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STRATEGIC ANALYSIS THROUGH THE COMBINATION OF SWOT, AHP AND TOWS (A CASE STUDY ON THE NEUROLOGICAL WARD IN THE MHAT "SAINT PANTELEYMON" – PLOVDIV)

This study is an attempt to apply a hybrid model for a SWOT-AHP-TOWS strategic analysis. The methodology and results of a survey are presented, it was conducted with the subject – the Neurological Ward (NW) of the Multi-profile Hospital for Active Treatment "Saint Panteleymon" – Plovdiv. The combination of the methods SWOT (Strengths, Weaknesses, Opportunities, Threats) and AHP (Analytic Hierarchy Process) is infamous in the academic field, however it is weakly represented in the practice of health care management. The purpose of integrating AHP with SWOT is to reach an expert proportionality of every individual factor and the assessment of their significance. As a logical final phase of applying the SWOT-AHP, a TWOS analysis is carried out to determine the strengths, weaknesses, opportunities and threats. The strategic alternatives that were identified for the NW through the drawn up TOWS matrix may be used by the Senior Management of the Multi-profile Hospital for Active Treatment "Saint Panteleymon" – Plovdiv in the process of generating development ideas and to facilitate future decision-making.
JEL: M31; L22

1. Introduction

The health care reform that was initiated in 1999 implemented the public-private model, described as a "Public-private mix". Through it the state, insurance (public and corporate) and private sectors were integrated into the Bulgarian health care system (with different rights and responsibilities). The initiation of the reform was made by the National Assembly's acceptance of five laws on the Health Care system by the year 2000 – for healthy and safe working conditions; for health care insurance; for professional organizations of physicians and dentists; for medical institutions (MI); for medication and pharmacies in human medicine and one more regarding public health care in 2004 – the Health Act.

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Part of the change was the transition to a mixed system of financing (health insurances, private insurance, direct payment by patients and budget financing), aimed at a gradual linking of financing with actual results, achieving freedom in the offered health care services and accumulation of experience in the economic activities that accompany the process. The focus was on the **contractual beginning in the relationship between the medical institutions and the financing authorities** in the form of the National Health Insurance Fund (NHIF) for the volume of activities and the quality of services. Another important feature of the reform was providing a **freedom of choice to the patient –** since 2000, of a physician or a dentist for initial medical help and a medical institution for specialized outpatient care, since 2004 **–** for hospital care. It is precisely these two changes that proved to be key in achieving a market pressure and a exacerbated the competitive relations in the field of hospital care. In practice, the removal of administrative obstacles before a patient's choice and financing based on clinical pathways (where the resource used to fund a patient's treatment follows the patient's choice) turned patients into clients. This extremely significant transformation imposed a generally different management philosophy with the respective new requirements for the competences of hospital management. A part of this new knowledge and these new skills relate to the forming of ambitious and realistic strategies. However, before transitioning to a specific strategic choice, the health care manager should focus his attention to important questions such as:

- What are the strengths and weaknesses of the MI?
- What are the possibilities and threats in the environment?
- Are there any expected future changes in the market situation?
- Do enough resources exist to implement the decisions that have been made?
- Does the adopted competitive position correspond to the desired position?
- Which advantage(s) will the positioning be based on...

Guidance in finding the right answers to such questions can be provided by one of the most popular analytical instruments **–** the SWOT analysis. However, for it to be effective, it's components must undergo not only a qualitative, but also a quantitative assessment. In this sense the ***aim*** of the study is to present the application of a SWOT-AHP-TOWS analysis.

2. Theoretical Background

2.1. SWOT analysis

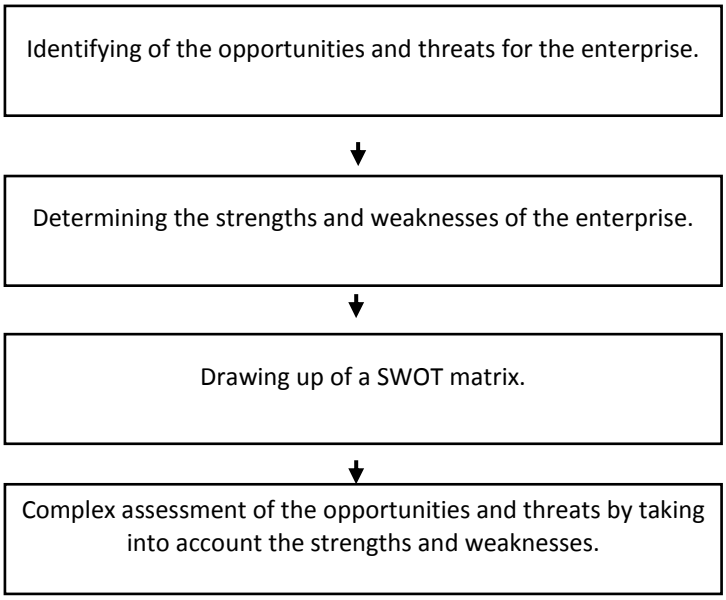
The SWOT analysis is one of the most popular instruments in the strategic planning for the activities of an organization and has been a long-standing staple in disciplines such as: Marketing (Faarup, 2010; Ferrell and Hartline, 2014; Lee and Kotler, 2016), Management (Koontz and Weihrich, 2008; Hill and Jones, 2010; Griffin, 2012) and business analysis (Carkenord, 2009; Cadle, Paul and Turner, 2010). Its essence lies in the identifying and

ranking (depending to their relative weight) of opportunities (O) and threats (T) from the external environment, as well as the strengths (S) and weaknesses (W) of the organization.

Four basic steps can be included while carrying out the modern SWOT analysis (Figure 1).

Figure 1

Stages of carrying out a SWOT analysis



Initially the SWOT analysis is used solely for the purpose of strategic management of the organization. Gradually it established itself as a popular practice of marketing planning. Finally, its subject was expanded out of the context of business practice and it began to include various socially-economic phenomena:

- countries (United Nations Development Program Cambodia, 2006; Jiang, 2013);
- cities (United Nations Human Settlements Programme, 2007; Bontje, Musterd and Pelzer, 2016);
- political parties (Lees-Marshment, 2001; Khawaja, 2013);
- public and non-profit organizations (Schulz and Johnson, 2003; Steiss, 2003);
- individual specialists, personnel, persons (Thomas, 2007; Kapoor and Kulshrestha, 2012).

