

# Assessing the Competencies of Team Members

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**Abstract** – Competencies are a key determinant of personal and professional success. This article presents the results of research focused on the evaluation and analysis of team members' competencies and characteristics. The basic hypothesis was that the combined assessment of an individual's competencies by both the entire team and the team leader could provide a more objective and accurate evaluation of their competencies and potential. Experimental verification was carried out in a team of university graduates prepared for practice. Competencies related to team leadership, project management and creative problem solving were mainly assessed. The results confirmed the effectiveness of the proposed approach, in particular, the possibility of identifying assessment congruence and the possibility of identifying team members who may be suitable for specific key tasks.

**Keywords** – Competencies, assessment, team quality, team management, systems approach.

## 1. Introduction

Organizations, firms, but also teams of employees, managers, scientists, doctors, programmers, students or teachers, all of these can generally be classified as mixed socio-technical systems. Each such system has a defined purpose and fulfils a certain goal set out for the given organization or a specific team. The identification and knowledge of the properties of individual components in the team, their competence, links between such components, as well as properties of the whole team, creates conditions for increasing the quality of the team and improving its management. This research focused on a team of university graduates. This team would be understood as a system, i.e., an internally articulated component or a set of components in their mutual relations and interactions. The team was analyzed with a focus on the competencies of individual members. The competencies of team members, i.e., students, graduates prepared to join the profession, were assessed using a team-based assessment approach. The concept of competence is generally understood as a sum of knowledge, abilities, skills, experience and behavior that result in successful and effective performance in the activity of an individual. In the corporate sphere, it is a set of skills and behavior of a staff member, while the requirements may vary for each position. The study of [1] emphasizes that the quality of competencies must attain certain level to cope with rapid environmental changes and ensure the sustainability of the organization. In their research [2] pointed out that the expectations of the employers under survey prioritize conscientiousness, professional and work-competence development, time management and kindness. Only then do they expect other managerial and work competencies, including IT skills, process management and knowledge of foreign languages. Research and self-assessment of competences in the field of information and communication technology (ICT) is investigated by [3].

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In [4] and [5] they emphasize that the development of employees' competencies during the induction period depends on the availability of knowledge sharing channels. The impact of employee competencies on their business performance is investigated by [6]. In the field of higher education, it compares students' competencies in creating innovations [7]. Methods for measuring students' mastery of competencies in the areas of communication, lifelong learning, innovation/creativity, and teamwork in engineering education were also reviewed by [8]. Publication [9] highlights that competences in the field of education are generally characterized as basic target categories, outputs from general education and upbringing. The entire educational content should be aimed at their acquisition and fostering. One of the possibilities for finding new forms, methods and content of preparing students for practice that improves their competencies was published, for example, in a paper by [10]. The evaluation of competences in the field of teaching is also addressed by [11]. Their research is focused on seeking relationships between performance functions and interaction style, as well as relationships between didactic competencies and teaching style. In practice, the term key competence is often used. The publication [12] states that without their adoption, a person cannot achieve success in any of the following areas: personal satisfaction and personal development, full participation in society, and lifelong employment. The issue of key competences for development of lifelong learning as a means of increasing competitiveness in the EU is also addressed by [13]. On competence issues, the European Council adopted its own updated recommendations "Council Recommendation on Key Competences for Lifelong Learning" [14]. The recommendations state that competences, in particular key competences, but also basic skills, are necessary for every person living in society for their personal satisfaction, personal development, good employability, social inclusion, as well as active citizenship. The recommendations are primarily aimed at supporting priority areas. These include provision of high-quality education, professional training and lifelong learning, support for teaching staff for competence-based teaching and learning, promotion of different approaches to further education, but also exploration into approaches to evaluation and validation of key competences. From a point of view of competence analysis, [15] remind that even non-profit organizations should perform competence analysis. The reviewed literature emphasizes the importance of key competences and their assessment as a fundamental prerequisite for sustainability, employability, and lifelong learning.

