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Combination of MEREC and WASPAS Methods for Performance Assessment in the Decision Support System for Member Admission for the Metaverse Team

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Abstract

The selection of the right team members is critical to the success of complex and multidisciplinary Metaverse projects, the previous method used in this selection employed criteria weights based on individual evaluator assessments.. This study proposes the application of a combination of MEREC (method based on the removal effects of criteria) and WASPAS (weighted aggregated sum product assessment) methods to build a DSS in the selection of Metaverse team members. The MEREC method is used to determine the weight of relevant criteria, such as technical skills, communication, innovation, problem-solving, team collaboration, and experience. Meanwhile, the WASPAS method is used to rank candidates based on evaluation scores calculated using a combination of the Weighted Sum Model (WSM) and the Weighted Product Model (WPM). The results showed that the candidate with the highest score was Member Candidate 5 with a score of 0.9806, followed by Member Candidate 11 with a score of 0.944 and Member Candidate 9 with a score of 0.9433. This research proves that the combination of MEREC and WASPAS methods can be used effectively to select team members who have the best quality and are in accordance with the needs of Metaverse projects. A major contribution of this research is the development of a more objective and structured method for the selection of team members in technology projects that require multidisciplinary expertise.

Keywords: Metaverse; Decision Support System; MEREC; WASPAS; Performance Evaluation

1. INTRODUCTION

The development of digital technology in recent years has experienced very rapid progress, encouraging the emergence of various new innovations in various sectors of life. One of the revolutionary concepts that is now in the spotlight is the Metaverse, which is an interactive virtual environment that allows users to interact, work, and create in a three-dimensional space that resembles the real world[1], [2]. This concept combines various technologies such as virtual reality (VR), augmented reality (AR), internet of things (IoT), and artificial intelligence (AI), which together create a new immersive and dynamic digital ecosystem. In developing and managing Metaverse projects, a work team is needed that not only has technical expertise, but is also able to collaborate creatively and adaptively to technological changes. The success of a Metaverse project relies heavily on synergy between team members, from software developers, 3D designers, to system analysts and project managers. Therefore, the formation of a competent and targeted team is a crucial step to ensure that the project can be executed effectively and efficiently. Nevertheless, the process of selecting team members for Metaverse projects is not a simple task. The main challenge lies in the complexity of the criteria to consider, which include qualitative aspects such as technical skills, communication, innovation, problem solving, teamwork, and experience. Decision-making that relies only on intuition or subjectivity can cause inaccuracies in selection. Therefore, a comprehensive and objective evaluation approach is needed to assess the performance of prospective team members based on various relevant criteria.

The decision-making process in the selection of team members, especially for complex projects such as the development of the Metaverse, presents its own challenges because it involves many interrelated factors. The selection of the right candidate must consider a wide range of criteria, ranging from technical abilities to personality characteristics, each of which has a different level of importance[3], [4]. Improper decisions can have a direct impact on team performance and the overall success of the project. Therefore, a system is needed that is able to assist decision-makers in evaluating candidates in a more structured and objective manner. Decision support system (DSS) is a relevant and needed solution. DSS allows the evaluation process to be carried out systematically by utilizing available data and information to produce rational recommendations[5]–[8]. With the help of DSS, decision-making is no longer based solely on intuition or subjective judgment, but rather through the analysis of measurable and accountable criteria. This is crucial in ensuring that each candidate is assessed fairly based on their competence and potential contribution to the team. To realize an effective DSS, an evaluation method is needed that is able to accommodate different types of criteria with different levels of importance[9]–[11]. Each criterion should have a weight that reflects its influence on the overall purpose of the selection. Therefore, an approach that can objectively determine weights and incorporate performance evaluation results from multiple points of view is essential. The combination of methods in DSS is one way to achieve this optimally.

