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Presenting A Multi-Objective Mathematical Model of Project Team Formation based on the Compatibility Components of Their Relations, Based on the Integration Approach of Fuzzy DEMATEL and Epsilon Constraints

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Abstract

The success of a project is significantly influenced by the project team, making human resource management and team development crucial responsibilities of a project manager. According to the PMBOK (5th edition) and the ICB standard, team building is a vital behavioral competency and a necessary skill for project managers. However, forming a project team is a complex task, requiring precise and artful execution, similar to setting up intricate machinery. Project teams consist of individuals with diverse perspectives, which can lead to conflicts due to differing

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viewpoints and the temporary nature of the team. Effective team formation and conflict management are thus essential. This study aims to develop an optimal project management team for project-oriented organizations using multi-objective decision-making approaches. The integration of Fuzzy DEMATEL and epsilon constraints was employed to address this issue. Our findings indicate that the Lagrange release algorithm outperforms other methods in forming efficient project teams. This research provides valuable insights into the team formation process and offers practical recommendations for project managers. The success of a project is intrinsically linked to the performance and cohesion of the project team, making the roles of human resource management and team development paramount for project managers. The Project Management Body of Knowledge (PMBOK, 5th edition) and the International Competence Baseline (ICB) standard emphasize that team building is not only a key behavioral competency but also a crucial skill set required for effective project management. Unlike the mechanical assembly of machines, forming a project team involves navigating the complex interplay of diverse human behaviors and technical skills, demanding both scientific rigor and the art of interpersonal dynamics. This study proposes a novel multi-objective mathematical model for project team formation, focusing on optimizing the compatibility of team members through an integrated approach combining Fuzzy Decision Making Trial and Evaluation Laboratory (DEMATEL) and epsilon constraints. The model addresses the multifaceted nature of team composition by evaluating both the technical and behavioral attributes of potential team members to mitigate conflicts and enhance team synergy.

Our methodology involves a comparative analysis of two Lagrange release algorithms, demonstrating that the epsilon constraint method significantly outperforms its counterpart in creating well-balanced and effective project teams. The results of this study provide robust evidence that integrating fuzzy logic with multi-objective optimization techniques can substantially improve team formation processes. Furthermore, practical recommendations based on our findings are offered to project managers, highlighting strategies for assembling high-performance teams and managing interpersonal relations effectively. This research not only contributes to the theoretical framework of project management but also delivers actionable insights for practitioners aiming to optimize team dynamics and project outcomes.

Keywords: Project Team Formation, Compatibility Components of Interrelationships, Fuzzy DEMATEL, Constraint Epsilon, Lagrange Release.

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1- Introduction

Since the early 1980s, project management literature has extensively covered human resource administration and planning. The primary goal of human resource management (HRM) is to develop the policies and procedures required for effectively managing aspects of employee behavior, including hiring, training, performance reviews, and fostering a positive, equitable work environment (Wedekind, 2018). In project-oriented organizations, HRM is crucial for aligning human resource efficiency with the strategic objectives of the organization (Monteiro, 2016).

The formation of the project team is a fundamental element that can challenge, promote, or ensure the success of a project (Paton, 2019). Effective project resource management involves the optimal utilization of team members' characteristics, which is one of the ten core principles of project management (Zaouga, 2019). According to the fifth edition of the PMBOK standard, team building is one of the key processes in human resource management and a critical behavioral competency for project managers. Additionally, team development is among the 46 essential skills required by portfolio, program, or project managers, as per the ICB standard (Hermano, 2019). Creating, managing, and controlling the project team are tactical approaches to bringing together individuals with diverse and sometimes conflicting traits and viewpoints (Saputra, 2020). Selecting the right project team and assigning staff to strategic projects are critical decisions; incorrect choices can lead to adverse effects on the organization (Sandhu, 2019). Project managers must ensure that highly qualified individuals are assigned to the right tasks at the appropriate times (Ramalho, 2019). One significant challenge in project scheduling is determining the tasks for team members during project implementation. Disagreements among team members on key decisions can lead to delays and inefficiencies. The inability to effectively assess and manage team interactions often results in execution issues, contributing to the inefficiency of the project management team and suboptimal workforce allocation (Yap, 2018).

A multi-indicator, multi-objective decision-making strategy has been suggested in the new literature for the evaluation and selection of project team members, and it includes a thorough analysis of the allocation of human resources in project teams. In light of the aforementioned situations, this research aims to find and assign the best candidates to the project team in order to maximize communication among team members, degree of agreement and coordination of viewpoints, technical and executive ability, and on the other hand, to reduce the costs associated with hiring and assigning personnel. The use of two multi-indicator decision-making approaches to evaluate the compliance indicators of the project team members in a communication approach based on the analysis of cause and solution in the relationships of DEMATEL's method and

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multi-objective decision-making, the allocation of people to specialized groups of the project team, is where this research innovates in relation to the goals that were taken into consideration. Until now, no research has been conducted in this area. On the other hand, the enhanced constraint epsilon technique has been employed in accordance with the multi-objective mathematical model currently in use in order to assess the Pareto front of the best choices for the distribution and selection of human resources within the project team. The introduction, problem statement, need to handle the issue of project team distribution, objectives, questions, and research ideas were given in the five parts that make up this study. The project team's research background is discussed and reviewed in the second section, the research methodology is presented in the third section, the research findings are discussed in the fourth section, and the summary and research recommendations are introduced in the fifth section.

2- Literature review

Different sources have described the method of creating the project team in various ways. Hugel and Winkoff's ideas state that the project team goes through three stages during the planning phase: The awareness period is the first stage. The project manager and team concentrate on setting objectives, selecting approaches and paths, and scheduling resources during this phase. The organizational phase is the following step, where the project manager and team are engaged in setting rules and regulations, outlining relationships, creating team tasks, and building values and norms. Last but not least, the majority of activities during the execution phase are focused on allowing team members to collaborate effectively with one another to succeed and on schedule complete the project (Kidanemariam, 2019). Manpower allotment and project team-building techniques are covered in this part. Using a multi-criteria decision-making strategy, Singh et al. (2009) did a study on the process of creating a project team for a software information technology project. Finally, based on the evaluation, 13 indicators were presented as the most crucial indicators of team formation, and 34 key indicators were found for the assessment of team members.

Russ (2013) examined the effectiveness of project management as a crucial source of competitive advantage and the secret to project execution success in his study. As a result, they discussed how project management subjects could be integrated into the existing paradigm for manager competence that is used in project-oriented companies. Finally, they used identically structured interviews with 8 project managers and supervisors to assess and examine the growth and learning in project-oriented companies. Jain (2020) looked at the crucial part that human resources play in the success of software initiatives in his study. As a result, they created a

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decision support system method to assess and combine the abilities needed for tasks with available human resources. Project management is described as "the application of knowledge, skills, tools, and techniques for project activities to fulfill the needs of the project," according to Garosma (2019). Time, quality, and expense are the three major project requirements, with consideration for the project's scope and the demands of its various stakeholders. Value engineering in the project team, which seeks to reduce expense, keep quality, and account for time (planning), is one of the techniques used in many nations to minimize problems in project management. This value engineering is thought to be a potent instrument for issue-solving. Dabirian (2019) found that the effective management of human resources is crucial to the success of building initiatives. The distribution of labor to the project is one of the most crucial and efficient processes in human resource management. Project success in terms of expense and timeline can be significantly impacted by the efficient management tool and improvement factor of human resource allocation. As a result, the required planning for the prompt supply and allocation of the project workforce was done using the multi-indicator decision-making model. Dutsenko (2019) built formal models for the formation and performance of project teams in a multi-project setting using a hybrid and rational strategy, as well as a stakeholder-oriented approach to the formation of resource requirements. In order to create a conceptual model of project-oriented resource management, compatible teams were formed in a setting with multiple projects, and it was suggested that the analysis of stakeholders' interest in human resource management processes take into account the stakeholders' loyalty. The creation of a team is one of the crucial project management stages, according to Rahmaniyai (2019). As a result, the two major problems with team formation are the cost optimization linked to the team members and the standard of the work produced by the team. So, in an issue involving team creation, they carried out the simultaneous optimization of expense and quality. A multi-objective multi-stage stochastic programming (MOMSP) paradigm is created and described because these problems in a project typically occur in multi-stage programming with uncertain parameters. The papers that took a novel approach to the creation of project teams were presented in the analysis above. As a result, a thorough study of the studies from the last few years has been performed in the categories of Table 1, in which each research's methods have been examined and classified.

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Table 1. Evaluating the history of the formation of the project team and the allocation of resources to it

No	Researcher name, year	Objective					Type of objective function			Problem orientation		Tool		
		nt ou	tea ng	m tea	the on ed	er ow	pur	mu h	pur	tai cer	tai	heu	ma on	uri
1	Boone and Sear (2003)	√					√					√		
2	Chen and Lin (2004)						√				√		√	
3	Baixoglu (2007)	√	√						√	√		√		
4	Wi (2009)	√	√					√		√		√		
5	Sternad (2009)	√					√			√		√		
6	La Paz (2009)						√				√		√	
7	Augustine (2011)	√					√				√	√		
8	Mazur and Chen (2011)			√				√		√		√		
9	Andre (2011)	√							√		√	√		
10	Karger and Ann (2011)						√				√			√
11	Farhadi (2011)	√						√			√		√	
12	Farhadi (2012)	√						√			√		√	
13	Data (2012)						√				√			√
14	Anagtolopoulos (2012)								√		√			√
15	Jaguar (2012)	√						√			√			√
16	Sorkhi (2012)						√				√			√
17	Kargar (2012)					√		√			√			√
18	Tavana (2012)	√								√			√	
19	Ahmad (2013)	√							√		√		√	
20	Zhang (2013)								√	√			√	
21	Kargar (2013)								√		√			√
22	Rangapuram (2013)	√						√			√			√
23	Chen (2013)	√									√		√	
24	Dadlo (2014)	√									√		√	
25	Golshan (2014)						√				√			√
26	Lee (2014)						√				√			√
27	Ozilan (2014)	√									√		√	
28	Gutierrez (2016)				√				√		√		√	
29	Dee (2017)	√									√		√	
30	Birdlet (2018)		√		√		√				√		√	
31	Pardes (2018)			√		√		√			√		√	
32	Garosma (2019)			√		√		√			√	√		

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No	Researcher name, year	Objective					Type of objective function			Problem orientation		Tool		
		ou nt	ng tea	tea m	ed on the	ow er	pur	h mu	pur	cer tai	tai	heu	on ma	uri
33	Dabirian (2019)			√		√		√			√	√		
34	Dutsenko (2019)	√		√		√		√			√	√		
35	Rahmaniyai (2019)			√		√		√			√	√		
36	Chen (2019)	√			√			√			√			
37	Current study	√	√	√	√	√			√		√		√	√

The majority of studies examined the signs of the formation of project management departments or project teams, as can be seen in the study literature. On the other hand, a multi-objective approach takes into account the organization's ideal goals when developing the project team based on multi-objective decision-making, developing relationships, lowering costs, and improving skills in the executive and subordinate teams assigned to the project. The evaluation indicators should always be assessed and categorized using a multi-indicator decision-making strategy, which will be discussed in more detail in the next section of this research's methods in light of the gaps in the literature that have been found.

3- Methodology

The endeavor to plan in this area is very essential because the current competitive climate among project-oriented businesses and groups makes it increasingly necessary to maximize the cost and time of the project. Additionally, sometimes the importance of both the expense and time factors for planning is equal, and other times, it is more important to minimize one of the two factors than the other. For these reasons, it is thought essential to conduct research in this area. Human resources are the most crucial resource for initiatives of this nature and the most valuable capital for their companies, so the absence of planning in this area is glaringly obvious. As a result, it is crucial to correctly distribute human resources among the projects, taking into account the number of projects and how they are shared, in order to meet the needs of each phase's specific human resources requirements in addition to the significance of reducing cost or time. As a result, it is crucial and essential to handle the problem of human resources planning and forming a project management team in the shape of project management offices. For that reason, this section discusses planning and creating the ideal team in project-oriented businesses. The following are the modeling presumptions:

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- Each project's required level of expertise is understood, and the project crew is assembled accordingly.
- Effective dialogue exists among members of the project crew.
- The project squad is selected based on how much it will cost to assign each individual to it.
- There are a set amount of people in each squad.
- There are several specialized divisions on every project team.

