Available Online: 21 May 2026 DOI: 10.54254/2977-5701/2026.33790

A study on the key influencing factors and improvement paths of team effectiveness in aerospace enterprises based on SPSS analysis

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Abstract. Teams are the most fundamental organizational units within the scientific research and production system of aerospace enterprises. Strengthening the "cell engineering" of teams is crucial for enterprises to accomplish their reform and development tasks. Taking the framework of "human factors–physical factors–operational factors" as the analytical foundation, this paper identifies six core variables affecting the effectiveness of team development in aerospace enterprises: basic management, objectives and tasks, quality and safety, cost engineering, technological innovation and problem-solving, and team building. Based on SPSS analysis results, improvement paths for enhancing team effectiveness are proposed from six dimensions, providing empirical support for team development practices in aerospace enterprises.

Keywords: aerospace enterprise, team development, effectiveness, SPSS, improvement path

1. Introduction

As the "nerve endings" and smallest operational units within the scientific research and production chain of aerospace enterprises, teams play a decisive role in the success of mission programs, breakthroughs in key core technologies, and the advancement of China's aerospace industry. At present, aerospace missions are characterized by high-frequency and high-intensity launches, the simultaneous advancement of multiple projects, broad technological coverage, and "zero-defect" quality requirements. Under these circumstances, teams are not only the execution units for technical operations, but also micro-level organizational carriers for knowledge accumulation, technological inheritance, collaborative problem-solving, and innovation incubation.

Based on authentic sample data obtained from a team development satisfaction survey conducted at an aerospace research institute, this study employs SPSS software to carry out reliability testing and Pearson correlation analysis. Through statistical methods, the paper systematically examines the factors influencing team development effectiveness, thereby providing both theoretical support and practical guidance for aerospace enterprises in advancing team development initiatives.

2. Research design and data analysis

This study takes the systematic methodology of "human factors–physical factors–operational factors" as its analytical foundation [1]. "Human factors" focus on team members' value identification and behavioral motivation; "physical factors" concern team organizational structure and resource allocation; and "operational factors" emphasize team operational logic and management mechanisms. Based on practical experience in team development, six core variables influencing team effectiveness were identified.

First, basic management. This dimension covers management standards, responsibility systems, on-site management, ledger records, and the promotion of organizational culture, reflecting the depth of organizational integration and the level of foundational governance [2].

Second, objectives and tasks. This dimension reflects the clarity of task decomposition, process controllability, and efficiency in meeting milestone requirements, serving as a direct representation of process management in aerospace mission programs.

Third, quality and safety. This dimension includes the operation of quality management systems, implementation of workplace safety responsibilities, closed-loop rectification of potential hazards, and enforcement of confidentiality regulations. It represents the essential bottom line of aerospace enterprises.

Fourth, cost engineering. This dimension reflects team members' cost awareness and the degree to which cost-reduction and efficiency-enhancement measures can be institutionalized, directly affecting the economic performance of aerospace programs throughout their full life cycle.

Fifth, technological innovation and problem-solving. This dimension measures the team atmosphere regarding problem resolution, continuous improvement, experience exchange, and skills sharing, and serves as a driving force for technological iteration [3].

Sixth, team building. This dimension integrates talent cultivation, transparency in team affairs, fairness in assessment and distribution, team cohesion, and employee care and support, representing a comprehensive reflection of both governance quality and talent development within the team [4].

Based on these six core variables, a Likert-scale matrix questionnaire covering three hierarchical levels and 23 items was designed and distributed to four categories of teams: research, production, support, and operations. The survey respondents included both team leaders and team members. The sample demonstrated a high degree of scientific validity and strong representativeness.

Using the SPSS statistical analysis software package, the research group employed the Pearson correlation coefficient to measure the correlation between overall team development effectiveness and the statistical scores of each variable. The Pearson correlation coefficients and satisfaction scores for the six variables are presented in Table 1.