The model of the SWOT analysis is universally applicable, because its methodology does not require the presence of a strict specific set of indicators in regards to the subject of the study. In addition, the SWOT factors are formulated in a conversational style, based on an expert assessment (for example: “Qualified medical specialists”; “Established very good

relationships with medical institutions from remote neighboring regions and business contacts with legal entities and institutional clients"; "Good material facilities ensuring the treatment process with a general and narrowly profiled medical equipment and furnishings, received as a result of systemically implemented investment policy for technical renovation and repair"). On the one hand, this is an advantage of the approach, because this allows for the analysis of factors, that have no formal expression and unequivocal assessment (as opposed to strictly objective indicators – net income from sales, profit, profitability, liquidity, etc.). On the other hand, such universality may also be seen as a flaw – a complication of the process of strategic analysis without any guarantee that all significant factors will actually be taken into account. Another important thing is – the SWOT analysis often ends with only a descriptive presentation of opportunities and threats from the external environment and strengths and weaknesses of an organization without a precise (or any whatsoever) quantitative assessment.

2.2. Analytical hierarchical process (AHP)

AHP is a Multi Criteria Decision Making (MCDM) method. It is one of the most reliable methods used to establish the degree of significance when assessing chosen factors. It was developed by Thomas L. Saaty in the 70s of the 20th century and is applied in various fields, including medicine, economics, environment, industry, etc. (Thungngern, Wijitkosum, Sriburi and Sukhsri, 2015). AHP is considered to be one of the most significant and widely used instruments that assist decision-making (Vachanadze, 2016) and has been established as a highly effective instrument for quantitative assessment and ranking of alternatives. Application of AHP consists of a subjective assessment of the weight of different criteria and subsequent use of mathematical tools. When it is applied a hierarchical structure is constructed, on top of which is the main objective, the criteria and sub-criteria are placed on the lower levels. The primary problem that it solves is the receipt of a quantitative assessment of alternatives that contain quantitative and/or qualitative features, which are measured in incomparable scales.

Some of the biggest advantages of AHP are:

- Presence of automatic software applications that assist its use process;
- Possibility to combine with other instruments, models and methodologies such as Fuzzy logic – FAHP (Radionovs and Užga-Rebrovs, 2016), Technique for Order of Preference by Similarity to Ideal Solution – TOPSIS (Berdie, Osaci, Muscalagiu and Barz, 2017), SWOT analysis (Kurttila Pesonen Kangas Kajanus, 2000);
- Allows the assessment of alternatives according to criteria that are mutually incomparable.

2.3. TOWS analysis

For decades the SWOT analysis was the most widely used method of identifying the strengths and weaknesses, the opportunities and threats of an organization. However, this

type of analysis characterizes the examined variables at a given time, i.e. It is static and seldom leads to the development of clear strategic alternatives, derived as future actions. Thus, in 1982 professor Heinz Weihrich offers a new instrument for situational analysis – the TOWS Matrix for analyzing the competitive situation. The TOWS model includes the familiar SWOT components, but places **T**hreats (**T** stands for threats, **O** for opportunities, **W** for weaknesses, and **S** for strengths) because in many situations a company undertakes strategic planning as a result of a perceived crisis, problem, or threat (Koontz and Weihrich, 2008). Apart from that he further develops the SWOT model by combining the company's weaknesses and especially its strengths – a similar combination is often neglected, while in most cases it requires distinct strategic choices.

The TOWS analysis makes an attempt to reorganize and integrate threats, opportunities, weaknesses and strengths more fully into the strategic planning process than another useful matrix for developing a firm's strategy (See Figure 2).

Weihrich proposes seven steps (which may vary) in the process of performing a TOWS analysis (Weihrich, 1982). Step 1, preparation of the enterprise profile, deals with some basic questions pertaining to the internal and external environments. This is about the description of the type of business, which the organization realizes; the geographic range of the offered production; the competitive situation, in which the organization is relative to its key competitors in the sector; what is management's vision for future development. Step 2 is related to the analysis and the assessment of the external environment. For the purpose it is necessary to identify the following factors – economic, social, political, demographic, production and technological, market and competition. It is important to note that the analysis is performed for a past and present period. This analysis ends with the Step 3 – drafting of a prognosis of the change in the factor in the future. The purpose is to determine future opportunities and threats from the external environment, which will influence the development of the organization. Step 4, the audit of strengths and weaknesses, focuses on the internal resources of the enterprise. It relates to the assessment of: management and the organization; production (operational management and technologies); finance; marketing and others (i.e. material resources, human resources, information systems, know-how, organizational culture, etc.). The purpose is to determine the strengths and weaknesses of the organization, as well as to foresee their development in the future. Strategic alternatives on the basis of the results of the analysis of the internal and external environment are developed in Step 5. The purpose is for the weaknesses and the threats to be minimized, while the strengths and opportunities are maximized. Step 6 is the strategic choice. This is a process, in which the manager has to make such an optimal decision that in the best possible way combines the internal opportunities of the organization with the external reality. During this process attention must be given to consistency of these decisions with the other steps in the strategy formulation process. Finally, since an organization operates in a dynamic environment, contingency plans must be prepared (Step 7).

Figure 2

Process of corporate strategy and the TOWS analysis

<table>
<tr><td colspan="4">Step 1: Prepare an Enterprise profile: (a) the Type of Business; (b) Geographic Domain; (c) Competitive Situation; (d) Top Management Orientation.</td></tr>
<tr><td></td><td colspan="3">Step 4: Prepare a Strengths and Weaknesses Audit of (a) the Management and Organization; (b) Operations; (c) Finance; (d) Marketing; and (e) the Other Parts of the Organization.</td></tr>
<tr><td>Internal Factors

External Factors</td><td>Step 5: Identify the Strategic Choices
Facing the Organization.

Step 6: Make the Strategic Choices.

Steps 1 to 6. Test for Consistency. Also Prepare the Contingency Plans (Step 7).</td><td>List Internal Strengths (S):
(1)</td><td>List Internal Weaknesses (W):
(1)</td></tr>
<tr><td rowspan="2">Step 2: Identify and Evaluate the Following Factors:
(a) Economic
(b) Social
(c) Political
(d) Demographic
(e) Products and Technology
(f) Market and Competition.