Mathematical model of the problem
Index:
I,j: potential options of people to be in the project team
H: Part of the project team
K: Expertise required in team k

Mathematical model parameters:
C_{ij}: the level of communication between person i and person j (the result of DEMATEL evaluation)
D_{ij}: the degree of conformity and coordination between person i and person j (the result of DEMATEL evaluation)
I_i: the individual ability of a person i
F_i: the level of expertise of individual i
O_i: the cost of a person i
B_k: the number of people needed with k expertise
V_{ik}: whether person i is an expert or not in k's type of expertise
A_{ih}: Membership or non-membership of person i in the h section
P_h: the number of people required from the h department to form a multi-specialty team
Q: The number of people required to form a multi-specialty team
Decision variable:
X_i: Binary variable that is 1 if the person i is selected in the project team, otherwise 0.
The goals and constraints of the study are described in accordance with the introduction of indices, parameters, and the judgment variable in this part. The objective function of the mathematical model is as follows:

$$MAX\ z1 = \sum_{i} \sum_{j \neq i} c_{ij} * X_i * X_j \quad (1)$$

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$$MAX\ z2 = \sum_{i} \sum_{j \neq i} D_{ij} * X_i * X_j \quad (2)$$

$$MAX\ z3 = \sum_{i} I_i * X_i \quad (3)$$

$$MAX\ z4 = \sum_{i} F_i * X_i \quad (4)$$

$$MIN\ z5 = \sum_{i} O_i * X_i \quad (5)$$

$$\sum_{i} A_{ih} * X_i = P_h \qquad \forall\ h \quad (6)$$

$$\sum_{i} V_{ik} * X_i \leq B_k \qquad \forall\ k \quad (7)$$

$$\sum_{i} X_i = Q \quad (8)$$

Objective Function 1: Increasing Non-linear Communication (z1)

The first objective function aims to enhance non-linear communication between team members. Effective communication plays a pivotal role in project success, facilitating information exchange, problem-solving, and decision-making processes within the team. However, traditional linear approaches to modeling communication may overlook the complex and dynamic nature of interactions among team members. Therefore, this objective function employs non-linear optimization techniques to capture the nuanced relationships and interactions within the project team. To achieve this objective, the function evaluates various communication channels and their impact on team dynamics. It considers factors such as frequency, clarity, and richness of communication, as well as the diversity of communication methods utilized by team members. By optimizing non-linear communication patterns, this objective aims to foster a collaborative and innovative environment where ideas are freely exchanged, feedback is readily provided, and conflicts are effectively resolved. Ultimately, enhancing non-linear communication can lead to improved team cohesion, higher levels of trust, and enhanced overall project performance.

Objective Function 2: Increasing Compliance and Coordination (z2)

The second objective function focuses on improving compliance and coordination among team members. Compliance refers to the extent to which team members adhere to project guidelines,

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policies, and procedures, while coordination relates to the synchronization of efforts and activities to achieve common goals. Effective compliance and coordination are essential for maintaining project alignment, minimizing conflicts, and maximizing resource utilization.

To address this objective, the function evaluates key metrics related to compliance and coordination, such as adherence to deadlines, adherence to quality standards, and alignment with project objectives. It also considers factors such as role clarity, task dependencies, and team dynamics that influence coordination within the project team. By optimizing compliance and coordination, this objective seeks to ensure that team members work synergistically towards shared objectives, leading to improved project efficiency, reduced rework, and enhanced stakeholder satisfaction.

Objective Function 3: Optimizing Selection of Qualified Individuals (z3)

The third objective function focuses on optimizing the selection of individuals who can best meet the capability requirements of the project team. This involves identifying and selecting team members with the necessary skills, knowledge, and experience to contribute effectively to the project's objectives. The function considers various factors, including technical expertise, domain knowledge, problem-solving abilities, and team compatibility, in evaluating potential team members. To achieve this objective, the function utilizes optimization algorithms to systematically evaluate and prioritize candidates based on their qualifications and suitability for the project. It aims to create a well-balanced and complementary team composition, where each member brings unique strengths and capabilities to the table. By optimizing the selection process, this objective ensures that the project team is equipped with the right talent to address project challenges effectively, leading to improved project outcomes and stakeholder satisfaction.

Objective Function 4: Increasing Expertise Coverage (z4)

The fourth objective function aims to maximize the coverage of expertise within the project team. Expertise coverage refers to the extent to which the team possesses a diverse range of skills, knowledge areas, and competencies relevant to the project's scope and requirements. A high level of expertise coverage ensures that the team is well-equipped to address various aspects of the project and overcome potential challenges. To address this objective, the function evaluates the distribution of expertise across different domains and disciplines within the project team. It seeks to identify gaps in expertise and prioritize the selection of team members with complementary skills to fill those gaps. By optimizing expertise coverage, this objective enhances the team's overall capability to tackle complex tasks, innovate solutions, and deliver high-quality results. Ultimately, maximizing expertise coverage contributes to project success by

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mitigating risks, accelerating project progress, and increasing the likelihood of achieving project objectives.

and the goal of the objective function (5) is to reduce the project team's expenses.

Constraint (6) makes sure that each necessary area is represented in the project team's selection of members. The chosen individuals will have all the necessary skills for the undertaking, according to constraint 7. Constraint (8) makes sure that the project team stays within the permitted range. Due to the non-linear nature of the first and second objective functions. As a result, the first and second objective functions must be linearized using the variable change method. The first and second objective functions are changed in the manner described below:

$$MAX\ z1 = \sum_{i} \sum_{j \neq i} c_{ij} * Y_{ij} \tag{9}$$

$$MAX\ z2 = \sum_{i} \sum_{j \neq i} D_{ij} * Y_{ij} \tag{10}$$

which the binary variable Y_{ij} is a binary variable, and that the model now includes the following three restrictions:

$$X_i + X_j - Y_{ij} \leq 1 \quad \forall\, i, j\, , i \neq j \tag{11}$$

$$X_i - Y_{ij} \geq 0 \quad \forall\, i, j, i \neq j \tag{12}$$

$$X_j - Y_{ij} \geq 0 \quad \forall\, i, j, i \neq j \tag{13}$$

A position has been taken in this research based on the approach of the DEMATEL method, which, while examining the influence and dependence of personnel in the project team, evaluates the method of communication. As stated in the statement of the problem, the communication of the employees with each other in the formation of the project management team has a special effect. As a result, Figure 1's description of the research's execution stages is accurate.

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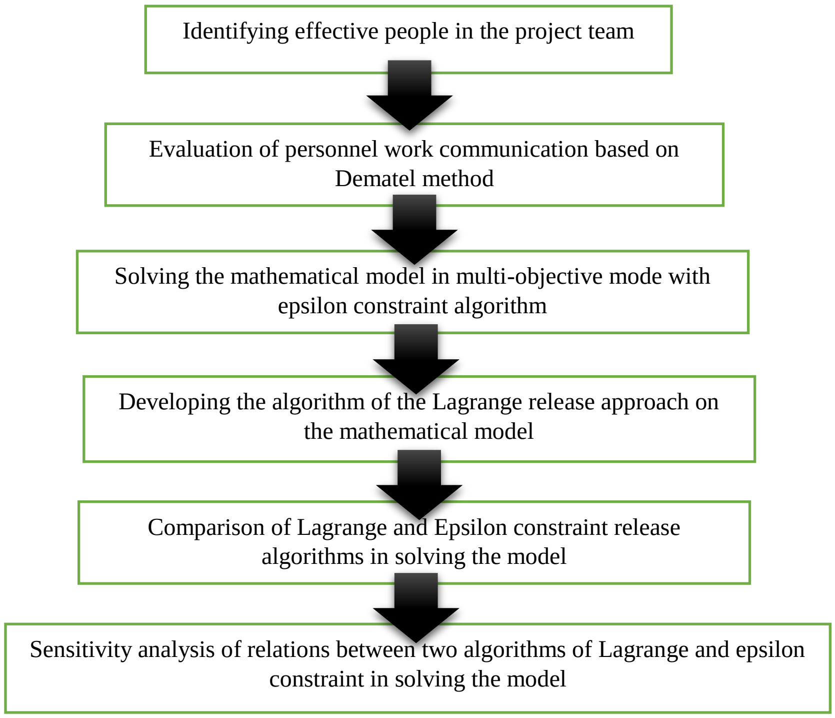

Figure 1. Flowchart of research implementation

Evaluating the interactions of each person based on interdependence in the project management team

It is advised to first determine the variables that cause dependence between the project management team members and then assess each individual's potential for synergy based on the information gathered from the research studies done on this topic. By examining earlier studies, it is possible to identify factors that make project team members dependent on one another, including common resources, technology, and expertise as well as technical and executive factors. Two methods have been used to assess how project team members interact with one another. The interactions were examined individually and with the help of expert views in the first approach, and the reciprocal connections between projects were examined using the DEMATEL technique in the second.

Evaluation and Relevance of Mathematical Model Parameters:

Assessing and evaluating parameters such as "individual ability," "level of expertise," "departmental personnel requirements," and "multi-specialty team composition" are indeed

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critical challenges in constructing a robust mathematical model for project team formation. Each of these parameters plays a significant role in determining the effectiveness and efficiency of the project team, and thus, their assessment methods and relevance in construction practice must be thoroughly elaborated.

1. Individual Ability and Level of Expertise: These parameters refer to the skills, knowledge, and experience possessed by each team member. Assessing individual abilities may involve evaluating technical competencies, problem-solving skills, communication abilities, and leadership qualities through interviews, assessments, and performance reviews. Similarly, determining the level of expertise requires analyzing past experiences, certifications, and project-specific knowledge. In the context of construction practice, individual abilities and expertise are crucial for executing tasks efficiently, ensuring quality, and managing project risks.

2. Departmental Personnel Requirements: This parameter pertains to the specific roles and responsibilities within the project team and the corresponding skill sets required to fulfill these roles. Assessing departmental personnel requirements involves analyzing project scopes, identifying key tasks and deliverables, and mapping them to relevant skill sets and expertise areas. Understanding departmental personnel requirements ensures that the project team is adequately staffed with individuals possessing the necessary competencies to address project needs effectively.

3. Multi-Specialty Team Composition: Construction projects often require interdisciplinary collaboration, involving professionals from various specialties such as engineering, architecture, project management, and construction management. Assessing and composing multi-specialty teams involve identifying the diverse skill sets and expertise areas required for project success, ensuring effective communication and coordination among team members from different disciplines, and fostering a collaborative work environment. In construction practice, multi-specialty team composition enhances innovation, problem-solving capabilities, and project adaptability to changing requirements and conditions.

The first approach: interactions between members individually

It should be mentioned that the suggested framework incorporates the impact of each person's effectiveness on exchanges between management team members, raising the idea of interdependence of members. This idea is investigated from the aforementioned angles in accordance with the factors that lead to reliance.

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Interactions between members from a resource perspective

Assume that Persons A and B are reliant on one another for certain resources, with corresponding projected prices of CA and CB, where CA > CB. As a result of their combined efforts, these two can reduce the overall expense of materials by the following amount:

A directional (reciprocal) curve connecting the two nodes signifying the project team symbolizes the binary connection between any two individuals in terms of resources. A square grid is used to calculate how each team member contributes to using the resources allotted to the management team. R~~jk~~ provides a number indication for it. Consider the situation where people A and B (with numbers of j and k, respectively) are dependent on one another for resources. The connection between r_{jk} and r_{kj} is as follows: Person A uses up to 20% of the resources, and person B receives the leftover 80%:

$$r_{jk}=1 - r_{kj}$$

The overall cost of resources, which is denoted by the letters RC_{jk} and is inscribed on each bow, is decreased as a result of the simultaneous inclusion of these two individuals in the project team. The efficient interdependence of resources, which is symbolized by RI_j, allows for the efficient calculation of each person's input to lower the cost of the complete project team:

$$RIj= \sum_{k\neq j.\ k=1}^{n} EF_j \times RC_{jk} \times r_{jk} \quad \forall\ j = 1.2. \ldots . n$$

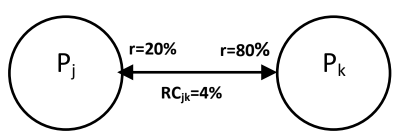

Figure 2. Network mapping of project interactions caused by common resources

Interactions between team members from the perspective of technology and knowledge

Technology transmission and learning can proceed more quickly when the project team makes use of its expertise and resources. This could shorten the time it takes for some projects to be completed, which would shorten the time it takes for the entire project inventory to be completed. To determine the project team's technology and expertise collaboration, take the following steps:

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With a directional (two-way) arc between the nodes, the binary connection between the two groups of people in terms of shared knowledge and technological advancement is shown:

$$TLj=\sum_{k\neq j.\ k=1}^{n} EF_j \times TP_{jk} \times r'_{jk} \qquad \forall\, j = 1.2.\dots.n$$

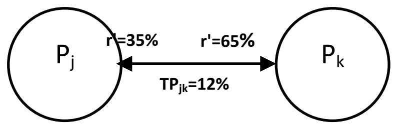

Figure 3. Network mapping of project interactions caused by technology and knowledge

Interactions between projects from the point of view of technical factors

The impact on other people's chances of success can be used to gauge how successful each member of the management team is. To determine a person's conditional success probability based on the joint distribution of other individuals, the following procedures are suggested:

Technically speaking, a directional (one-way) path between the points represents communication between project team members. A square matrix is used to determine how each individual interacts with the technological variables taken into account by the project team. PE_{jk} is used to represent its numbers. Consider the case where A and B, who have the numbers j and k, respectively, have technological interdependence. If the choosing and success of person B determine whether person A succeeds, then the conditional chance that person A will succeed if person B is selected can be calculated using the following equation using their joint distribution. As a result, Person A's achievement grows as much as PE_{jk}:

$$PEjk= (PA\ ,\ PB)= PA|B= Psuccess\ of\ P_A|success\ of\ P_B= \frac{P_{(success\ of\ P_A.success\ of\ P_B)}}{P_{(\ success\ of\ P_B)}}$$

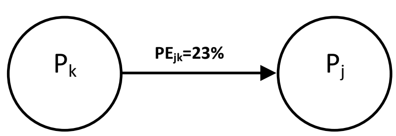

Figure 4. Network mapping of people's interactions caused by technical factors

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The following equation is used to determine the success rate of each member of the management team as a consequence of the successful interdependence of technological variables (TI_j):

$$TIj= \sum_{k\neq j.\ k=1}^{n} EF_j \times PE_{jk} \qquad \forall\ j = 1.2. \ldots . n$$

Interactions between people from the point of view of the management team

In terms of anticipated income or sales, the outcomes of each management team may have an impact on other initiatives. For the purposes of project management, the following assessment is made for this sort of interaction:

A knot between the nodes represents communication among project team members.

