

A Methodological Approach to Computer Support of SWOT Analysis in Strategic Orientation

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Abstract: *This paper represents a cooperative presentation of strategic planning and program system, using a quantitative presentation of SWOT analysis in environmental strategic orientation. Identifies potential internal strengths and weaknesses and external opportunities and threats related to environmental protection. Methodologically, computer support for the calculation of SWOT analysis is presented, which can be applied in the general case of this analysis.*

Keywords: *SWOT matrix; environment; computer support*

1. INTRODUCTION

The strategic process consists of analyzing the environment, directing the organization, formulating the strategy, implementing the strategy, and strategically controlling. The first step of this process is the foundation of any strategy and involves assessing the current situation of the organization in relation to its mission, vision and goals [1], [2]. The analysis of the internal and external environment identifies relevant strategic factors that may influence the change or redefinition of the strategy according to the fluctuations and changes that are estimated to affect the organization. In addition to qualitative analysis, which is much more often used in the analysis of the company's environment, the quantitative approach gives an even more precise picture of the environment and its impact on the organization [3], [4]. If we complete the analysis of the environment of the business strategic system PSS, with software, we have facilitated and accelerated the process of analysis and implementation of the strategy [5], [6]. "The potential of advanced PSS can only be realized if system planners and developers begin to share knowledge and requirements and identify opportunities in the process of cooperative PSS development. Without such a process, the benefits and opportunities of PSS will remain untapped." [7] Albert Humphrey, is considered the forerunner of today's SWOT matrix. Namely, during his work at the Stanford Research Institute (1960-1970), Humphrey created a team planning method called

SOFT analysis. Later, this analysis developed into what we know today as a SWOT analysis [8], [9].

SWOT analysis helps us achieve a competitive advantage. According to Bradley, by collecting, selecting and analyzing the obtained information, it is possible to achieve a competitive advantage in the target market [10]. Of course, only with a good knowledge of the matrix and environment can we achieve an improvement in the performance of the organization. It is also a very complex approach, as Grant states: "Companies should use it as a guide, not necessarily as a recipe." [11]

2. SWOT ANALYSIS

SWOT analysis is very important both in the formation of the strategy, and during its implementation, in order to correct due to deviations caused by changes in the internal and external environment. Bearing in mind that the strategy is adopted for a longer period of time, such changes are very certain and frequent in practice. The problem of this analysis can be a subjective approach, so it is important that in its development for the needs of the analysis of the environment in environmental protection, more professional people are involved, in order to reduce any subjectivity to a minimum.

This analysis is suitable for decision making in a variety of situations and has its character in the mirror, with the emergence of TOWS analysis. Namely, SWOT analysis puts the internal environment in the first place (strengths and weaknesses), and then the external one, while TOWS analysis puts the external environment

(opportunities and dangers) in the first place, and then the internal environment.

Opting for the application of SWOT analysis in order to make decisions and create a clear picture of the impact and importance of certain (internal and external) environmental factors on environmental protection and its development in the local government unit, an example of qualitative SWOT analysis and its quantitative matrix. The data obtained from this analysis can be used for decisions that are strategically important, but also to determine priority actions in the future. The approach to the development of this matrix is mainly defined through the following steps: 1) defining internal strengths and weaknesses; 2) defining external possibilities and dangers; 3) defining general goals; 4) defining different strategic possibilities and 5) implementing strategies.

Table 1. Relationship between internal and external environment in SWOT analysis

	Opportunities	Threats
Strengths	Using the power of the organization to seize opportunities	Use the power of the organization to avoid threats
Weaknesses	Overcoming weaknesses to take advantage of opportunities	Minimize weaknesses to avoid threats

The strength of the local self-government unit is a strategically very important factor because it is based on and results in the abilities, resources, skills and knowledge of human resources, both employees in the field of environmental protection and human resources of the local community. The role of forces is crucial in seizing opportunities and avoiding the dangers that come from the environment.