Step 3: Prepare a Forecast, Make Predictions and Assess of the Future.</td><td>List External Opportunities (O):
(1)</td><td>SO:
Maxi-Maxi</td><td>WO:
Mini-Maxi</td></tr>
<tr><td>List External Threats (T):
(1)</td><td>ST:
Maxi-Mini</td><td>WT:
Mini-Mini</td></tr>
</table>

Source: Adapted of Weihrich, 1982.

In practice, for the building of this TOWS Matrix the knowledge, received from the SWOT analysis to identify the strengths and weaknesses, threats or opportunities is employed. The SWOT components are cross-combined, to receive the four quadrants, containing the different strategic alternatives: **W-T quadrant** (from **W**eaknesses with **T**hreats), **W-O quadrant** (from **W**eaknesses with **O**pportunities), **S-T quadrant** (from **S**trengths with **T**hreats), **S-O quadrant** (from **S**trengths with **O**pportunities). Through this visual representation managers can trace idea generation process for the purposes of business development and be facilitated in making adequate management decisions, regarding the future of the organizations. Figure 3 represents the four strategic alternatives of the TOWS Matrix.

The strategies are based on the analysis of the external environment (threats and opportunities) and the internal environment (weaknesses and strengths) (Koontz and Weihrich, 2015):

1) **The W-T Strategy** (or Mini – Mini) aims to minimize both weaknesses and threats.

2) **The W-O Strategy** (or Mini – Maxi) attempts to minimize the weaknesses and maximize the opportunities. This strategy that constitutes a development plan with the intention of converting weaknesses into strengths, given the present opportunities in the external environment. Thus, an enterprise with weaknesses in some areas may either develop those areas within the enterprise or acquire the needed competencies (such as technology or human resources) from outside in order to enable it to take advantages of present opportunities in the external environment.

Figure 3

TOWS Matrix for Strategy Formulation

	Strengths (S) Strengths in the areas of Administration, Production, Finances, Marketing, R&D, Innovation and Engineering.	**Weaknesses (W)** Weaknesses in the areas shown in the quadrant corresponding to the Strengths.
Opportunities (O) **(Consider risks also)** The present and future economic conditions, political and social changes, new products, services, and technological changes.	**SO:** **Maxi-Maxi** Potentially the most successful strategy, utilizing the organization's Strengths to take advantages of the Opportunities.	**WO:** **Mini-Maxi** Strategy of development to overcome the Weaknesses in order to take advantages of Opportunities.
Threats (T) Competition, shortage of energy sources, and areas similar to those shown in the quadrant corresponding to the Opportunities.	**ST:** **Maxi-Mini** Strategy that concerns the use of Strengths to cope with Threats or to avoid Threats.	**WT:** **Mini-Mini** Strategy that contemplates a retrenchment, liquidation, or joint venture to minimize both Weaknesses and Threats.

Source: Adapted of Weihrich, 1982; Koontz and Weihrich, 2015.

3) **The S-T Strategy** (or Maxi – Mini) is based on using the organization's strengths to deal with threats in the environment. The aim is to maximize the former while minimizing the latter. Thus, an enterprise may use its technological, financial,

managerial, or marketing strengths to cope with the threats of a new product introduced by its competitor.

4) **The S-O Strategy** (or Maxi – Maxi), which represents the most desirable situation because it is one in which an enterprise can use its strengths to take advantage of opportunities presented by the external environment. Indeed, it is the aim of companies to move from other positions in the matrix to this one. If they have weaknesses, they will strive to overcome them, turning them into strengths. If they face threats, they will cope with them so that they can focus on opportunities.

The TOWS Matrix was originally introduced to assist in the formulation of enterprise strategies. Later, it was used as a conceptual framework for the development of career strategies for individuals, analyzing industries and identifying the competitive advantage of a region or nation (Weihrich, 1999; Ferreira, Leitão and Raposo, 2005; Bhattacharjee, 2012; Lin, 2016).

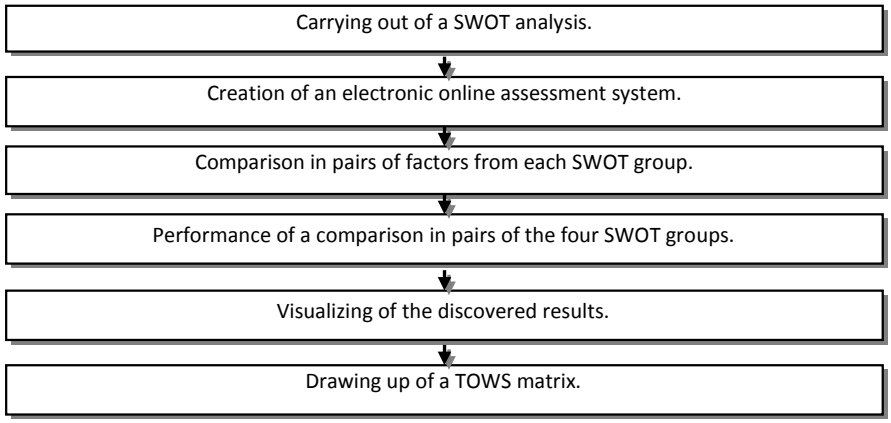
3. Methodology and Application

This study presents a hybrid model for strategic analysis that combines the methods SWOT, AHP and TOWS. This kind of integration is not a novelty in academic literature, which offers a series of examples of the joint application of AHP with other models such as **BSC** (Lee, Chen and Chang, 2008), **Gray-TOPSIS** (Oztaysi, 2014), **RealOptions** (Angelou and Economides, 2009), **SWOT** (Kurttila, Kangas and Kajunas, 2000), etc. The advantage of AHP lies in extracting quantitative features for the studied factors on the basis of expert assessments. Software applications were used for the purposes of this study, they are based on MS Excel, as well as the following languages and technologies: PHP, HTML, MySQL.

The sequence of the steps in the SWOT-AHP-TOWS model is presented in Figure 4.