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One approach that can be used in the development of DSS for team member selection is to utilize methods in multi-criteria decision making (MCDM)[12], [13]. The method based on the removal effects of criteria (MEREC) is one of the objective techniques in determining the weight of criteria. MEREC works by analyzing the effect of the elimination of each criterion on the overall evaluation results[14]–[16]. In this way, the weight of each criterion is calculated based on its impact on the accuracy of the decision, resulting in a weighting that truly reflects the importance of each criterion objectively and free from the subjective bias of the decision-maker. Meanwhile, the weighted aggregated sum product assessment (WASPAS) method is an MCDM method used to assess alternatives based on certain criteria[13], [17], [18]. WASPAS is a combination of two basic methods, namely the weighted sum model (WSM) and the weighted product model (WPM). WSM calculates the total score of the alternative by adding the value of each criterion multiplied by its weight, while WPM calculates the score by multiplying the value of the criteria in the form of a rank of its weight. The combination of these two approaches in WASPAS provides more stable and accurate results because it takes advantage of the advantages of each basic method[19], [20]. By combining the MEREC and WASPAS methods, the decision-making process in SPK becomes stronger and more comprehensive. MEREC ensures that the weight of criteria is objectively determined based on data, not perception. Meanwhile, WASPAS allows alternative evaluations to be carried out comprehensively by considering both additive and multiplicative contributions of each criterion. This combination is particularly appropriate for the context of multi-criteria performance evaluation in the selection of Metaverse team members, as it is able to capture the complexity of assessments and provide reliable and transparent results.

Research related to the selection of member admissions was conducted by Tambunan (2023) using the profile matching method in the selection of Paskibraka members, which allows for the process of comparing or matching the target profile and the individual profile, resulting in the differences in their competencies[21]. Research conducted by Rahmawati (2023) used the profile matching method in the selection process for admitting members of the information systems student association to determine the final results and rankings to facilitate evaluators in assessing prospective members[22]. The research conducted by Jaka (2022) used the SAW method for selecting quality candidates from the membership acceptance results in the Muhammadiyah Student Association and to expedite the selection of new member candidates and the selection committee in making decisions about new members[23]. The gap between this research and previous studies is the combination of MEREC and WASPAS to produce a member selection system that is more objective, accurate, and adaptive compared to conventional approaches such as profile matching and SAW. This gap serves as a strong foundation for the development of a superior and comprehensive MCDM-based organizational member selection method.

This research aims to apply a DSS that utilizes a combination of MEREC and WASPAS methods in the performance assessment process of prospective team members in the Metaverse project. With this approach, the system built is expected to be able to evaluate each candidate objectively based on various relevant criteria, as well as produce a final ranking that reflects the level of eligibility of each candidate as a whole. This combined approach not only improves accuracy and transparency in decision-making, but also provides a methodologically strong foundation in the context of selecting the right human resources. Scientifically, this research contributes to the development of hybrid models in the realm of multi-criteria decision-making, in particular by integrating objective methods and more adaptive evaluation aggregation. From a practical perspective, the developed system can be used as a tool in the recruitment process of immersive technology projects such as the Metaverse, where the need for cross-disciplinary collaboration and decision-making speed are crucial. Thus, this research is expected to be able to answer the challenge of team selection more efficiently and data-based, as well as open up opportunities for the application of similar methods in various other fields.

2. RESEARCH METHODOLOGY

2.1 Research Framework

A research framework is a conceptual structure that explains the relationship between variables studied in a research. This framework serves as a guide in compiling the research flow, starting from problem identification, objectives, to data analysis. With the research framework, the research implementation process becomes more systematic, directed, and easy to understand, both as shown in Figure 1.

