Analysis of Sustainability of IT Team Development in an Organization

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Abstract **– The paper shows the results of experiments focused on the analysis of sustainability of a quality work team in an IT organization. The analysis has been carried out based on the evaluation of the new real dates. Data consists of competences and direction of the strategy of individual specialists, as well as the strategy of the IT team as a whole. The principles of the SWOT analysis and of confrontational matrix have been used to evaluate the strategy and focus of individuals. The next step of the solution assumes the use of the principles of artificial intelligence in the process of solving relations within organizations.**

Keywords **– sustainability of team, SWOT analysis model, employees´ focus, team quality.**

1. Introduction

The sustainability of quality work, research and specialized teams is of great importance to organizations. Our goal has been evaluation of the factors of sustainability of the quality of human resources. The sustainability of the quality of teams of experts using new technologies, especially Information Technologies (IT) is very important.
In these teams, each individual is very important, as well as his harmonization and correct direction of the overall social-technological system.

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IT teams in businesses and organizations usually comprise small groups of experts, programmers and specialists from practice, who are capable of developing, deploying and maintaining extensive technical systems to keep businesses or organizations running. Some IT teams are typically focused only on extensive projects, others on very specific technologies. They may often include data experts or analysts with profound experience of business processes. These teams may be different, based on the culture and needs of the business, experience, skills and individual traits of the team members, as well as based on the types of systems they work on.

People in the organization and its individual teams have their qualitative characteristics, professional competences, job focus and personal strategies. Understanding this focus of whole work teams may affect the sustainability of teams and fulfillment of the goals of the IT firms. Different methods may be used to examine the sustainability and focus of the team. SWOT analysis is one of the effective methods. In the past, we have successfully used this method for the analysis of team strategy in an educational organization. We briefly present in this paper also the confirmation of the conclusions at the time, compared to the current state. However, the emphasis of this research is oriented on the analysis of sustainability of an IT team in an organization. For this purpose, we have used the improved SWOT analysis model. This type of analysis is an important tool in decision-making in an organization or a company. Organizations use it for solving of issues of quality management of systems, sectors and processes of production. SWOT is most of all a universally used method or tool, which maps and analyzes a system, organization, company, certain project or a specific team. It is an important part of management processes. It is an aid for analysis, which is suitable for use especially at the planning of the beginning process, proposal or decision-making. In organization may be used as tool for looking for of the position of a firm, enterprise, team or individuals as well. Result is view on system, company, team or an individual from four perspectives. Most often these dimensions are labelled by the symbols S, W, O and T (Strengths, Weaknesses, Opportunities and Threats).

The result of the method is usually the formulation of a focus or an element direction. We have improved the concept of the SWOT analysis for an effective analysis and evaluation of sustainability and focus of an IT team in an organization and compiled a practical application. The used method allows identifying a suitable strategy for the system, showing possibilities for its direction and provides a perspective of system sustainability. The principles of SWOT analysis are described in many publications, for example [1],[2],[3],[4],[5],[6] and others. Lind in paper [1] evaluates the method as a tool for selecting management measures. Production businesses and public administration authorities apply the SWOT analysis especially to analyze their strategy, which was published by many authors. Kim et al. [7] have used the SWOT analysis in combination with AHP (Analytic Hierarchy Process) to examine the sustainable and effective directions of the development strategy in the textile industry. Using said method, they were able to determine the high importance of especially the weak aspects and opportunities. Kramar et al. [8] have used a combination of methods to examine the sustainability and planning of the urban transportation system. They have also included the SWOT analysis in their created model. Okraszewska et al. [9] have followed similar steps in the integration of the transportation system. Other authors [10] used this analysis to implement the evaluation in smaller businesses. Görener et al. [11] applied this analysis in combination with the AHP method in a production company. Zavadskas et al. [12] have likewise used the SWOT analysis for the selection of algorithm for the management of a construction business. Gao et al. [13] proposed to use the SWOT analysis in the field of decision-making. They have applied it to decision support systems, which operate with uncertainty.