Figure 4

SWOT-AHP-TOWS analysis model



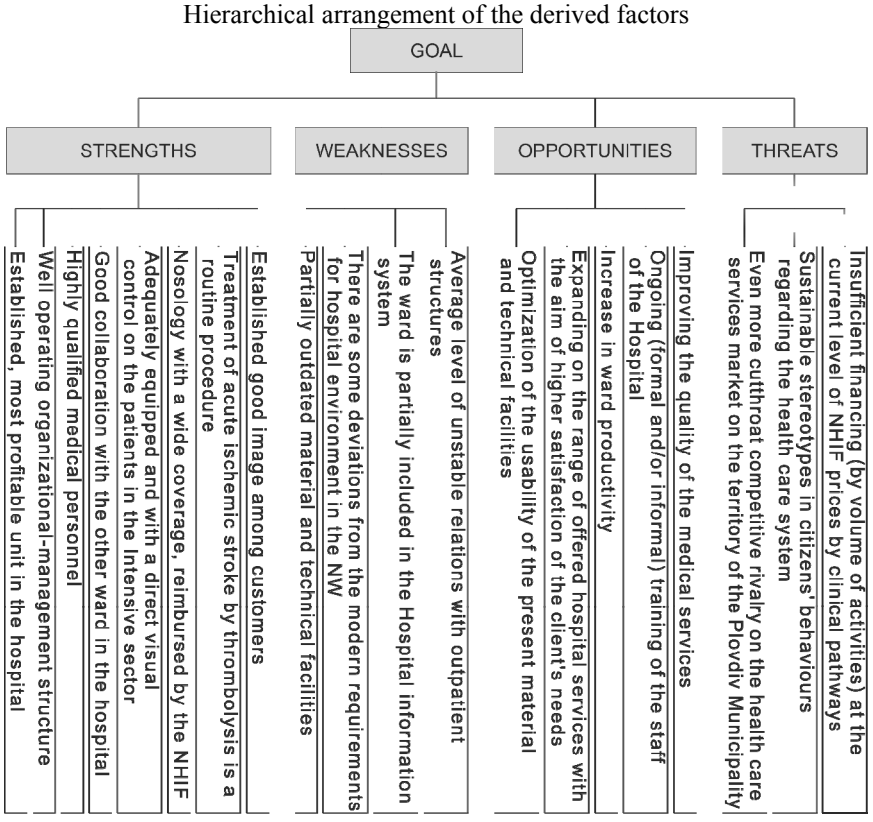
Stage 1. Carrying out of a SWOT analysis

The subject of the following survey study is the Neurological ward (NW) in the MHAT "Saint Panteleymon" – Plovdiv. The ward has existed since the founding of the hospital in 1960. At the moment, NW has 62 beds (including 12 beds in an Intensive Ward). Over the years, it has been repeatedly renewed both in terms of medical equipment, as well as living environment for the patients. In 2016, NW was accredited with an excellent grading of five stars for a term of five years. For more than fifteen years the ward has been the most profitable for the hospital and provides inpatient care to patients from the entire Plovdiv district. Precisely for that reason, treatment for ischemic stroke (IS) by thrombolysis was performed in this ward for the first time ever in Bulgaria.

With assistance from experts in the field – *the head of the ward*, *the senior physician* and one of the *interns* from the NW of Multi-profile Hospital for Active Treatment (MHAT) "Saint Panteleymon" – Plovdiv, an analysis was performed, from it 20 factors were derived that fall into one of the four groups, name Strengths, Weaknesses, Opportunities and Threats. The results from analysis are presented in Figure 5, whereas the elements are arranged hierarchically, reflecting the different stages on which the subsequent AHP method was carried out.

Figure 5

Hierarchical arrangement of the derived factors



Stage 2. Creation of an electronic online assessment system

At this stage a system to gather and store expert assessment was developed (it is active at this address: http://uni-research.eu/ahp/). The assessment in pairs of the factors was assisted by it. The following technologies and programming languages were used for its creation: PHP, MySQL and HTML. In the process of receiving the answers it was considered appropriate to perform additional personal interviews. That is how some of the specifics on the application of the AHP method were clarified and the questions raised regarding the factors being compared were answered. The assessments were received in written form, which is a printed copy of the developed interface from the information system.

Stage 3. Comparing factors from each SWOT group in pairs

The data received from the factor assessment allowed for the drawing up of assessment matrices, which represent:

$$A = \begin{bmatrix} 1 & a_{12} & a_{13} & \dots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & \cdots & a_{2n} \\ 1/a_{13} & 1/a_{23} & 1 & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & 1/a_{3n} & \cdots & 1 \end{bmatrix}$$

Where a_{ij} characterizes the given assessment from the comparison between the *i* and *j* factors, or the $a_{ij} = w_i / w_j$ assessment was performed on a nine-step scale from 1 to 9, where 1 stands for equal significance of the two factors, while 9 shows that the one factor w_i is of much more significance than the other factor w_j .

The resulting matrices from the comparison of the three experts are presented in tables 1, 2, 3, 6, 7, 8, 11, 12, 13, 16, 17, 18, 21, 22 and 23. They cover the assessment of the factors from the four groups, as well as the assessment of the significance between the groups themselves. The matrices are with *n*x*n* dimensions, where *n* is the number of factors, while each element a_{ij} represents an assessment of the weight of the *i* factor relative to the *j* factor.

Table 1

Assessment matrix S1

	S1	S2	S3	S4	S5	S6	S7	S8
S1	1	1/2	1/2	3	1/4	1/4	1/9	4
S2	2	1	6	4	3	2	1/8	1/4
S3	2	1/6	1	9	4	6	1	1
S4	1/3	1/4	1/9	1	1/4	1/4	1/5	1/6
S5	4	1/3	1/4	4	1	1	1/6	1/6
S6	4	1/2	1/6	4	1	1	1/7	1/5
S7	9	8	1	5	6	7	1	9
S8	1/4	4	1	6	6	5	1/9	1

Table 2

Assessment matrix S2

	S1	S2	S3	S4	S5	S6	S7	S8
S1	1	1/7	1/6	1/5	1/7	1	1/8	1/8
S2	7	1	1	6	1	6	1	1/3
S3	6	1	1	5	4	5	4	1
S4	5	1/6	1/5	1	1/7	1/6	1/7	1/8
S5	7	1	1/4	7	1	4	1	1/3
S6	1	1/6	1/5	6	1/4	1	1/6	1/8
S7	8	1	1/4	7	1	6	1	1/4
S8	8	3	1	8	3	8	4	1

Table 3

Assessment matrix S3

	S1	S2	S3	S4	S5	S6	S7	S8
S1	1	1	1	1	2	1	1	1
S2	1	1	1	1	1	1	1/2	3
S3	1	1	1	2	1	1	1	2
S4	1	1	1/2	1	1/2	1	1/5	2
S5	1/2	1	1	2	1	1	1/3	3
S6	1	1	1	1	1	1	1/5	1
S7	1	2	1	5	3	5	1	1
S8	1	1/3	1/2	1/2	1/3	1	1	1

