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Organizational components and athlete participation in university team sports: A systems-based analysis

Componentes organizacionales y participación de atletas en deportes colectivos universitarios: un análisis basado en sistemas

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Ethical aspects: This study was conducted in accordance with the ethical principles for research involving human participants. Ethical approval was obtained from the institutional ethics review board of the researchers' affiliated institution under an approved ethics review protocol. The study underwent expedited ethical review and was approved for implementation at the participating university. Informed consent was obtained from all participants, and confidentiality and anonymity were maintained throughout the study. The research complied with the provisions of the Philippine Data Privacy Act of 2012 (Republic Act No. 10173).

Abstract

Collegiate sports programs rely on coordinated organizational support to sustain athlete participation across competitive levels. This study examined the implementation of four organizational components of a university Sports Development Program and their relationships with athlete participation among collegiate varsity student-athletes. A quantitative cross-sectional explanatory design was employed with 75 varsity student-athletes from basketball, volleyball, baseball, and softball at a public university in the Philippines. Data were collected using a researcher-developed 70-item questionnaire assessing recruitment and retention, benefits and incentives, sports facilities, equipment maintenance, and participation in local, regional, and national competitions. Descriptive statistics, Pearson product-moment correlation, and multiple linear regression were used. The organizational components were generally highly to very highly implemented. Athlete participation was very high at the local and regional levels and high at the national level. The organizational components were generally positively associated with participation, although the strength and significance of relationships varied across competitive levels. The regression model was significant, $F(4, 70) = 8.425$, $p < .001$, explaining 32.5% of the variance in overall athlete participation. Equipment maintenance was the only significant predictor ($\beta = .487$, $p < .001$). The findings suggest that equipment maintenance represents an important organizational area associated with athlete participation, while the broader systems perspective highlights the complementary roles of recruitment and retention, benefits and incentives, and sports facilities. The findings provide an empirical basis for strengthening collegiate Sports Development Programs through coordinated organizational planning and resource management.

Keywords: athletes; college sports; sports management; sports facilities; equipment maintenance

Resumen

Los programas deportivos universitarios requieren un apoyo organizacional coordinado para mantener la participación de los atletas en diferentes niveles competitivos. Este estudio examinó la implementación de cuatro componentes organizacionales de un Programa de Desarrollo Deportivo universitario y sus relaciones con la participación de atletas universitarios. Se empleó un diseño explicativo transversal cuantitativo con 75 atletas universitarios de baloncesto, voleibol, béisbol y fútbol de una universidad pública de Filipinas. Los datos se recopilaron mediante un cuestionario de 70 ítems elaborado por el investigador, que evaluó el reclutamiento y la retención, los beneficios e incentivos, las instalaciones deportivas, el mantenimiento del



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equipo y la participación en competencias locales, regionales y nacionales. Se utilizaron estadísticos descriptivos, correlación de Pearson y regresión lineal múltiple. Los componentes organizacionales presentaron niveles de implementación generalmente altos a muy altos. La participación fue muy alta en los niveles local y regional y alta en el nivel nacional. Los componentes organizacionales mostraron asociaciones generalmente positivas con la participación, aunque la fuerza y significancia de las relaciones variaron según el nivel competitivo. El modelo de regresión fue significativo, $F(4, 70) = 8.425$, $p < .001$, y explicó el 32.5% de la varianza de la participación general. El mantenimiento del equipo fue el único predictor significativo ($\beta = .487$, $p < .001$). Los resultados proporcionan una base empírica para fortalecer los programas deportivos universitarios mediante una planificación organizacional y una gestión coordinada de los recursos.