Based on network mapping, the square grid that results from these interdependencies is produced.

Each project team's success has an impact on how well the project as a whole performs. The SR_{jk} variable displays the project's revenue synergy proportion when team members j and k are both present. Through the use of expert surveys, it is possible to implicitly determine the revenue per project (BN).

Explaining the Relationship between Project Team Formation and Anticipated Income/Sales:

The mention of anticipated income or sales in relation to the formation of construction project teams on page 9 requires clarification to elucidate the connection between these seemingly disparate concepts. In construction project management, the composition and effectiveness of project teams can indeed have a profound impact on various aspects of project performance, including financial outcomes such as anticipated income or sales. This relationship can be explained through several key points:

1. Resource Allocation and Efficiency: The composition of project teams directly influences resource allocation and utilization throughout the project lifecycle. A well-structured and skilled project team can enhance operational efficiency, reduce project delays, and optimize resource utilization, ultimately leading to cost savings and increased profitability. Consequently, the anticipated income or sales projections for a construction project may be affected by the efficiency and effectiveness of the project team in delivering project objectives within budget and schedule constraints.

2. Client Satisfaction and Repeat Business: Effective project teams play a crucial role in delivering high-quality construction projects that meet or exceed client expectations. Client satisfaction and positive project outcomes can lead to repeat business, referrals, and enhanced reputation within the industry. As a result, the financial success of a construction project, as

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measured by anticipated income or sales, may be influenced by the ability of project teams to foster positive client relationships, deliver superior project results, and secure future business opportunities.

3. Risk Management and Project Performance: Project teams are responsible for identifying, assessing, and mitigating risks throughout the project lifecycle. A proactive and competent project team can effectively manage project risks, anticipate challenges, and implement timely solutions to prevent costly delays or disruptions. By minimizing project risks and maximizing performance, project teams contribute to the overall financial success of the project, as reflected in anticipated income or sales projections.

4. Cross-Project Dependencies and Portfolio Management: In complex construction environments, where multiple projects may be executed concurrently or sequentially, the outcomes of each project team can have ripple effects on other initiatives within the organization's project portfolio. For example, delays or cost overruns in one project may impact resource availability or funding allocations for other projects, potentially affecting their anticipated income or sales projections. Therefore, the performance of individual project teams can influence the overall financial health and success of the organization's project portfolio.

By elaborating on these points, the authors can provide a clearer explanation of how the formation and performance of construction project teams are intricately linked to anticipated income or sales projections. This clarification enhances the reader's understanding of the broader implications of project team dynamics on project outcomes and financial performance.

The following equation can be used to determine the revenue growth score for each project as a consequence of the management team's synergy and the MIj team's interdependence:

$$\mathrm{MIj}=\sum_{k\neq j.\ k=1}^{n} \mathrm{EF_j} \times \mathrm{BN_k} \times \mathrm{SR_{jk}} \quad \forall\, j = 1.2. \dots . n$$

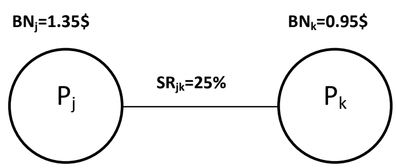

Figure 5. Network mapping of team member interactions caused by managerial attitude

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Evaluation of communication between people in the project team using DEMATEL's approach

The quantity of communication among the project team will be evaluated using the DEMATEL technique in this part because it is a factor in decision-making.

As a result, these are the stages to apply DEMATEL's method:

First step: Forming the direct relationship matrix: A grid is used to represent interpersonal relationships. We create a straight connection matrix by taking the basic average of the views of the various specialists into consideration.

The second step is the formation of the normal direct correlation matrix: Using Equations (3–13) and, one obtains the adjusted matrix. (3-15). The total of all rows and columns is first computed. The amount of k is the inverse of the biggest row and column integer. The normal direct correlation matrix is then produced from the sum of the value of k in the direct correlation matrix:

$$k = \frac{1}{\max(\sum_{i,j=1}^{n} a_{ij})} \quad (14)$$

a_{ij}= The entry of the i-th row and the j-th column of the direct correlation matrix n: the number of rows or columns:

$$N = K*D \quad (15)$$

D: direct correlation matrix

N: normal direct correlation matrix

Third step: Calculation of complete correlation matrix: This matrix is calculated according to equation (15-3):

$$T = N \times (I - N)^{-1} \quad (16)$$

T: complete association matrix

I: identity matrix

Step 4: creating a Causal Diagram

Rows Sumation Vector (D): It shows the extent to which each element influences the other factors in the system. (the degree of influence of individuals on each other). Columns Sumation Vector (R): The level of impact and impression of the wanted individual in the system is therefore represented by the horizontal vector (D + R), also known as superiority. In other terms, an agent interacts with other users of the system more frequently the greater their D + R number. The impact each individual has on others is represented by the vertical vector (D-R), also known as dependence. D-R is typically regarded as an impact if it is negative and a causative variable if

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it is positive. A Cartesian grid system is then depicted. The horizontal axis of this instrument is based on D-R values, while the longitudinal axis is based on D+R values. A spot in the gadget with the coordinates (D+R, D-R) identifies each person's location. In this way, a graphic diagram will be obtained. Fifth step: Calculation of threshold value: Calculating the threshold value is necessary to produce the network connections diagram. By using this technique, one can avoid incomplete ties and create a network of important connections. Only connections with values larger than the cutoff value in the full relationship matrix will be shown in NRM. Calculating the average of the numbers in the entire matrix is sufficient to determine the connection cutoff value. All values of the entire correlation matrix that are less than the threshold are zeroed after the threshold intensity has been established, i.e., the causative connection is not taken into account.

To assess and examine the Pareto front of optimal solutions, however, new algorithms must be used because the mathematical model under investigation is multi-objective. Therefore, techniques for determining the Pareto front of optimum solutions must be developed. The epsilon constraint approach, first proposed by Aljadan, is one of the precise techniques for getting optimum Pareto solutions. The primary benefit of this approach over other multi-objective optimization techniques is that it can be used in non-convex solution spaces, where other techniques like the weighted combination of objectives become ineffective. One of the key criteria used to evaluate algorithms is their computational time. Since the epsilon method and other exact search-based algorithms have severe computational time limitations, using a meta-heuristic algorithm will obviously result in a significant reduction in computational time. For a two-objective issue, we will have the following algebraic expression: In this technique, we always maximize one of the objectives, given that we set the maximum permissible limit for the other objectives in the majority of the constraints:

$$\begin{aligned} &\text{Min } f_1(x) \\ &\text{Subject to } f_2(x) \le \varepsilon_2,\, f_3(x) \le \varepsilon_3, \dots, f_p(x) \le \varepsilon_p,\ x \in S \end{aligned} \tag{17}$$

The Pareto edge of the issue can be found by modifying the numbers on the right side of the new restrictions. The high volume of calculations required by the epsilon-limitation technique, which requires testing several various values ε_i of the values for each objective function that is turned into a limit ($p-1$), is one of its major drawbacks. One of the most popular methods for putting the epsilon-constraint technique into practice is to first determine the maximum and half of each objective function without taking into account other objective functions in the space $x \in S$. The interval related to each of the target functions is then calculated using the values acquired in the

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preceding phase. If we refer to the objective functions' highest and lowest values as $f_i^{\max}$ and $f_i^{\min}$, respectively, then the interval of each of them is determined as follows:

$$r_i = f_i^{\max} - f_i^{\min} \tag{18}$$

The interval r_i is divided into the interval q_i. Then ε_i in the following equation, $q_i + 1$ different values that are calculated from the following formula can be obtained:

$$\varepsilon_i^k = f_i^{\max} - \frac{r_i}{q_i} \times k \quad k = 0,1,\ldots,q_i \tag{19}$$

where k shows the new point number related to ε_i. The above multi-objective optimization problem can be converted to $\prod_{i=2}^{p}(q_i + 1)$ the number of sub-problems of single-objective optimization using the epsilon-constraint method. Given that the inequalities related to the objective functions will further limit it, each sub-problem has a solution space S. Each sub-problem leads to a candidate solution for the desired multi-objective optimization problem or Pareto optimal front. Sometimes some sub-problems create unfeasible space. The decision-maker can then select and use the best solution after obtaining the ideal Pareto front.

Solving the mathematical model using the Lagrange decomposition algorithm

With the successful solution of the traveling salesman problem in 1970, whose dimensions were extremely large compared to the computing power of that time, the freeing of Lagrange coefficients as a method to obtain upper (and lower) bounds for the value of the objective function of mathematical programming problems was taken into consideration. (Zia, 2018). Considering the volume of calculations in large problems, obtaining the upper and lower bounds in terms of increasing the efficiency of the method is of particular importance. In the problem, RP with the form of $Z^{RP} = \max\{f(x):\ x \in T\ \subseteq \mathbb{R}^n\}$, releasing the problem P has the form of $Z^P = \max\{c(x):\ x \in S\ \subseteq \mathbb{R}^n\}$ if first $S \subseteq T$, let problem P's justified region be a subgroup of problem RP's justified region. Second, for every location in the valid region of the P problem, the value of the objective function of the RP problem should be higher than the value of the objective function of the P problem. A technique used in optimization to locate local peaks and

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minima for functions subject to one or more equality requirements is called Lagrange coefficients. This approach bears Joseph Louis Lagrange's name.

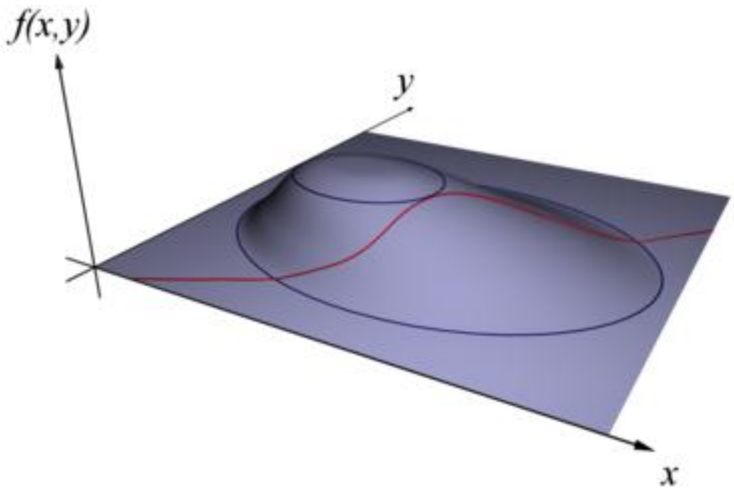

Figure 6. Finding values of x and y to maximize f(x)

In honor of the Italian scientist Joseph Louis Lagrange, this theory bears his name. And many theories, including Karush Kan Tucker, are based on it.
This is the fundamental algebraic formula for it:

$$\begin{aligned} &Minimize\ f(x) \\ &subject\ to\ \ g_i(x) \leq 0 \quad for\ i = 1, \dots, m \\ &\qquad\quad h_i(x) = 0 \qquad for\ i = 1, \dots, l \\ &x \in X \end{aligned} \tag{20}$$

It could be represented differently as follows:

$$\begin{aligned} &Minimize\ \theta(u, v) \\ &Subject\ to\ u \geq 0 \\ &\theta(u, v) = \min\left\{f(x) + \sum_{i=1}^{m} u_i g_i(x) + \sum_{i=1}^{l} v_i h_i(x):\ \ x \in X\right\} \end{aligned} \tag{21}$$

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An optimization issue that is limited actually becomes an unconstrained optimization problem. In other terms, we have a maximin function and are attempting to find its infimum.