Table 4

Consolidated matrix S

	S1	S2	S3	S4	S5	S6	S7	S8
S1		0.41	0.44	0.84	0.41	0.63	0.24	0.79
S2	2.41		1.82	2.88	1.44	2.29	0.4	0.63
S3	2.29	0.55		4.48	2.52	3.11	1.59	1.26
S4	1.19	0.35	0.22		0.26	0.35	0.18	0.35
S5	2.41	0.69	0.4	3.83		1.59	0.38	0.55
S6	1.59	0.44	0.32	2.88	0.63		0.17	0.29
S7	4.16	2.52	0.63	5.59	2.62	5.94		1.31
S8	1.26	1.59	0.79	2.88	1.82	3.42	0.76	

Table 5

Significance of the factors – strengths

STRENGTHS	Significance
(S1) Established, most profitable unit in the hospital	0,059
(S2) Well operating organizational-management structure	0,146
(S3) Highly qualified medical personnel	0,191
(S4) Good collaboration with the other ward in the hospital	0,041
(S5) Adequately equipped and with a direct visual control on the patients in the Intensive sector	0,101
(S6) Nosology with a wide coverage, reimbursed by the NHIF	0,065
(S7) Treatment of acute ischemic stroke by thrombolysis is a routine procedure	0,242
(S8) Established good image among customers	0,155
Eigenvalue : Lambda = 8.510; CR = 5.2%	

Table 6

Assessment matrix W1

	W1	W2	W3	W4
W1	1	1/9	1/4	1/3
W2	9	1	8	8
W3	4	1/8	1	3
W4	3	1/8	1/3	1

Table 7

Assessment matrix W2

	W1	W2	W3	W4
W1	1	1/3	1	1/3
W2	3	1	5	6
W3	1	1/5	1	1/3
W4	3	1/6	3	1

Table 8

Assessment matrix W3

	W1	W2	W3	W4
W1	1	1/4	3	1
W2	4	1	1	1
W3	1/3	1	1	1/4
W4	1	1	4	1

Table 9

Consolidated matrix W

	W1	W2	W3	W4
W1		0.21	0.909	1
W2	4.762		3.42	1
W3	1.101	0.292		1
W4	2.08	0.275	1.587	

Table 10

Significance of the factors – weaknesses

WEAKNESSES	Significance
(W1) Partially outdated material and technical facilities	0,007
(W2) There are some deviations from the modern requirements for hospital environment in the	0,035
(W3) The ward is partially included in the Hospital information system	0,009
(W4) Average level of unstable relations with outpatient structures	0,012
Eigenvalue : Lambda = 4.036; CR = 1.3%	

Table 11

Assessment matrix O1

	O1	O2	O3	O4	O5
O1	1	1/6	4	2	1/5
O2	6	1	4	2	1/4
O3	1/4	1/4	1	1/4	1/5
O4	1/2	1/2	4	1	1/2
O5	5	4	5	2	1

Table 12

Assessment matrix O2

	O1	O2	O3	O4	O5
O1	1	3	4	1/9	1/7
O2	1/3	1	1/3	1/9	1/8
O3	1/4	3	1	1/9	1/8
O4	9	9	9	1	3
O5	7	8	8	1/3	1

Table 13

Assessment matrix O3

	O1	O2	O3	O4	O5
O1	1	1/5	1	1	1
O2	5	1	½	1	1
O3	1	2	1	1/5	1/5
O4	1	1	5	1	1
O5	1	1	5	1	1

Table 14

Consolidated matrix O

	O1	O2	O3	O4	O5
O1		0.464	2.52	0.606	0.306
O2	2.154		0.874	0.606	0.315
O3	0.397	1.145		0.177	0.171
O4	1.651	1.651	5.646		1.145
O5	3.271	3.175	5.848	0.874	

Table 15

Significance of the factors – opportunities

OPPORTUNITIES	Significance
(O1) Optimization of the usability of the present material and technical facilities	0,125
(O2) Expanding on the range of offered hospital services with the aim of higher satisfaction of the client's needs	0,144
(O3) Increase in ward productivity	0,075
(O4) Ongoing (formal and/or informal) training of the staff	0,295
(O5) Improving the quality of the medical services	0,36
Eigenvalue : Lambda = 5.533; CR = 7.9%	

Table 16
Assessment matrix T1

	T1	T2	T3
T1	1	4	1/5
T2	1/4	1	1/5
T3	5	5	1

Table 17
Assessment matrix T2

	T1	T2	T3
T1	1	4	3
T2	1/4	1	4
T3	1/3	1/4	1

Table 18
Assessment matrix T3

	T1	T2	T3
T1	1	1/5	1/9
T2	5	1	1
T3	9	1	1

Table 19
Consolidated matrix T

	T1	T2	T3
T1		1.47	0.41
T2	0.68		0.93
T3	2.47	1.08	

Table 20

Significance of the factors – threats

THREATS	Significance
(T1) Even more cutthroat competitive rivalry on the health care services market on the territory of the Plovdiv Municipality	0,273
(T2) Sustainable stereotypes in citizens' behaviours regarding the health care system	0,278
(T3) Insufficient financing (by volume of activities) at the current level of NHIF prices by clinical pathways	0,449
Eigenvalue : Lambda = 3.167; CR = 17.4%	

Stage 4. Performing a comparison of the four SWOT groups in pairs

Table 21
Assessment matrix SWOT1

	S	W	O	T
S	1	9	1	6
W	1/9	1	1/5	1/3
O	1	5	1	9
T	1/6	3	1/9	1

Table 22
Assessment matrix SWOT2

	S	W	O	T
S	1	6	4	6
W	1/6	1	1/5	4
O	1/4	5	1	5
T	1/6	1/4	1/5	1

Table 23
Assessment matrix SWOT3

	S	W	O	T
S	1	9	1	9
W	1/9	1	1/9	1
O	1	9	1	9
T	1/9	1	1/9	1

Table 24
Consolidated matrix SWOT

	S	W	O	T
S		7.862	1.587	6.868
W	0.127		0.164	1.101
O	0.63	6.082		7.399
T	0.146	0.909	0.135	

Table 25

Significance of the factors – SWOT

SWOT	(S)	(W)	(O)	(T)	Significance
(S) Strengths	-	7.86	1.59	6.87	0.499
(W) Weaknesses	0.13	-	0.16	1.1	0.063
(O) Opportunities	0.63	6.08	-	7.4	0.378
(T) Threats	0.15	0.91	0.14	-	0.06
Eigenvalue : Lambda = 4.025; CR = 0.9%					

