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Strategic Prioritization of Human Resource Performance Indicators in Power Plants: A Hybrid MCDM Approach Applied to the Nowshahr Combined Cycle Power Plant

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Abstract: In an increasingly competitive energy sector, the strategic utilization of human resources is paramount to achieving sustainable competitive advantage. The alignment between human resource management (HRM) and strategic objectives plays a critical role in enhancing organizational performance, particularly in power plant operations. This study aims to prioritize human resource performance indicators within the context of power plants by employing a hybrid multi-criteria decision-making (MCDM) approach. Through a comprehensive literature review, the key evaluation criteria—preparation, implementation, and evaluation—were identified. A mixed-method research design was adopted, integrating the Delphi method for expert consensus with a fuzzy Analytic Hierarchy Process (AHP)-Complex Proportional Assessment (COPRAS) approach for quantitative analysis. The study was conducted as an applied case study, with data collected from 15 senior experts and managers at the Nowshahr Combined Cycle Power Plant. Findings indicate that among the main criteria, the implementation dimension was assigned the highest priority, with a final weight of 0.418. Within this category, the training system emerged as the most influential sub-criterion, receiving a weight of 0.1154. Additionally, continuous performance measurement was identified as the most effective strategy for sustaining workforce efficiency. The proposed methodology provides a systematic framework for decision-makers in the energy sector to enhance human resource performance from a strategic perspective, thereby improving overall operational effectiveness.

Keywords: Human resource management (HRM); Employee performance; Strategic decision-making; Hybrid multi-criteria decision-making (MCDM); Analytic Hierarchy Process (AHP)-Complex Proportional Assessment (COPRAS); Power plant operations

1. Introduction

Research indicates a strong correlation between strategic HRM practices and employee commitment, which in turn enhances organizational performance (Jala & Bation, 2023). Furthermore, companies such as Alibaba and Tesla demonstrate that aligning HRM with business goals leads to increased employee satisfaction and improved market positioning (Kazachenko, 2023). These findings emphasize that strategic human resource management not only strengthens employee commitment but also serves as a key factor in achieving a competitive advantage in today's markets. Effective HR practices, such as talent management and employee engagement, significantly improve financial performance and operational efficiency. Developing a robust talent management strategy is essential for optimizing the performance of high-achieving employees (Syukri et al., 2024). The strategy of attracting, developing, and retaining talent is essential for aligning human resources with organizational goals. This comprehensive approach not only enhances productivity but also strengthens the organization's competitive advantage (Kryvoruchko & Femiak, 2024). Applicant Tracking Systems (ATS) streamline the recruitment process by automating candidate screening, enabling HR to focus on high-potential candidates (Mızrak, 2023). Additionally, Artificial Intelligence (AI) tools facilitate data-driven decision-making, enhancing the ability to

assess candidate fit and predict performance outcomes (Parimalam & Dhanabagiyam, 2023). These technologies not only improve the efficiency of the hiring process but also help organizations identify and attract top talent. However, some critics argue that an excessive focus on human resources may lead to the neglect of other critical organizational elements, such as technology and market dynamics, which also play significant roles in achieving competitive advantage.

The employees of an organization play a vital role in its success and are a significant source of lasting competitive edge. As a result, one of the foremost challenges organizations encounter in reaching their objectives is the efficient management of human resources. In complex and unstable business environments, the role of HRM in building sustainable competitive advantage is crucial. Selecting and developing a motivated and capable workforce can significantly enhance organizational performance and sustainability. Moreover, innovation in HRM strategies, such as continuous training and leveraging technology, can improve an organization's competitiveness (Enjang, 2024). Human resources are one of the factors of development and a strategic driver of production and economic progress in any country. The importance of this resource becomes evident when an organization recruits committed and skilled personnel in line with its actual needs, nurtures them effectively, and establishes a common ground between the interests of employees and the organization (Kazachenko, 2023). According to the idea of SHRM, the strategies for human resources must correspond with the broader strategies of the organization. If human resources within an organization are neglected from a strategic management perspective, they may become disruptive rather than effective, turning into a source of blame for the organization instead of enhancing its efficiency (Wuntu & Mogea, 2022)

On one hand, organizations need to achieve their objectives, and on the other hand, to improve their performance and foster positive transformations, they must understand the capabilities and performance of their workforce. SHRM is vital for organizations to successfully manage environmental changes and utilize human resources to achieve a competitive edge. Aligning HR strategies with overall business goals is increasingly acknowledged as a significant challenge. This method links organizational objectives with employee skills, ensuring that HR practices are in line with long-term goals (Grynko et al., 2024). The incorporation of digital technologies into HR functions greatly boosts efficiency, enhances data management, and promotes improved decision-making. Digital tools optimize HR workflows, elevate employee engagement, and offer important insights through data analysis, ultimately resulting in enhanced organizational performance. Conversely, Strategic Human Resource Management (SHRM) allows organizations to predict and respond to market fluctuations, technological progress, and demographic changes. By synchronizing HR strategies with business goals, SHRM increases organizational agility and adaptability (Makovoz & Lysenko, 2024). Digital tools further enhance communication and motivation, especially among younger employees. Nevertheless, achieving alignment between HR strategies and business objectives necessitates a thorough understanding of both domains, which can be intricate and difficult (Pereira, 2024). Organizations may also encounter internal resistance when evolving from conventional HR practices to a strategic model. While achieving strategic alignment in HRM is essential for organizational success, it is crucial to acknowledge that not all organizations possess the resources or readiness to effectively implement such comprehensive strategies, resulting in variations in HRM effectiveness across different industries.

Given the importance of the aforementioned points, the research question of this study is: How does the AHP rank the performance indicators of human resources in power plants from a strategic perspective?