The method for multi-criteria decision making was used in [14] and [15]. They have focused on identifying weaknesses and strengths, opportunities and threats in solving the strategy of waste management. Christodoulou et al. [16] have used the SWOT analysis in the field of energy systems and reduction of greenhouse gas (GHG) emissions. In this case, they have used the SWOT analysis in combination with the PASTLE method to analyze factors, which affect Port Energy System. Zhang [17] and Kolkman [18] have used the analysis in the field of tourism to analyze sustainability and develop improvement proposals. Shakerian et al. [19] have applied said analysis and the system of expert evaluation in the sector of human resources. They have aimed on integration and sustainability of human resources and quality of business strategies of the organization.

Salar et al. [20] have used the analysis to assess the advantages and disadvantages of providing usage rights to industrial and intellectual ownership. Ifediora et al. [21] have applied said method in the analysis of schools. They have pointed out how the method helped students to stability and sustainability of higher performance. Pandya [22] also emphasizes the use of the SWOT analysis in education and development of the organization's potential. He expands the analysis with other horizontal views from the macro-environment and the internal environment perspective. At the same time, he emphasized the need to preserve the ethical dimension in evaluating people in an organization. The authors of listed publications have confirmed that this type of analysis may be used in different areas. These findings have supported our goal of the evaluation of sustainability of real teams and individuals.

2. Methodology

The research goal was to examine the sustainability of a quality work team of experts in an IT organization. The basis for the solution was the assessment of strategy focus (direction) of individual employees, as well as the strategy focus of the team as a whole. To meet the set goal, the selected suitable SWOT analysis method was applied as a computer model. Possibilities of suing the SWOT analysis in the analysis of sustainability of a quality team of IT experts in an organization have been verified.

An important task of the solution was to verify the compiled program and adapt its use in the system of sustainability of teams. An important task of the solution was to verify the compiled program and adapt its use in the system of sustainability of teams.

Also in this project it was required for the application to work in a known and available software environment. The program must be capable to rate the focus of individuals in a firm and state of sustainable development of the organization and the fulfillment of its goals. The main requirements for the solution were simplicity of the application, speed, efficiency, clarity and sufficient accuracy of obtaining results. The project solution scheme is shown in Figure 1.

The discovered values of S, W, O and T will be used to determine the sustainability of individual team members. The directions of strategies of individuals of the examined system will significantly impact the sustainability of given work team. They may affect also the relations between the members of the team and their focus towards achieving the goals of the team and the goals of the whole organization.

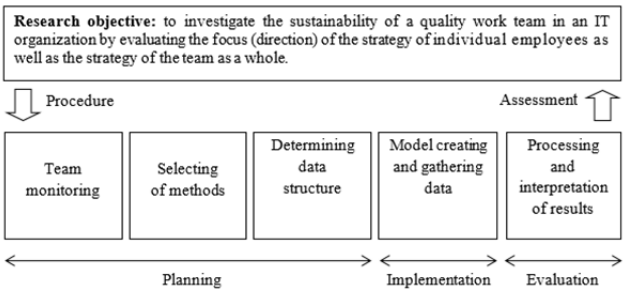

Figure 1. Project solution scheme

To determine the sustainability of individuals, professional, work and selected personality skills were assessed.

2.1. Model Application

A computer model was designed and then improved for using the mentioned method. An input unit has been created within the model to input information on elements of the evaluated system. The proposed solution offers speed, effectiveness, clarity and accuracy in entering input data, calculation and in the presentation of the results. It allows operatively entering and changing data and it also offers the possibility to simulate with of the predicted changes. In the final solution of the task only two basic conversion units have been created. Unit 1 - Input and calculation and Unit 2 - Output. Unit 2 consists of a section accelerating the creation of the output graph and the accompanying graphical segment.