Table 1. Pearson correlation coefficients and satisfaction scores

Variable	Pearson Correlation Coefficient (r)	Satisfaction Score
Basic Management	0.983	92.5
Quality and Safety	0.962	95.2
Objectives and Tasks	0.951	93.4
Team Building	0.948	90.9
Cost Engineering	0.925	90.5
Technological Innovation and Problem-Solving	0.906	89.8

The results indicate that all six variables exhibit a significant and strong positive correlation with overall team development effectiveness ($r > 0.91$), demonstrating that the six-dimensional model can effectively explain the mechanism underlying team effectiveness generation. Since all dimensions are highly correlated with overall effectiveness, attention should be paid to the interaction effects among dimensions in practical applications. The data analysis further leads to the following conclusions.

Quality and safety constitute the primary core supporting variable, highlighting the aerospace industry's strong commitment to the principles of "quality first and safety foremost". This dimension demonstrates the most stable and effective performance and serves as the most fundamental guarantee of team effectiveness.

Basic management provides the essential foundation for effectiveness enhancement. The findings indicate that sound institutional norms, effective responsibility implementation, and rigorous ledger management constitute prerequisites for efficient team operation. The execution effectiveness of objectives and tasks is particularly prominent, indicating that task decomposition within teams is clear, milestone control is effective, and problem-solving capabilities are strong. This also reflects the close integration of teams with the central tasks of scientific research and production. Team building provides solid support but still has room for improvement. Democratic management, organizational culture, and humanistic care are generally well established, although further optimization is needed in strengthening cohesion, communication and coordination, and empowerment through employee support. Cost engineering and technological innovation and problem-solving represent the principal weaknesses. Both dimensions rank lowest in satisfaction scores and correlation coefficients, making them the most critical bottlenecks restricting the further improvement of team development effectiveness. These areas should therefore become the primary focus of subsequent enhancement efforts.

3. Paths for enhancing team development effectiveness

Based on the Pearson correlation analysis and satisfaction scores presented above, clear structural disparities can be identified among the six dimensions. In response, this paper proposes an optimization framework characterized by "six-dimensional coordination and targeted enhancement". By aligning the mature mechanisms formed through aerospace enterprise team-development practices with the weaknesses revealed in the data analysis, the study aims to provide practical pathways for the continued improvement of team development initiatives.

3.1. Strengthening foundations through basic management to ensure the correct direction of team development

Basic management achieved the highest correlation coefficient with overall effectiveness (0.983). However, despite its relatively high satisfaction score of 92.5, the presence of dispersed sample responses indicates that standardized governance remains the foundation of aerospace teams, while consistency still requires improvement [2]. The enhancement path focuses on "standard consolidation, institutional closed-loop management, and digital empowerment". First, a hierarchical and categorized standards system should be established. According to the management characteristics of research, production, support, and operations teams, both the General Evaluation Standards for Team Development and Categorized Evaluation Standards should be formulated. In addition, specialized regulations such as the Measures for Team Development Management should be introduced to standardize team development, evaluation, assessment, dynamic management, and continuous improvement, thereby forming a closed-loop management mechanism. Second, a three-tier documentation system for team management should be promoted. A systematic framework consisting of management documents, technical documents, and operational documents should be established to transform management requirements into standards that are searchable, traceable, and assessable. Third, digital empowerment of management should be implemented. Information technology should be fully utilized to integrate all categories of basic management information, thereby enabling efficient, precise, and dynamic management of teams.

3.2. Goal alignment through target penetration to anchor mission-oriented tasks

The correlation coefficient between objectives and tasks and overall effectiveness reached 0.951, while its satisfaction score of 93.4 indicates a relatively strong baseline. Nevertheless, support-oriented teams exhibited a phenomenon of "weak integration" with core mission objectives. The enhancement path therefore focuses on "vertical penetration, horizontal coordination, and dynamic feedback". First, a penetrating decomposition mechanism linking "mission objectives to team goals" should be established. High-quality development requirements should be decomposed into annual, quarterly, and monthly team objectives, forming a three-level target chain consisting of "institute-level milestones–department-level nodes–team operational procedures". For support-oriented teams, clear response-time and quality indicators for logistical support should be defined to strengthen their sense of value and contribution. Second, a task-driven "joint team" model should be promoted. In response to cross-disciplinary and cross-team collaboration demands, administrative barriers should be removed to establish mission-oriented joint teams dedicated to major engineering challenges and key technical tasks. Third, a dynamic feedback and adjustment mechanism for objectives should be established. A monthly target review system should be implemented for teams to conduct root-cause analyses of milestone deviations and promptly adjust resource allocation and operational arrangements. For support-oriented teams, a dual-dimensional evaluation mechanism based on both task completion and service satisfaction should be introduced to strengthen their value alignment with core research and production missions.