1.1 Theoretical Foundations and Research Background

The alignment of HR practices with organizational goals not only enhances the management of talent but also significantly boosts employee engagement. Additionally, organizations that successfully integrate their HR strategies with their broader business objectives are more likely to achieve outstanding performance outcomes, thereby highlighting the critical importance of strategic alignment in ensuring organizational success (Junaidi et al., 2024).

Strategic Human Resource Management (SHRM) is crucial for aligning HR initiatives with an organization's strategic goals and improving overall efficiency, as this method involves the integration of HR functions with the organizational vision, promoting employee growth, and adapting to changes in the external environment (Geethanjali et al., 2023). SHRM underscores that employees are critical assets of the organization and play a significant role in realizing strategic objectives. This alignment enhances organizational performance and increases the organization's capacity to respond to changes in its environment. SHRM involves a series of interconnected planned or innovative actions that can produce beneficial results for the organization. Effective HR strategies prioritize attracting and retaining talent that aligns with organizational sustainability goals, thereby enhancing overall organizational capabilities. Investing in leadership development ensures that leaders are equipped to drive sustainability initiatives and effectively engage employees. Furthermore, fostering diversity and inclusion within the workforce promotes innovation and adaptability, which are essential for thriving in dynamic and ever-changing market conditions (Burke & Holmes, 2023). The SHRM framework emphasizes the importance of human resource strategies in aligning HR practices with the goals of the organization. These strategies involve a variety of decisions

the Strategic Human Resource Management (SHRM) framework highlights the importance of aligning HR practices with the objectives of the organization, which is crucial for improving organizational effectiveness. SHRM consists of a methodical approach to HR strategies that assist the overall mission of the organization, concentrating on the integration of HR systems with business strategies (Krishnan & Singh, 2011).

A summary of the elements of an HRM system with a strategic perspective is as follows:

1. Primary Objective or Output of the System: This includes achieving personal, societal, and organizational benefits based on the priorities defined by the societal value system and management.

2. Process or Throughput: This involves actions and operations in four areas—training, retention, utilization, and effective recruitment of human resources—and how system inputs are transformed into planned and executed outputs.

3. Requirements or Inputs of the System: Beyond human and financial resources, this includes policies and overarching values.

4. External and Internal Environmental Conditions: These identify opportunities, threats, strengths, and weaknesses to outline planning and execution strategies.

5. Feedback or System Responses from the External Environment: Gathering information from the environment before the system's operational results are transmitted externally. In HR strategy, any change can weaken initial momentum and, consequently, threaten the organization's survival. In the realm of rewards within HR strategy design, all environmental factors are first considered through legal, value-based, economic, and other studies before formulating the strategy.

1.2 Empirical Review

Yalcin et al. (2022) used the MCDM approach to analyze business performance. The article states that entrepreneurs, who can potentially enhance company performance, can benefit significantly from analyzing various investments.

Eshragh et al. (2021), in analyzing factors affecting brand performance in the petrochemical industry using the Dematel decision-making method, identified organizational competitive strategies as the most influential factor.

Amiri et al. (2021) investigated how HRM practices influence performance, with strategic orientation serving as a mediator and environmental dynamics acting as a moderator in knowledge-based organizations. Their results indicated a significant and positive mediating effect in this connection. Furthermore, the analysis confirmed that both entrepreneurial orientation and market orientation have statistically significant positive impacts on performance. Nevertheless, within rapidly changing competitive settings, entrepreneurial orientation demonstrated a positive and significant influence, whereas market orientation resulted in a negative and significant impact on performance. These findings highlight the importance of adopting entrepreneurial and market-oriented strategies to enhance HRM practices while emphasizing the need for entrepreneurial strategies in fluctuating environments. The study provides both practical insights and suggestions for future research.

Wang et al. (2023) As the population in India continues to grow and urban areas expand, the energy demand is rising rapidly while traditional energy sources are unable to keep pace. To address energy shortages and combat climate change, India must focus on renewable energy sources (RES), which provide sustainable alternatives. The country possesses abundant RES that can diversify its electricity generation mix. This research examines various RES in India—specifically solar, geothermal, hydro, biomass, wave, as well as onshore and offshore wind energy—by utilizing an integrated data envelopment analysis (DEA) alongside a fuzzy AHP approach. Four key parameters—technical, economic, environmental, and socio-political—are established, supported by 19 criteria, with the environmental parameters including both favorable and unfavorable aspects. In the initial phase, unfavorable criteria are converted into favorable ones using the Modified Ratio model. Subsequently, DEA is applied to determine the initial efficiency score of each RES across the respective parameter categories. Fuzzy AHP is used to assign weights to each parameter. These weights, in conjunction with the initial efficiency scores, are then combined to compute an overall efficiency score and ranking for the RES. Sensitivity analysis demonstrates that the outcomes derived from the proposed methodology are both significant and robust. Offshore wind energy achieves the highest efficiency ranking, followed by hydro and then onshore wind, whereas geothermal ranks lowest. This methodology has the potential to assist developing nations and inform policymakers in the adoption of RES.

Pansare et al. (2023) A study was conducted on a hybrid framework for prioritizing performance metrics of reconfigurable manufacturing systems (RMS) using the fuzzy AHP–TOPSIS method. According to their research findings, smart factory enablers have the highest weight among all main criteria, followed by strategy and policy enablers. The prioritization of performance metrics indicates that the top three performance metrics for RMS are lead time, reconfiguration time, and product flexibility. The feasibility and suitability of this framework were tested through a case analysis in a manufacturing organization.

2. Methodology

2.1 Conceptual Model

From a strategic perspective, the ranking of human resource performance indicators in power plants includes three main dimensions: Preparation, implementation, and evaluation. Each indicator comprises several sub-criteria, which are selected for analysis in the subsequent stages of the research using the Delphi technique and expert opinions.