Unit 1 - Input (Table 1) contains elements organized into columns. The user enters factors in the marked fields in the first column, he proposes to evaluate. Four groups of factors are used for the evaluated system, element of the system or member of the team (S, W, O and T). The number of factors in S, W, O and T group we can change based on the actual need. In the next column, the expert rates set factors. The range of 10 or 20 point was recommended for a more accurate expression of the rating of the factors. In columns 3 through 10 there is space to determine the weight of individual factors. The AHP method can also be used to determine the weight of the factors. The collection and input of data for the AHP application is time-wise and the collected expert scoring is quite subjective. The extended Fuller method was used (columns 3 through 10) as a much more suitable option. It better meets the requirements for clarity, speed and effectiveness of data input in the developed application. In our solution, the user first enters his comparison of the importance of a pair of factors in the marked dark triangle (columns 4-8) in the range of values 1 through 3.

A value of 3 expresses that the first of the pair of the compared factors is more important than the second. A value of 2 expresses that the compared factors are equally important. A value of 1 expresses that the first factor of the compared pair is less important. The application is designed to automatically display an opposite value in the triangle under the diagonal, where given par of evaluated factors is rated in reverse order. The ninth column contains a sum of the columns 4 through 8 assigned in the comparison of pairs of factors. The tenth column automatically calculates the weight of the factor W_f. based on the equation:

$$W_f = \frac{\sum_{i=1}^{k} e_{f(i)}}{e_{f\_all}} \quad (1)$$

ef(i) - is an indication of the rating of the factor with the i number,
k - is the number of all factors,
e_{f_all} - represent the sum of ratings of all factors in given area S (W, O or T).

The last eleventh column labelled WS_f, contains the automatically calculated weighted rating of the factor in the line *f***.** The WS_f value represents the multiplication of the score of the factor in given line (V_f) and the weight of given factor (W_f).

$$WS_f = V_f \cdot W_f \quad (2)$$

The sum of weighted values of the factors for the quadrant S (Strengths) also represents the resulting value S_x (coordinates of the endpoint of the vector S on the axis **x),** for example (S_x=6.075; S_y=0).

$$S_x = \sum_{i=1}^{n} WS_{f(i)} \quad (3)$$

The other resulting values of endpoints for the vectors W, O and T are calculated identically. The resulting vector will be obtained through the sum of said vectors S, W, O and T, which expresses the direction and value of sustainability for the analysed team.

Parts of the model for the calculation of parameters in the area (sector) W, O and T have been solved identically. Unit 2 (output) - carries out the presentation and organization of the output values, which are found in the table of data for the creation of a graphic output. The graphic output is in the resulting vectors of direction of all team members (Figure 3) or the location of the endpoints of said vectors (Figure 2). The vector of the direction of the whole team is also part of the output. The vector of the team is made of the sum of vectors of individuals.

The program makes the output vectors by linking the start point of the vector with the coordinates (0; 0) to the calculated endpoint.

Table 1. The Unit 1 - input and calculation in area Strengths

Strengths (S)	V_f	F	1	2	3	4	5	Σ	W_f	WS_f
Completed Education	6	**1**		3	2	3	3	11	0.28	1.65
Implemented Projects	5	**2**	1		2	3	2	8	0.20	1.0
Expertise and Experience	9	**3**	2	2		2	1	7	0.17	1.575
Ability to Assert Oneself	7	**4**	1	1	2		2	6	0.15	1.05
Creativity	4	**5**	1	2	3	2		8	0.20	0.8
Sum	**31**							**40**	**1.0**	**6.075**
Weaknesses (W)	V_f	F	1	2	3	4	5	Σ	W_f	WS_f
No knowledge of languages	4	**1**		2	2	3	1	8	0.20	0,8
Little experience	3	**2**	2		2	3	1	8	0.20	0,6
Fear of conflict	5	**3**	2	2		2	1	7	0.18	0,875
Fear of the future	5	**4**	1	1	2		1	5	0.11	0,625
Impropriety	3	**5**	3	3	3	3		12	0.30	0,9
Sum	**20**							**40**	**1.0**	**3,80**
Opportunities (O)	V_f	F	1	2	3	4	5	Σ	W_f	WS_f
Projects offer	6	**1**		3	2	3	2	10	0.25	1,5
Educational opportunities	9	**2**	1		2	2	2	7	0.18	1,575
Availability of external resources	5	**3**	2	2		2	2	8	0.20	1.0
Cooperation of other teams	4	**4**	1	2	2		2	7	0.16	0,7
Family support	7	**5**	2	2	2	2		8	0.20	1,4
Sum	**31**							**40**	**1.0**	**6,175**
Threats (T)	V_f	F	1	2	3	4	5	Σ	W_f	WS_f
Market instability	7	**1**		3	3	2	3	11	0.28	1,925
Competition	8	**2**	1		1	3	2	7	0.18	1,4
Low product demand	8	**3**	1	3		1	3	8	0.20	1,6
Weak support from supervisors	9	**4**	2	1	3		3	9	0.22	2,025
Labour market offers	7	**5**	1	2	1	1		5	0.12	0,875
Sum	**39**							**40**	**1.0**	**7,825**