The problem $RP: Z^R = \max\{f(x)\ x \in T \subseteq \mathbb{R}^n\}$ is called the released problem $IP: Z = \max\{c^T x | x \in X \subseteq \mathbb{R}^n\}$, if:

$$X \subseteq T \quad (22)$$
$$\forall x \in X \quad f(x) \geq c^T x$$

Theorems

Theorem: if problem RP is the released problem of IP, then $Z^R \geq Z$.

Proof: suppose thatx^* is the optimal answer to the IP problem, then:

$$x^* \in X \subseteq T \quad , \quad Z = c^T(x^*) \leq f(x^*) \quad (23)$$

And because $x^* \in T$, then $f(x^*)$ is a lower bound for Z^R, i.e. if $\bar{x}$ is the optimal answer for Z^R, then we have:

$$Z = f(x^*) \leq f(\bar{x}) = Z^R \quad (24)$$

Definition: For the linear programming model $Z = \max\{cx | x \in P\}$with the formulation, $P = \{x \in \mathbb{R}^n | Ax \leq b\}$, the released form of linear programming is defined as follows:

$$Z^{LP} = \max\{cx | x \in X \subseteq Z^n\} \quad (25)$$

Theorem: let's suppose that P_1 and P_2 are two formulations for the integer problem Z_{LP} so that $Z_{LP} = \max\{cx | x \in X \subseteq Z^n\}$ in a way that P_1 is better than P_2 . if $Z_1^{LP} = \max\{cx | x \in X\}$ and $Z_2^{LP} = \max\{cx | x \in X\}$, then $Z_1^{LP} \leq Z_2^{LP}$.

Proof: first, since P_1 is better than P_2 , then :

$$P_1 \subseteq P_2 \quad (26)$$

if we suppose that x^* is the optimal answer to Z_1^{LP} the problem, then $x^* \in P_1$. Therefore, given the above equation, we have $x^* \in P_2$. On the contrary, considering Z_2^{LP}, cx^* is a lower bound for Z_2^{LP}, then Z_2^{LP}.

Theorem: if the released problem LP is not feasible, then the main problem IP is also not feasible.

Proof: Since the released problem is not feasible, then $T =$, and because $X \subseteq T$, thus $X = \emptyset$.

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Theorem: suppose that x^* is the optimal answer for the RP problem, if $x^* \in X$ and $f(x^*) = c(x^*)$, then $x^*$is the optimal answer for the IP problem.
Proof: since $x^* \in X$, then:

$$Z \geq c(x^*) = f(x^*) = Z^R \quad (27)$$

On the other hand, we have $Z \leq Z^R$. Therefore, it is concluded that $Z = Z^R$ i.e. x^* is the optimal answer for the IP problem.
Definition: let's consider the main linear programming problem with the following form:

$$Z(P) = \max C^T x \quad (28)$$

$subject\ to$
$Ax \leq b$
$Bx \leq d$
$x \in X \subseteq \mathbb{Z}^n$

The above problem's freed Lagrange RP problem is described as follows:

$$Z(LR_\lambda) = \max C^T x + \lambda^T (b - Ax) \quad (29)$$

$subject\ to$
$Bx \leq d$
$x \in X \subseteq \mathbb{Z}^n$
$\lambda \geq 0$

Indeed, the hard constraint is added to the goal function in the Lagrange release technique rather than being removed. (In this problem, the restriction $Ax \leq b$ is difficult restriction.)
Accordingly, an upper bound for the value of the ideal answer to the initial issue Z is specified by Lagrangian relaxation. (P).
Theorem: suppose that for each set of multipliers $\lambda \geq 0$, we have:

$$Z(P) \leq Z(LR_\lambda) \quad (30)$$

Proof: suppose that $x^*$is an optimal (or feasible) answer for the ILP problem, then we have:

$$x^* \in X\,, Ax^* \leq b \qquad (b - Ax^* \geq 0) \quad (31)$$

On the other hand, $\lambda \geq 0$, then:

$$Z(P) = c^T x^* + \lambda(b - Ax^*) \leq Z(LR_\lambda) \quad (32)$$

Therefore, the implementation steps of the Lagrange method are as follows:
Step 1) Starting with the vector of Lagrange coefficients $\lambda = 0$ and the size of $step\ size = k$.
Step 2) Solving the released problem (D) and calculating x^*.

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Step 3) If the i[th] released constraint $x^*$is not feasible, then $\lambda_i = \lambda_i + k$.
Step 4) If the i[th] released constraint $x^*$is feasible, then $\lambda_i = \lambda_i - k$.
Step 5) If after m rounds there is no increase in the value of the best lower bound, then $k = {}^{k}/_{2}$.
Step 6) refers to step 2.

Consequently, the mathematical model is explained and assessed using the Lagrange liberation method technique while taking into account the dimensions of the optimum Pareto box of the objective function solution: Consequently, the overall flowchart of the Lagrange method assessment on the mathematical model is as shown in the flowchart below:

Consequently, the Lagrange release method diagram can be decoded as follows:

Step 1	$u(t) = 0$; Initialize multipliers $u_t \in [\underline{u}_t, \overline{u}_t]$, that $\underline{u}_t = Min\{u(t)\}$, $\overline{u}_t = Max\{u(t)\}$ Set a lower bound $LB = 0$ and upper bound $UB = \hat{Z}$ Where $\hat{Z}$ is any feasible solution, e.g., the final solution obtained from the epsilon Algorithm
Step 2	Calculate $Z_{LR}^n = Z_{LR}(u_t)$. Set $LB = \max\{LB, Z_{LR}^n\}$. If $UB - LB \leq \varepsilon$ or $n = MAX\_n$ then STOP else go to step 3.
Step 3	Compute subgradients and step size Subgradients: $\sqrt{\sum_{P} TF_p * \sum_{I \in N_F} XY_{pTI}}$ Step size : $teta^n = \dfrac{\sqrt{\sum_{P} TF_p * \sum_{I \in N_F} XY_{pTI}}}{\sum_t \sqrt{\sum_{P} TF_p * \sum_{I \in N_F} XY_{pTI}}}$ If $Z_{LR}^n - Z_{LR}^{n-1} \leq 0$ then use $teta^n = \frac{1}{2} teta^{n-1}$, if not use $teta^n = teta^{n-1}$.
Step 4	Update each multiplier as $u_t^{n+1} = \max\{0, u_t^n - \sqrt{\sum_{P} TF_p * \sum_{I \in N_F} XY_{pTI}})\}$.
Step 5	Set $n = n + 1$ and go to Step 2.

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4- Findings

4-1- Evaluation of each project's relations based on how dependent they are on one another

Different project team selection models concentrated on the teamwork of the management team while taking into account various assumptions and constraints. The following presumptions are made in this research:

• The partnership between project participants is regarded as a pair. In other words, owing to great complexity, interdependence between more than two individuals is not taken into account.

• It is believed that each organization's anticipated costs and revenues have been computed during the feasibility study stage of that project team. Expert surveys can be used because anticipated costs and revenues are unclear.

• As a consequence of choosing numerous interdependent teams, the worth of each project team's metrics, such as time, expense, and revenue, is expected to shift linearly.

• The following are some ways that the interdependencies between member groups that were noted in the literature study impact the project team selection criteria:

• The interdependence of resources causes earnings and incomes to decline.

• The amount of time it takes a project team to finish a project is decreased by the interdependence of learning and technical expertise.

• Technical dependency raises the likelihood that the project team will succeed.

• The anticipated sales or income as a result of the team's creation is increased by the interconnectedness of teams in the administration of the goal project.

In conclusion, Table 2 lists the variables, interaction patterns, and measurements affected by each component. It should be mentioned that the network analysis procedure was used to choose the most pertinent criterion for the suggested framework.

Table 2. Risk assessment of project team formation

Dependence making factors	Interaction pattern	Mutual criterion
Common resource	Input-input	The financial value of forming a project team
Technology and knowledge	Input-input	The qualitative value of project team formation
Technical factors	Output-input	Development of the organization's infrastructure due to the formation of the project team
Project management perspective	Output-output	Earned financial value from forming the project team

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Approach one: interactions between the project team separately
Interactions between the project management team from the resource perspective
The rjk matrix values are shown in Table 3.

Table 3. Values of rjk matrix

	DMU2	DMU5	DMU 12	DMU 15	DMU 18	DMU19	DMU21	DMU22	DMU23	DMU24	DMU25	DMU27	DMU31	DMU32
DMU2	0	0.85	0.6	0	0	0	0	0	0	0	0.45	0	0.75	0
DMU5	0.15	0	0.3	0.25	0	0	0	0	0.45	0	0	0	0	0
DMU12	0.4	0.7	0	0	0.8	0.45	0	0	0	0	0	0.5	0	0
DMU15	0	0.75	0	0	0.6	0.75	0.35	0	0	0	0	0	0	0
DMU18	0	0	0.2	0.4	0	0	0	0.2	0.4	0	0.45	0	0	0
DMU19	0	0	0.55	0.25	0	0	0	0.3	0.2	0	0	0.15	0	0
DMU21	0	0	0	0.65	0	0	0	0.25	0.15	0	0	0	0	0
DMU22	0	0	0	0	0.8	0.7	0.75	0	0	0	0	0	0	0
DMU23	0	0.55	0	0	0.6	0.8	0.85	0	0	0.7	0	0	0	0
DMU24	0	0	0	0	0	0	0	0	0.3	0	0.15	0	0	0
DMU25	0.55	0	0	0	0.55	0	0	0	0	0.85	0	0	0	0.8
DMU27	0	0	0.5	0	0	0.85	0	0	0	0	0	0	0.85	0
DMU31	0.35	0	0	0	0	0	0	0	0	0	0	0.15	0	0.5

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DMU32	0	0	0	0	0	0	0	0	0	0	0.2	0	0.5	0

Figure 8 displays the network layout that results from these interactions.

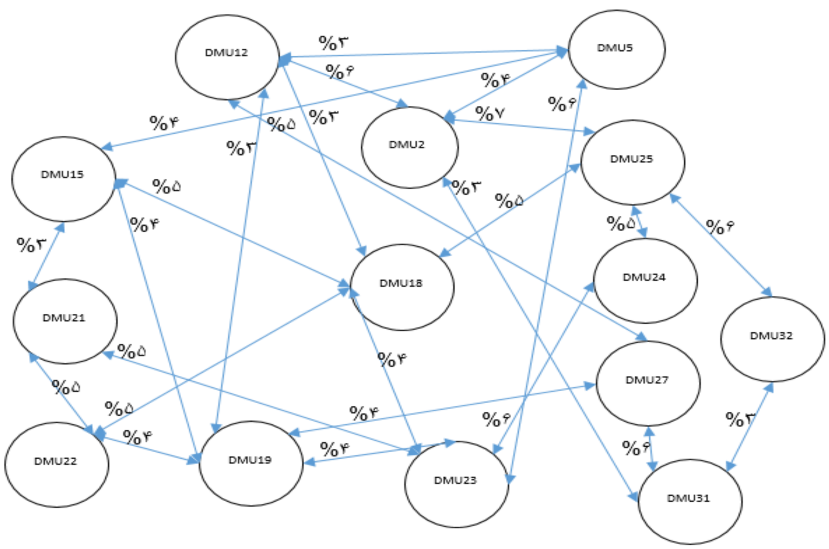

Figure 8. Network mapping of resource interactions

Table 4 illustrates how each individual helped to lower the overall project management cost as a result of the effective resource dependency.

Table 4. Effective dependence on resources

DMU2	16.938
DMU5	7.025
DMU12	10.815
DMU15	10.944
DMU18	9.424
DMU19	8.846
DMU21	4.136
DMU22	13.124
DMU23	2.970

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DMU24	3.550
DMU25	16.151
DMU27	23.870
DMU31	3.792
DMU32	4.604

Interactions between the employees of the project management team in terms of expertise and technology. Table 5 displays the r'jk matrix's numbers.

Table 5. Values of the r'jk matrix

	DMU 2	DMU 5	DMU 12	DMU 15	DMU 18	DMU 19	DMU 21	DMU 22	DMU 23	DMU 24	DMU 25	DMU 27	DMU 31	DMU 32
DMU2	0	0.75	0	0.6	0.55	0	0.65	0.7	0.65	0	0	0.6	0	0
DMU5	0.15	0	0	0.3	0.45	0	0.55	0.55	0.45	0	0	0.25	0	0
DMU12	0	0	0	0	0	0	0	0	0	0.5	0	0	0.5	0
DMU15	0.4	0.7	0	0	0.75	0	0.65	0.5	0	0	0	0.5	0	0
DMU18	0.45	0.55	0	0.25	0	0	0.65	0.35	0.4	0	0	0.45	0	0
DMU19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU21	0.35	0.45	0	0.35	0.35	0	0	0.25	0.15	0	0	0.15	0	0
DMU22	0.3	0.45	0	0.5	0.65	0	0.75	0	0.5	0	0.5	0.65	0	0
DMU23	0.35	0.55	0	0	0.6	0	0.85	0.5	0	0	0	0.5	0	0
DMU24	0	0	0.5	0	0	0	0	0	0	0	0	0	0.5	0
DMU25	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0.8
DMU27	0.4	0.75	0	0.5	0.55	0	0.85	0.35	0.5	0	0	0	0	0
DMU31	0	0	0.5	0	0	0	0	0	0	0.5	0	0	0	0
DMU32	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0

Figure 9 displays the network layout that results from these interactions.