A system's approach can be also used to examine team characteristics. It is important to understand how individuals on the team perceive one another and how they view the competencies of their colleagues within the observed system. The author [16] states that a system is a set of interacting entities or components, with relationships between them. In a system, the behavior of each component has an impact on the behavior of the whole, and these behaviors are mutually interdependent. Other authors understand the concept of system similarly [17], [18], [19]. The above view is generally also valid for organizations, organizational complexes, enterprises, firms, as well as other socio-economic objects. A systems approach is generally considered to be a way of thinking, problem solving and acting in which phenomena are understood comprehensively in their internal and external relations. The research using a systems approach has been elaborated and used in many areas. Authors in [20] apply systems approach especially in the field of social, business and development challenges. Issues related to using a systems approach in solving soft systems problems are discussed in [21]. In [22], the authors report that systems thinking is widely considered critical for managing the complexity faced by the world in the decades to come. Systems thinking is analyzed using a reductionist approach in [23]. The possibilities of systems dynamics models as tools for supporting a systems approach within scientific research in computer science were presented, in the paper by [24]. The concept of a systems view of information is also often used in technical sciences. For example, in the field of information systems management, the concept of systems view was used by [25]. In order to determine the properties of the individuals and to select suitable ones for certain positions in the team, two-way communication is necessary. Research of [26] confirms that if an individual in any team is to increase their performance, a two-way flow of information with team leadership is needed. Communication with individuals in the team is also necessary when assessing their competences. The reviewed literature suggests that a systemic approach enhances understanding of team characteristics and the interactions among its members. The research presented below was also focused on such aspects.

## 2. Methodology

The aim of the presented research is to examine the selected competencies and capabilities of students before graduating from university using a systems approach. Priority was given to competencies required for future team leaders, particularly in project management and creative problem-solving within teams.

Competencies for team leadership, as well as for active participation in a team, can be understood as a set of knowledge, abilities, skills, and experience, along with the physical and psychological readiness necessary to effectively perform specific tasks, functions, and roles. To assess the extent of the declared and expected properties of individual team members (components in the system), twenty important competencies and abilities ( $C_1$ - $C_{20}$ ) were evaluated:

1. Communication and expression skills (referred to as communicativeness in figures).
2. Self-confidence, to be confident in oneself (referred to as self-confidence in figures).
3. Willingness to take responsibility for one's decisions and work done (taking responsibility).
4. Ability to lead and manage a team (leadership).
5. Ability to make decisions (decision-making).
6. Orientation to goals, to desired results, ability to change decisions and established procedures to achieve a goal (result orientation).
7. Ability to resolve conflicts (conflict resolution).
8. Creativity, inventiveness (creativity).
9. Approach to innovation and new technologies (innovation).
10. Ability to withstand loads, load capacity, resistance (load capacity).
11. Ability to work in a team, cooperativeness (teamwork).
12. Autonomy in solving tasks (independence).
13. Attitude towards learning, continuing education (continuing education).
14. Identification with the organization, the school, the company, its goals and strategy, patriotism (identification with the organization).
15. Orientation to the established procedure, to strict rules (orientation to progress).
16. Social competences, sensitivity towards people, empathy (empathy).
17. Ability to verify the factuality and correctness of results (verification).
18. Ability to persuade others (persuasion).
19. Activity, action orientation (activeness).
20. Ability to assert oneself (self-assertion).

Data for the evaluation of competencies were obtained from students in the final year of their study, just before graduation. A team of university graduates specializing in computer science education served as the research sample for the experimental study. The team members filled out evaluation forms, in which they rated their own competencies on a scale from 1 to 10 points. The ranking of 10 points is understood as a maximally developed specific competence.