The vectors show the direction of each individual in four basic quadrants SO, WO, WT and ST. The SO quadrant shows Offensive strategy, which recommends high activity in achieving the goals of the firm. The ST quadrant suggests Diversification strategy, which assumes divide of interest or projects with the goal of splitting the risk and eliminating threats. The WO quadrant suggests Turnaround strategy (turnover, reversal, or internal changes), sometimes also referred to as the Strategy of the alliance or Strategy of integration. The WT quadrant suggests Defensive strategy. This result indicates the demise of a team, system or project. Unit 2 contains the calculated coordinates of the vectors of all elements of the system (individuals within the IT team) and their age sums based on the required categories, for example, younger, older or men and women. It also contains the depiction of the resulting vectors. A group of experts may be engaged in said process to further improve objectivity in determining the weight of individual factors or ratings of elements in the system. Rating of the team leader, co-workers as well as self-assessment of individuals in the team may be used in the field of team management. A disadvantage of this procedure is the longer time needed to get solution, but the accuracy of the results is higher.

2.2. Data Analysis

To verify the application and the solution procedure, an IT organization has been selected with 20 employees. 6 of these were women (labelled W_1 - W_6) and 14 men (labelled M_1 - M_{14}). The dataset was obtained for the model from the rating of the managers of the IT organization, which is presented in Table 2.

Table 2. Score of team members

	W	W	W	W	W	W	M	M	M	M	M	M	M	M	M	M	M	M	M	M
N.	1	2	3	4	5	6	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Women						Men													
S	6	5	7	7	2	8	8	8	8	8	7	8	8	8	8	8	7	3	7	5
	5	5	6	10	3	2	5	6	6	6	6	5	6	6	6	6	6	3	10	5
	9	8	6	8	5	7	8	8	7	5	8	9	9	9	9	9	9	7	7	5
	7	5	6	2	5	5	7	8	9	10	8	7	7	6	8	6	6	3	8	6
	4	6	6	8	3	7	4	9	9	1	6	5	8	7	5	6	8	7	10	9
W	4	4	4	4	2	6	1	5	5	8	2	1	5	6	6	4	4	6	6	8
	3	4	3	3	5	4	2	4	7	4	4	3	3	4	4	5	6	8	4	7
	5	8	7	2	8	7	5	3	4	3	1	4	4	4	3	6	6	9	4	8
	5	6	8	10	10	6	1	5	4	2	3	3	3	3	6	3	4	2	7	
	3	5	1	1	1	2	2	1	2	2	1	2	2	5	4	5	2	4	1	1
O	6	4	10	10	2	4	6	8	7	10	10	6	6	6	7	7	7	2	9	6
	9	8	7	5	5	8	5	5	5	7	10	9	9	9	9	9	9	9	10	10
	5	5	10	10	2	5	9	10	8	10	10	6	5	5	7	5	5	3	10	8
	4	5	10	10	10	8	10	10	10	10	10	8	6	6	8	5	6	5	10	10
	7	6	10	10	10	7	10	10	10	10	10	9	9	9	8	8	9	8	10	10
T	7	8	1	10	9	6	1	1	2	1	6	2	2	2	4	5	5	7	4	7
	8	8	2	2	2	6	2	2	2		2	2	4	4	5	5	4	6	2	3
	8	8	7	7	10	7	7	7	7	7	5	3	4	3	5	6	6	7	5	5
	9	8	2	4	2	4	2	2	2	2	2	4	5	5	7	7	6	5	2	2
	7	6	2	10	7	4	1	3	3	2	7	3	3	3	4	5	6	7	5	7