3.3. Reinforcing bottom-line safeguards through quality and safety management

Quality and safety achieved a correlation coefficient of 0.962 with overall effectiveness, while its satisfaction score of 95.2 ranked highest among all six dimensions. However, efforts to strengthen quality foundations are a continuous process and must evolve from merely "maintaining the bottom line" to "building a higher standard". The enhancement path focuses on "quality foundation strengthening, closed-loop management, and weak-link governance". First, foundational quality enhancement at the team level should be implemented. Systematic efforts should be carried out in areas such as team-level quality analysis, organizational technical reviews, supporting standards and specifications, and fault-tolerant design. Based on the characteristics and existing capabilities of different teams, differentiated quality enhancement plans should be formulated, with research offices or workshops providing overall coordination and guidance. Second, a team-level quality and safety closed-loop management mechanism featuring "double-zeroing" and "dual prevention" should be established. The "double-zeroing" requirements for quality management, together with confidentiality management provisions, should be embedded into team operational guidelines. At the same time, positive and negative case databases for team-level quality and safety management should be established, and regular warning and education activities should be conducted. Hazard rectification should adopt a "list-based and closed-loop" management approach to ensure that corrective measures, responsibilities, deadlines, and verification procedures are fully implemented. Third, governance of weak links and the application of quality management tools should be strengthened. Special rectification initiatives should be carried out for weak aspects of team quality management. In addition, a catalog of quality management tools and methodologies should be established, while information technology should be utilized to enable the timely updating and sharing of quality issues, thereby supporting efficient and precise operation of quality management activities.

3.4. Enhancing full-life-cycle economic efficiency through refined cost engineering

The correlation coefficient between cost engineering and overall effectiveness reached 0.925; however, its satisfaction score of 90.5 ranked second lowest among the six dimensions, revealing an entrenched tendency to "prioritize mission completion over cost control." The enhancement path focuses on "accounting systems, competition-driven incentives, and proposal-based rewards," aiming to independently establish a comprehensive team-level cost-reduction system. First, a "micro-level" team cost accounting system should be established. Cost categories should be refined to the team level, and a team-level cost database should be developed. Indicators such as material consumption, labor-hour utilization, and equipment maintenance expenses should be incorporated into monthly team dashboards. Second, integrated labor competitions combining economic and technological objectives should be further promoted. With optimal economic efficiency as the guiding principle, specialized labor competitions should be jointly organized with business and operations departments. Teams should be encouraged to identify optimal solutions through process optimization for efficiency improvement, universal design of experimental tooling to reduce costs, and independent innovation initiatives to strengthen capabilities, thereby promoting the integrated application of technological and economic management throughout the entire team workflow. Third, a "cost reduction and efficiency enhancement proposal" mechanism should be implemented. Rationalization proposals from teams should be solicited on a quarterly basis, and special rewards should be granted for institutionalizable practices related to process optimization, consumable substitution, and energy-consumption control. In this way, an organizational atmosphere characterized by "cost awareness among all staff and efficiency orientation in all tasks" can gradually be established.

3.5. Empowering innovation ecosystems to stimulate teams' endogenous creativity

The correlation coefficient between technological innovation and problem-solving and overall effectiveness reached 0.906, while its satisfaction score of 89.8 ranked lowest among all six dimensions, exhibiting the distinctive characteristic of "high correlation but low satisfaction" [3]. The enhancement path therefore focuses on "platform construction, innovation evaluation, and collaborative problem-solving", with all measures centered on building an innovation ecosystem and stimulating innovation vitality. First, support platforms for employee innovation studios should be established. A management system for employee innovation studios should be developed, relying on platforms such as employee innovation studios and master craftsman studios to organize specialized skills competitions. These activities would facilitate technical exchange and mutual learning among skilled personnel, thereby fostering a strong atmosphere in which all employees strive to become highly skilled professionals and craftsmen of the new era. Second, an evaluation mechanism for team innovation achievements should be implemented. Competitions for "small-scale and micro-level" innovation achievement in tools and methodologies should be organized, with evaluations conducted across categories such as methodological templates, tooling equipment, and software tools. This approach would help integrate team innovation more effectively into operational workflows and aerospace mission development processes. Third, a cross-team collaborative innovation network should be established. Professional barriers should be broken down through the creation of inter-team innovation cooperation platforms, encouraging teams from different specialties to jointly apply for innovation and problem-solving projects. A "competitive task bidding" mechanism should also be introduced, under which critical bottlenecks in mission development are publicly announced and teams independently organize and compete for project leadership, thereby forming a large-scale collaborative innovation force.