Table 1. Criteria and sub-criteria of the research

Source	Index	Criteria
Amini et al. (2016)	Mission appointment	Preparation
	Monitoring internal elements	
	Monitoring external elements	
	Long-term goal setting	
	Strategy selection and monitoring	
Samimiat (2008)	Education system	
	Skill recognition Employees	
Amini et al. (2016)	Annual goal setting	Implementation
	Politics placement	
Mirsepassi et al. (2010)	Resource allocation	
	Employee empowerment	
	Employee participation	
	Communications	
	Ethics	
	Observance of religious principles	
	Resource utilization	
	Responsibility	
	Establishing proper communication with the customer	
	Creativity and innovation	
	Flexibility acceptability	
	Proper communication with colleagues	
	Discipline	
Amini et al. (2016)	To updating information and skills	
	Ability to perform work	Evaluation Criteria
	Amount of work	
	Quality of work	
	Work motivation	
	In-service training	
	Participation in work	
	Recruitment	
	Damage	
	Work qualification	
	Wasted timezone	
Mirsepassi et al. (2010)	An accident occurred	
	Energy waste	

2.2 Research Methodology

Given that the present study aims to examine applied knowledge within a specific domain, it is classified as field-based in terms of execution and as applied in terms of purpose. Additionally, the data collection method is survey-based, and the identification of evaluation indicators is exploratory. Furthermore, this research is quantitative and falls under the category of mathematical modeling.

Population and Sample: Although the statistical sample size is not the primary focus of this study, the responses to the questionnaire are crucial as they pertain to the indicators influencing the research and their relative importance. The experts and managers involved in the decision-making panel have extensive experience in power plant operations and possess the necessary expertise in this field.

The target population of this study, due to the use of industrial engineering and operations research approaches, consists of senior experts and specialists in the relevant domain. The Analytic Network Process (ANP) technique has been employed to prioritize the criteria. Considering the significance of the discussion and the feedback received, the questionnaire was distributed among 15 experts from the power plant, these experts were randomly selected from among individuals with extensive knowledge and experience in the power plant, who are actively engaged in this field.

Data Collection Methods and Tools To collect data related to the research question, a field-based method was used. For gathering data related to the background and literature of the subject, a library-based method was utilized. Additionally, questionnaires and interviews were employed as tools for data collection. To prioritize the main criteria, the questionnaires were designed based on a 9-point Saaty scale, and pairwise comparison techniques were applied.

The criteria and sub-criteria of this research are presented in Table 1.

On the other hand, the strategies allocated for improving human resource performance are as follows (Table 2):

Table 2. Strategies for improving human resource performance

Source	Strategy
Mohammadi & Varzeshkar (2008)	Increasing employee influence System improvement work
Mohammadi & Varzeshkar (2008) and Soltani (2009)	Improving human resource flow System improvement bonus points
Soltani (2009)	Improving the learning and development process
Mirsepassi et al. (2010)	Continuous performance measurement Increasing management power

3. Result

Table 3. Summary of the results of the final round of the Delphi technique

Criteria	Substandard	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
Preparation	Mission appointment	8	8	9	9	8	8	7	9	8	8	8	7	8	7	8	0/8
	Education system	8	9	9	8	8	7	9	8	8	8	8	8	8	8	8	8/1
	Monitoring external elements	8	9	8	8	7	7	9	8	7	8	7	9	8	9	9	8/1
	Long-term goal setting	8	9	9	7	8	8	7	9	7	8	7	9	9	9	8	8/1
	Monitoring internal elements	8	8	8	7	7	7	8	8	8	8	8	8	7	8	7	7/7
	Skill recognition employees	8	8	7	9	8	9	9	8	8	8	8	7	9	8	8	8/1
Implementation	Annual goal setting	7	8	7	9	8	8	8	7	7	7	8	7	9	9	8	7/8
	Politics Placement	7	9	8	9	9	7	9	8	7	7	9	8	9	8	8	8/1
	Resource allocation	8	7	9	7	9	8	7	9	7	8	7	9	9	9	7	0/8
	Employee empowerment	8	8	7	9	9	8	9	8	8	8	8	7	7	9	8	8/1
	Employee participation	8	8	7	9	8	8	7	9	8	8	8	7	7	8	8	7/9
	Responsibility	7	8	7	9	8	7	9	8	8	7	8	9	9	7	8	7/9
	Establishing proper communication with the customer	9	8	8	9	9	8	7	7	9	9	8	7	9	8	8	8/2
	Creativity and innovation	7	8	7	9	8	8	8	7	7	7	8	7	7	9	8	7/7
	Flexibility Acceptability	7	9	8	9	9	7	9	8	7	7	9	8	9	8	7	8/1
Evaluation Criteria	To Updating information and skills	8	8	7	8	8	9	7	9	8	9	8	8	7	8	8	0/8
	Ability to perform work	9	9	7	9	8	7	8	8	7	9	9	7	9	7	9	8/1
	Quality of work	8	8	8	7	9	9	9	7	9	8	8	8	9	9	7	8/2
	Work motivation	8	7	8	8	7	9	8	7	9	7	9	8	8	9	8	0/8
	Participation in work	8	7	9	7	9	8	7	9	7	8	7	9	9	9	8	8/1
	Damage	8	8	7	9	7	9	9	8	8	9	9	8	8	9	9	8/3
	Wasted timezone	8	8	8	7	9	9	9	7	9	8	8	9	9	8	7	8/3
	Energy waste	7	8	8	8	7	8	8	8	8	7	8	9	8	8	7	7/8

Source: Research findings

In this research, the Delphi method was applied to establish the final ranking of criteria and sub-criteria, which

were identified using a fuzzy approach. Furthermore, the fuzzy COPRAS method was applied to achieve the final ranking of strategies. The analysis of the collected data was facilitated by software tools including Excel, SPSS, and Super Decision.