Furthermore, they also anonymously expressed their personal opinions of the competencies of the other classmates in the class of final year students. Separately, an evaluation of all team members was prepared by the appointed team leader. The proposed methodology followed two basic views of the competencies of a team member (component of the system). The first view – is a view of each component of the system from the outside. It contains evaluation of each team member by the team leader, but also anonymous evaluation of everyone individual by other team members. Based on the evaluations of one component by all team members, a more objective average rating was compiled. This average rating can show a so-called systems view of a given component. The team leader evaluates individual team members based on his/her observations and information about them, their work results, their performance indicators and their operation in the team. At the same time, team members evaluate their colleagues based on the experience and observations from joint work, their own observations, but also other interaction in the team. The second view – is a view of the component of the system from the inside. It is represented by self-evaluation of each person in the team. It shows each team member's vision of their own competencies. This methodology can also be used, after minor modifications, for the assessment of teams of teachers, teams of employees in companies or other organizations. An omnidirectional radar graph was selected to present the information output. It is recommended that the scope of competencies be examined, as a priority, in four main directions.

First direction: The prevailing direction of the graph to the right. It will identify team members who pull the team forward towards the goal, inspire it, lead it and put forward new visions.

Second direction: The prevailing upward direction of the graph. It will identify the components of the system that are open toward the outside, communicate with the environment, make the team visible, study information from the outside and bring the latest knowledge.

Third direction: The prevailing downward direction of the graph. It will identify the components that focus on the creation of real solutions, product creation, that consistently implement the team's activities necessary for the real fulfilment of the goal, perform product tests, simulations, prepare quality documents for decision-making and final approval.

Fourth direction: The prevailing direction of the graph to the left. It will identify the components that "hold back", ask opposing questions, oppose prepared designs, check the feasibility of the results, and consistently verify the quality of the final products.

The research was carried out in four stages. In the first stage, the main objective was to obtain the information about the team members and the most credible evaluations of the competences of the persons being a part of a certain team. In the second stage, the information was processed numerically. Two basic views of the properties of the selected components of the system, i.e., individual students in the team, were shown in the graphs. In the third stage, a comparison of counter-directional evaluations was carried out. A synthesis was carried out of the relevant conclusions about the consenting or dissenting views of individual of the team members, as well as the view of the entire team. In the last fourth stage, an evaluation of the overall competencies of the entire team was carried out.

### 3. Results

The results of the team's analysis, obtained from the evaluations of the team members, are recorded in the graphs. For demonstration, the results of one of the team members are presented. The first result of the experiment (Figure 1) shows a different view of the team leader of one (particular) person of the team compared to this person's own self-evaluation. It clearly points to those competencies and directions in which the evaluations do not coincide. In this way, the team leader's views were compared with the self-evaluation by all team members.

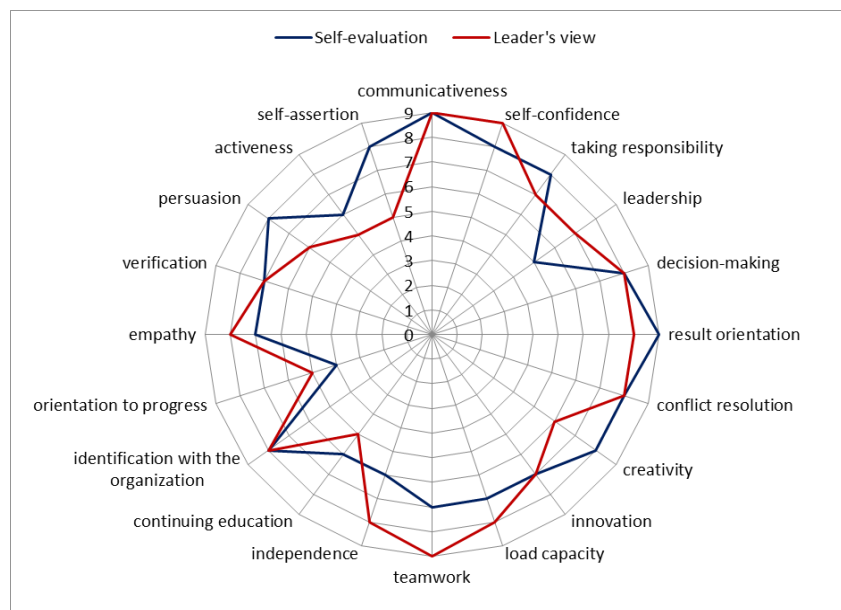


Figure 1. Comparison of the team leader's view with a view of specific team member

Such a result can be used by the team leader to compare and possibly correct the evaluation of specific members of the team. At the same time, it can also serve the evaluated team member as feedback and an incentive for their own development. The result shows a divergence of views. The difference observed can be used to make the evaluation of the examined subject more objective. The team leader may consider a partial reassessment of the outside view, and the team member may carry out self-reflection.

