20;8,5 \\ 3,24;8;21,82 \end{vmatrix}$$

and maximums vector = ||25,95 20 21,82 ||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,6;0,44 \\ 0,42;1;0,39 \\ 0,13;0,4;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=33/100=0,33$, $T_{log12}=T_{log22}=T_{log32}=66/100=0,66$, $T_{log13}=T_{log23}=T_{log33}=100/100=1$. After making the transformation, obtain a set of parameter reference values PM=T_{log} = {low (H), middle (C), high (B)} and the terms of the linguistic variables for this parameter:

H = {0/0,33; 1/0,33, 0,6/0,66; 0,44/1; 0/1},
C = {0/0,33; 0,42/0,33; 1/0,66; 0,39/1; 0/1},
B = {0/0,33; 0,13/0,33; 0,4/0,67; 1/1, 0/1}.

Graph of the membership function of the terms of the linguistic variable "The level of protest attitudes of the population" shown in fig. 7:

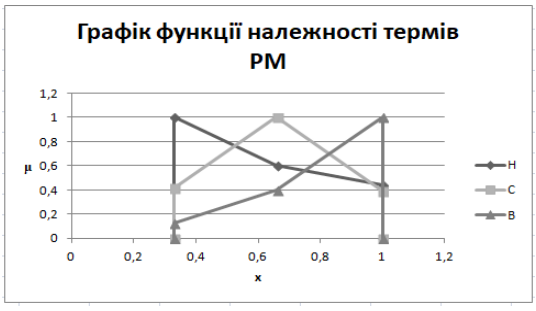

Fig. 7. Graph of terms affiliation «The level of protest attitudes of the population»

The parameter II characterized by the following linguistic assessment: {undeveloped (H), moderately developed (C), developed (P)}. Intervals for reference values determination = {[0-5], [6-10], [11-15]} score. Creating assessments summary table and basic frequencies matrix that are presented in table 8.

TABLE 8

	0-5	6-10	11-15
H	7	4	2
C	8	10	6
P	4	17	12

Define v= | 19; 31; 20 | i Max = 31

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 11,42;4;3,1 \\ 13,05;10;9,3 \\ 6,53;17;18,6 \end{vmatrix}$$

and maximums vector = ||13,05 17 18,6 ||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 0,88;0,24;0,17 \\ 1;0,59;0,5 \\ 0,5;1;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=5/15=0,33$, $T_{log12}=T_{log22}=T_{log32}=10/15=0,67$, $T_{log13}=T_{log23}=T_{log33}=15/15=1$. After making the transformation, obtain a set of parameter reference values $II=T_{log}$ = {undeveloped (H), moderately developed (C), developed (P)} and the terms of the linguistic variables for this parameter:

H = {0/0,33; 0,88/0,33, 0,24/0,67; 0,17/1; 0/1},
C = {0/0,33; 1/0,33; 0,59/0,67, 0,5/1; 0/1},
P = {0/0,33; 0,5/0,33; 1/0,67; 1/1; 0/1}.

Graph of the membership function of the terms of the linguistic variable "Information infrastructure development degree" shown in fig. 8:

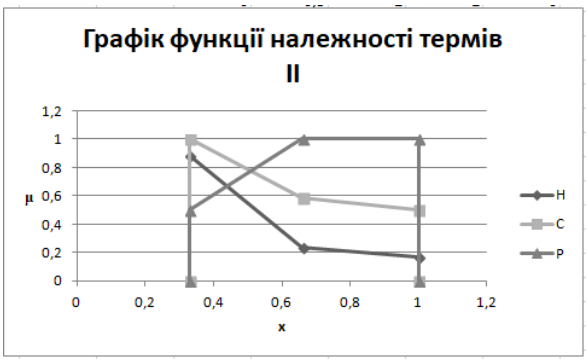

Fig. 8. Graph of terms affiliation «Information infrastructure development degree»

The parameter IF characterized by the following linguistic assessment: {low (H), middle (C), high (B)}. Intervals for reference values determination = {[0-33], [34-66], [67-100]} score. Creating assessments summary table and basic frequencies matrix that are presented in table 9.

TABLE 9

	0-33	34-66	67-100
H	28	15	10
C	19	32	12
B	9	12	20

Define v= | 56; 59; 42 | i Max = 59

Calculating the derivative frequency matrix:

$$\begin{vmatrix} 29,5;15;14,05 \\ 20,02;32;16,86 \\ 9,48;12;28,10 \end{vmatrix}$$

and maximums vector = ||29,5 32 28,10 ||

Calculating the matrix of supplies and reference guards for the parameter

$$\begin{vmatrix} 1;0,47;0,5 \\ 0,68;1;0,6 \\ 0,32;0,38;1 \end{vmatrix}$$

Supports: $T_{log11}=T_{log21}=T_{log31}=33/100=0,33$, $T_{log12}=T_{log22}=T_{log32}=66/100=0,66$, $T_{log13}=T_{log23}=T_{log33}=100/100=1$. After making the transformation, obtain a set of parameter reference values $IF=T_{log}$ = {low (H), middle (C), high (B)} and the terms of the linguistic variables for this parameter:

H = {0/0,33; 1/0,33, 0,47/0,66; 0,5/1; 0/1},
C = {0/0,33; 0,68/0,33; 1/0,66; 0,6/1; 0/1},
B = {0/0,33; 0,32/0,33; 0,38/0,66; 1/1, 0/1}.

Graph of the membership function of the terms of the linguistic variable "External factors influence degree" shown in fig. 9:

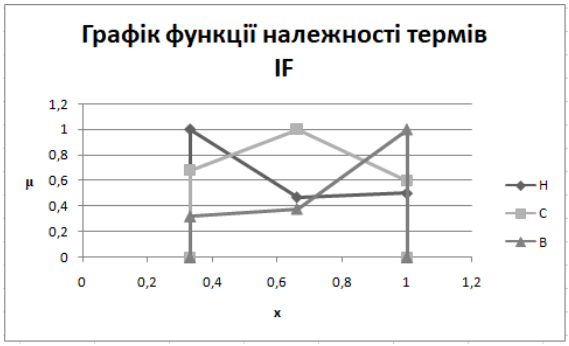

Fig. 9. Graph of terms affiliation «External factors influence degree»

Conclusions

Therefore, in order to predict the possibility of realizing information-psychological influence or to define and identify it is necessary to develop a system that will monitor the basic characteristics and, basing on heuristic rules, to reveal information and psychological influence, comparing the current values of the proposed parameters with the reference values given in this assemblage.

References

[1] Korchenko A.A. Metod formyrovanyya lynhvystycheskykh etalonov dlya system vyyavlenyya vtorzhenyy / A.A. Korchenko // Zakhyst informatsiyi. – T. 16, #1. – 2014. – S. 5-12.

[2] Hizun A.I. Formalizovana model' pobudovy evrystychnykh pravyl dlya vyyavlennya intsydentiv / A. I. Hizun, V. O. Hnatyuk, O. M. Suprun // Visnyk Inzhenernoyi akademiyi Ukrayiny. – 2015. – #1. – S. 110-115.