3.1 Delphi Technique for Selecting Options

Based on this technique, a questionnaire containing the desired options was first presented to each member of the group. These options were then evaluated by 15 selected experts familiar with all aspects using the Delphi method. For the initial screening of the identified indicators, scores ranging from 1 to 10 were assigned, and indicators with scores below 7 were eliminated. The Delphi process was conducted in two rounds, and in the second round, the process was concluded after reaching a final consensus. The outcomes of the Delphi method are displayed in Table 3.

Kendall's coefficient of agreement was used to calculate the consistency of expert opinions, which is important (Table 4).

Table 4. Kendall's coefficient of concordance

	Number of Items	Number of Experts	Kendall Coefficient	Degree Freedom	Meaningful Value
First Round	35	15	374/0	34	0/003
Second Round	23	15	571/0	22	0/001

Source: Research findings

3.2 Identification of Final Criteria and Sub-Criteria

Initially, the criteria and sub-criteria for the study were recognized and chosen. The main criteria include preparation, implementation, and evaluation. For each of these main criteria, sub-criteria were identified, resulting in 23 sub-criteria. In the initial step, literature reviews and expert interviews were used to identify the sub-criteria. Additionally, the criteria and sub-criteria of the research were assigned numerical labels in Table 5 to facilitate easy tracking and examination throughout the study.

Table 5. Criteria and sub-criteria of the research

Criteria	Standard Symbol	Substandard	Sub-Criterion Symbol	Z
Preparation	C1	Mission appointment	S11	+
		Education system	S12	+
		Monitoring external elements	S13	+
		Long-term goal setting	S14	+
		Monitoring internal elements	S15	+
		Skill recognition employees	S16	+
Implementation	C2	Annual goal setting	S21	+
		Politics and placement	S22	+
		Resource allocation	S23	-
		Employee empowerment	S24	+
		Employee participation	S25	+
Evaluation	C3	Responsibility	S31	+
		Establishing proper communication with the customer	S32	+
		Creativity and innovation	S33	+
		Flexibility acceptability	S34	+
		To updating information and skills	S35	+
		Ability to perform work	S36	+
		Quality of work	S37	+
		Work motivation	S38	+
		Participation in work	S39	+
		Damage	S310	-
		Wasted time zone	S311	-
		Energy waste	S312	-

Source: Research findings

3.3 Determining the Priority of Model Elements Using Fuzzy AHP Technique

The essential criteria underwent pairwise comparison at the beginning to support a hierarchical analysis focused

on the overall objective. The pairwise comparison process is straightforward, and all elements within each category must be compared in pairs. Therefore, if there are *n* criteria in a category, $\frac{n(n-1)}{2}$ comparisons will be made. Since there are 3 criteria, the number of comparisons performed is:

$$\frac{n(n-1)}{2} = \frac{3(3-1)}{2} = 3$$

In this process, three pairwise comparisons were conducted based on the perspectives of a group of experts. Their opinions were initially quantified using a fuzzy scale, collected using a 9-point scale, and then modeled in a fuzzy format. Following that, the geometric mean approach integrated the viewpoints of experts within the fuzzy AHP framework. The outcome of consolidating these viewpoints resulted in the creation of a pairwise comparison matrix, which is shown in Table 6.

Table 6. Pairwise comparison matrix of the main research criteria

C3			C2			C1			
1/334	1/602	1/892	1/257	1/583	1/955	1	1	1	**C1**
1/5100	1/990	2/496	1	1	1	0/511	0/632	0/795	**C2**
1	1	1	0/401	0/503	0/662	0/529	0/624	0/749	**C3**

Source: Research findings

After forming the pairwise comparison matrix, the fuzzy sum of each row is calculated. The fuzzy preferences of each criterion in the following form will be expanded:

An example of a fuzzy expansion of the C1 criterion can be seen:

Fuzzy expansion of row 1 = (4.847, 4.185, 3.592) = (1.892, 1.602, 10334) (1.955, 1.583, 1.257) (111)

Therefore, the fuzzy extension of preferences for each of the main criteria will be calculated as follows:

$$\sum_{j=1}^{3} M_{g_1}^{j} = (3.592, 4.185, 4.847)$$

$$\sum_{j=1}^{3} M_{g_2}^{j} = (4.291, 3.621, 3.022)$$

$$\sum_{j=1}^{3} M_{g_3}^{j} = (2.411, 2.127, 1.929)$$

The sum of the elements in the column corresponding to the preferences of the main criteria will be as follows:

$$\sum_{i=1}^{3}\sum_{j=1}^{3} M_{g}^{j} = (8.543, 9.934, 11.550)$$

To standardize the preferences for each criterion, it is necessary to divide the total values of that criterion by the overall sum of preferences for each column. Given that the fuzzy values are represented in fuzzy form, the fuzzy sum of each row is then multiplied by the reciprocal of the total sum. To achieve this, we must first compute the reciprocal of the total sum.

$$\text{F1-1} = (1/u1, 1/m1, 1/l1)$$

$$(\sum_{i=1}^{n}\sum_{j=1}^{n} M_g^j)^{-1} = (0.087, 0.101, 0.117)$$

$$S_k = \sum_{i=1}^{n} M * (\sum_{i=1}^{n}\sum_{j=1}^{n} M_g^j)^{-1}$$

Every value obtained indicates the fuzzy and normalized weight associated with the primary criteria. In the subsequent phase, the defuzzification process is executed for the resulting values, and the computations regarding the precise number are conducted. The essential calculations required to establish the priority of the main criteria are outlined as follows (Table 7):

Table 7. Defuzzification of calculated normal weights of the main study variables

Crisp	X1max	X2max	X3max	Deffuzy	Normal
Preparation	433/0	430/0	427/0	433/0	386/0
Implementation	376/0	737/0	370/0	422/0	418/0
Evaluation	221/0	219/0	218/0	198/0	197/0

Source: Research findings

According to Table 8, the eigenvector priority of the main criteria will be W21.

$$W21 = \begin{pmatrix} 0.386 \\ 0.418 \\ 0.197 \end{pmatrix}$$

Based on the obtained eigenvector:
Implementation with a normalized weight of 0.418 has the highest priority.
Preparation with a normalized weight of 0.386 is the second priority.
Evaluation with a normalized weight of 0.197 has the lowest priority.
Comparison incompatibility rate: The results obtained are 0.0521, which is smaller than 0.1, and therefore the comparisons made can be trusted.