The next output is a scale of evaluations of the entire team in relation to one specific member. The opinions of all team members regarding the competencies of each individual in the team were evaluated. The results indicated that each team member was perceived differently in terms of their properties and capabilities. An example of extremely different evaluations of the monitored person is shown in Figure 2.

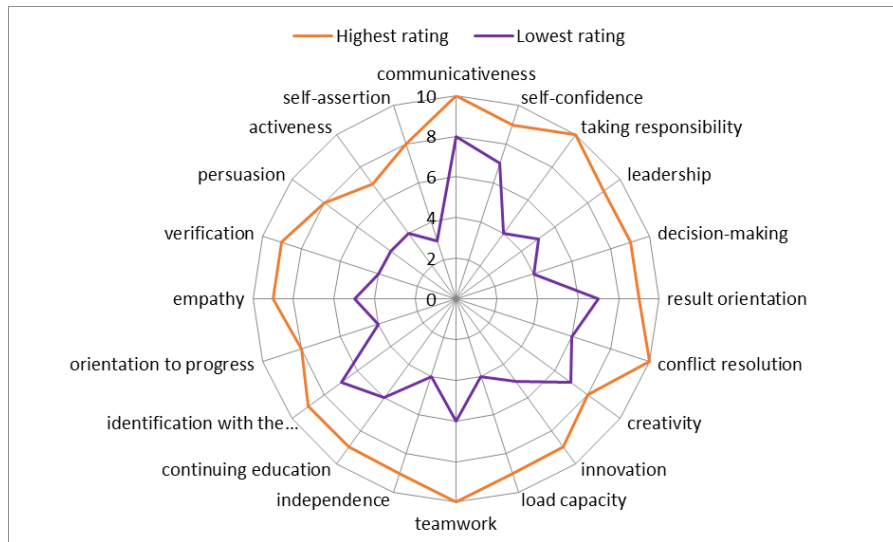


Figure 2. Demonstration of extremely different evaluations

The other evaluations showed a partial concurrence of individual evaluations of team members, but also a certain difference. Such highlights should be analyzed in more detail by the team leader. Extreme negative deviations can signal a disruption in the relationships within the team. Sometimes it can also show an unfavorable real situation, which is kept unsaid for various reasons. Larger positive deviations can signal better properties of a particular team member compared to his/her modest self-evaluation.

On the other hand, it can signal an uncritical evaluation by friends in the team, or superficiality in evaluation. In the third result (Figure 3), three views of one of the evaluated components are incorporated. In addition to the self-evaluation by the evaluated component (shown by the thin line) and the view by the team leader (the dashed line), a systems' view (shown by the thick line) is also added. The system view is expressed as the average of all evaluations of a particular component from the perspective of all external cooperating components in the system, i.e., the overall view of the team member from the outside.