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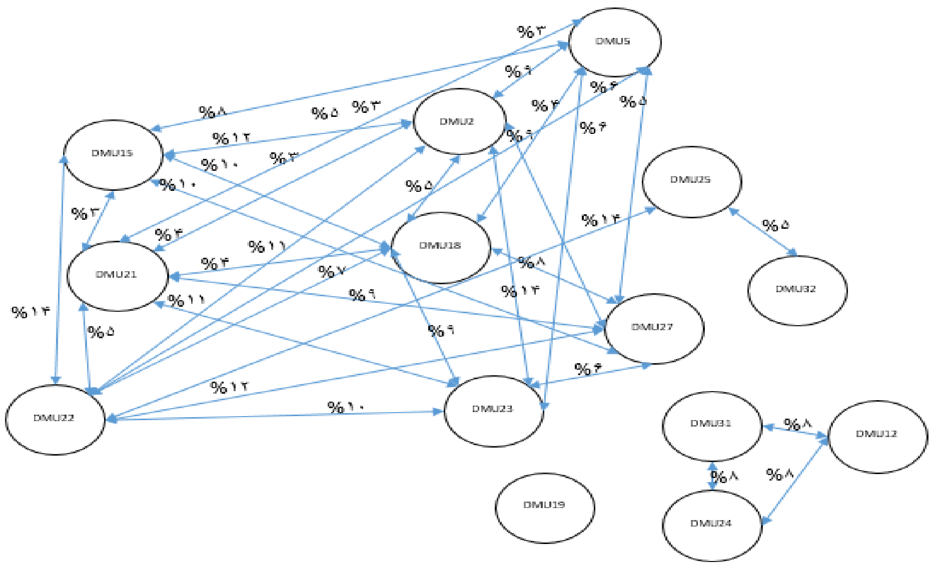

Figure 9. Network mapping of technology and knowledge interactions

Table 6 details how much each individual contributed to the project team's ability to finish sooner due to the connection between technical proficiency and knowledge.

Table 6. Effective dependence on technology and knowledge

DMU2	56.689
DMU5	19.522
DMU12	8.048
DMU15	34.685
DMU18	24.288
DMU19	0.000
DMU21	9.894
DMU22	51.128
DMU23	36.552
DMU24	11.136
DMU25	11.352
DMU27	68.572
DMU31	8.792
DMU32	1.705

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4-2- Interactions between project team members from the perspective of technical agents

The technical interdependence score of each project is displayed in Table 7 after gathering source data on the likelihood of success and failure of project team pairs that have technical interdependence and computing the joint probability distribution functions in the team.

Table 7. PEjk matrix values

	DMU 2	DMU 5	DMU 12	DMU 15	DMU 18	DMU 19	DMU 21	DMU 22	DMU 23	DMU 24	DMU 25	DMU 27	DMU 31	DMU 32
DMU2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU21	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0
DMU22	0	0	0	0	0.34	0	0	0	0	0	0.21	0	0	0
DMU23	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0
DMU24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU31	0	0	0	0	0	0	0	0	0	0.21	0	0	0	0
DMU32	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 10. displays the network layout that results from these interactions.

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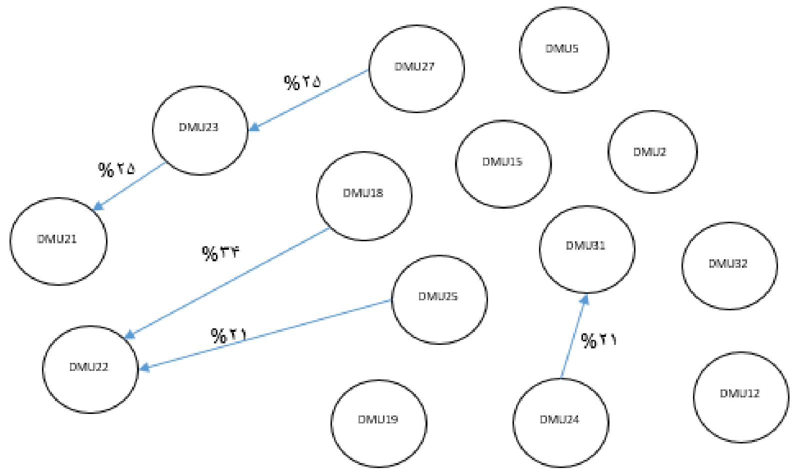

Figure 10. Network mapping of interactions between technical factors among project team members

Table 8 illustrates the extent to which each project team's performance has increased under senior administration as a consequence of the interdependence of team members as technical variables.

Table 8. Effective dependence on technical factors

DMU2	0.000
DMU5	0.000
DMU12	0.000
DMU15	0.000
DMU18	0.000
DMU19	0.000
DMU21	0.262
DMU22	0.684
DMU23	0.295
DMU24	0.000
DMU25	0.000
DMU27	0.000

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DMU31	0.231
DMU32	0.000

4-3- Interactions between members from the perspective of management

As a consequence of the management point of view's successful interdependence, Table 9 and Table 10 respectively display the performance information for the members of the management point of view as well as the objective and income growth score of each project.

Table 9. SRjk matrix values

	DMU 2	DMU 5	DMU 12	DMU 15	DMU 18	DMU 19	DMU 21	DMU 22	DMU 23	DMU 24	DMU 25	DMU 27	DMU 31	DMU 32
DMU 2	0	0.05	0	0.1	0	0	0	0.2	0	0	0	0.15	0	0
DMU 5	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU 12	0	0	0	0	0	0	0	0	0	0.05	0	0	0.1	0
DMU 15	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU 18	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
DMU 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMU 21	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0
DMU 22	0.2	0	0	0	0.1	0	0	0	0	0	0.15	0	0	0
DMU 23	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0
DMU 24	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0
DMU	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0

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25								5						
DMU 27	0.1 5	0	0	0	0	0	0.1 5	0	0.1	0	0	0	0	0
DMU 31	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0
DMU 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 11. displays the network layout that results from these interactions.

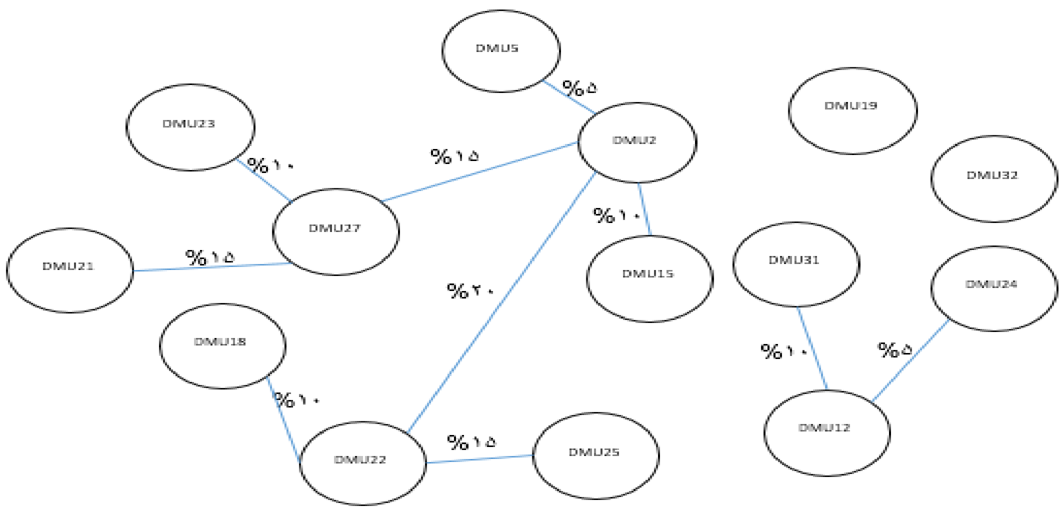

Figure 11. Network mapping of management perspective interactions

Table 10. The functional dependence of the managerial perspective

DMU2	423.46
DMU5	64.1725
DMU12	105.63
DMU15	103.455
DMU18	50.6
DMU19	0
DMU21	125.64
DMU22	398.08
DMU23	94.48
DMU24	97.44

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DMU25	61.92
DMU27	678.125
DMU31	153.86
DMU32	0

4-4- The second approach: interactions between members based on the DEMATEL method

The causal analysis method has been used to assess and study the members' relationship. According to the suggested dependent factors, such as common resources, technology, and expertise, and technological and market factors, the members of the assessed project team have been examined and evaluated in this part. Consequently, the following is the executive procedure of squad formation:

Step 1: Forming the matrix of direct communication

• Evaluating the mutual relations based on common resources:

Table 11. Interrelationships based on shared resources

DMU 32			DMU 31			DMU 27			DMU 25			DMU 22			DMU 21			DMU 19			DMU 18			DMU 15			DMU 12			DMU 5			DMU 2			
0.9	0.7	0.5	0.9	0.7	0.5	0.3	0.1	0.0	0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.9	0.7	0.5	0.3	0.1	0.0	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0.0	DMU 2
1.0	0.9	0.7	0.9	0.7	0.5	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	1.0	0.9	0.7	0.9	0.7	0.5	0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0.0	0.7	0.5	0.3	DMU 5
0.7	0.5	0.3	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0.0	0.9	0.7	0.5	0.7	0.5	0.3	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0.0	0.3	0.1	0.0	0.7	0.5	0.3	0.9	0.7	0.5	DMU 12
0.3	0.1	0.0	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0.0	0.3	0.1	0.0	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0.0	0.5	0.3	0.1	0.3	0.1	0.0	0.3	0.1	0.0	DMU 15
1.0	0.9	0.7	1.0	0.9	0.7	0.7	0.5	0.3	0.5	0.3	0.1	0.3	0.1	0.0	1.0	0.9	0.7	1.0	0.9	0.7	0.3	0.1	0.0	0.5	0.3	0.1	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0.0	DMU 18
1.0	0.9	0.7	1.0	0.9	0.7	0.7	0.5	0.3	0.5	0.3	0.1	0.3	0.1	0.0	1.0	0.9	0.7	0.3	0.1	0.0	0.7	0.5	0.3	0.5	0.3	0.1	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0.0	DMU 19

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DMU 32	DMU 31	DMU 27	DMU 25	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	
0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0.0	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0.0	0.3 0.1 0.0	DMU 21
0.9 0.7 0.5	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0.0	0.9 0.7 0.5	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0.0	DMU 22
0.5 0.3 0.1	0.9 0.7 0.5	0.7 0.5 0.3	0.7 0.5 0.3	0.5 0.3 0.1	0.5 0.3 0.1	0.9 0.7 0.5	0.7 0.5 0.3	0.7 0.5 0.3	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	DMU 23
1.0 0.9 0.7	0.9 0.7 0.5	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	1.0 0.9 0.7	0.9 0.7 0.5	0.7 0.5 0.3	0.7 0.5 0.3	0.9 0.7 0.5	0.3 0.1 0.0	0.7 0.5 0.3	DMU 24
0.5 0.3 0.1	0.9 0.7 0.5	0.7 0.5 0.3	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	0.9 0.7 0.5	0.7 0.5 0.3	0.7 0.5 0.3	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	DMU 25
0.9 0.7 0.5	0.9 0.7 0.5	0.3 0.1 0.0	0.7 0.5 0.3	0.7 0.5 0.3	0.9 0.7 0.5	0.9 0.7 0.5	0.3 0.1 0.0	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	DMU 27
0.9 0.7 0.5	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0.0	0.9 0.7 0.5	0.3 0.1 0.0	0.5 0.3 0.1	0.5 0.3 0.1	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0.0	DMU 31
0.3 0.1 0.0	0.9 0.7 0.5	0.7 0.5 0.3	0.3 0.1 0.0	0.9 0.7 0.5	0.7 0.5 0.3	0.9 0.7 0.5	0.7 0.5 0.3	0.3 0.1 0.0	0.7 0.5 0.3	0.7 0.5 0.3	0.9 0.7 0.5	DMU 32

• Evaluating the mutual relations based on technology and knowledge:

Table 12. Interrelationships based on technology and knowledge

DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	
0.3 0.1 0	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	0.3 0.1 0	DMU 2
0.9 0.7 0.5	0.9 0.7 0.5	1 0.9 0.7	0.3 0.1 0	0.7 0.5 0.3	0.5 0.3 0.1	0.7 0.5 0.3	0.9 0.7 0.5	0.9 0.7 0.5	1 0.9 0.7	0.3 0.1 0	0.7 0.5 0.3	DMU 5