Keywords: atletas; deportes universitarios; gestión deportiva; instalaciones deportivas; mantenimiento de equipos

Introduction

Collegiate sports have become an essential component of higher education because they contribute not only to athletic excellence but also to students' physical, psychological, social, and leadership development. Participation in organized university sports promotes healthy lifestyles, teamwork, resilience, discipline, and interpersonal competence while fostering institutional identity and student engagement. Consequently, universities increasingly recognize sports development programs as strategic investments that support student success, institutional competitiveness, and community engagement. As collegiate athletics continue to evolve within increasingly competitive educational environments, institutions are expected to provide comprehensive organizational support systems that enable student-athletes to achieve both academic and athletic success (Kumbhar & Jadhav, 2025; Kumar & Saruk, 2025; Liu & Chang, 2024).

The effectiveness of collegiate sports programs depends not only on the abilities of athletes and coaches but also on the organizational capacity of institutions to manage resources efficiently and coordinate multiple program components. Organizational efficiency has therefore emerged as a central concept in sports management because it reflects an organization's ability to transform available human, financial, and material resources into desired outcomes through effective planning, implementation, coordination, and evaluation



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(ShahbaZ, 2025; Bouchet et al, 2022). In university sports, organizational efficiency encompasses the strategic allocation of resources, effective governance, sustainable program management, and continuous organizational improvement, all of which contribute to athlete development and program sustainability. Previous studies have demonstrated that organizations characterized by efficient governance structures, effective resource management, and coordinated administrative systems consistently achieve higher levels of organizational performance, stakeholder satisfaction, and long-term sustainability (Aliyev et al, 2025; Ramos et al, 2024).

Within collegiate sports programs, several organizational components are particularly important in supporting athletes and sustaining program operations. Recruitment and retention systems enable institutions to identify, attract, and maintain student-athletes who can contribute to program continuity and competitive participation. Effective recruitment practices combined with appropriate retention strategies can strengthen organizational stability while minimizing athlete attrition and promoting continued engagement in university sports (Dwyer, 2020). Benefits and incentives, including scholarships, academic assistance, recognition systems, and welfare services, address both the athletic and educational needs of student-athletes and may contribute to motivation, satisfaction, and continued participation (Qomariah et al, 2024). Sports facilities provide appropriate and safe environments for training and competition, while equipment maintenance ensures continued access to reliable and safe resources needed for athletic preparation and participation. Investments in sports infrastructure and equipment have been associated with improved athlete experiences, greater organizational credibility, and enhanced competitive preparedness (Magnusen et al, 2023; Ulep, 2025). Taken together, these components represent important organizational dimensions through which university sports programs provide support to student-athletes.

The relationships among these organizational components can be understood through General Systems Theory (Bertalanffy, 1968), which conceptualizes organizations as integrated systems composed of interdependent subsystems working toward common objectives. From this perspective, recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance do not operate as isolated administrative functions. Rather, they form



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interconnected components of the broader sports development system, in which changes or limitations in one component may have implications for the functioning of other components and for athlete participation. Organizational inputs, resources, and support mechanisms are processed through coordinated administrative and operational activities and translated into outcomes that can provide feedback for continuous program improvement. Recent applications of systems thinking in sport management similarly emphasize that sustainable organizational performance depends on the coordinated functioning of multiple organizational subsystems rather than isolated administrative interventions (McLean et al, 2024; Glibo & Koenigstorfer, 2023). Accordingly, a systems-based perspective provides an appropriate lens for examining how multiple organizational components are collectively related to athlete participation.

Athlete participation represents an important outcome of collegiate sports programs because sustained involvement in local, regional, and national competitions reflects the institution's capacity to recruit, prepare, support, and retain student-athletes throughout their collegiate careers. Although athletic performance is influenced by individual ability, coaching quality, and competitive context, participation is also shaped by the organizational conditions and support mechanisms available to student-athletes. Previous research has shown that athlete-centered organizational environments characterized by effective leadership, accessible resources, supportive institutional policies, quality facilities, and comprehensive athlete services promote higher levels of motivation, commitment, competitive engagement, and long-term participation (Tompsett et al, 2023; Erikstad et al, 2021; Li & Xing, 2025). Consequently, athlete participation may serve as a meaningful outcome for examining how organizational components within collegiate sports development programs are associated with athletes' continued engagement in competitive activities.