3.4 The Final Priority of the Indicator Model with Technique AHP

To establish the ultimate priority of the sub-criteria and main indicators within the model via the AHP method, it is essential to compute the initial unweighted supermatrix, the weighted supermatrix, and ultimately the limit supermatrix. At this stage, the final prioritization of the sub-criteria is calculated. The results of the comparison of the research sub-criteria and their associated weights form the W2 matrix. To calculate the final priority of the indicators using the AHP technique, it is sufficient to multiply the weight of the indicators based on each criterion (W2) by the weight of the main criteria (W1). By weighting each main criterion (W1) and sub-criteria (W2), the final weight of each sub-criterion is calculated. The results of the calculations and the weights related to the sub-criteria are presented in Table 8:

Table 8. Final priority of research sub-criteria

Criteria	Weight Criterion	Substandard	Substandard Weight	Final Weight
Preparation	386/0	Mission appointment	204/0	0/079
		Education system	0.299	1154/0
		Monitoring external elements	219/0	0/084
		Long-term goal setting	210/0	0/081
		Monitoring internal elements	0/029	0/011
		Skill recognition employees	0/039	0/015
Implementation	418/0	Annual goal setting	222/0	0/093
		Politics placement	276/0	1152/0
		Resource allocation	217/0	0/091
		Employee empowerment	146/0	0/061
		Employee participation	139/0	0/058
		Responsibility	110/0	0/022
		Establishing proper communication with the customer	0/059	0/012
Evaluation	197/0	Creativity and innovation	0/078	0/015
		Flexibility acceptability	0/063	0/012
		To updating information and skills	0/088	0/017
		Ability to perform work	0/070	0/014
		Quality of work	0/100	0/020
		Work motivation	0/102	0/020
		Participation in work	0/088	0/017
		Damage	0/090	0/018
		Wasted timezone	0/073	0/014
		Energy waste	0/079	0/015

Source: Research findings

Therefore, based on the obtained results, the sub-criterion "Training System" with a final weight of 0.1154 is in the first priority, "Policy-making" with a final weight of 0.1152 is in the second priority, and "Annual Goal Setting" with a final weight of 0.093 is in the third priority as the most important sub-criteria.

3.5 Selecting the Best Solution with the Fuzzy COPRAS Technique

In this study, the Fuzzy COPRAS model has been employed to select the best solution. At this stage, the COPRAS technique has been used to choose the optimal solution. Initially, the criteria were ranked in order of importance by employing the fuzzy AHP. Finally, the best solution was selected using the COPRAS technique. This method is one of the best MCDM methods for selecting the optimal solution.

In this study, 23 indicators were used for the decision-making process, and 7 solutions were prioritized based on the examined indicators. Therefore, a scoring matrix (decision matrix) was formed based on these criteria.

To evaluate the projects based on each criterion, a 7-point scale mentioned in Table 2 was used. Similar to other MCDM methods, the decision matrix is first established. This matrix is represented by the symbol X, and each of its elements is denoted by X_{ij}.

When the fuzzy approach with triangular fuzzy numbers is used, the decision matrix $\tilde{X}$ is represented as follows. Each element of the decision matrix is also represented as $\tilde{x}_{ij}$:

$$\tilde{X} = [\tilde{x}_{ij}]_{m\times n}$$

$$\tilde{x}_{ij} = (l_{ij}, m_{ij}, u_{ij})$$

Step Two: Normalizing the Decision Matrix

The normalized fuzzy decision matrix is represented by the symbol $\tilde{N}$, and each element of this normalized matrix is denoted as $\tilde{n}_{ij}$. For normalization, the following formula is used:

$$\tilde{N} = [\tilde{n}_{ij}]_{m\times n}$$

If the criterion has a positive impact, we will have:

$$\tilde{n}_{ij} = \left(\frac{l_{ij}}{u_j^*}, \frac{m_{ij}}{u_j^*}, \frac{u_{ij}}{u_j^*}\right)$$

$$u_j^* = max\ u_{ij}$$

If the criterion has a negative impact, we will have:

$$\tilde{n}_{ij} = \left(\frac{l_j^-}{u_{ij}}, \frac{l_j^-}{m_{ij}}, \frac{l_j^-}{l_{ij}}\right)$$

$$l_j^- = min\ l_{ij}$$

Now, to prepare the weighted normalized matrix, each element of the decision matrix is divided by the sum of its respective column to obtain a dimensionless matrix. Then, it is multiplied by the weight obtained from the AHP technique to achieve the weighted dimensionless matrix.

$$d_{ij} = \frac{q_i}{\sum_{j=1}^{n} x_{ij}} x_{ij}$$

To calculate the sum of the positive and negative indicators for each option, the positive and negative indicators are calculated separately. This is done by calculating the sum of the positive and negative indicators for each option (Table 9).