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DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	
0.3 0.1 0	0.3 0.1 0	1 0.9 0.7	1 0.9 0.7	0.9 0.7 0.5	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0	0.3 0.1 0	0.3 0.1 0	1 0.9 0.7	0.9 0.7 0.5	DMU 12
0.7 0.5 0.3	0.5 0.3 0.1	0.7 0.5 0.3	0.9 0.7 0.5	0.5 0.3 0.1	0.3 0.1 0	0.5 0.3 0.1	0.7 0.5 0.3	0.3 0.1 0	0.7 0.5 0.3	0.9 0.7 0.5	0.5 0.3 0.1	DMU 15
0.7 0.5 0.3	0.9 0.7 0.5	0.5 0.3 0.1	0.7 0.5 0.3	0.3 0.1 0	0.5 0.3 0.1	0.9 0.7 0.5	0.3 0.1 0	0.9 0.7 0.5	0.5 0.3 0.1	0.7 0.5 0.3	0.3 0.1 0	DMU 18
0.7 0.5 0.3	0.9 0.7 0.5	0.5 0.3 0.1	0.7 0.5 0.3	0.3 0.1 0	0.5 0.3 0.1	0.3 0.1 0	0.7 0.5 0.3	0.9 0.7 0.5	0.5 0.3 0.1	0.7 0.5 0.3	0.3 0.1 0	DMU 19
0.7 0.5 0.3	0.5 0.3 0.1	0.7 0.5 0.3	0.9 0.7 0.5	0.5 0.3 0.1	0.3 0.1 0	0.5 0.3 0.1	0.7 0.5 0.3	0.5 0.3 0.1	0.7 0.5 0.3	0.9 0.7 0.5	0.5 0.3 0.1	DMU 21
0.5 0.3 0.1	0.5 0.3 0.1	0.9 0.7 0.5	0.7 0.5 0.3	0.3 0.1 0	0.9 0.7 0.5	0.3 0.1 0	0.5 0.3 0.1	0.5 0.3 0.1	0.9 0.7 0.5	0.7 0.5 0.3	0.9 0.7 0.5	DMU 22
0.7 0.5 0.3	1 0.9 0.7	0.3 0.1 0	0.3 0.1 0	1 0.9 0.7	0.9 0.7 0.5	1 0.9 0.7	0.7 0.5 0.3	1 0.9 0.7	0.3 0.1 0	1 0.9 0.7	1 0.9 0.7	DMU 23
0.9 0.7 0.5	0.9 0.7 0.5	0.3 0.1 0	0.3 0.1 0	0.7 0.5 0.3	0.5 0.3 0.1	0.7 0.5 0.3	0.9 0.7 0.5	0.9 0.7 0.5	1 0.9 0.7	0.3 0.1 0	0.7 0.5 0.3	DMU 24
0.7 0.5 0.3	0.3 0.1 0	0.3 0.1 0	1 0.9 0.7	1 0.9 0.7	0.9 0.7 0.5	1 0.9 0.7	0.7 0.5 0.3	1 0.9 0.7	0.3 0.1 0	1 0.9 0.7	1 0.9 0.7	DMU 25
0.3 0.1 0	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	0.5 0.3 0.1	0.5 0.3 0.1	0.3 0.1 0	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	0.7 0.5 0.3	DMU 27

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Table 13. Interrelationships based on technical factors

DMU 27			DMU 25			DMU 24			DMU 23			DMU 22			DMU 21			DMU 19			DMU 18			DMU 15			DMU 12			DMU 5			DMU 2			
0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.5	0.3	0.1	0.3	0.1	0	DMU 2
0.7	0.5	0.3	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	0.5	0.3	0.1	0.9	0.7	0.5	0.9	0.7	0.5	0.7	0.5	0.3	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	0.5	0.3	0.1	DMU 5
0.5	0.3	0.1	0.3	0.1	0	0.9	0.7	0.5	0.7	0.5	0.3	0.5	0.3	0.1	0.7	0.5	0.3	1	0.9	0.7	0.5	0.3	0.1	0.3	0.1	0	0.3	0.1	0	0.7	0.5	0.3	0.5	0.3	0.1	DMU 12
1	0.9	0.7	0.9	0.7	0.5	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.3	0.1	0	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	DMU 15
0.5	0.3	0.1	1	0.9	0.7	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	0.5	0.3	0.1	0.7	0.5	0.3	0.3	0.1	0	1	0.9	0.7	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	DMU 18
0.5	0.3	0.1	1	0.9	0.7	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	0.5	0.3	0.1	0.3	0.1	0	0.5	0.3	0.1	1	0.9	0.7	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	DMU 19
1	0.9	0.7	0.9	0.7	0.5	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.9	0.7	0.5	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	DMU 21
0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	1	0.9	0.7	0.3	0.1	0	0.7	0.5	0.3	0.3	0.1	0	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	1	0.9	0.7	0.5	0.3	0.1	DMU 22
0.7	0.5	0.3	0.5	0.3	0.1	0.3	0.1	0	0.3	0.1	0	0.9	0.7	0.5	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	0.5	0.3	0.1	0.3	0.1	0	0.7	0.5	0.3	0.9	0.7	0.5	DMU 23
0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	0.3	0.1	0	0.5	0.3	0.1	0.9	0.7	0.5	0.9	0.7	0.5	0.7	0.5	0.3	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	0.5	0.3	0.1	DMU 24
0.7	0.5	0.3	0.3	0.1	0	0.3	0.1	0	0.7	0.5	0.3	0.9	0.7	0.5	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	0.5	0.3	0.1	0.3	0.1	0	0.7	0.5	0.3	0.9	0.7	0.5	DMU 25
0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.5	0.3	0.1	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.5	0.3	0.1	0.7	0.5	0.3	DMU 27

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Table 14. Interrelationships based on market

DMU 27			DMU 25			DMU 24			DMU 23			DMU 22			DMU 21			DMU 19			DMU 18			DMU 15			DMU 12			DMU 5			DMU 2			
0.3	0.1	0	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.9	0.7	0.5	0.3	0.1	0	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	DMU 2
0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.9	0.7	0.5	0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	0.7	0.5	0.3	DMU 5
0.7	0.5	0.3	0.3	0.1	0	0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.9	0.7	0.5	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	0.3	0.1	0	0.7	0.5	0.3	0.9	0.7	0.5	DMU 12
0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0	0.3	0.1	0	0.3	0.1	0	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0	0.5	0.3	0.1	0.3	0.1	0	0.3	0.1	0	DMU 15
0.7	0.5	0.3	0.5	0.3	0.1	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	1	0.9	0.7	1	0.9	0.7	0.3	0.1	0	0.5	0.3	0.1	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	DMU 18
0.7	0.5	0.3	0.5	0.3	0.1	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	1	0.9	0.7	0.3	0.1	0	0.7	0.5	0.3	0.5	0.3	0.1	0.9	0.7	0.5	0.7	0.5	0.3	0.3	0.1	0	DMU 19
0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0	0.3	0.1	0	0.3	0.1	0	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0	0.3	0.1	0	DMU 21
0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0	0.9	0.7	0.5	0.3	0.1	0	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1	0.3	0.1	0	DMU 22
0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.3	0.1	0	0.5	0.3	0.1	0.9	0.7	0.5	0.9	0.7	0.5	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.5	0.3	0.1	0.5	0.3	0.1	DMU 23
0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.3	0.1	0	0.7	0.5	0.3	1	0.9	0.7	0.9	0.7	0.5	0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.3	0.1	0	0.7	0.5	0.3	DMU 24
0.7	0.5	0.3	0.3	0.1	0	0.3	0.1	0	0.5	0.3	0.1	0.5	0.3	0.1	0.9	0.7	0.5	0.9	0.7	0.5	0.7	0.5	0.3	0.7	0.5	0.3	0.3	0.1	0	0.5	0.3	0.1	0.5	0.3	0.1	DMU 25
0.3	0.1	0	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.9	0.7	0.5	0.9	0.7	0.5	0.3	0.1	0	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	0.7	0.5	0.3	DMU 27

Step 2: determining the direct correlation matrix

Direct correlation matrix defuzzification has been done using it. The decided values of the direct communication matrix are displayed in the following chart in accordance with the defuzzification calculations:

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Table 15. Determination of direct correlation matrix

Sum	DMU 27			DMU 25			DMU 24			DMU 23			DMU 22			DMU 21			DMU 19			DMU 18			DMU 15			DMU 12			DMU 5			DMU 2			
8.85	0.30	0.10	0.00	0.70	0.50	0.30	0.78	0.60	0.40	0.65	0.45	0.25	0.70	0.50	0.30	0.75	0.55	0.35	0.75	0.55	0.35	0.30	0.10	0.00	0.70	0.50	0.30	0.78	0.60	0.40	0.65	0.45	0.25	0.30	0.10	0.00	DMU 2
10.15	0.75	0.55	0.35	0.80	0.60	0.40	0.88	0.70	0.50	0.30	0.10	0.00	0.65	0.45	0.25	0.85	0.70	0.50	0.85	0.65	0.45	0.75	0.55	0.35	0.80	0.60	0.40	0.88	0.70	0.50	0.30	0.10	0.00	0.65	0.45	0.25	DMU 5
9.03	0.55	0.35	0.18	0.30	0.10	0.00	0.83	0.65	0.45	0.78	0.60	0.40	0.80	0.60	0.40	0.70	0.50	0.30	0.83	0.65	0.45	0.55	0.35	0.18	0.30	0.10	0.00	0.30	0.10	0.00	0.78	0.60	0.40	0.80	0.60	0.40	DMU 12
7.05	0.68	0.50	0.30	0.60	0.40	0.20	0.55	0.35	0.15	0.55	0.35	0.20	0.45	0.25	0.10	0.30	0.10	0.00	0.55	0.35	0.15	0.68	0.50	0.30	0.30	0.10	0.00	0.55	0.35	0.15	0.55	0.35	0.20	0.45	0.25	0.10	DMU 15
9.30	0.65	0.45	0.25	0.73	0.55	0.35	0.75	0.55	0.35	0.75	0.55	0.35	0.30	0.10	0.00	0.75	0.60	0.40	0.90	0.75	0.55	0.30	0.10	0.00	0.73	0.55	0.35	0.75	0.55	0.35	0.75	0.55	0.35	0.30	0.10	0.00	DMU 18
9.05	0.65	0.45	0.25	0.73	0.55	0.35	0.75	0.55	0.35	0.75	0.55	0.35	0.30	0.10	0.00	0.75	0.60	0.40	0.30	0.10	0.00	0.65	0.45	0.25	0.73	0.55	0.35	0.75	0.55	0.35	0.75	0.55	0.35	0.30	0.10	0.00	DMU 19
7.35	0.68	0.50	0.30	0.60	0.40	0.20	0.55	0.35	0.15	0.55	0.35	0.20	0.45	0.25	0.10	0.30	0.10	0.00	0.55	0.35	0.15	0.68	0.50	0.30	0.60	0.40	0.20	0.55	0.35	0.15	0.55	0.35	0.20	0.45	0.25	0.10	DMU 21
7.85	0.50	0.30	0.10	0.55	0.35	0.15	0.65	0.45	0.25	0.68	0.50	0.30	0.30	0.10	0.00	0.85	0.65	0.45	0.30	0.10	0.00	0.50	0.30	0.10	0.55	0.35	0.15	0.65	0.45	0.25	0.68	0.50	0.30	0.50	0.30	0.15	DMU 22
9.03	0.70	0.50	0.30	0.73	0.55	0.35	0.30	0.10	0.00	0.30	0.10	0.00	0.73	0.55	0.35	0.70	0.50	0.30	0.88	0.70	0.50	0.70	0.50	0.30	0.73	0.55	0.35	0.30	0.10	0.00	0.68	0.50	0.30	0.73	0.55	0.35	DMU 23
9.58	0.75	0.55	0.35	0.80	0.60	0.40	0.30	0.10	0.00	0.30	0.10	0.00	0.65	0.45	0.25	0.85	0.70	0.50	0.85	0.65	0.45	0.75	0.55	0.35	0.80	0.60	0.40	0.88	0.70	0.50	0.30	0.10	0.00	0.65	0.45	0.25	DMU 24
8.98	0.70	0.50	0.30	0.30	0.10	0.00	0.30	0.10	0.00	0.68	0.50	0.30	0.73	0.55	0.35	0.70	0.50	0.30	0.88	0.70	0.50	0.70	0.50	0.30	0.73	0.55	0.35	0.30	0.10	0.00	0.68	0.50	0.30	0.73	0.55	0.35	DMU 25

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Sum	DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	
9.25	0.30 0.10 0.00	0.70 0.50 0.30	0.78 0.60 0.40	0.65 0.45 0.25	0.70 0.50 0.30	0.75 0.55 0.35	0.75 0.55 0.35	0.30 0.10 0.00	0.70 0.50 0.30	0.78 0.60 0.40	0.65 0.45 0.25	0.70 0.50 0.30	DMU 27
8.05	0.50 0.30 0.10	0.55 0.35 0.15	0.65 0.45 0.25	0.68 0.50 0.30	0.50 0.30 0.15	0.85 0.65 0.45	0.30 0.10 0.00	0.50 0.30 0.10	0.55 0.35 0.15	0.65 0.45 0.25	0.68 0.50 0.30	0.50 0.30 0.15	DMU 31
8.93	0.55 0.35 0.18	0.30 0.10 0.00	0.83 0.65 0.45	0.78 0.60 0.40	0.80 0.60 0.40	0.70 0.50 0.30	0.83 0.65 0.45	0.55 0.35 0.18	0.30 0.10 0.00	0.83 0.65 0.45	0.78 0.60 0.40	0.80 0.60 0.40	DMU 32

Step 3: Calculating the normal direct correlation matrix

The total of all rows and columns is first computed. The biggest row and column number k are formed by the opposite. The direct correlation matrix's numbers are multiplied by the inverse of the highest integer, or 7.51, or 0.13, to create the standard direct correlation matrix. In Table 16, this grid is displayed.