Despite increasing scholarly attention to sports management and organizational performance, empirical evidence explaining how multiple organizational components collectively relate to athlete participation remains limited. Existing studies have largely investigated organizational variables independently, focusing on leadership, coaching effectiveness, financial support, facilities, or athlete motivation without sufficiently considering the interconnected relationships among these components within a unified organizational



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system. There is therefore a need for empirical investigations that examine multiple organizational components simultaneously and determine which components are significantly associated with athlete participation. This need is particularly relevant within collegiate sports programs in developing countries, where empirical evidence supporting evidence-based sports management and institutional decision-making remains limited. Addressing this gap can provide a more comprehensive basis for resource allocation, policy formulation, and program evaluation in higher education sports systems.

Therefore, this study aimed to examine the organizational components of collegiate team sports programs and their association with athlete participation from a systems-based perspective. Specifically, the study sought to: (1) determine the level of implementation of the organizational components of the Sports Development Program; (2) determine the level of athlete participation in local, regional, and national competitions; (3) determine the relationships between the organizational components and athlete participation; and (4) identify which organizational components significantly predict athlete participation when considered simultaneously. The findings are expected to contribute to the growing body of knowledge in sports management by providing an evidence-based systems perspective that can assist university administrators, athletic directors, coaches, and policymakers in strengthening collegiate sports development programs, improving organizational practices, and enhancing athlete participation.

Methods

Research Design

This study employed a quantitative cross-sectional explanatory research design to examine the organizational components of collegiate team sports programs and their association with athlete participation. A cross-sectional design was considered appropriate because data were collected from participants at a single point in time to determine the implementation of organizational components within the Sports Development Program and examine their relationships with athlete participation. As an observational study, no variables were manipulated, allowing the investigation of naturally occurring organizational conditions within



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collegiate sports programs. The study was conducted in accordance with the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement for cross-sectional research.

Grounded in General Systems Theory (Bertalanffy, 1968), the study conceptualized collegiate sports programs as integrated organizational systems in which recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance function as interdependent organizational components associated with athlete participation. The systems perspective provided a theoretical basis for examining how these components operate within the broader Sports Development Program and how their implementation relates to athlete participation.

The study integrated descriptive and inferential statistical analyses to address its research objectives. Descriptive statistics were used to determine the levels of implementation of the organizational components and athlete participation. Pearson product-moment correlation analysis was employed to examine the relationships between the organizational components and athlete participation, while multiple linear regression analysis was used to identify which organizational components significantly predicted athlete participation when considered simultaneously. This analytical approach provided an empirical basis for understanding the organizational factors associated with athlete participation within collegiate team sports programs.

Participants

The participants of this study consisted of varsity student-athletes from a public state university in the Philippines who were officially recognized members of selected collegiate team sports and actively participated in the university's Sports Development Program. The study included athletes from five varsity teams: Basketball (Men), Volleyball (Men), Volleyball (Women), Baseball, and Softball. These sports were included because they represented selected team-sport contexts within the university's Sports Development Program and provided an appropriate setting for examining the implementation of organizational components and their association with athlete participation.



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A total enumeration sampling technique was employed to include all eligible members of the identified target population. The final sample consisted of seventy-five (75) varsity student-athletes, with fifteen (15) participants from each of the five varsity teams: Basketball (Men), Volleyball (Men), Volleyball (Women), Baseball, and Softball. Eligibility was limited to athletes who were officially listed on the university's varsity roster, actively participated in the Sports Development Program, and had completed at least one academic year within the program. These criteria ensured that the participants had sufficient experience with the program's recruitment and retention practices, benefits and incentives, sports facilities, equipment maintenance, and competitive participation to provide informed responses to the study instrument.

Participation in the study was voluntary. Before data collection, the participants were provided with information regarding the study's purpose, procedures, and participation requirements and were asked to provide written informed consent. They were informed that participation was voluntary and that they could decline participation without penalty. The participants were also assured that their responses would be treated confidentially and anonymously and that the information collected would be used solely for academic and research purposes.