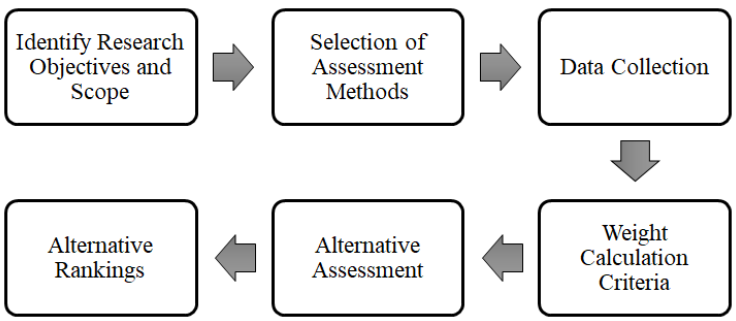

Figure 1. Research Framework

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This research began with the identification of the objectives and scope of the research, where the main goal was to develop a DSS that could help in objectively assessing the performance of prospective Metaverse team members. The scope of the research includes the determination of relevant assessment criteria, such as technical skills, communication, innovation, problem solving, teamwork, and experience, which will be used to assess each prospective team member. After that, the next step is the selection of an assessment method, where in this study, a combination of MEREC and WASPAS methods is used. MEREC will be used for the determination of the weights of the criteria, while WASPAS will be used to combine the values obtained from each criterion by considering the weights of each of those criteria. At the data collection stage, assessment data is collected from various evaluators who have knowledge or experience related to prospective team members. This data is in the form of a score or score given for each predetermined criterion, and will be used to comprehensively analyze the performance of prospective team members. Furthermore, the weight of the criteria was calculated using the MEREC method. In this stage, the weight of each criterion is calculated based on the judgment given by the evaluators. This weight illustrates the importance of each criterion in the overall evaluation, which will be used to make a distinct contribution to the final value of a prospective team member. Once the weight of the criteria is determined, the next stage is an alternative assessment, where each prospective team member will be assessed based on predetermined criteria. The values of each alternative will be normalized to ensure that comparisons between criteria can be made on a uniform scale. Finally, the alternative ranking stage was carried out using the WASPAS method to calculate the aggregate score of each prospective team member. Based on the scores obtained, the alternative with the highest score will be prioritized as the most viable candidate to be accepted into the Metaverse team. The results of this ranking are then used as a basis for making the final decision about who will be accepted as a team member.

2.2 MEREC Method

Method based on the removal effects of criteria (MEREC) is a decision-making method used to evaluate and rank alternatives based on the effect of certain criteria removal. This method is very useful for understanding how the omission of a criterion can affect existing alternative rankings. MEREC helps in identifying how important each criterion is in the decision-making process, as well as measuring its influence on the final decision outcome.
The decision matrix is the first stage in MEREC as an initial representation of the assessment of alternatives based on predetermined criteria. This matrix describes the value assigned to each alternative on each relevant criterion.

$$X = \begin{bmatrix} x_{11} & \cdots & x_{m1} \\ \vdots & \ddots & \vdots \\ x_{1n} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

Normalization is the second stage in MEREC to convert the values in the decision matrix into the same scale so that they can be directly compared.

$$n_{ij} = \begin{cases} \frac{\min x_{kj}}{x_{ij}} & (for\ benefical\ criteria) \\ \frac{x_{ij}}{\max x_{kj}} (for\ non-benefical\ criteria) \end{cases} \quad (2)$$

The overall value of the criteria is the third stage in MEREC to calculate the overall value of the criteria from all alternatives.

$$S_i = \ln\left(1 + \left(\frac{1}{m}\sum\left|\ln\left(n_{ij}\right)\right|\right)\right) \quad (3)$$

The overall value of the criteria with deletion is the fourth stage in MEREC to calculate the overall value of the criteria from all alternatives by considering the effect of the deletion criteria.

$$S'_{ij} = \ln\left(1 + \left(\frac{1}{m}\sum_{k,k\neq j}\left|\ln\left(n_{ij}\right)\right|\right)\right) \quad (4)$$

The overall value of the criteria after the removal is the fifth step of the MEREC to find out how much the overall value of the alternative has changed after the removal of a particular criterion.

$$E_j = \sum\left|S'_{ij} - S_i\right| \quad (5)$$

The weight of criteria is the sixth step of MEREC used to calculate and show the importance of each criterion in the decision-making process.

$$w_j = \frac{E_j}{\sum_k E_k} \quad (6)$$

By following these stages, MEREC makes it possible to analyze the impact of the elimination of each criterion, and helps in producing a more robust and objective weight of criteria.

2.3 WASPAS Method

The Weighted Aggregated Sum Product Assessment (WASPAS) method is a method in multi-criteria decision-making (MCDM) that is used to evaluate and rank alternatives based on a number of criteria. This method combines two value

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aggregation techniques, weighted addition and weighted multiplication, to provide a more accurate and balanced ranking between the two approaches. By combining both weighted approaches (addition and multiplication), WASPAS provides a more comprehensive and stable solution in decision-making that involves many criteria.

The Decision Matrix is the first stage in WASPAS where the decision matrix contains the value or assessment of the alternatives to each criterion is made using (1).

Decision Matrix Normalization is the second stage in WASPAS where the normalization of the decision matrix is to convert all values into the same scale, so that they can be compared fairly. This normalization can be done using a maximum scale (for higher criteria is better) or a minimum scale (for lower criteria is better).

$$x_{ij} = \frac{x_{ij}}{\max x_i} \tag{7}$$

$$x_{ij} = \frac{\min x_i}{x_{ij}} \tag{8}$$

The value of alternative optimization is the third stage in WASPAS obtained based on the results of the two approaches (weighted addition and weighted multiplication) combined to produce the final value of each alternative. Typically, this incorporation is done by calculating averages or giving weight to each approach.

$$Q_i = \left(0.5 * \sum_{J=1}^{N} (x_{ij} * W_j)\right) + \left(0.5 * \prod_{J=1}^{N} (x_{ij} * W_j)\right) \tag{9}$$

The WASPAS method offers a balance between the addition and weighted multiplication approaches, resulting in a more accurate evaluation of alternatives. This approach is flexible and can be applied to different types of problems with different criteria. Additionally, the method is relatively simple and easy to implement, making it an efficient option in multi-criteria decision-making.