To prioritize the best option, Q_j was first calculated using the following formula:

$$Q_j = S_j{}^+ + \frac{\sum_{j=1}^{n} S_j^-}{S_j^- \sum_{j=1}^{n} \frac{1}{S_j^-}}$$

Then, the value of N_j was calculated using the following formula:

$$N_j = \frac{Q_j}{Q_{max}} \times 100$$

Based on the calculations performed and the computation of N_j using the above formulas, the strategies were ranked as follows (Table 10):

1. Continuous performance measurement is the top priority.
2. Increasing employee influence is the second priority.
3. Improving human resource flow is the third priority.
4. Enhancing management power is the fourth priority.
5. Improving learning and development processes is the fifth priority.
6. Enhancing work systems is the sixth priority.
7. Improving reward systems is the lowest priority.

Table 9. The sum of negative and positive indicators

Solutions	S_{j+}	S_{j-}
Increasing Employee Influence	911/0	246/0
System Improvement Work	875/1	360/0
Improving Human Resource Flow	1/109	247/0
System Improvement Bonus Points	693/1	305/0
Improving the Learning and Development Process	146/1	199/0
Continuous Performance Measurement	205/1	266/0
Increasing Management Power	294/1	313/0
Increasing Employee Influence	247/1	378/0
System Improvement Work	241/1	382/0

Source: Research findings

Table 10. Prioritization of options by calculating Q_j and N_j

Solutions	S_{j+}	S_{j-}	Q_j	N_j	Rank Bandi
Increasing Employee Influence	174/1	132/1	862/457	248/59	2
System Improvement Work	976/1	288/0	073/212	443/27	6
Improving Human Resource Flow	307/1	0/135	439/449	159/58	3
System Improvement Bonus Points	983/1	323/0	124/189	473/24	7
Improving the Learning and Development Process	229/1	232/0	088/262	915/33	5
Continuous Performance Measurement	489/1	0/078	784/772	000/100	1
Increasing Management Power	429/1	176/0	444/344	572/44	4

Source: Research findings

4. Discussion

This research was conducted to rank the performance indicators of human resources in power plants from a strategic perspective at the Noshahr Combined Cycle Power Plant. In the current study, due to the use of operations research approaches, the target population consists of experts in the relevant field.

In the first phase of the study, after screening the sub-criteria using the Delphi method, the fuzzy AHP technique was used to prioritize the sub-criteria, and then the Fuzzy COPRAS technique was employed to prioritize the solutions. After ensuring the reliability and validity of the questionnaire as the primary data collection tool, the questionnaire was distributed among the experts in the field, and thus, the raw primary data for processing, analysis, and answering the research questions were collected. A summary of the results obtained from these tests is presented below.

In the first step, the sub-criteria were screened, reducing the number of final sub-criteria from 35 to 23. In the second step, the main criteria of the research were prioritized. Based on the results, "implementation" with a normalized weight of 0.418 was ranked first, "preparation" with a normalized weight of 0.386 was ranked second, and "evaluation" with a normalized weight of 0.197 had the lowest priority. The inconsistency rate of the comparisons, calculated as 0.0521, indicated that the comparisons could be trusted.

In the next step, the sub-criteria of the study were compared pairwise. The calculations performed to determine the priority of the "preparation" sub-criteria showed that the "training system" with a normalized weight of 0.299 was ranked first, "monitoring external elements" with a normalized weight of 0.219 was ranked second, "long-term goal setting" with a normalized weight of 0.210 was ranked third, "mission assignment" with a normalized weight of 0.204 was ranked fourth, "identifying employee skills" with a normalized weight of 0.039 was ranked

fifth, and "monitoring internal elements" with a normalized weight of 0.029 had the lowest priority. The calculations performed to determine the priority of the "implementation" sub-criteria showed that "policy-making" with a normalized weight of 0.276 was ranked first, "annual goal setting" with a normalized weight of 0.222 was ranked second, "resource allocation" with a normalized weight of 0.217 was ranked third, "employee empowerment" with a normalized weight of 0.146 was ranked fifth, and "employee participation" with a normalized weight of 0.139 was ranked last. The calculations performed to determine the priority of the "evaluation" sub-criteria showed that "responsibility" with a normalized weight of 0.110 was ranked first, "work motivation" with a normalized weight of 0.102 was ranked second, "work quality" with a normalized weight of 0.100 was ranked third, "damage" with a normalized weight of 0.090 was ranked fourth, "participation in work" with a normalized weight of 0.0884 was ranked fifth, "updating information and skills" with a normalized weight of 0.0878 was ranked sixth, "energy waste" with a normalized weight of 0.079 was ranked seventh, "creativity and innovation" with a normalized weight of 0.078 was ranked eighth, "wasted time" with a normalized weight of 0.073 was ranked ninth, "ability to perform tasks" with a normalized weight of 0.070 was ranked tenth, "flexibility" with a normalized weight of 0.063 was ranked eleventh, and "establishing proper communication with customers" with a normalized weight of 0.059 was ranked last.

In the next stage, the final priority of the main criteria of the model was calculated using the AHP technique. Based on the calculations, the sub-criterion "training system" with a final weight of 0.1154 was ranked first, "policy-making" with a final weight of 0.1152 was ranked second, and "resource allocation" with a final weight of 0.091 was ranked third as the most important sub-criteria.

Finally, the Fuzzy COPRAS technique was used to select the best solution for the performance of human resources in power plants from a strategic perspective. Based on this, it can be concluded that "continuous performance measurement" was ranked first, "increasing employee influence" was ranked second, "improving human resource flow" was ranked third, "increasing management power" was ranked fourth, "improving learning and development processes" was ranked fifth, "improving work systems" was ranked sixth, and "improving reward systems" was ranked last.