Instrumentation

Data were collected using a researcher-developed questionnaire designed to assess the implementation of the Sports Development Program and self-reported athlete participation among collegiate varsity student-athletes. The instrument was developed based on a review of literature related to sports management, organizational efficiency, athlete development, and collegiate sports programs and was conceptually aligned with the systems perspective of General Systems Theory (Bertalanffy, 1968).

The questionnaire consisted of seventy (70) items organized into two major sections. The first section assessed self-reported athlete participation across three competitive levels: local, regional, and national, with ten (10) items assigned to each level. The second section assessed the implementation of the Sports Development Program across four organizational



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components: recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance, with ten (10) items for each component. All items were answered using a four-point Likert-type response scale ranging from 4 (Strongly Agree) to 1 (Strongly Disagree). Higher scores indicated higher levels of perceived implementation of the organizational components and self-reported athlete participation. Thus, athlete participation was operationalized as respondents' self-reported participation-related perceptions at the local, regional, and national competitive levels rather than as an objective count of competitions or official participation records.

Content validity of the questionnaire was addressed through expert evaluation. The instrument was reviewed by individuals with relevant expertise in sports management, physical education, research methodology, and educational measurement. The review focused on the clarity, relevance, representativeness, and alignment of the items with the intended study constructs. The recommendations provided by the experts were considered in refining the questionnaire before its administration to the study participants. No numerical content-validity index was reported because the individual expert-rating records required for calculating such indices were not available. Accordingly, the evidence of validity reported in this study is limited to expert review of the questionnaire content.

Internal consistency reliability was examined using Cronbach's alpha coefficient, with reliability assessed separately for each ten-item construct rather than for the 70-item questionnaire as a single scale. During data screening, thirteen (13) out-of-range entries were identified in the encoded dataset. Because the original completed questionnaires were unavailable for verification, these entries were treated as missing values rather than assigned presumed response categories. The resulting Cronbach's alpha coefficients were .921 for Local Participation, .902 for Regional Participation, .967 for National Participation, .890 for Recruitment and Retention, .876 for Benefits and Incentives, .932 for Sports Facilities, and .931 for Equipment Maintenance, indicating satisfactory to excellent internal consistency across the seven constructs. No item was removed based on the internal-consistency analysis.

Because the study did not include confirmatory factor analysis or another factorial validation procedure, factorial validity, convergent validity, and discriminant validity were not



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established in the present investigation. Future research should undertake further psychometric validation of the researcher-developed questionnaire using an independent and sufficiently large sample to examine its underlying factor structure and additional validity evidence.

Data Collection Procedure

Prior to data collection, the researcher secured approval from the appropriate university authorities and the administrative office responsible for the institutional Sports Development Program. Coordination was established with athletic administrators and team coaches to facilitate access to the identified varsity student-athletes and to schedule the administration of the questionnaire at times that would not interfere with participants' training sessions, academic responsibilities, or competition activities.

Following the necessary approvals, the researcher personally administered the survey questionnaire to the identified respondents during scheduled team meetings and training sessions. Before the administration of the questionnaire, participants were provided with information regarding the study's purpose, objectives, procedures, and participation requirements. Participation was voluntary, and written informed consent was obtained from each participant before questionnaire administration. Participants were informed of their right to decline participation or withdraw from the study at any time without penalty.

Participants were given approximately 15–20 minutes to complete the questionnaire. The researcher remained available during the administration to clarify instructions and procedural questions while taking care not to influence the participants' responses. Upon completion, the questionnaires were retrieved and checked for completeness. Where responses were incomplete, clarification was sought from the participant when appropriate and without coercion.

After collection, the completed questionnaires were securely stored and subsequently encoded into statistical software for analysis. Identifying information was not included in the analytical dataset, and responses were treated confidentially. The collected information was used solely for the purposes of the study. Appropriate data-management procedures were



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observed throughout the collection, storage, encoding, and analysis of the data to protect participant confidentiality and maintain data integrity.