Table 16. Direct thermal correlation matrix

DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	**M**
0.939	3.756	4.461	3.381	3.756	4.132	4.132	0.939	3.756	4.461	3.381	0.939	DMU2
4.132	4.508	5.212	0.939	3.381	5.165	4.883	4.132	4.508	5.212	0.939	3.381	DMU5
2.676	0.939	4.836	4.461	4.508	3.756	4.836	2.676	0.939	0.939	4.461	4.508	DMU12
3.709	3.005	2.629	2.723	1.972	0.939	2.629	3.709	0.939	2.629	2.723	1.972	DMU15
2.348	0.939	1.549	3.756	4.085	3.756	4.508	4.132	3.756	4.508	4.132	0.939	DMU18
3.381	4.085	4.132	4.132	0.939	4.414	0.939	3.381	4.085	4.132	4.132	0.939	DMU19
3.709	3.005	2.629	2.723	1.972	0.939	2.629	3.709	3.005	2.629	2.723	1.972	DMU21
2.254	2.629	3.381	3.709	0.939	4.883	0.939	2.254	2.629	3.381	3.709	2.348	DMU22
3.756	4.085	0.939	0.939	4.085	3.756	5.212	3.756	4.085	0.939	3.709	4.085	DMU23

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DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	M
4.132	4.508	0.939	0.939	3.381	5.165	4.883	4.132	4.508	5.212	0.939	3.381	DMU24
3.756	0.939	0.939	3.709	4.085	3.756	5.212	3.756	4.085	0.939	3.709	4.085	DMU25
0.939	3.756	4.461	3.381	3.756	4.132	4.132	0.939	3.756	4.461	3.381	3.756	DMU27
2.254	2.629	3.381	3.709	2.348	4.883	0.939	2.254	2.629	3.381	3.709	2.348	DMU31
2.676	0.939	4.836	4.461	4.508	3.756	4.836	2.676	0.939	4.836	4.461	4.508	DMU32

Step 4: Calculating the complete correlation matrix

The same matrix must first be created in order to compute the full association matrix. The same matrix is then normalized by subtracting the normal matrix, and the resulting matrix is then inverted. The full correlation matrix is produced by multiplying the normal matrix by the inverted matrix, and it is displayed in Table 17 as a result.

Table 17. Complete correlation matrix

DMU 32	DMU 31	DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	I-M
-4.13	-4.13	-0.94	-3.76	-4.46	-3.38	-3.76	-4.13	-4.13	-0.94	-3.76	-4.46	-3.38	0.06	DMU2
-5.16	-4.88	-4.13	-4.51	-5.21	-0.94	-3.38	-5.16	-4.88	-4.13	-4.51	-5.21	0.06	-3.38	DMU5
-3.76	-4.84	-2.68	-0.94	-4.84	-4.46	-4.51	-3.76	-4.84	-2.68	-0.94	0.06	-4.46	-4.51	DMU12
-0.94	-2.63	-3.71	-3.01	-2.63	-2.72	-1.97	-0.94	-2.63	-3.71	0.06	-2.63	-2.72	-1.97	DMU15
-5.54	-4.04	-2.35	-0.94	-1.55	-3.76	-4.08	-3.76	-4.51	-3.13	-3.76	-4.51	-4.13	-0.94	DMU18
-4.41	-5.54	-3.38	-4.08	-4.13	-4.13	-0.94	-4.41	0.06	-3.38	-4.08	-4.13	-4.13	-0.94	DMU19
-0.94	-2.63	-3.71	-3.01	-2.63	-2.72	-1.97	0.06	-2.63	-3.71	-3.01	-2.63	-2.72	-1.97	DMU21
-4.88	-0.94	-2.25	-2.63	-3.38	-3.71	0.06	-4.88	-0.94	-2.25	-2.63	-3.38	-3.71	-2.35	DMU22
-3.76	-5.21	-3.76	-4.08	-0.94	0.06	-4.08	-3.76	-5.21	-3.76	-4.08	-0.94	-3.71	-4.08	DMU23
-5.16	-4.88	-4.13	-4.51	0.06	-0.94	-3.38	-5.16	-4.88	-4.13	-4.51	-5.21	-0.94	-3.38	DMU24

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DMU 32	DMU 31	DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	I-M
-3.76	-5.21	-3.76	0.06	-0.94	-3.71	-4.08	-3.76	-5.21	-3.76	-4.08	-0.94	-3.71	-4.08	DMU25
-4.13	-4.13	0.06	-3.76	-4.46	-3.38	-3.76	-4.13	-4.13	-0.94	-3.76	-4.46	-3.38	-3.76	DMU27
-4.88	0.06	-2.25	-2.63	-3.38	-3.71	-2.35	-4.88	-0.94	-2.25	-2.63	-3.38	-3.71	-2.35	DMU31
0.06	-4.41	-2.68	-0.94	-4.84	-4.46	-4.51	-3.76	-4.84	-2.68	-0.94	-4.84	-4.46	-4.51	DMU32

Step 5: Drawing a map of network relationships

Calculating the threshold number is necessary to create a network diagram showing the connections among the project management team members. By using this technique, one can avoid incomplete ties and create a network of important connections. Only connections with values larger than the cutoff value in the full relationship matrix will be shown in NRM. Calculating the average values of the T matrix is sufficient to determine the connection cutoff value. Once the threshold's intensity has been established, all values of the full correlation matrix below the threshold are set to zero, meaning that the causative connection is not taken into account. The threshold number in this study is equivalent to -161.478. As a result, Table 18 represents the structure of important relationships:

Table 18. Relationships between projects

DMU 32	DMU 31	DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	T
0	1	1	1	0	1	0	0	1	1	1	0	1	0	DMU2
0	1	1	1	1	0	0	0	1	0	1	0	0	1	DMU5
0	1	1	1	0	1	0	0	1	0	1	0	1	1	DMU12
1	0	0	0	1	1	1	1	1	1	0	1	0	1	DMU15
1	0	0	0	1	0	1	1	1	0	0	1	0	1	DMU18
1	1	1	0	1	1	0	1	0	1	0	1	1	0	DMU19
1	0	0	0	1	0	1	0	1	1	0	1	0	0	DMU21

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DMU 32	DMU 31	DMU 27	DMU 25	DMU 24	DMU 23	DMU 22	DMU 21	DMU 19	DMU 18	DMU 15	DMU 12	DMU 5	DMU 2	T
1	0	1	1	0	1	0	1	1	1	1	0	1	1	DMU22
1	0	0	0	1	0	1	1	1	1	0	1	1	0	DMU23
1	1	1	1	0	1	1	1	1	1	1	1	0	1	DMU24
1	0	0	0	1	1	1	1	1	1	0	1	1	0	DMU25
0	1	0	1	0	1	0	0	1	0	1	0	1	1	DMU27
1	0	1	1	0	1	1	0	0	1	1	0	1	1	DMU31
0	1	1	1	0	1	0	0	1	0	1	0	1	1	DMU32

The values 0 and 1 are put in each matrix in Table 18, and it is clear that the houses with a value of 1 indicate that individuals can be assigned to the same team and collaborate to create the project management team. The following is how processes are now optimized in accordance with the creation of project management teams.

In GEMS software, the mathematical model was solved along with the epsilon constraint, and it was found that as the epsilon number rises, the time required to solve the model also increases. The hardening condition of the model is linked to the demand function, so using the method technique to release this condition is necessary because, on the other hand, the given model is in NP-HARD mode and takes a long time to solve. The tightening condition of the model was released using the Lagrange release technique because, according to the assessment, it is connected to the demand function. The mathematical model is explained and verified using the Lagrange release method technique, taking into account the dimensions of the optimal Pareto box solution of the objective function. This constraint was subsequently released.

Validation of Research Results:

Ensuring the reliability and validity of the proposed method is paramount in any research endeavor, and this holds true for the current study on project team formation. The utilization of the DEMATEL method to assess team member interactions presents a critical aspect of the research methodology. However, it is essential to provide a comprehensive discussion on the validation of the evaluation results obtained through this method.

To address this critical issue, several validation strategies can be employed:

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1. Internal Consistency Analysis: This involves assessing the consistency of responses within the DEMATEL questionnaire. Internal consistency measures, such as Cronbach's alpha coefficient, can be calculated to ensure that the questionnaire items are measuring the same underlying construct consistently.
2. Test-Retest Reliability: Conducting a test-retest reliability analysis involves administering the DEMATEL questionnaire to the same group of respondents at two different time points and assessing the consistency of responses over time. High test-retest reliability indicates that the questionnaire yields consistent results across repeated administrations.
3. Expert Validation: Seeking validation from domain experts in project management or related fields can provide valuable insights into the relevance and accuracy of the evaluation results. Experts can review the methodology, questionnaire design, and interpretation of results to confirm the validity of the findings.
4. Comparison with Benchmark Data: Comparing the results obtained from the DEMATEL evaluation with existing benchmark data or established norms can help validate the findings. If the results align with known patterns or expectations in the literature, it adds credibility to the validity of the evaluation method.
5. Qualitative Data Triangulation: Supplementing quantitative DEMATEL analysis with qualitative data collection methods, such as interviews or focus groups, can provide a more comprehensive understanding of team member interactions and corroborate the quantitative findings.

By incorporating these validation strategies, the current research can strengthen the credibility and robustness of its findings. Demonstrating the reliability and validity of the proposed method enhances confidence in the research outcomes and contributes to the advancement of knowledge in project team formation.

We have the numbers listed below as a result of the Lagrange algorithm's assessment of the mathematical model:

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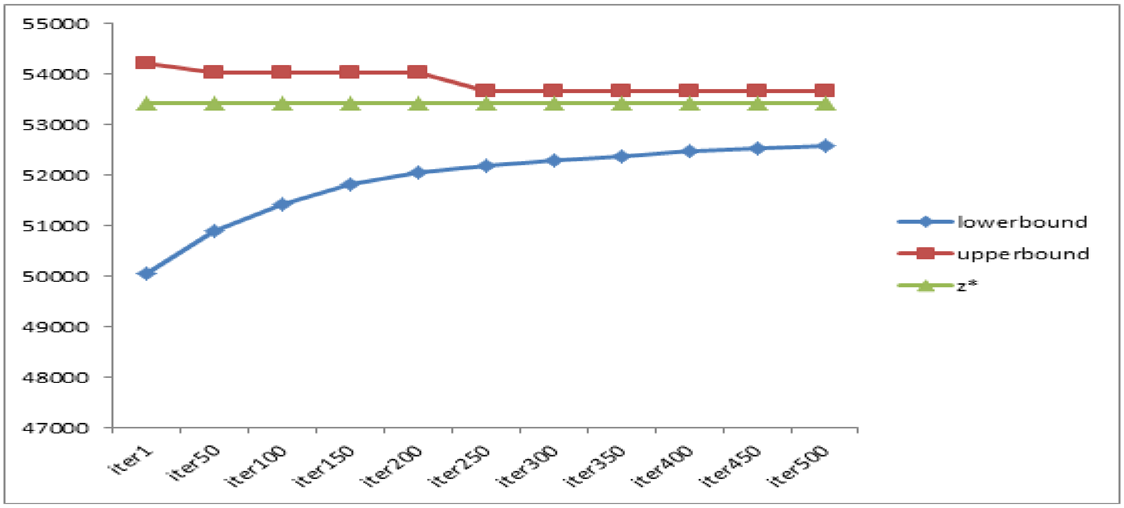

Figure 12. Convergence of the Lagrange release algorithm to the optimal solution

After 250 rotation cycles, the assessment shows that the Lagrange release algorithm's convergence has achieved its optimum. However, because the lower limit of the Lagrange algorithm is far from the ideal level, it is appropriate to evaluate the higher limit of the algorithm in order to assess the project team creation model for this issue. In this assessment, the two techniques of epsilon constraint and Lagrange release's optimum value are reviewed, along with the length of the solution:

Problem	Expertise required	Number of people on the team	Target members	Epsilon solution	Lagrange's solution	Epsilon(s) resolution time	Lagrange solution time(s)
Sam1	4	8	15	6989	6989	0.811	0.062
Sam2	5	9	15	4096	4096	0.359	0.343
Sam3	6	9	20	21215	21215	0.562	0.546
Sam4	6	9	25	18259	18259	0.708	0.500
Sam5	7	9	30	82372	82372	12.3	2.714
Sam6	7	10	35	102341	102341	13.42	6.461
Sam7	7	10	40	121430	121430	14.87	7.453
Sam8	8	15	45	187962	187962	17.34	8.213

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Sam9	9	15	50	231908	231908	19.34	10/47
Sam10	10	15	55	347604	347604	26.427	11.23
Sam11	10	15	60	868906	768906	124.083	15.464
Sam12	11	20	65	1093405	1093405	534.098	27.435

The evaluation of the epsilon constraint solution and the Lagrange release method shows that in small dimensions, the time required to solve the epsilon constraint is proportional to the Lagrange method, and the values of the objective function obtained using the Lagrange release method have lower error rates than those obtained using the exact solution method. The Lagrange release method, on the other hand, has been shown to be successful in the mathematical model of project team formation because the duration of the Lagrange release solution has been observed to take much less time as the problem's dimensions have increased.