3. RESULT AND DISCUSSION

The application of the MEREC and WASPAS methods in the decision support system for the assessment of team member performance in the metaverse, the results obtained show the effectiveness of the combination of the two methods in providing an objective and thorough rating. The process of normalizing the decision matrix and applying the weighting of criteria is carefully carried out to ensure that each assessment factor contributes according to its level of importance. The results of the initial evaluation showed that the best performing alternatives were ranked highest, but more importantly was the effect of the elimination of each criterion in the ranking. Through the analysis of the effect of removing criteria using MEREC, important information was obtained about the criteria that had the most influence on the final decision, which provided insight for team managers to focus more on critical aspects of team member selection.

The results of the WASPAS method show an effective incorporation between the weighted addition and weighted multiplication approaches, which provides a more balanced result in ranking alternatives. This method is able to balance the strengths of the two approaches to produce more robust decisions in multi-criteria situations. A comparative analysis of the results of WASPAS and MEREC provides evidence that the combination of these two methods can improve accuracy in selecting the team members who best suit the needs of the project in the metaverse. Overall, this study confirms that the merger of MEREC and WASPAS can be used to create a more accurate, adaptive, and effective decision support system, especially in the context of selecting team members based on dynamic and diverse criteria.

This research makes an important contribution in a more effective DSS for the assessment of team members' performance in the metaverse. By combining the MEREC and WASPAS methods, the study offers a novel approach that not only takes into account the overall value of the alternative, but also evaluates the impact of each criterion on the final decision through an analysis of the effects of the elimination of the criteria. This allows decision-makers to gain deeper insights into the important role each criterion plays in influencing alternative rankings, which can improve objectivity and accuracy in team member selection. Another contribution is the use of the combination of MEREC and WASPAS to handle complex problems in the selection of team members with diverse and interrelated criteria, as well as providing an applicative and adaptive framework to be applied in the virtual world or metaverse. Thus, this study enriches the literature in the field of multi-criteria decision-making and opens up the potential for the application of this method in a variety of other contexts that require complex criteria-based evaluation.

3.1 Data Collection

In the process of collecting data for the admission of metaverse team members, data is collected through a series of systematic stages to ensure that the selection is objective and transparent. The first step involves the preparation of evaluation criteria which include technical skills, communication skills, innovation, problem-solving and team collaboration. Furthermore, prospective members are asked to fill out a registration form that includes biodata, project portfolio, and answers to case study-based questions. In addition, an interview session was conducted to explore aspects of each candidate's personality, communication skills, and problem-solving abilities. The assessment data from prospective metaverse team members is shown in Table 1.

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Table 1. The assessment data

Candidate Name	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
Member Candidate 1	9	7	8	9	8	7
Member Candidate 2	8	8	7	8	9	8
Member Candidate 3	7	6	8	7	7	6
Member Candidate 4	6	7	6	6	8	5
Member Candidate 5	9	9	9	8	9	9
Member Candidate 6	8	7	7	9	7	8
Member Candidate 7	7	8	6	7	8	7
Member Candidate 8	6	6	7	6	7	5
Member Candidate 9	8	9	8	8	9	9
Member Candidates 10	7	7	7	7	7	6
Member Candidate 11	9	8	9	9	8	8

The assessment data that has been collected will be used as the basis for the selection process of the Metaverse Team members, where each candidate is assessed by one evaluator on a scale of 1-9 for each of the existing criteria. This data can also be processed using DSS methods to obtain a more accurate and systematic ranking of candidates.

3.2 Weight Calculation Criteria

In this study, the calculation of the weight of the criteria was carried out using the MEREC method. MEREC is an objective approach to determining the weight of criteria by measuring how much the deletion of each criterion affects the stability of the decision. The first step in MEREC is to calculate the initial value of alternative performance against all available criteria. Then, each criterion is removed one by one, and the change in the alternative performance value without the criteria is calculated. The difference that occurs is measured for each criterion, and the greater the change caused by the removal of a criterion, the more important the criterion is, so the higher the weight. In this way, MEREC ensures that the weight of criteria reflects the level of their contribution to the quality of decision-making, without relying on the subjectivity of the assessor. This process results in a fair and data-driven weighting of criteria, which is then used in the selection stage of Metaverse Team members.
The decision matrix is the first stage in MEREC as an initial representation of alternative assessments based on predetermined criteria. This matrix describes the value assigned to each alternative on each relevant criterion created using (1).