Ethical Aspects

The study obtained ethical approval from the institutional ethics review board of the researchers' affiliated institution under an approved ethics review protocol. The study underwent expedited ethical review and was approved for implementation at the participating university. Prior to participation, all respondents were informed about the purpose, procedures, voluntary nature, and expected requirements of the study and provided written informed consent. Participants were informed of their right to decline participation or withdraw from the study without penalty. Confidentiality and anonymity of responses were maintained throughout data collection, encoding, analysis, and reporting. The collected information was used solely for academic and research purposes and was handled in accordance with applicable ethical standards and data privacy requirements.

Data Analysis

The quantitative data were analyzed using descriptive and inferential statistical techniques consistent with the study objectives. Mean and standard deviation were computed to describe the levels of implementation of the Sports Development Program in terms of recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance, as well as the levels of self-reported athlete participation in local, regional, and national competitions. For interpreting the four-point Likert-type responses, mean scores from 3.26 to 4.00 were interpreted as Very Highly Implemented for program components and Very High for athlete participation, scores from 2.51 to 3.25 as Highly Implemented and High, respectively, scores from 1.76 to 2.50 as Moderately Implemented and Moderate, respectively, and scores from 1.00 to 1.75 as Low Implemented and Low, respectively.

For the analysis of relationships, Pearson product-moment correlation analysis was performed to examine the associations between the organizational components of the Sports Development Program and the three dimensions of self-reported athlete participation. The three



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participation dimensions—local, regional, and national—were also summarized as an overall athlete participation score by combining the corresponding valid item responses across the 30 participation items. This composite score was used as the dependent variable in the multiple linear regression analysis. The three participation dimensions were retained as separate variables for the descriptive and correlation analyses to examine differences in relationships across competitive levels.

Multiple linear regression analysis was employed to determine which organizational components significantly predicted overall athlete participation when recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance were entered simultaneously as predictors. Regression diagnostics were examined to assess the assumptions underlying the analysis, including multicollinearity, independence of errors, linearity, homoscedasticity, residual normality, and influential observations. Tolerance and variance inflation factor (VIF) were examined for multicollinearity; the Durbin–Watson statistic was examined for independence of errors; residual-based procedures were used to assess linearity, homoscedasticity, and normality; and Cook's distance and leverage values were examined to identify potentially influential observations. HC3 heteroskedasticity-consistent standard errors were also examined as a robustness check.

Prior to the inferential analyses, the dataset was screened for completeness and out-of-range responses. Thirteen out-of-range item entries were identified in the encoded dataset. Because the original completed questionnaires were unavailable for verification, these entries were treated as missing values rather than assigned presumed response categories. Construct-level scores were calculated from the valid item responses, with missing item responses excluded from the corresponding construct-level calculations.

All inferential statistical tests were evaluated at the 0.05 level of significance. Statistical analyses were performed using appropriate statistical software.



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Results

Program Components and Athlete Participation Levels

TABLE 1. Descriptive Statistics of Program Components and Athlete Participation Levels

VARIABLE	LEVELS		
	M	SD	INTERPRETATION
Program Components			
Recruitment and Retention	3.46	0.46	Very Highly Implemented
Benefits and Incentives	3.19	0.54	Highly Implemented
Sports Facilities	3.13	0.68	Highly Implemented
Equipment Maintenance	3.47	0.60	Very Highly Implemented
ATHLETE PARTICIPATION			
Local Participation	3.52	0.48	Very High
Regional Participation	3.53	0.44	Very High
National Participation	2.98	0.93	High

NOTE. M = mean; SD = standard deviation.