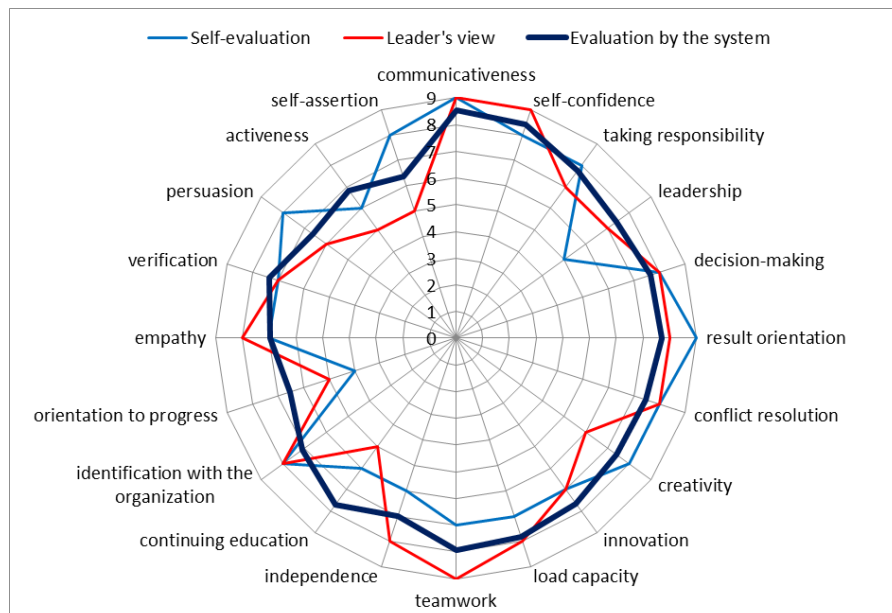


Figure 3. Comparison of the three main views of the component

This result (Figure 3) provides an even more comprehensive, so-called systems view of the selected competencies of a particular team member. From the above result, it is assumed that this team member will primarily bring the team together, support teamwork and encourage the team to achieve the goals of the entire team. The presented results (Figure 1, Figure 2 and Figure 3) allow to confront different views concerning a given team member. The ideal situation would be if the views were consenting.

Differences in the evaluation of a person's competencies between male and female team members were also statistically tested. A hypothesis test was used for verification. *Hypothesis H0: Men and women evaluate the competencies of the selected team member equally.* The gender of the evaluator does not affect the evaluation.

*Hypothesis H1: The gender of the evaluator has an impact on the final evaluation.*

Using the t-test, a dataset (Table 1) consisting of the evaluation of 17 team members was tested.

Table 1. The data set for the assessment of the observed individual

|                 | M <sub>1</sub> | M <sub>2</sub> | M <sub>3</sub> | M <sub>4</sub> | M <sub>5</sub> | M <sub>6</sub> | M <sub>7</sub> | M <sub>8</sub> | M <sub>9</sub> | W <sub>1</sub> | W <sub>2</sub> | W <sub>3</sub> | W <sub>4</sub> | W <sub>5</sub> | W <sub>6</sub> | W <sub>7</sub> | W <sub>8</sub> |
|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| C <sub>1</sub>  | 8              | 8              | 9              | 9              | 10             | 8              | 7              | 9              | 10             | 9              | 9              | 9              | 8              | 8              | 8              | 8              | 8              |
| C <sub>2</sub>  | 7              | 7              | 8              | 7              | 8              | 9              | 10             | 9              | 9              | 9              | 9              | 9              | 7              | 7              | 8              | 10             | 9              |
| C <sub>3</sub>  | 7              | 6              | 8              | 7              | 10             | 7              | 9              | 9              | 10             | 8              | 8              | 8              | 4              | 4              | 8              | 9              | 10             |
| C <sub>4</sub>  | 4              | 5              | 7              | 7              | 10             | 8              | 8              | 9              | 9              | 9              | 9              | 8              | 5              | 5              | 8              | 8              | 7              |
| C <sub>5</sub>  | 7              | 7              | 8              | 8              | 8              | 7              | 9              | 9              | 9              | 8              | 8              | 7              | 4              | 4              | 10             | 9              | 7              |
| C <sub>6</sub>  | 8              | 9              | 9              | 8              | 7              | 7              | 7              | 8              | 9              | 9              | 9              | 8              | 7              | 8              | 8              | 7              | 4              |
| C <sub>7</sub>  | 7              | 8              | 8              | 9              | 7              | 7              | 7              | 7              | 10             | 9              | 9              | 7              | 6              | 6              | 7              | 7              | 6              |
| C <sub>8</sub>  | 6              | 7              | 8              | 7              | 8              | 8              | 8              | 7              | 8              | 7              | 7              | 8              | 7              | 8              | 9              | 8              | 5              |
| C <sub>9</sub>  | 6              | 7              | 7              | 6              | 6              | 8              | 10             | 8              | 9              | 7              | 7              | 8              | 5              | 5              | 10             | 10             | 10             |
| C <sub>10</sub> | 7              | 5              | 8              | 9              | 6              | 8              | 10             | 9              | 9              | 8              | 8              | 8              | 4              | 4              | 10             | 10             | 9              |
| C <sub>11</sub> | 8              | 8              | 8              | 9              | 9              | 7              | 8              | 7              | 10             | 9              | 9              | 8              | 6              | 6              | 6              | 8              | 8              |
| C <sub>12</sub> | 5              | 5              | 8              | 8              | 7              | 8              | 8              | 9              | 9              | 7              | 7              | 8              | 4              | 4              | 6              | 8              | 7              |
| C <sub>13</sub> | 6              | 6              | 6              | 4              | 10             | 9              | 9              | 9              | 9              | 7              | 7              | 8              | 6              | 6              | 10             | 9              | 10             |
| C <sub>14</sub> | 8              | 7              | 8              | 8              | 8              | 9              | 6              | 8              | 9              | 6              | 6              | 7              | 7              | 8              | 7              | 5              | 5              |
| C <sub>15</sub> | 5              | 5              | 6              | 6              | 8              | 7              | 8              | 8              | 8              | 3              | 3              | 8              | 4              | 4              | 10             | 9              | 9              |
| C <sub>16</sub> | 8              | 7              | 7              | 7              | 8              | 9              | 6              | 8              | 9              | 6              | 6              | 8              | 5              | 6              | 6              | 6              | 7              |
| C <sub>17</sub> | 8              | 7              | 7              | 7              | 7              | 7              | 9              | 7              | 9              | 8              | 8              | 7              | 4              | 4              | 8              | 9              | 8              |
| C <sub>18</sub> | 8              | 6              | 8              | 7              | 5              | 7              | 6              | 8              | 8              | 8              | 8              | 8              | 4              | 5              | 7              | 5              | 5              |
| C <sub>19</sub> | 6              | 6              | 8              | 7              | 8              | 7              | 8              | 7              | 7              | 7              | 7              | 7              | 4              | 4              | 6              | 8              | 8              |
| C <sub>20</sub> | 8              | 5              | 7              | 6              | 4              | 7              | 8              | 6              | 8              | 7              | 7              | 7              | 3              | 4              | 8              | 8              | 7              |