$$X = \begin{bmatrix} 9 & 7 & 8 & 9 & 8 & 7 \\ 8 & 8 & 7 & 8 & 9 & 8 \\ 7 & 6 & 8 & 7 & 7 & 6 \\ 6 & 7 & 6 & 6 & 8 & 5 \\ 9 & 9 & 9 & 8 & 9 & 9 \\ 8 & 7 & 7 & 9 & 7 & 8 \\ 7 & 8 & 6 & 7 & 8 & 7 \\ 6 & 6 & 7 & 6 & 7 & 5 \\ 8 & 9 & 8 & 8 & 9 & 9 \\ 7 & 7 & 7 & 7 & 7 & 6 \\ 9 & 8 & 9 & 9 & 8 & 8 \end{bmatrix}$$

Normalization is the second stage in MEREC to convert the values in the decision matrix into the same scale so that they can be directly compared calculated using (2).

$$n_{11} = \frac{x_{11}}{\max x_{11,111}} = \frac{9}{9} = 1$$

The total normalization values in the MEREC method that have been calculated from each alternative based on the existing criteria are shown in Table 2.

Table 2. Normalization MEREC

Candidate Name	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
Member Candidate 1	1.0000	0.7778	0.8889	1.0000	0.8889	0.7778
Member Candidate 2	0.8889	0.8889	0.7778	0.8889	1.0000	0.8889
Member Candidate 3	0.7778	0.6667	0.8889	0.7778	0.7778	0.6667
Member Candidate 4	0.6667	0.7778	0.6667	0.6667	0.8889	0.5556
Member Candidate 5	1.0000	1.0000	1.0000	0.8889	1.0000	1.0000
Member Candidate 6	0.8889	0.7778	0.7778	1.0000	0.7778	0.8889

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Candidate Name	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
Member Candidate 7	0.7778	0.8889	0.6667	0.7778	0.8889	0.7778
Member Candidate 8	0.6667	0.6667	0.7778	0.6667	0.7778	0.5556
Member Candidate 9	0.8889	1.0000	0.8889	0.8889	1.0000	1.0000
Member Candidates 10	0.7778	0.7778	0.7778	0.7778	0.7778	0.6667
Member Candidate 11	1.0000	0.8889	1.0000	1.0000	0.8889	0.8889

The overall value of the criteria is the third stage in MEREC to calculate the overall value of the criteria of all alternatives calculated using (3).

$$S_1 = \ln\left(1 + \left(\frac{1}{6}\sum\left|\ln\left(n_{11,61}\right)\right|\right)\right) = \ln(1 + (\frac{1}{6} * 0.7382)) = \ln(1.1230)) = 0.1160$$

The total value of the alternatives that have been calculated from each alternative based on the existing criteria is shown in Table 3.

Table 3. The total value of the alternatives MEREC

Candidate Name	S_i
Member Candidate 1	0.1160
Member Candidate 2	0.1137
Member Candidate 3	0.2472
Member Candidate 4	0.3091
Member Candidate 5	0.0194
Member Candidate 6	0.1527
Member Candidate 7	0.2090
Member Candidate 8	0.3253
Member Candidate 9	0.0572
Member Candidates 10	0.2445
Member Candidate 11	0.0572

The overall value of the criteria with removal is the fourth stage in the MEREC to calculate the overall value of the criteria of all alternatives taking into account the effect of the removal criteria calculated using (5), the overall results are shown in Table 4.

Table 4. The overall value of the criteria with removal MEREC

Candidate Name	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
Member Candidate 1	0.1160	0.0780	0.0984	0.1160	0.0984	0.0780
Member Candidate 2	0.0960	0.0960	0.0756	0.0960	0.1137	0.0960
Member Candidate 3	0.2139	0.1930	0.2318	0.2139	0.2139	0.1930
Member Candidate 4	0.2582	0.2779	0.2582	0.2582	0.2946	0.2345
Member Candidate 5	0.0194	0.0194	0.0194	0.0000	0.0194	0.0194
Member Candidate 6	0.1357	0.1160	0.1160	0.1527	0.1160	0.1357
Member Candidate 7	0.1745	0.1930	0.1527	0.1745	0.1930	0.1745
Member Candidate 8	0.2753	0.2753	0.2946	0.2753	0.2946	0.2519
Member Candidate 9	0.0385	0.0572	0.0385	0.0385	0.0572	0.0572
Member Candidates 10	0.2112	0.2112	0.2112	0.2112	0.2112	0.1901
Member Candidate 11	0.0572	0.0385	0.0572	0.0572	0.0385	0.0385

The overall value of the criteria after removal is the fifth step of MEREC to find out how much the overall value of the alternative has changed after the removal of a particular criterion is calculated using (5).

$$E_j = \sum\left|S'_{11,111} - S_1\right| = 0.8255$$

The overall value of the criteria after removal of the criteira that have been calculated from each alternative based on the existing criteria is shown in Table 5.