Tables 4, 9, 14, 19 and 24 represent consolidated matrices in which the elements of the matrix are the geometrical average of the elements of the assessment matrices of the three experts. The elements were calculated with the formula:

$$A = \begin{bmatrix} & x_{12} & \cdots & x_{1n} \\ 1/x_{12} & & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/x_{1n} & 1/x_{2n} & \cdots & \end{bmatrix},$$

where

$$x_{ij} = \left(\prod_{k=1}^{3} a_{ij\,k} \right)^{\frac{1}{3}}$$

Using the consolidated matrices, the vectors of significance of the factors were calculated, they are presented in tables 5, 10, 15, 20 and 25. Calculation of the vectors of weights from matrices is performed via the following formula (Chang and Huang, 2006):

$$(A - \lambda_{\max} I)w = 0$$

Where $\lambda_{\max}$ is the highest (eigenvalue) internal value of Matrix A, w is a vector, representing the significance of the factors and I is an identical matrix.

In most cases the consolidated matrices are inconsistent due to the small probability for the expert assessment of the factors to be consistent at each comparison of the assessed factors.

The index and consistency degree in accordance of the AHP model of Saaty (1980) can be determined via the following formulas:

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

Where n is the number of rows (columns) of the assessment matrix.

$$CR = \frac{CI}{RI}$$

RI depends on the number of rows (columns) of the matrix. The values according to Saaty are given in Table 26 (Gorner, Toker and Ulucay, 2012).

Table 26

RI values

n	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

A value of RI under 0.1 is deemed as acceptable. Despite this in practice it is permissible for higher values to be accepted (Tomar and Board, 2012; Anushiya and Illeperuma, 2016).

The meanings of $\lambda_{\max}$, CR, w are presented in tables 5, 10, 15, 20 and 25.

The actions of Stage 2 were automatically performed with the assistance of an electronic table, developed by Klaus D. Goepel, which is based on Microsoft Excel. The application can be found on the following link: http://bpmsg.com**.**

Stage 5. Visualizing of the discovered results

Table 27 presents the significance of the factors and factor groups. The factors with the most significance (weight) are bolded.

Table 27

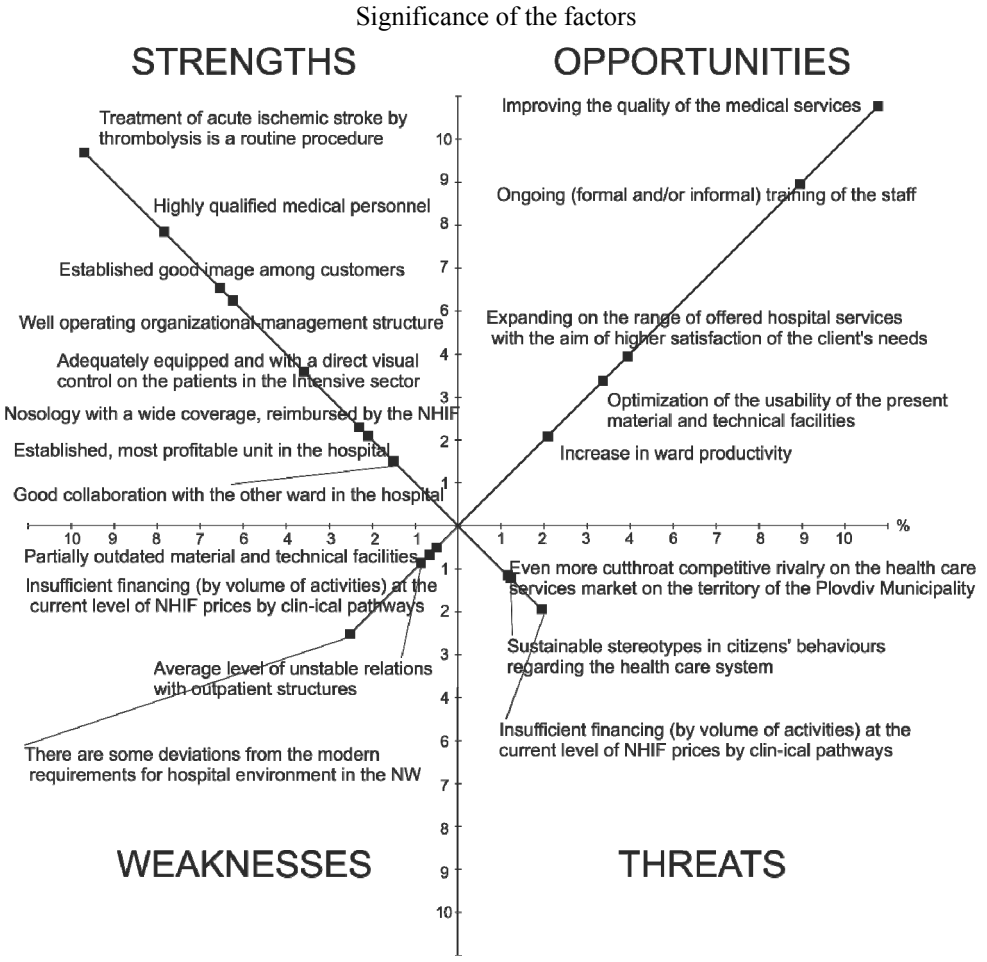
Total significance of the factors of the SWOT matrix

SWOT group	Significance of a group	Factor	Significance in the group	Total significance
Strengths	0.499	Established, most profitable unit in the hospital.	0.059	0.029
		Well operating organizational-management structure.	0.146	0.073
		Highly qualified medical personnel.	**0.191**	**0.095**
		Good collaboration with the other ward in the hospital.	0.041	0.021
		Adequately equipped and with a direct visual control on the patients in the Intensive sector.	0.101	0.050
		Nosology with a wide coverage, reimbursed by the NHIF.	0.065	0.032
		Treatment of acute ischemic stroke by thrombolysis is a routine procedure.	**0.242**	**0.121**
		Established good image among customers.	0.155	0.077
Weaknesses	0.063	Partially outdated material and technical facilities.	0.110	0.007
		There are some deviations from the modern requirements for hospital environment in the NW.	**0.559**	**0.035**