The scores have been used to calculate the weighted values of endpoints for the S, W, O, T vectors for each member of the team (Tables 3, 4a and 4b).

Table 3. The weighted score for women

	W1	W2	W3	W4	W5	W6
S	6.075	5.725	6.275	7.225	3.375	5.975
W	3.8	5.25	3.925	3.3	4.35	4.575
O	6.175	5.475	9.475	9.125	5.525	6.2
T	7.825	7.75	2.725	6.65	6.15	5.5

Table 4a. The weighted score for men – part 1

	M1	M2	M3	M4	M5	M6	M7
S	6.45	7.8	7.775	5.975	6.925	6.825	7.625
W	2.2	3.25	4.2	3.775	2.05	2.475	3.275
O	7.925	8.625	7.975	9.475	10	7.475	6.925
T	2.6	2.85	3.125	2.375	4.325	2.775	3.55

Table 4b. The weighted score for men – part 2

	M8	M9	M10	M11	M12	M13	M14
S	7.275	7.175	7.075	7.2	4.5	8.35	5.95
W	4.575	4.1	5.1	4.025	6.075	3.25	5.57
O	6.925	7.725	6.8	7.175	5.15	9.75	8.6
T	3.35	5.05	5.65	5.375	6.375	3.525	4.775

3. Results

The results of the analysis are the parameters for determination level of sustainability of IT specialists in the examined organization. Other results are the calculated parameters of the vector of the overall strategy of the IT team of employees in the organization. The resulting vectors of the strategic direction of individual workers are shown in Figure 3 and the endpoints of said vectors in Figure 2.

The strategies of direction of individual employees - experts are mainly in the sector (quadrant) Offensive strategy. To a lesser extent (two experts) they are directed at Diversification strategy and two on Defensive strategy, which is also called the Strategy of escape. The results suggest that the majority of employees (in this case, IT experts) feel good in the organization and that their basic needs and personal securities are fulfilled. This indicates that there an assumption of them staying in the organization, which supports the sustainability of the team quality. This means that the team is prepared and willing to fulfill the goals of the organization. The vectors of direction of two employees indicate distortion. Said employees do not have the prerequisites yet or they do not have suitable conditions. The sustainability of these workers in the team is endangered. In this case these are younger employees and their professional growth for the fulfillment of the qualification requirements can be assumed.

It is also a signal for the team leader to increase attention and adopt suitable measures. There is also a threat that they will gradually redirect their focus on own interests and activities, or they may decide to leave the organization.

In terms of comparing men and women in the team, the distribution of vectors of strategic direction of women is seemingly more focused on the Diversification strategy (Figure 2 and 3), or close to this strategy. This creates an unverified assumption that women do not have in the examined IT team identical conditions as men have, which might lead to the deterioration of the sustainability of the team.

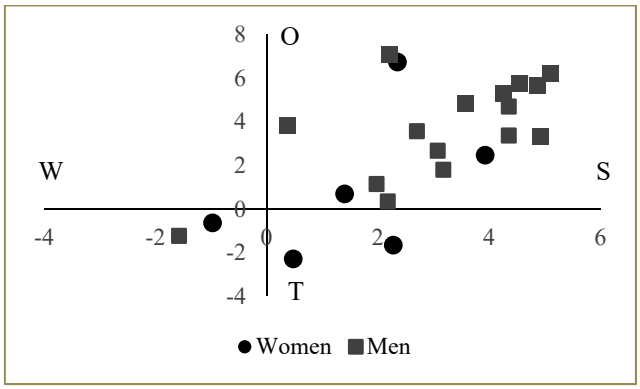

Figure 2. Endpoints of vectors of direction of all employees in the selected team

To verify this assumption, we have used statistical testing of hypotheses.