Table 5. The total value of the alternatives MEREC

	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
E_j	0.8255	0.8611	0.8592	0.8619	0.8800	0.7744

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The weight of criteria is the sixth step of MEREC used to calculate and show the importance of each criterion in the decision-making process is calculated using (6).

$$w_1 = \frac{E_1}{\sum_k E_{1,6}} = \frac{0.8255}{0.8255 + 0.8611 + 0.8592 + 0.8619 + 0.8800 + 0.7744} = \frac{0.8255}{5.0622} = 0.1631$$

The total value of the weighted criteria that has been calculated from all the criteria in the MEREC method is shown in Table 6.

Table 6. The total value of the alternatives MEREC

	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
w_j	0.1631	0.1701	0.1697	0.1703	0.1738	0.1530

The results of the calculation using the MEREC method, the weight of each criterion was obtained, namely Technical Skills has a weight of 0.1631, showing that technical skills play an important role but are not dominant in absolute terms compared to other criteria. Communication Skills has a weight of 0.1701, reflecting the importance of the ability to communicate effectively in collaborative and cross-disciplinary Metaverse teamwork. Innovation gained a weight of 0.1697, indicating that creativity and the ability to create new solutions are crucial factors in the development of a dynamic virtual world. Problem Solving got the second highest weight of 0.1703, showing that the ability to solve problems quickly and effectively is needed in facing technical challenges in Metaverse projects. Team Collaboration occupies the highest weighted position at 0.1738, confirming that team collaboration is the main foundation in building a complex Metaverse ecosystem. Meanwhile, Knowledge has a weight of 0.1530, slightly lower than other criteria, but still important as a supporting indicator of the candidate's technical abilities and practical contributions. Overall, this weight reflects the balance between technical expertise, innovation, communication, problem-solving skills, teamwork, and knowledge as determining factors in choosing Metaverse team members.

3.3 Alternative Assessment

In the selection of Metaverse team members, the WASPAS method is used to determine the best candidates based on various predetermined criteria. The process begins with the assessment of candidates using criteria such as Technical Skills, Communication Skills, Innovation, Problem Solving, Team Collaboration, and Experience. Each criterion is given a weight that reflects the importance of those criteria in the success of the Metaverse project. Furthermore, the assessment for each candidate is normalized so that it can be objectively compared, regardless of the scale or unit used in the assessment.

The Decision Matrix is the first stage in WASPAS where the decision matrix contains the value or assessment of the alternatives to each criterion is made using (1).

$$X = \begin{bmatrix} 9 & 7 & 8 & 9 & 8 & 7 \\ 8 & 8 & 7 & 8 & 9 & 8 \\ 7 & 6 & 8 & 7 & 7 & 6 \\ 6 & 7 & 6 & 6 & 8 & 5 \\ 9 & 9 & 9 & 8 & 9 & 9 \\ 8 & 7 & 7 & 9 & 7 & 8 \\ 7 & 8 & 6 & 7 & 8 & 7 \\ 6 & 6 & 7 & 6 & 7 & 5 \\ 8 & 9 & 8 & 8 & 9 & 9 \\ 7 & 7 & 7 & 7 & 7 & 6 \\ 9 & 8 & 9 & 9 & 8 & 8 \end{bmatrix}$$

Decision Matrix Normalization is the second stage in WASPAS, where decision matrix normalization is carried out by converting all values into the same scale calculated using (7).

$$x_{11} = \frac{x_{11}}{\max x_1} = \frac{9}{9} = 1$$

The total normalization values in the WASPAS method that have been calculated from each alternative based on the existing criteria are shown in Table 7.