Weaknesses of the local self-government unit are those areas in which and due to which, the work of this local community is not at the desired level of business. Constraints in the form of lack of resources, knowledge, finances, etc., can greatly affect productivity and business performance. Weaknesses are omissions and shortcomings that may arise from a possible poor organization that prevents the quality of management and requires

the elimination of these destructions and their consequences for the environment.

The possibilities of the local self-government unit represent potential opportunities that could contribute to the fulfillment of the strategic goals of environmental protection. Identifying opportunities involves observing changes that occur in the micro and macro environment.

Dangers per unit of local self-government can be current, but they can also be defined as dangers that may arise in the near or distant future for the environment. Anticipating future, dangerous conditions for the local self-government, can change the desired course of achieving the goal and establish control to a certain extent. The local self-government strategy is aimed at identifying hazards using SWOT analysis in order to take preventive actions in environmental protection.

Russian experts further developed the SWOT analysis, giving it a quantitative character. The first step of this process is the introduction of the interaction assessment of each pair of factors, in the direct dependence of the positive assessment (or the inverse dependence of the negative assessment), and the stronger the dependence, the higher the assessment [12].

3. METHODOLOGICAL APPROACH TO COMPUTER SUPPORT

This paper presents computer support for this methodology. Fig. 1 shows the initial data that represent an estimate of the interaction of each pair of sample factors.

STRENGTHS

1. Knowledge and experience of local human resources in environmental protection
2. Expertise for key areas of environmental protection
3. Creating an expert team for environmental protection
4. Created a closed loop model at the local government level

WEAKNESSES

1. Lack of professional human resources in the local government itself
2. Lack of a human resources management sector
3. Lack of environmental sector
4. Lack of professional training of employees in the field of environmental protection

OPPORTUNITIES

1. Additional education of employees in the field of environmental protection
2. Additional education of preschool and school age children
3. Strengthening the environmental awareness of the population of the local self-government unit
4. Creating a brand of an ecological unit of local self-government

	A	B	C	D	E	F	G	H	I	J	K
1	SWOT analysis		Opportunities				Threats				
2											
3											
4											
5			1	2	3	4	5	1	2	3	4
6	Strengths	1	1	0.6	0.7	0.6	0.8	0.2	0.4	0.2	0
7		2	0.8	0.2	0.7	0.6	0.6	0	0.4	0.4	0.4
8		3	0.8	0.4	1	1	0.8	0.2	0.8	0.4	0
9		4	0.8	0.6	0.8	0.8	1	0	0.9	0.4	0.4
10	Weaknesses	1	0.4	0.2	0.2	-0.7	-0.6	0	-0.4	-0.2	0
11		2	-0.2	0	-0.2	0	-0.2	-0.2	-0.2	-0.2	0
12		3	-0.4	-0.2	-0.8	-0.8	-0.8	0	-0.6	-0.4	-0.2
13		4	0.4	0	-0.4	-0.4	-0.6	-0.2	-0.6	-0.2	-0.4

Figure 1. Assessment of the interaction of each pair of factors

5. Support and financing of the created closed loop model by the EU DANGERS

1. Economic crisis at the global level
2. Constant increase of pollution and waste
3. Unpredictable future and great turbulence
4. Systemic gaps in environmental education at the state level

Fig. 2 shows the results of the SWOT assessment matrix. Some characteristic parts of the budget are shown in the following listing.

Strengths - Opportunities

$$D27=C27*D22*D24$$

$$D28=C28*D22*D24$$

$$D29=C29*D22*D24$$

$$D30=C30*D22*D24$$

$$E27=C27*E22*E24$$

$$E28=C28*E22*E24$$

$$E29=C29*E22*E24$$

$$E30=C30*E22*E24$$

...

Weaknesses - Opportunities

$$D31=C31*D22*D24$$

$$D32=C32*D22*D24$$

$$D33=C33*D22*D24$$

$$D34=C34*D22*D24$$

$$E31=C31*E22*E24$$

$$E32=C32*E22*E24$$

$$E33=C33*E22*E24$$

$$E34=C34*E22*E24$$

...