SWOT group	Significance of a group	Factor	Significance in the group	Total significance
		The ward is partially included in the Hospital information system.	0.134	0.009
		Average level of unstable relations with outpatient structures	0.196	0.012
Opportunities	0.378	Optimization of the usability of the present material and technical facilities.	0.125	0.047
		Expanding on the range of offered hospital services with the aim of higher satisfaction of the client's needs.	0.144	0.055
		Increase inward productivity.	0.075	0.029
		Ongoing (formal and/or informal) training of the staff.	**0.295**	**0.111**
		Improving the quality of the medical services.	**0.360**	**0.136**
Threats	0.060	Even more cutthroat competitive rivalry on the healthcare services market on the territory of the Plovdiv Municipality.	0.273	0.016
		Sustainable stereotypes in citizens' behaviours regarding the health care system.	0.278	0.017
		Insufficient financing (by volume of activities) at the current level of NHIF prices by clinical pathways.	**0.449**	**0.027**

To illustrate the significance of the factors their respective weight relative to each other, the results are depicted in Figure 6. The figure clearly shows the dominating significance of the factors from the strengths and opportunities groups.

Figure 6



Stage 6. Drawing up of a TOWS matrix

The final stage of the suggested hybrid model focuses on combining the identified strengths/weaknesses and opportunities/threats for the NW. A TOWS matrix is designed for the purpose, it provides four strategic development alternatives (Figure 7).

Figure 7

TOWS matrix for the NW of MHAT "Saint Panteleymon" – Plovdiv

	Strengths S_1.Established, most profitable unit in the hospital. S_2.Well operating organizational-management structure. ***S_3*.Highly qualified medical personnel.** S_4.Good collaboration with the other ward in the hospital. S_5.Adequately equipped and with a direct visual control on the patients in the IS. S_6.Nosology with a wide coverage, reimbursed by the NHIF. ***S_7*.Treatment of acute ischemic stroke by thrombolysis is a routine procedure.** S_8.Established good image among customers.	**Weaknesses** W_1.Partially outdated material and technical facilities. ***W_2*.There are some deviations from the modern requirements for hospital environment in the NW.** W_3.The ward is partially included in the Hospital information system. W_4.Average level of unstable relations with outpatient structures.
Opportunities O_1.Optimization of the usability of the present material and technical facilities. O_2.Expanding on the range of offered hospital services with the aim of higher satisfaction of the client's needs. O_3. Increase inward productivity. ***O_4*.Ongoing (formal and/or informal) training of the staff.** ***O_5*. Improving the quality of the medical services.**	**SO:** **Maxi-Maxi** • S_1, S_2, ***S_3***, S_4, S_6, O_1. • ***S_3***, S_4, S_8, O_2. • S_1, S_2, ***S_3***, S_4, ***S_7***, O_3. • S_1, ***S_3***, ***S_7***, ***O_4***. • S_2, ***S_3***, S_4, ***O_5***.	**WO:** **Mini-Maxi** • W_1, O_1, O_2, O_3. • ***W_2***, O_1, O_2.
Threats T_1.Even more cutthroat competitive rivalry on the healthcare services market on the territory of the Plovdiv Municipality. T_2.Sustainable stereotypes in citizens' behaviours regarding the health care system. ***T_3*.Insufficient financing (by volume of activities) at the current level of NHIF prices by clinical pathways.**	**ST:** **Maxi-Mini** • ***S_3***, S_4, S_5, ***S_7***, S_8, T_1. • ***S_7***, T_2. • S_6, ***T_3***.	**WT:** **Mini-Mini** • W_1, T_1. • ***W_2***, T_1. • W_4, T_2.

Figure 7 clearly shows the dominating position of quadrant – Maxi-Maxi strategy (S-O Strategy), which combines the factors from the strengths and opportunities groups of the NW. As it has already become clear, these SWOT components received the highest relative weight.

This strategic alternative is the most favorable for the subject of the study and should be a future priority. Therefore, in the following lines, we will solely focus on its description.

- S_1, S_2, S_4, S_6, O_1. The first combination of strengths with opportunities of the NW is a strategy of *optimizing the usability of the current material and technical facilities* based on:

  - *Over fifteen years of experience in providing the hospital's primary income.* If the leadership position is preserved (of primary source of income for MHAT "Saint Panteleymon" – Plovdiv) in the future, additional funds may be earmarked for the expansion and modernization of the material and technical facilities.

  - *Adequately operating organizational forms and the managerial relations between them* play and will continue to play a significant role in the improvement of the usability of the current material and technical facilities.

  - *Good collaboration with the other wards in the hospital.* The work organization created in the NW provides the necessary level of coordination with the other hospital wards (Clinical Laboratory, Microbiology, Pathoanatomic Laboratory, Physiotherapy and rehabilitation ward, Radiology ward, Technical Support Service, System Administrative for the Hospital Information System), which could assist the optimization activities of the usability of the current material and technical facilities. In addition, if necessary part of the wards can provide an exchange in bed capacity and equipment.

  - *Nosology with a wide coverage, reimbursed by the NHIF* The needs for the optimization of the material and technical facilities can be met only if the possibility to operate at the maximum volume of clinical pathways (CP) is supported.

- $\boldsymbol{S_3}, S_4, S_8, O_2$. The second strategy is *an expansion of the range of provided hospital services* through:

  - *The highly qualified hospital personnel* that has long-term work experience (after successfully specializing in "Neurology") and a number if certificates for highly specialized activities. It is directly engaged with the volume of provided diagnosis, treatment and prophylaxis of the patients. Of course, apart from the necessary knowledge and competencies of the hospital personnel it is necessary to account for its motivation and social responsibility. For this purpose, the senior management of MHAT "Saint Panteleymon" – Plovdiv has implemented a differentiated bonus awarding system for achieving results.

- *Good collaboration with the other wards* is necessary for the inclusion in new clinical pathways, as well as for the performance of additional activities out of the ones paid by the NHIF.