Basic problem 1: Is gender a deciding aspect for the direction of IT experts (employees) in selected factors? We have used the t-test of two mean values at the significance level of α= 0,05 in the group of selected vectors to verify this.

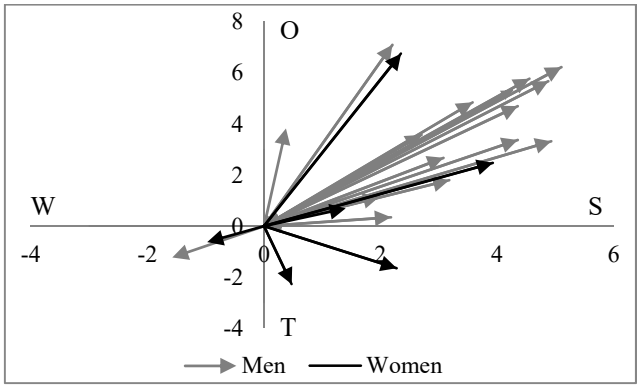

Figure 3. Vectors of direction of all employees in the selected team of the organization

Hypothesis H0: The gender of IT experts does not have an effect on the rating result of their staying in the company. Men and women have identical interest to meet the goals of the organization.

Hypothesis H_1: The gender of the experts does have on the resulting score of the examined characteristics. The score in the set of men, which is the result of the direction of men, is statistically significantly different from the score in the set of women.

By applying the t-test on the created file of weighted data (Tables 3, 4a and 4b), which consists of 6 entities in the file of women and 14 entities in the file of men, we have obtained the following results at the 0.05 level (Table 5).

Table 5. The output of the t-test of two median values with equal variance

	S	W	O	T
F test	Equal	Equal	Equal	Equal
t Stat	-2,201236	0,653714	-1,248072	2,959339
t krit (1)	1,734063	1,734063	1,734063	1,734063
t krit (2)	2,100922	2,100922	2,100922	2,100922

The validity of the hypothesis H_0 has been confirmed in two categories (W, O). Gender does not have an effect on the direction of the employees. In the examined team of specialists, women and men have overall similar direction in the fulfillment of the goals of the organization. The validity of the hypothesis H_1 has been confirmed in the categories (S, T). Gender does have an effect on the direction of employees in the field of strengths and in the field of perceiving external threats. In the examined team of employees, based on the selected characteristics (in the area of S and T), men and women do not have an overall similar direction in the fulfillment of the goals of the organization. Some women in the team are especially directed into the quadrant of Diversification Strategy and in one case into the quadrant of Defensive Strategy (Escape Strategy). For the company managers, this means that it is necessary to improve the conditions for women in the organization, especially by strengthening their strengths. Practically, this means to expand their possibilities of improving their qualification, engaging women in more significant projects and creating conditions for the presentation of the results of professional work. Furthermore, it is necessary to eliminate external threats, especially the threat to their job position, which will considerably improve the prerequisites for sustainability of the IT team. Significantly smaller differences are seen in the perspective of comparing younger and older IT experts. We assume that they have the required conditions in the team, which suit the younger and the older employees alike. We have also tested this conclusion.

To verify this assumption we have also used statistical testing of hypotheses. We have formulated the second basic problem.

Basic problem 2: Is age a factor, which significantly affects the direction of IT experts in the company? Is focus (direction) of younger specialists similar or significantly different from the direction of older experts? Two hypotheses were formulated for verification:

Hypothesis H_0: Age does not have an effect on the resulting score. Younger and older IT experts are rated in selected characteristics identically.