Discussion and conclusion

The theme of the project, its creation as a system, installation, and execution were presented at the outset of this study. We then looked at the contexts of conflicts and investigated their successful management in the occurrence of conflict and when it happens. The success of the project and achieving its goals within the three dimensions of time, cost, and quality will not go through the path except for correct and effective team building, and every success should be achieved by the project team members, as we move in this direction and learn more and more about this subject in-depth. Here, it is crucial to obtain an effective internal commitment from the members, as well as a discussion appropriate to the situation, the correct method, the effective solution, and the management of the employees. This goes along with effective team building concurrently with the expansion of the work failure structure. It is anticipated that by taking these management team-building factors into account and resolving conflicts, it has contributed to improving project conditions and elevating various parts of its surroundings to a more professional level. The project team was then created using the fuzzy DEMATEL approach and the member compatibility pattern. Finally, the level of goal optimization was examined using the epsilon constraint and Lagrange release algorithms, and it was discovered that the latter is more effective at creating the project team. Finally, it is recommended that future study proposals examine how project management teams are formed using cutting-edge algorithms like red deer and gray wolf.

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References

1. Agustín-Blas, L. E., Salcedo-Sanz, S., Ortiz-García, E. G., Portilla-Figueras, A., Pérez-Bellido, Á. M., & Jiménez-Fernández, S. (2011). Team formation based on group technology: A hybrid grouping genetic algorithm approach. *Computers & Operations Research*, *38*(2), 484-495.
2. Ahmed, F., Deb, K., & Jindal, A. (2013). Multi-objective optimization and decision-making approaches to cricket team selection. *Applied Soft Computing*, *13*(1), 402-414.
3. Akhavan, P., Hosseini, S. M., & Abbasi, M. (2016). Selecting new product development team members with a knowledge-sharing approach. Program.
4. Anagnostopoulos, A., Becchetti, L., Castillo, C., Gionis, A., & Leonardi, S. (2012, April). Online team formation in social networks. In Proceedings of the 21st international conference on World Wide Web (pp. 839-848).
5. Anagnostopoulos, A., Becchetti, L., Castillo, C., Gionis, A., & Leonardi, S. (2012, April). Online team formation in social networks. In *Proceedings of the 21st international conference on World Wide Web* (pp. 839-848).
6. André, M., Baldoquín, M. G., & Acuña, S. T. (2011). A formal model for assigning human resources to teams in software projects. *Information and Software Technology*, *53*(3), 259-275.
7. Baykasoglu, A., Dereli, T., & Das, S. (2007). Project team selection using a fuzzy optimization approach. *Cybernetics and Systems: An International Journal*, *38*(2), 155-185.
8. Boon, B. H., & Sierksma, G. (2003). Team formation: Matching quality supply and quality demand. *European Journal of Operational Research*, *148*(2), 277-292.
9. Bredillet, C., Tywoniak, S., & Tootoonchy, M. (2018). Exploring the dynamics of the project management office and portfolio management co-evolution: A routine lens. *International Journal of Project Management*, *36*(1), 27-42.
10. Chen, C. C., Lee, Y. T., & Tsai, C. M. (2014). Professional baseball team starting pitcher selection using AHP and TOPSIS methods. *International Journal of Performance Analysis in Sport*, *14*(2), 545-563.
11. Chen, S. J., & Lin, L. (2004). Modeling team member characteristics for the formation of a multifunctional team in concurrent engineering. *IEEE Transactions on Engineering Management*, *51*(2), 111-124.

Received: 06-10-2024 Revised: 15-11-2024 Accepted: 10-12-2024

12. Dabirian, S., Abbaspour, S., Khanzadi, M., & Ahmadi, M. (2019). Dynamic modeling of human resource allocation in construction projects. *International Journal of Construction Management*, 1-10.
13. Dadelo, S., Turskis, Z., Zavadskas, E. K., & Dadeliene, R. (2014). Multi-criteria assessment and ranking system of sports team formation based on objective-measured values of criteria set. *Expert Systems with Applications*, *41*(14), 6106-6113.
14. De Cooman, R., Vantilborgh, T., Bal, M., & Lub, X. (2016). Creating inclusive teams through perceptions of supplementary and complementary person–team fit: examining the relationship between person–team fit and team effectiveness. Group & Organization Management, 41(3), 310-342.
15. Dey, P., Ganguly, M., & Roy, S. (2017). Network centrality based team formation: A case study on T-20 cricket. *Applied computing and informatics*, *13*(2), 161-168.
16. Dotsenko, N. (2019). Methodological provision of human resources management in a multi-project environment. *Technology audit and production reserves*, *1*(2 (45)), 52-54.
17. Farhadi, F., Sorkhi, M., Hashemi, S., & Hamzeh, A. (2011, December). An effective expert team formation in social networks based on skill grading. In *2011 IEEE 11th International Conference on Data Mining Workshops* (pp. 366-372). IEEE.
18. Farhadi, F., Sorkhi, M., Hashemi, S., & Hamzeh, A. (2012). An effective framework for fast expert mining in collaboration networks: a group-oriented and cost-based method. *Journal of Computer Science and Technology*, *27*(3), 577-590.
19. Gajewar, A., & Das Sarma, A. (2012, April). Multi-skill collaborative teams based on the densest subgraphs. In *Proceedings of the 2012 SIAM International Conference on Data Mining* (pp. 165-176). Society for Industrial and Applied Mathematics.
20. Garomsa, T., Agon, E. D. C., & Assefa, S. (2019). Concept of Value Engineering and Current Project Management Practice in Ethiopian Building Construction Projects. *American Journal of Civil Engineering*, *7*(1), 1-8.
21. Golshan, B., Lappas, T., & Terzi, E. (2014, August). Profit-maximizing cluster hires. In *Proceedings of the 20th ACM SIGKDD international conference on Knowledge discovery and data mining* (pp. 1196-1205).
22. Hermano, V., & Martín-Cruz, N. (2019). Expanding the Knowledge on Project Management Standards: A Look into the PMBOK® with Dynamic Lenses. In Project Management and Engineering Research (pp. 19-34). Springer, Cham.

Power System Technology
ISSN:1000-3673

Received: 06-10-2024 Revised: 15-11-2024 Accepted: 10-12-2024

23. Jin, C. X., Li, F. C., Zhang, K., Xu, L. D., & Chen, Y. (2020). A cooperative effect-based decision support model for team formation. *Enterprise Information Systems*, *14*(1), 110-132.
24. Jørgensen, M. (2014). Failure factors of small software projects in a global outsourcing marketplace. Journal of Systems and Software, 92, 157-169.
25. Kargar, M., & An, A. (2011, October). Discovering top-k teams of experts with/without a leader in social networks. In *Proceedings of the 20th ACM international conference on Information and knowledge management* (pp. 985-994).
26. Kargar, M., Zihayat, M., & An, A. (2013, May). Finding affordable and collaborative teams from a network of experts. In *Proceedings of the 2013 SIAM International Conference on Data Mining* (pp. 587-595). Society for Industrial and Applied Mathematics.
27. Kidanemariam, A. (2019). *Effect of Human Resource Management Practice on Project Success: A case study on Telecom Expansion Project, Ethiotelecom* (Doctoral dissertation, Addis Ababa University).
28. Lappas, T., Liu, K., & Terzi, E. (2009, June). Finding a team of experts in social networks. In Proceedings of the 15th ACM SIGKDD international conference on Knowledge discovery and data mining (pp. 467-476).
29. Li, C. T., Shan, M. K., & Lin, S. D. (2015). On team formation with expertise query in collaborative social networks. *Knowledge and Information Systems*, *42*(2), 441-463.
30. Majumder, A., Datta, S., & Naidu, K. V. M. (2012, August). Capacitated team formation problem on social networks. In *Proceedings of the 18th ACM SIGKDD international conference on Knowledge discovery and data mining* (pp. 1005-1013).
31. Mazur, L. M., & Chen, S. J. (2011). A task-member assignment model for complex engineering projects. *International Journal of Industrial and Systems Engineering*, *7*(1), 1-25.
32. Monteiro, A., Santos, V., & Varajão, J. (2016). Project management office models–a review. Procedía computer science, 100, 1085-1094.
33. Omrani, H., Alizadeh, A., & Amini, M. (2019). A new approach based on BWM and MULTIMOORA methods for calculating semi-human development index: An application for provinces of Iran. Socio-Economic Planning Sciences, 100689.
34. Ozceylan, E. (2016). A mathematical model using AHP priorities for soccer player selection: a case study. *South African Journal of Industrial Engineering*, *27*(2), 190-205.

Received: 06-10-2024 Revised: 15-11-2024 Accepted: 10-12-2024

35. Paredes-Valverde, M. A., del Pilar Salas-Zárate, M., Colomo-Palacios, R., Gómez-Berbís, J. M., & Valencia-García, R. (2018). An ontology-based approach with which to assign human resources to software projects. *Science of Computer Programming*, *156*, 90-103
36. Paton, S., & Andrew, B. (2019). The role of the Project Management Office (PMO) in product lifecycle management: A case study in the defense industry. International Journal of Production Economics, 208, 43-52.
37. Rahmanniyay, F., Yu, A. J., & Seif, J. (2019). A multi-objective multi-stage stochastic model for project team formation under uncertainty in time requirements. *Computers & Industrial Engineering*, *132*, 153-165.
38. Ramalho, F. D., Ekel, P. Y., Pedrycz, W., Júnior, J. G. P., & Soares, G. L. (2019). Multicriteria decision-making under conditions of uncertainty in application to multiobjective allocation of resources. Information Fusion, 49, 249-261.
39. Rangapuram, S. S., Bühler, T., & Hein, M. (2013, May). Towards realistic team formation in social networks based on densest subgraphs. In *Proceedings of the 22nd international conference on World Wide Web* (pp. 1077-1088).
40. Rose, K. H. (2013). A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition. Project management journal, 44(3), e1-e1.
41. Sandhu, M. A., Al Ameri, T. Z., & Wikström, K. (2019). Benchmarking the strategic roles of the project management office (PMO) when developing business ecosystems. Benchmarking: An International Journal.
42. Saputra, Y. M., & Paramitha, S. T. (2020, February). Project Management Office Strategies of Hosting Indonesia National Olympic Games (PON) XIX/2016 in West Java. In 4th International Conference on Sport Science, Health, and Physical Education (ICSSHPE 2019) (pp. 115-118). Atlantis Press.
43. Singh, R., Keil, M., & Kasi, V. (2009). Identifying and overcoming the challenges of implementing a project management office. European journal of information systems, 18(5), 409-427.
44. Sorkhi, M., Alvari, H., Hashemi, S., & Hamzeh, A. (2012, October). A Game-Theoretic Framework to Identify Top-K Teams in Social Networks. In *KDIR* (pp. 252-257).
45. Surbakti, E. E., Purwandari, B., Solichah, I., & Kumaralalita, L. (2019, September). Analysis of software development method selection: a case of a private financial institution. In Proceedings of the 3rd International Conference on Business and Information Management (pp. 168-173).

Received: 06-10-2024 Revised: 15-11-2024 Accepted: 10-12-2024

46. Tavana, M., Azizi, F., Azizi, F., & Behzadian, M. (2013). A fuzzy inference system with application to player selection and team formation in multi-player sports. *Sport Management Review*, *16*(1), 97-110.
47. Wedekind, G. K., & Philbin, S. P. (2018). Research and Grant Management: The Role of the Project Management Office (PMO) in a European Research Consortium Context. Journal of Research Administration, 49(1), 43-62.
48. Wi, H., Mun, J., Oh, S., & Jung, M. (2009). Modeling and analysis of project team formation factors in a project-oriented virtual organization (ProVO). *Expert Systems with Applications*, *36*(3), 5775-5783.