- *The established good image among customers* of the NW could stimulate its managing authorities to expand the product mix with additional hospital services, such as – prophylactic examinations, specialized testing (Electromyography, Electroencephalographs and Doppler Ultrasound), nutrition under the guidance of a professional dietitian according to an example menu.

- S_1, S_2, $\boldsymbol{S_3}$, S_4, $\boldsymbol{S_7}$, O_3. This third strategic alternative demonstrates the increase in productivity of the ward on account of:

  - *Experience as an established, most profitable unit of the hospital.* It is apparent from the data presented in Table 28 that over the last three years there is an attempt to reduce costs for medication and medical consumables in the NW. At the same time, there is also a tendency for a decrease in incomes from CP (for example, for 2016 there is a 80.24% decrease compared to the previous year). This fact is due to the imposed by the NHIF (for all MI) limit on financing for activities under clinical pathways. An increase of incoming cash flow can be achieved by the performance of a larger volume of paid services and the introduction of additional fees for better living environments for patients.

  - *Well operating organizational-management system* which provides efficiency of the social system of the NW as a whole.

  - *Highly qualified medical personnel* It is engaged not only with the quality provision of the hospital services, but also with reaching previously planned results.

  - *Good collaboration with the other wards of the hospital* in regards to the necessary quick and timely reaction in treating every patient.

  - *Treatment of acute IS by thrombolysis is a routine procedure.* It should be kept in mind that the costs for the performance of an intravenous thrombolysis (IT) in the case of acute ischemic stroke are high, but income from this clinical pathway is also high. That is, the good work organization and most of all the strict performance of each step of the regulated procedure have a significant impact on the final result of the treatment. The decade-long experience of the NW is associated with a relative share of more than 50% of patients with minimal/missing disability (after thrombolysis). However, the positive result of this most effective method (worldwide) for the treatment of IS depends on the time of initiation of the IT. Among reasons for delaying or postponing the start of the procedure are the weak awareness of patients and the insufficient coordination between the outpatient and hospital care. In this regard, NW must expand its activity on promoting the effect of the treatment, identifying the first symptoms of the IS, the emergency transportation of the patient to the hospital (before the third hour of manifestation of the initial symptoms)...

Table 28

Economic indicators of the NW for the period between 2014-2016 (BGN)

Year	Units	Costs	Medi-cations	Medi-cations per day	Med. Cons. per day	Total Med. Cons.	Bed-day	Income from CP, etc. payments	Income From CP
2014	NW	907,323	63,640	4.0	2.57	6.57	57.05	1,460,086	1,409,454
	Intensive Sector	660,015	89,455	22.42	6.80	29.22	165.43	417,069	417,069
	Total	**1,567,338**	**153,095**	**7.69**	**3.42**	**11.11**	**78.76**	**1,877,155**	**1,826,523**
2015	NW	1,001,768	79,612	5.02	2.10	7.12	63.15	1,267,986	1,225,372
	Intensive Sector	671,104	90,939	22.54	5.07	27.6	166.03	391,939	388,595
	Total	**1,672,872**	**170551**	**8.57**	**2.70**	**11.27**	**84.07**	**1,659,925**	**1,613,967**
2016	NW	775,209	57,896	4.78	2.05	6.82	63.97	1,017,845	981,296
	Intensive Sector	518,278	63,506	20.52	5.01	25.53	167.46	317,013	313,740
	Total	**1,293,487**	**121,402**	**7.17**	**3.10**	**10.27**	**76.38**	**1,334,858**	**1,295,036**

- S_1, $\boldsymbol{S_3}$, $\boldsymbol{S_7}$, $\boldsymbol{O_4}$. This fourth strategy present an *ongoing training of the staff* through:
  - *The position of an established, most profitable unit in the hospital* suggest the possibility of financing for the ongoing training of medical personnel to obtain certificates for the performance of highly specialized activities.
  - *Highly qualified medical personnel* It is one of the leading factors in the receipt of highest accreditation rating that entitles the NW to train "Neurology" postgraduates for a period of five years. To renew this possibility for subsequent periods it is necessary for the qualification status of the medical personnel to be continuously developed.
  - *Treatment of acute IS by thrombolysis is a routine procedure.* The NW is a participant in the "Angels" international program, which aims at the creation of a community of 1500 centres and hospitals in Europe for the treatment of strokes. Within the framework of the project medical specialists from the ward could exchange ideas, share valuable practical experience (in regard to achieving better therapeutic results), receive access to results from clinical trials, etc.
- S_2, $\boldsymbol{S_3}$, S_4, $\boldsymbol{O_5}$. This final strategic alternative shows the combination of *improving the quality of the medical services* through:
  - *Well operating organizational-management system.* Functioning of the organizational forms and the relations between them requires continuous improvement. In searching for alternatives for the improvement of the quality of medical services, the NW may undertake measures on improving the attitude towards the patient and the conditions of the patient environment.

- *Highly qualified medical personnel*, which is directly engaged with the provision of quality diagnosis, treatment, prophylaxis, etc. - observing the principles and rules of medical ethics (regarding all persons active in healthcare).

- *Good collaboration with the other wards in the hospital.* Expanding the volume of activities, performed by other wards/units of MHAT "Saint Panteleymon" – Plovdiv immediately reflects on an increase in diagnosis and treatment possibilities for the NW. For example, equipping the radiology ward with an MRI will significantly improve the diagnosis and will determine the correct attitude in regards to the patients.

4. Conclusion

Application of the AHP method in collaboration with the SWOT and TOWS analyses had the aim of providing a possibility for the studied factors to be expertly dimensioned and respectively prioritized. Through the established results it was discovered that the **factors-possibilities** with the most total significance for the subject chosen for the study are "Increase in the quality of medical services" and "Ongoing training of the staff", whereas the **factors-strengths** with the most total significance are "Treatment of acute ischemic stroke by thrombolysis is a routine procedure" and "Highly qualified medical personnel". It is precisely the combination of these two SWOT groups that is expressed in the suggestion of a specific strategic alternative – Maxi-Maxi from drawn up TOWS matrix.

The applied combination of a SWOT-TOWS-AHP methodology allowed for the performance of a quantitative assessment and an analysis of factors that are otherwise difficult to compare. In this regard, additional tools were provided to assist the senior management of the NW of the MHAT "Saint Panteleymon" – Plovdiv in the process of generating development ideas and to facilitate future decision-making.

A graphic interpretation of the results was also created based on the comparison in pairs of the four groups of SWOT factors.

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