H_1: Age does have an effect on the resulting score. Younger and older IT experts are rated in selected characteristics differently.

The evaluated set had 6 entities in the file younger and 14 in entities in the file older experts. We have used the t-test of two mean values at the level 0.05 also in this case. The output is in Table 6:

Table 6. The output of the t-test of two median values with unequal and equal variance

	S	W	O	T
F test	Unequal	Unequal	Equal	Equal
t Stat	1,300848	-1,97030	1,097516	-1,130494
t krit (1)	1,943180	1,83311	1,734063	1,734063
t krit (2)	2,446911	2,262157	2,100922	2,100922

In this case, the H_0 hypothesis has been confirmed for all four areas S, W, O and T. Older and younger IT experts are rated in all rating areas about the same. The age does not have an effect on the direction and sustainability of the team. The overall good condition in the organization is confirmed also by vector sums. All vectors are directed into the Offensive strategy quadrant.

A confrontational matrix has also been created within the analysis (Figure 4). The principle of confrontational matrix was shown in [23]. The maximums and minimums of the sums of confrontation ratings are interpreted as the result. The factor in the column with the maximum sum shows the greatest internal strength of given IT team. It is important for the team to lean on this factor as much as possible (in this case, expertise). The factor in the line with the maximum sum represents the greatest external opportunity of the team. This factor (in our case, educational opportunities) must be used preferentially in favor of the team.

The second part of the interpretation of the result of the confrontational matrix is the discovered minimum in the field of threats and weaknesses. The lowest-rated component in the columns represents the most dangerous internal weakness of the team.

This factor (fear of conflict) must be improved preferentially as soon as possible. The lowest-rated factor in lines is the greatest threat of the external environment. This external effect (weak support from supervisors) must be preferentially eliminated.

		Strengths (S)					Weaknesses (W)					
		Level of education	Carried out projects	Expertise	Ability to assert oneself	Creativity	No knowledge of foreign languages	Little experience	Fear of conflict	Fear of the future	Impropriety	Σ
Opportunities (O)		**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	
Projects offer	**1**	2	2	2	2	2	-1	-1	-1	0	-1	**6**
Educational opportunities	**2**	1	2	2	2	2	1	1	0	1	-1	**11** max
Availability of external resources	**3**	1	2	2	1	2	-1	-1	-1	0	0	**5**
Cooperation of other teams	**4**	0	2	2	1	2	1	1	0	0	0	**9**
Family support	**5**	2	2	2	1	2	1	0	0	0	0	**10**
Threats (T)												
Market instability	**1**	0	1	1	0	-1	-2	-2	-2	-2	-2	**-9**
Competition	**2**	0	0	1	0	1	-1	-1	0	-1	0	**-1**
Low product demand	**3**	-1	0	0	0	0	0	-1	-1	-2	-1	**-6**
Weak support from supervisors	**4**	-1	-1	-1	0	0	-2	-1	-2	-1	-1	**-10** min
Labour market offers	**5**	0	0	0	0	0	-1	-1	0	1	0	**-1**
Σ		**4**	**10**	**11**	**7**	**10**	**-5**	**-6**	**-7**	**-4**	**-6**	
				max					min			

Figure 4. Confrontation matrix applied for IT team analysis

4. Discussion

The project analyzed and verified some possibility of examining sustainability of a quality work team in an IT organization. The basis for the analysis was the evaluation of focus and direction of the strategy of individual employees – IT team members, as well as the team strategy as a whole. The use of the SWOT analysis has proven to be effective. The results suggest that the employees of the assessed IT organization (members of the IT expert team) Have overall good professional, personal and strategic direction. The obtained vectors of direction of strategies of individual team members, as well as the organization as a whole, provided useful information for improving the sustainability of the team. The discovered state is a good starting point for the sustainability of the team and for the fulfillment of the goals of the organization.