Of these, 8 elements were in the female category (W<sub>1</sub>-W<sub>8</sub>) and 9 elements were in the male category (M<sub>1</sub>-M<sub>9</sub>). At the level of 0.05, the following results were obtained (Table 2).

Table 2. The output of the t-test of two median values with equal variance

|            | Men / Women  |
|------------|--------------|
| F test     | Equal        |
| t Stat     | -2,539223675 |
| t krit (1) | 1,68595446   |
| t krit (2) | 2,024394164  |

The hypothesis H0 was rejected. The evaluation in the male subsystem is not statistically identical to the evaluation in the female subsystem.

The last stage of the experiment is to compile an overall view of the team (Figure 4). The overall view of the team was obtained as the average of the competence ratings of all team members.

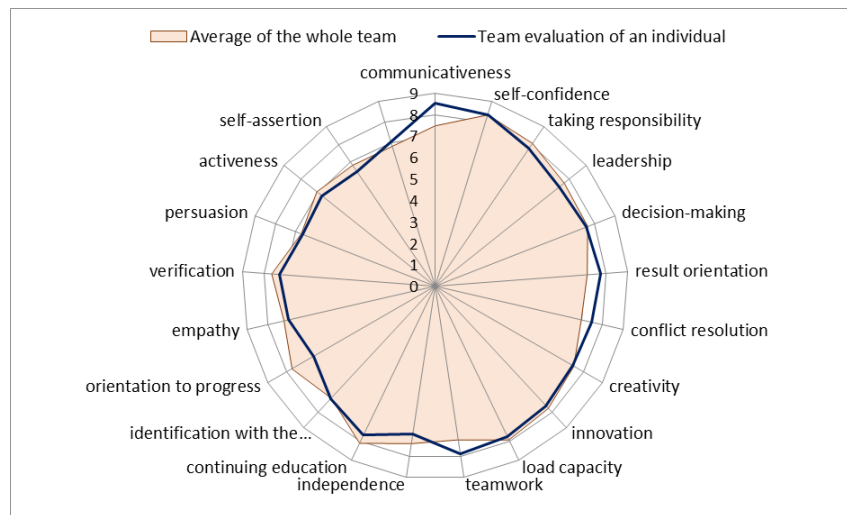


Figure 4. Average of the competencies of the whole team compared to the selected member