5. Conclusions

1) The sub-criterion "Training System" holds the top position. Hence, it can be stated that the leaders of the Noshahr Combined Cycle Power Plant ought to acknowledge that training significantly contributes to empowering and enhancing staff performance. If their training initiatives correspond with the core requirements of the organization, it will improve the productivity and efficacy of human resources and aid in realizing the power plant's objectives. Consequently, the Noshahr Combined Cycle Power Plant can impact the conduct of its employees and members through the introduction of training initiatives. The most prevalent approach is to directly impart the required skills (for executing intended tasks) to its members, thus boosting individual abilities and allowing them to undertake tasks at a higher and improved standard. For this aim, training needs evaluations and necessary arrangements for executing practical training programs should be carried out by the human resources and training departments. Therefore, it is crucial for the authorities of the Noshahr Combined Cycle Power Plant to fortify the organization’s training unit and allocate the necessary budget and resources for implementing training programs customized to the existing working circumstances. Moreover, the application of modern educational technologies and skilled trainers can aid in accomplishing this objective.

2) The sub-criterion labeled "Policy-Making" is ranked as the second most significant. As a result, it can be inferred that the performance of human resources at the Noshahr Combined Cycle Power Plant is largely contingent upon the policies and strategies adopted by its management team. If the enhancement and development of human resources are embedded within the power plant's policies and programs, all operational units will be mandated to work towards this aim. Additionally, the creation of a model for human resource excellence in policy-making can have a beneficial effect on the efficiency and effectiveness of human resources. Therefore, it is imperative to provide a suitable work environment for employees, address their issues, and improve their qualitative and quantitative productivity.

3) The criterion "Resource Allocation" holds the third position in ranking. Thus, it can be concluded that resources are typically distributed according to the priorities established by yearly objectives. A significant hurdle in effectively executing organizational strategies is the disconnect between operational planning and the prioritization of resource distribution for long-term strategic initiatives. Consequently, financial managers at the Noshahr Combined Cycle Power Plant must engage in both long-term strategic planning and create annual and short-term budgets for the various divisions within the power plant. To achieve this, the power plant's priorities should initially be identified based on set objectives, after which financial and other resources can be distributed according to the importance of each priority. Given that human resources are the most valuable asset of any organization, they should be given precedence in resource allocation to facilitate employee development and subsequently enhance the power plant's overall performance. To guarantee effective resource distribution at the Noshahr Combined Cycle Power Plant, organizational objectives must first be articulated, and resource allocation

should align with the vision established for accomplishing those objectives.

4) Continuous performance assessment is considered the top solution. Therefore, it can be concluded that assessing and measuring employee performance primarily aims to improve human resources and evaluate the achievement of objectives. As a result, ongoing evaluation of employee performance at the Noshahr Combined Cycle Power Plant will supply managers with the necessary information to make decisions regarding promotions, salaries, and wages. Moreover, analyzing how employees accomplish their tasks provides managers with a chance to review work behaviors and offer suitable feedback for enhancing performance. Additionally, if employee evaluations are carried out accurately and rely on appropriate scientific methods, they can assist managers in effectively utilizing employees, positioning them suitably, and motivating them. In general, officials at the Noshahr Combined Cycle Power Plant can only be assured of their performance in various areas, such as human resources management and finance, if they implement a system for regular performance assessments. The findings from internal and external audits may act as one of the indicators for performance evaluation at the Noshahr Combined Cycle Power Plant.

5) Increasing the influence of employees is identified as the second most effective solution. Thus, it's evident that employees in any organization will support the initiatives put forth by their managers if they feel appreciated. When employees' perspectives are taken into account while developing performance enhancement programs at the Noshahr Combined Cycle Power Plant, it will foster greater motivation for them to accomplish their assigned duties. To achieve this, the Noshahr Combined Cycle Power Plant could select one or more employee representatives through a voting process and include them in discussions and decision-making regarding human resources, thereby boosting employee involvement in strategic planning. Furthermore, introducing strategies to promote employee engagement is another consideration that the management at the Noshahr Combined Cycle Power Plant should address, offering the necessary motivation for complete employee participation and collaboration through both financial and non-financial incentives.

In relation to the limitations of the research, time was dedicated to conducting field studies and analyzing data. Additionally, some workers and managers displayed less willingness to participate in the study due to work commitments or organizational considerations, which resulted in a smaller sample size for the research.

Author Contributions

Conceptualization, Seyed Fakhreddin Fakhrhosseini; methodology, Seyed Fakhreddin Fakhrhosseini; validation, Rasoul Naserhojjati Rudsari; formal analysis, Rasoul Naserhojjati Rudsari; investigation, Rasoul Naserhojjati Rudsari; resources, Rasoul Naserhojjati Rudsari; data curation, Rasoul Naserhojjati Rudsari; writing—original draft preparation, Rasoul Naserhojjati Rudsari; writing—review and editing, Seyed Fakhreddin Fakhrhosseini and Rasoul Naserhojjati Rudsari; visualization, Rasoul Naserhojjati Rudsari; supervision, Seyed Fakhreddin Fakhrhosseini. Both authors have read and agreed to the final version of the manuscript.

Data Availability

The datasets employed and examined in this research can be obtained from the corresponding author, pending reasonable requests.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Amini, M. T., Keshavarz, E., Keshavarz, A., & Bagheri, S. M. (2016). Prioritisation and performance evaluation of employees at strategic human resource management process using fuzzy AHP and fuzzy TOPSIS methods. *Int. J. Product. Qual. Manage.*, *17*(1), 61-81. https://doi.org/10.1504/IJPQM.2016.073275.