Table 7. Normalization WASPAS

Candidate Name	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
Member Candidate 1	1.0000	0.7778	0.8889	1.0000	0.8889	0.7778
Member Candidate 2	0.8889	0.8889	0.7778	0.8889	1.0000	0.8889
Member Candidate 3	0.7778	0.6667	0.8889	0.7778	0.7778	0.6667

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Candidate Name	Technical Skills	Communication Skills	Innovation	Problem Solving	Team Collaboration	Knowledge
Member Candidate 4	0.6667	0.7778	0.6667	0.6667	0.8889	0.5556
Member Candidate 5	1.0000	1.0000	1.0000	0.8889	1.0000	1.0000
Member Candidate 6	0.8889	0.7778	0.7778	1.0000	0.7778	0.8889
Member Candidate 7	0.7778	0.8889	0.6667	0.7778	0.8889	0.7778
Member Candidate 8	0.6667	0.6667	0.7778	0.6667	0.7778	0.5556
Member Candidate 9	0.8889	1.0000	0.8889	0.8889	1.0000	1.0000
Member Candidates 10	0.7778	0.7778	0.7778	0.7778	0.7778	0.6667
Member Candidate 11	1.0000	0.8889	1.0000	1.0000	0.8889	0.8889

The alternative optimization value is the third stage in WASPAS which is obtained based on the results of both approaches (weighted addition and weighted multiplication) calculated using (9).

$$Q_1 = \left(0.5 * \sum_{J=1}^{N} (x_{11,61} * W_{1,6})\right) + \left(0.5 * \prod_{J=1}^{N} (x_{11,16} * W_{1,6})\right) = 0.4450 + 0.4427 = 0.8877$$

The alternative optimization value in the WASPAS method that have been calculated from each alternative based on the existing criteria are shown in Table 8.

Table 8. Optimization value WASPAS

Candidate Name	Q_i
Member Candidate 1	0.8877
Member Candidate 2	0.8881
Member Candidate 3	0.7588
Member Candidate 4	0.7034
Member Candidate 5	0.9806
Member Candidate 6	0.8488
Member Candidate 7	0.7952
Member Candidate 8	0.6857
Member Candidate 9	0.9433
Member Candidates 10	0.7602
Member Candidate 11	0.9440

The final result of the WASPAS method offers a balance between the addition and weighted multiplication approaches, resulting in a more accurate evaluation of alternatives. This approach is flexible and can be applied to different types of problems with different criteria.

3.4 Alternative Rankings

Alternative rankings are one of the important stages in the decision-making process, especially in issues that involve various competing criteria or factors. In many situations, decision-makers must choose the best alternative from a set of available options, taking into account a variety of relevant and sometimes conflicting criteria. This alternative ranking process aims to rank alternatives based on the extent to which they meet predetermined criteria. The results of this systematic selection not only ensure the quality of the selected team members, but also help build a balanced team with complementary skills, support common goals, and be able to face the complex challenges of creating and managing an innovative Metaverse virtual world. The results of the ranking of the metaverse team selection are shown in figure 2.