Forces - Dangers

$$I27=C27*I22*I24$$

$$I28=C28*I22*I24$$

$$I29=C29*I22*I24$$

$$I30=C30*I22*I24$$

$$J27=C27*J22*J24$$

$$J28=C28*J22*J24$$

$$J29=C29*J22*J24$$

$$J30=C30*J22*J24$$

...

Weaknesses - Dangers

$$I31=C31*I22*I24$$

$$I32=C32*I22*I24$$

$$I33=C33*I22*I24$$

$$I34=C34*I22*I24$$

$$J31=C31*J22*J24$$

$$J32=C32*J22*J24$$

$$J33=C33*J22*J24$$

$$J34=C34*J22*J24$$

...

Fig. 3 shows an impact coefficient matrix, probability of occurrence and estimation of the intensity of environmental factors. The characteristic parts of the budget are shown in the following listing.

Strengths - Opportunities

$$D48=C6*D27$$

$$D49=C7*D28$$

$$D50=C8*D29$$

$$D51=C9*D30$$

$$E48=D6*E27$$

$$E49=D7*E28$$

$$E50=D8*E29$$

$$E51=D9*E30$$

...

Sum of Strengths - Opportunities

$$I48=SUM(D48:H48)$$

$$I49=SUM(D49:H49)$$

$$I50=SUM(D50:H50)$$

$$I51=SUM(D51:H51)$$

	A	B	C	D	E	F	G	H	I	J	K	L
15	SWOT analysis			<i>Opportunities</i>					<i>Threats</i>			
16												
17												
18												
19												
20				1	2	3	4	5	1	2	3	4
21												
22	Coefficient of K_i			0.9	0.6	0.8	0.8	1.0	0.3	0.6	0.4	0.7
23												
24	Probability of P_i											
25			A_i	0.9	0.8	0.9	0.8	0.5	0.7	0.8	0.8	0.6
26												
27	<i>Strengths</i>	1	5.00	4.05	2.40	3.60	3.20	2.50	1.05	2.40	1.60	2.10
28		2	3.0	2.4	1.4	2.2	1.9	1.5	0.6	1.4	1.0	1.3
29		3	4.0	3.2	1.9	2.9	2.6	2.0	0.8	1.9	1.3	1.7
30		4	5.0	4.1	2.4	3.6	3.2	2.5	1.1	2.4	1.6	2.1
31	<i>Weaknesses</i>	1	4.0	3.2	1.9	2.9	2.6	2.0	0.8	1.9	1.3	1.7
32		2	4.0	3.2	1.9	2.9	2.6	2.0	0.8	1.9	1.3	1.7
33		3	4.0	3.2	1.9	2.9	2.6	2.0	0.8	1.9	1.3	1.7
34		4	3.0	2.4	1.4	2.2	1.9	1.5	0.6	1.4	1.0	1.3

Figure 2. Impact coefficient matrix , probability of occurrence and estimation of intensity of environmental factors

Sum of Opportunities - Strengths
 $D52 = \text{SUM}(D48:D51)$
 $E52 = \text{SUM}(E48:E51)$
 $F52 = \text{SUM}(F48:F51)$
 $G52 = \text{SUM}(G48:G51)$
 $H52 = \text{SUM}(H48:H51)$

Weaknesses - Opportunities
 $D54 = C10 * D31$
 $D55 = C11 * D32$
 $D56 = C12 * D33$
 $D57 = C13 * D34$
 ...