Amiri, A. A., Ehsanfar, M. H., Javanmard Ghasab, A., Chabok, S. H., & Abbaszadeh Amirdehi, Z. (2021). The impact of human resource management practices on performance: Mediating role of strategic orientation and moderating role of environmental dynamism in knowledge-oriented firms. *J. Sustain. Hum. Resour. Manag.*,

3(4), 89-126.
Burke, L. N. & Holmes, Y. (2023). The role of human resources management in sustainable competitive advantage. *Int. J. Appl. Res. Bus. Manag.*, *4*(2), 1-17. https://doi.org/10.51137/ijarbm.2023.4.2.1.
Enjang, S. (2024). Human resource management innovation strategy in realizing competitive advantage. *Evol. Stud. Imagin. Cult.*, *8*(2), 1685-1692. https://doi.org/10.70082/esiculture.vi.1534.
Eshragh, S., Delafrooz, N., Shahrood, K., & Rahmati, Y. (2021). Analysis of factors affecting brand performance in petrochemical industry using dimethyl method. *J. Decisions & Oper. Res.*, *6*(4), 592-604. https://doi.org/10.22105/dmor.2020.243959.1202.
Geethanjali, N., Ashifa, K. M., Raina, A., Patil, J., Byloppilly, R., & Rajest, S. S. (2023). Application of strategic human resource management models for organizational performance. *IGI Global*, 1-19. https://doi.org/10.4018/979-8-3693-2193-5.ch001.
Grynko, T., Bazyk, O., & Ivanov, K. (2024). Strategic management of human resources in the sphere of entrepreneurial activity. *Econ. Scope*, *192,* 7-11. https://doi.org/10.30838/ep.192.7-11.
Jala, J. V. M. & Bation, N. D. (2023). Understanding the dynamics of employee commitment in the relationship with strategic human resource management practices. *Int. J. Soc. Sci. Hum. Res.*, *6*(12). https://doi.org/10.47191/ijsshr/v6-i12-50.
Junaidi, M., Partayasa, K., & Sulaimawan, D. (2024). Analysis of human resource management strategies in improving organizational performance. *Target: J. Manajemen Bisnis*, *6*(1), 73-80. https://doi.org/10.30812/target.v6i1.3983.
Kazachenko, E. (2023). Strategic role of human resources in successful operation and business development. *Věda A Perspekt.*, *10*(29). https://doi.org/10.52058/2695-1592-2023-10(29)-16-26.
Krishnan, S. K. & Singh, M. (2011). Strategic human resource management: A three-stage process model and its influencing factors. *S. Asian J. Manage.*, *18*(1), 60-82.
Kryvoruchko, O. & Femiak, O. (2024). Conceptual aspects of strategic HR management of an enterprise in the context of digitalization. *Econ. Transp. Complex*, *44*, 111. https://doi.org/10.30977/etk.2225-2304.2024.44.111.
Makovoz, O. & Lysenko, S. (2024). Digital technologies in personnel management. In *Proceedings of London International Conferences*, 65-76. https://doi.org/10.31039/plic.2024.10.208.
Mirsepassi, N., Toloie Eshlaghy, A., Memarzadeh, G., & Peidaie, M. (2010). Designing a of human resource excellence model in iranian public sectors using the fuzzy Delphi technique. *Future stud. Manage.*, *21*(87), 1-22.
Mızrak, F. (2023). Use of information technologies in strategic human resource management. *IGI Global*, 332-351. https://doi.org/10.4018/978-1-6684-9172-0.ch017.
Mohammadi, A. & Varzeshkar, A. (2008). Introducing the method of human resource management researches in a military organization. *J. Res. Hum. Resour. Manage.*, *1*(1), 51-78.
Pansare, R., Yadav, G., & Nagare, M. R. (2023). A hybrid framework to prioritize the performance metrics of reconfigurable manufacturing system (RMS) using fuzzy AHP–TOPSIS method. *Int. J. Adv. Manuf. Tech.*, *124*(3), 863-885. https://doi.org/10.1007/s00170-022-10440-8.
Parimalam, P. I. & Dhanabagiyam, S. (2023). Strategic role of artificial intelligence and the power of ehrm for innovative human resource management. *Asian J. Manage*., *14*(3), 207-210. https://doi.org/10.52711/2321-5763.2023.00035.
Pereira, T. C. (2024). Planejamento estrategico de recursos humanos: Uma abordagem das vantagens competitivas para as organizacoes. *Revista Ft*, 22-23. https://doi.org/10.69849/revistaft/fa10202409191222.
Samimiat, M. (2008). Preparing employees for the future: The mission of human resource management. In *Paper presented at the 4th Conference on Human Resource Development, Tehran, Iran*. https://civilica.com/doc/48509
Soltani, A. (2009). *Performance management as the foundation for human resource development (Employee performance evaluation) (3rd ed.)*. Arkan Danesh Publications.
Syukri, A. M., Malik, T., Sandra, K., Mattalatta, M., Ansar, A., & Farida, U. (2024). The role of human resources in improving the company's financial performance. *Atestasi: J. Ilm. Akunt.*, *7*(2), 1380-1399. https://doi.org/10.57178/atestasi.v7i2.1079.
Wang, C. N., Chung, Y. C., Wibowo, F. D., Dang, T. T., & Nguyen, N. A. T. (2023). Site selection of solar power plants using hybrid MCDM models: A case study in Indonesia. *Energies*, *16*(10), 4042. https://doi.org/10.3390/en16104042.
Wuntu, C. N. & Mogea, T. (2022). The impact of human resources training in improving organizational performance. *ENGGANG: J. Pendidik. Bahasa Sastra Seni Budaya*, *3*(1), 247-253. https://doi.org/10.37304/enggang.v3i1.8779.
Yalcin, A. S., Kilic, H. S., & Delen, D. (2022). The use of multi-criteria decision-making methods in business analytics: A comprehensive literature review. *Technol. Forecast. Soc. Change*, *174*, 121193. https://doi.org/10.1016/j.techfore.2021.121193.