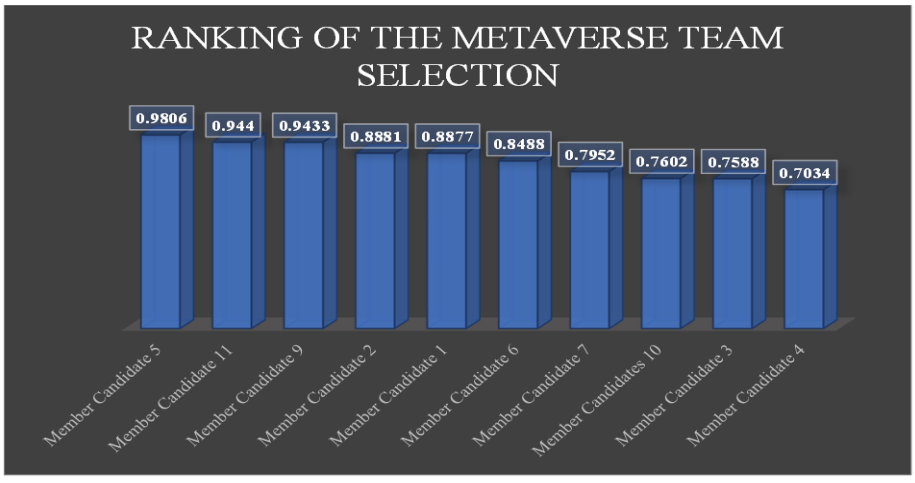

Figure 2. Ranking of the Metaverse Team Selection

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The results of the ranking of the selection of metaverse team members show the ranking of eleven candidates based on their respective evaluation scores. The candidate with the highest score is Member Candidate 5 with a score of 0.9806, which indicates the best performance in meeting the selection criteria that have been set. In the second and third positions in a row are Member Candidate 11 with a score of 0.944 and Member Candidate 9 with a score of 0.9433, both reflect very strong competence. Other candidates who also performed well, albeit with slightly lower scores, were Member Candidate 2 (0.8881), Member Candidate 1 (0.8877), and Member Candidate 6 (0.8488). Meanwhile, Member Candidate 7 (0.7952), Member Candidate 10 (0.7602), Member Candidate 3 (0.7588), and Member Candidate 4 (0.7034) were in the lower score group, which indicates that there is room for improvement in meeting the selection criteria. Overall, the score distribution shows a fairly pronounced disparity among candidates, reflecting variations in the level of ability and suitability for the metaverse team's needs. These findings can serve as an objective basis in the final decision-making process regarding the appointment of team members, as well as support transparency and accountability in the selection process.

3.5 Discussion

The results of this study indicate that the combination of the MEREC and WASPAS methods provides a more objective and accurate approach in the performance assessment process of prospective Metaverse team members. The MEREC method plays a crucial role in determining the weight of each criterion objectively based on its elimination impact on the final result, thereby reducing the potential subjectivity in weight determination that commonly occurs in manual or intuition-based approaches. Once the weights are determined, the WASPAS method is used to perform the aggregation calculation of preference values by combining the advantages of the weighted sum method (WSM) and the weighted product method (WPM), which can enhance the level of accuracy and consistency in ranking. The application of this combination not only speeds up the decision-making process in member selection but also increases the transparency and reliability of the decision support system. In addition, the ranking results produced reflect a more proportional assessment of each candidate based on the relative contribution of each criterion. This finding indicates that the combined MEREC-WASPAS approach has great potential to be widely applied in multi-criteria based selection scenarios, especially in the context of teams that require members with balanced and measurable capabilities, such as in Metaverse teams.

The combination of MEREC and WASPAS is also capable of overcoming the limitations of previous methods that relied solely on subjective or singular approaches, such as profile matching and SAW. In the context of selecting Metaverse team members who demand multidisciplinary skills and adaptability to immersive technology, an approach that objectively considers the weight of criteria becomes very crucial. The evaluation process produced by this system not only considers the absolute values of candidates but also comprehensively accounts for the relative influence of each criterion. Thus, the developed decision support system is capable of generating more comprehensive and highly applicable recommendations. In addition, the integration of these two methods allows for the dynamic application of the system across various selection periods with continuously updated data without losing accuracy. This opens up opportunities for organizations to continuously improve the recruitment process as the needs of the team evolve. Therefore, this research not only provides theoretical contributions to the development of MCDM methods but also strong practical contributions in supporting data-driven and analytical selection processes in the digital era.

4. CONCLUSION

This research successfully applied the MEREC and WASPAS methods for decision support systems in the selection of Metaverse team members. Both methods are used to evaluate and rank candidates based on various selection criteria, such as technical skills, communication skills, innovation, problem-solving, team collaboration, and experience. The results of the Metaverse team member selection ranking showed that Member Candidate 5 achieved the highest rank with a score of 0.9806, which shows the best performance in meeting the selection criteria that have been set. This candidate excels in various aspects of the assessment, demonstrating his or her ability to contribute to the maximum in the team. In the second and third positions in a row are Member Candidate 11 with a score of 0.944 and Member Candidate 9 with a score of 0.9433. Both candidates also showed excellent results, meeting the selection criteria significantly. These results indicate that the MEREC and WASPAS methods can be used effectively to assess and select the best candidates based on various relevant factors in the selection of Metaverse team members, and can be a reliable tool to support decisions in forming competent and high-performing teams. This research makes a significant contribution to the development of a DSS for the selection of Metaverse team members by combining the MEREC method for determining the weight of criteria and WASPAS for alternative ranking. In addition, this research provides the basis for the development of a more efficient and scalable decision support system, which is not only useful for the selection of Metaverse team members, but can also be applied in various contexts of team member selection in other technology sectors. Thus, this research helps reduce potential bias in the selection process and ensures more accountable decisions, improving the quality and performance of teams in the face of complex challenges in the Metaverse world. This research has several main limitations, namely the relatively small sample size in terms of the number of evaluators involved in assessing candidates. For future research development, there are several directions that can be taken to strengthen and expand the existing findings. First, research can be applied to a larger and more diverse dataset to improve external validity and the generalization of results. Second,

it is recommended to involve more evaluators and to implement standardization mechanisms for assessments to reduce subjectivity and enhance data consistency.

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