That is, the average of all outputs of the experiment, like the output of the evaluation of one team member. The result can be expressed as an overall radar graph for the whole team. Such an output can clearly show the strengths and weaknesses of the whole. It can also be compared with the above-mentioned competencies of the selected individual (Figure 4). This result also suggests that the selected team member could be used as a communicative motivator of the given team. It can be assumed that she/he will focus on achieving results, meeting the goals of the team, the goals for which the team was created.

#### 4. Discussion

As shown in Figure 1, in principle, it is a comparison and possible correction of the views from the outside and from the inside. Acceptance of the result of the comparison is a form of support for a better understanding of the actions, attitudes, opinions and sometimes even feelings of the evaluated component of the team. For example, the ability to lead parameter shows that the expectations of the team leader in this area are eliminated by the lower self-evaluation of a particular team member. The result in Figure 3 could even be supplemented by another view, a third view from the outside. It can be the evaluation of a component of the team by a team member whom the team leader considers to be very objective. This evaluation could show some shift in the direction of the competencies of the evaluated team member.

It can be used to complement and eliminate the influence of the average evaluation by the team members. From the results presented above, a lot of important information emerged for both the team leader and the team members. For an individual team member, it is a relatively objective systems view of his/her competencies.

It provides feedback from the team. For the team leader, it is primarily the information about where there is a need to implement measures to improve. The presented methodology, procedures and results of the experiment obtained can also be used to compare several teams. Output graphs, like Figure 4, can present a kind of “team maps” that would show areas where the competencies of the compared teams are more or less developed. They can show where the strengths and weaknesses of the compared teams are. The outputs of such evaluations can be used in companies to compare several teams of employees. In the field of education, they can be used to compare several classes of the same grade in the school. In sports teams, when evaluating sports competencies, it can be an evaluation of the home team, but also an estimate of the rival team.

In the next period, it is possible to expand the presented research with further analyses. It can be based on the evaluation of the team of sustainability published in [27] but extended by the evaluation using Artificial Intelligence (AI). It is also possible to modify the principles of the classification model using a neural network [28]. It can also apply hero analyses, as implemented by [29], but also the use of Artificial Intelligence in the analyses of team performance, team management and teamwork improvement [30].

## 5. Conclusion

The article shows some new possibilities for the practical application of assessing individual competencies in professionally oriented teams. The primary task was to evaluate the potential of an innovative approach for a more comprehensive assessment of the competencies of university graduates prepared for professional practice. An innovative combined competency assessment approach was proposed and empirically tested, integrating the individual's self-assessment, the aggregated assessment provided by all team members, and the assessment conducted by the team leader. A similar approach can also be applied to the evaluation of employees' competencies in various sectors. These can be teams of employees, managers, but also teachers or students. The results proved the possibility of identifying certain similarities, but also differences, in the perception of competencies among individual team members. The issue may stem from differences in evaluation among certain team members. At the same time, however, these differences can provide valuable insights into potential problems within the team or highlight the lack of objectivity in some assessments.

At the same time, the results indicate the possibility of identifying those areas and competencies in which it is necessary to analyze and address substantial differences more deeply. The resulting charts identify the competencies that need to be enhanced within the team. In addition, the results outlined the possibility of identifying team members who may be suitable for specific key roles within the team. For example, the presented results demonstrated the identification of a communicator and a motivator within the team. Subsequent experimental studies could focus on verifying the sustainability of teams over longer time horizons, examining the practical applicability of classification models in real-world settings, as well as exploring the growing potential of artificial intelligence techniques in comprehensive team performance analysis. Such research can contribute to a deeper understanding of team dynamics, predictive factors of performance, and decision-making processes.

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