Sum of Weaknesses - Opportunities
 $I54 = \text{SUM}(D54:H54)$
 $I55 = \text{SUM}(D55:H55)$
 $I56 = \text{SUM}(D56:H56)$
 $I57 = \text{SUM}(D57:H57)$

Sum of Opportunities - Weaknesses
 $D58 = \text{SUM}(D54:D57)$
 $E58 = \text{SUM}(E54:E57)$
 $F58 = \text{SUM}(F54:F57)$
 $G58 = \text{SUM}(G54:G57)$
 $H58 = \text{SUM}(H54:H57)$

Strengths - Threats
 $J48 = H6 * I27$
 $J49 = H7 * I28$
 $J50 = H8 * I29$
 $J51 = H9 * I30$
 $K48 = I6 * J27$
 $K49 = I7 * J28$

Sum of Strengths - Threats
 $N48 = \text{SUM}(J48:M48)$
 $N49 = \text{SUM}(J49:M49)$
 $N50 = \text{SUM}(J50:M50)$
 $N51 = \text{SUM}(D51:H51)$

Sum of Threats - Strengths
 $J52 = \text{SUM}(J48:J51)$
 $K52 = \text{SUM}(K48:K51)$
 $L52 = \text{SUM}(L48:L51)$
 $M52 = \text{SUM}(M48:M51)$

Weaknesses - Threats
 $J54 = H10 * I31$
 $J55 = H11 * I32$
 $J56 = H12 * I33$
 $J57 = H13 * I34$
 $K54 = I10 * J31$
 $K55 = I11 * J32$
 $K56 = I12 * J33$
 $K57 = I13 * J34$
 ...

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
36	SWOT analysis			Opportunities					Threats					
37														
38														
39														
40														
41				1	2	3	4	5	Σ	1	2	3	4	Σ
42	Coefficient of													
43	K _i													
44				0.9	0.6	0.8	0.8	1.0		0.3	0.6	0.4	0.7	
45	Probability of													
46	P _i													
47				A _i										
48	Strengths	1	5	4.1	1.4	2.5	1.9	2.0	11.9	0.2	1.0	0.3	0.0	1.5
49		2	3	1.9	0.3	1.5	1.2	0.9	5.8	0.0	0.6	0.4	0.5	1.5
50		3	4	2.6	0.8	2.9	2.6	1.6	10.4	0.2	1.5	0.5	0.0	2.2
51		4	5	3.2	1.4	2.9	2.6	2.5	12.6	0.0	2.2	0.6	0.8	3.6
52														
53				11.8	3.9	9.8	8.2	7.0		0.4	5.2	1.9	1.3	
54	Weaknesses	1	4	1.3	0.4	0.6	-1.8	-1.2	-0.7	0.0	-0.8	-0.3	0.0	-1.0
55		2	4	-0.6	0.0	-0.6	0.0	-0.4	-1.6	-0.2	-0.4	-0.3	0.0	-0.8
56		3	4	-1.3	-0.4	-2.3	-2.0	-1.6	-7.6	0.0	-1.2	-0.5	-0.3	-2.0
57		4	3	1.0	0.0	-0.9	-0.8	-0.9	-1.6	-0.1	-0.9	-0.2	-0.5	-1.7
58				0.3	0.0	-3.2	-4.6	-4.1		-0.3	-3.2	-1.2	-0.8	

Figure 3. Results of the SWOT assessment matrix

Sum of Weaknesses - Threats

$$N54 = \text{SUM}(J54:M54)$$

$$N55 = \text{SUM}(J55:M55)$$

$$N56 = \text{SUM}(J56:M56)$$

$$N57 = \text{SUM}(J57:M57)$$

Sum of Threats - Weaknesses

$$J58 = \text{SUM}(J54:J57)$$

$$K58 = \text{SUM}(K54:K57)$$

$$L58 = \text{SUM}(L54:L57)$$

$$M58 = \text{SUM}(M54:M57)$$

4. CONCLUSION

Opting for the application of SWOT analysis for decision making and creating a clear picture of the impact and importance of certain (internal and external) environmental factors on environmental protection and its development in the local government, a sample example of qualitative SWOT analysis and its quantitative matrix. The data obtained from this analysis can be used for decisions that are strategically important, but also for determining priority actions in the future.

If we complete the analysis of the environment of the business strategic system PSS with software, we have facilitated and accelerated the process of analysis and implementation of the strategy. The paper methodologically presents computer support for the calculation of SWOT analysis that can be applied in the general case of this analysis.

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