For further improvement of the designed application, we will apply more confrontational matrixes [24], [25], [3], [26] to compare the relations between the sector of team‘s weaknesses and strengths compared to the sectors of threats and opportunities. There is also the option of using the principles of the adjacency matrix, as applied by [27]. The assumption for the solution would be the creation of a system of automatic matrixes evaluation.

The use of confrontational matrix may be effective also in the field Employee Relationship Management (ERM). This approach may optimise the overall process of managing in the organization even more. In previous work [23], we have pointed out the fact that the confrontation matrix is rarely used in practice. The issue of solving said project might be the use of some personal data experts. It is subject to the General Data Protection Regulation (GDPR). The observation of the EU standards, as well as ethical standards, is a necessary precondition of the developed solution. As emphasized by [28], ethical dimension bring success to the company. Another important factor, which may affect the improvement of the presented analysis, will be cultural specifics. They may manifest themselves in visible cultural forms, as suggested by [29]. The application of the model is implemented in a commonly available office software environment. Another possibility is to program the application in a standard programming language. In this case, it is necessary to utilize the knowledge of algorithm creation. Currently the creation of algorithm and programming is taught on technical and economic schools, as examined by [30], [31] and others. The advantage of the alternative application solution of the input form, and the overall model, would be its creation in the form of a web application. An effective solution could be the use of ASP.NET Core framework. Pillár [32] states that technologies based on NET Framework are a suitable platform for the development, launching and deployment of applications especially in the programming languages of C#, VB and F# and the System.Web.dll library. The projects created in this environment often use the principle of Model View Controller (MVC). The MVC process of development streamlines and facilitates team cooperation [30].

In further examination of the issues, we would like to implement elements of Artificial Intelligence (AI) and Internet of Things (IoT) in the process of analysis and recognition of factors of sustainability of teams and other systems. Many works in this field inspired us. For example, Nawaz [33], who uses the principles of AI in his research of the process of new employees hiring. The teams will always consist of cooperating pairs, triples and larger groups of elements of the system.

The use of AI principles will open new space for the expansion of our research. We will look for ways how to implement AI in such sensible area as the process of analysis and improvement of quality and performance of teams in organizations. Webber et al. [34] also examine the possibilities of using AI in the field of team management, team effectiveness in organizations and improvement of teamwork.

It is also possible to apply regression analysis, which is used by Gavurova et al. [35] and to combine this method with the possibilities of AI. The possibility of evaluating internal variables of the organization using neuron network analysis is shown in [36]. They inspire us to recognize parameters of

objective nature and demographic nature. The parameters linked to human resources are used to verify the relation to the issue of employee fluctuation. A possible research direction is also the use of AI in contact with the public. Galloway et al. [37] suggested some solutions. It opens the possibility for the experts in this field, their clients and employers to examine the consequences of AI application. These topics are related to our ongoing research.

Another related issue, which we want to solve, is the area of communication of teams and the evaluation of their performance in Collaborative Problem Solving (CPS). The work [38] directs us to look for new solutions with the support of AI. We assume that AI has big potential in the analysis of quality of organisation, support of teams sustainability and in proposing improvement steps.

5. Conclusion

The created concept and program is an easily available, effective and undemanding tool to evaluate a system, important factors of the sustainability of a team of experts, as well as other employees of the organization. The solution provides a picture of sustainability of the selected team in the organization. It is also suitable for fast and effective evaluation of the actual direction of the team or an individual. The principles of the presented solution may be used, after changing the examined factors, also to analyze strategy of an organization or a selected process. The compiled application is suitable also for fast comparison of situational conditions in changes of teams and organization. The solution was practically verified several times in the field of management of social-technical systems. The results of the analysis are vectors of strategic direction of individual in organization, as well as vectors of direction of the whole team or an organization. The output data provides useful information for the evaluation of sustainability of the quality of the team and to make changes in the analyzed team.

Further improvement of the solution and the designed application requires the engagement of the principles and tools of artificial intelligence in the process of analysis and improvement of the examined systems. The improved solution may be an effective tool also for the management in an organization or a company.

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