3.6. Promoting co-governance and shared development through team building

The correlation coefficient between team building and overall effectiveness reached 0.948, indicating that the synergistic effects of talent cultivation, democratic management, and cultural cohesion constitute a stabilizing cornerstone of team effectiveness [4, 5]. The enhancement path focuses on "talent pipeline cultivation, democratic governance, and cultural branding", emphasizing institutionalized full-cycle talent development and the strengthening of organizational belonging. First, a comprehensive full-cycle talent development mechanism should be improved. Career development pathways should be established for both technical and skilled personnel, while special funding programs for young talent cultivation should be introduced to support employees in professional training and skills certification. Continuous job training and vocational skills competitions should be carried out to make teams important platforms for labor creativity and capability enhancement. Second, democratic governance within teams should be further strengthened. Matters such as task allocation, performance evaluation, honors and awards selection, and training opportunities should be incorporated into transparent team affairs management. A democratic evaluation system for team leaders should be implemented, with evaluation results directly linked to appointments, removals, and incentive mechanisms, thereby substantially enhancing employees' sense of participation. Third, distinctive team cultural brands should be cultivated. Activities such as team logo design competitions should be organized to encourage teams to refine and showcase their own cultural identities and unique characteristics, thereby fostering a positive atmosphere in which culture drives management. At the same time, communication and experience-sharing through mainstream media channels should be strengthened to enhance the external reputation and visibility of teams.

4. Conclusion

Enhancing team development effectiveness is a systematic undertaking involving organizational structures, human resources, institutional mechanisms, organizational culture, and technological capability. Based on the analytical framework of "human factors–physical factors–operational factors," this study constructs a six-dimensional model of the key influencing factors affecting team development effectiveness in aerospace enterprises and verifies the significant and strong positive correlations between each variable and overall effectiveness. The findings indicate that basic management and quality and safety constitute the foundation of team effectiveness, objectives and tasks serve as the guiding force, and team building functions as the stabilizing cornerstone. Meanwhile, technological innovation and problem-solving represent the variable with the greatest potential to drive teams from mere "production units" toward higher-value "value-creation units". In the new stage of building China into a leading aerospace power, team governance must further evolve from an "experience-driven" model toward a "data-driven" model, and from "standardized compliance" toward "innovative excellence". Only in this way can the organizational and managerial advantages of aerospace enterprises be effectively transformed into strong operational capabilities on the front lines of scientific research and production, enabling teams to contribute greater strength and wisdom to the development of China's aerospace industry.

References

[1] Gu, J. F., Tang, X. J., & Zhu, Z. X. (2007). A review of the Wuli–Shili–Renli system methodology. *Journal of Transportation Systems Engineering and Information Technology, 7*(6), 51–60.

[2] Liu, S. S., Liu, T. T., & Liu, X. Y. (2007). Relationships among human resource management systems, innovation capability, and organizational performance: Evidence from high-tech enterprises. *Studies in Science of Science*, (4), 764–771.

[3] Sui, Y., Chen, Y. Y., & Wang, H. (2012). Innovation climate, innovation self-efficacy, and team innovation: The moderating role of team leadership. *Acta Psychologica Sinica, 44*(2), 237–248.

[4] Wang, C. M., & Liu, X. F. (2007). An empirical study on the impact of top management team cohesion on succession performance in family businesses. *Management World*, (10), 84–98.

[5] Chen, G. Q., & Ning, N. (2010). Research on the relationship among team constructive controversy, learning from experience, and performance. *Journal of Management Sciences in China, 13*(8), 65–77.