Table 1 presents the descriptive statistics for the organizational components of the Sports Development Program and the levels of athlete participation among collegiate varsity student-athletes. Among the four organizational components, equipment maintenance obtained the highest mean score ($M = 3.47$, $SD = 0.60$), interpreted as very highly implemented, followed by recruitment and retention ($M = 3.46$, $SD = 0.46$), also interpreted as very highly implemented. Benefits and incentives ($M = 3.19$, $SD = 0.54$) and sports facilities ($M = 3.13$, $SD = 0.68$) were interpreted as highly implemented. These findings indicate that respondents generally reported high levels of implementation across the organizational components of the Sports Development Program.

With respect to athlete participation, regional participation obtained the highest mean ($M = 3.53$, $SD = 0.44$), followed closely by local participation ($M = 3.52$, $SD = 0.48$), both interpreted as very high. National participation obtained a comparatively lower mean ($M = 2.98$, $SD = 0.93$) and was interpreted as high. The results indicate that respondents reported higher participation at the local and regional levels than at the national level.



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Relationships Between Program Components and Athlete Participation

TABLE 2. Pearson Correlation Matrix Between Program Components and Athlete Participation

Variables	1	2	3	4	5	6	7
1. Recruitment and Retention	1						
2. Benefits and Incentives	.604***	1					
3. Sports Facilities	.565***	.615***	1				
4. Equipment Maintenance	.439***	.533***	.601***	1			
5. Local Participation	.290*	.234*	.376***	.449***	1		
6. Regional Participation	.438***	.258*	.315**	.561***	.560***	1	
7. National Participation	.243*	.348**	.078	.305**	.221	.435***	1

NOTE. $p < .05$; $p < .01$; $p < .001$.

Table 2 presents the Pearson product-moment correlation coefficients between the organizational components of the Sports Development Program and the three dimensions of athlete participation. The results show that the organizational components were positively associated with athlete participation, although the strength and statistical significance of the relationships varied across the three levels of competition.

Recruitment and retention demonstrated significant positive relationships with local participation ($r = .290$, $p = .012$), regional participation ($r = .438$, $p < .001$), and national participation ($r = .243$, $p = .036$). Benefits and incentives were also positively related to local participation ($r = .234$, $p = .044$), regional participation ($r = .258$, $p = .025$), and national participation ($r = .348$, $p = .002$). Sports facilities demonstrated significant positive relationships with local participation ($r = .376$, $p < .001$) and regional participation ($r = .315$, $p = .006$), but its relationship with national participation was not statistically significant ($r = .078$, $p = .505$).

Equipment maintenance demonstrated significant positive relationships with all three participation dimensions. Specifically, it was positively associated with local participation ($r = .449$, $p < .001$), regional participation ($r = .561$, $p < .001$), and national participation ($r = .305$, $p = .008$). Among the four organizational components, equipment maintenance showed the strongest and most consistent associations with the three participation dimensions.



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The three participation dimensions were also positively associated with one another. Local and regional participation demonstrated a moderate positive relationship ($r = .560$, $p < .001$), while regional and national participation were also positively related ($r = .435$, $p < .001$). The relationship between local and national participation was positive but not statistically significant ($r = .221$, $p = .057$).

Overall, the findings indicate that the organizational components of the Sports Development Program were generally positively associated with athlete participation, although the strength and significance of the associations differed across competitive levels. These results provide a basis for the subsequent multiple linear regression analysis.

Predictors of Athlete Participation

TABLE 3. Multiple Linear Regression Predicting Overall Athlete Participation

Predictor	B	SE	β	t	p
Constant	1.311	0.390	—	3.364	.001
Recruitment and Retention	0.237	0.137	.225	1.734	.087
Benefits and Incentives	0.109	0.123	.123	0.884	.380
Sports Facilities	-0.159	0.100	-.224	-1.581	.118
Equipment Maintenance	0.393	0.103	.487	3.825	< .001

Model statistics: $R^2 = .325$; Adjusted $R^2 = .286$; $F(4, 70) = 8.425$, $p < .001$.

Table 3 presents the results of the multiple linear regression analysis examining the organizational components of the Sports Development Program as predictors of overall athlete participation. The regression model was statistically significant, $F(4, 70) = 8.425$, $p < .001$, with an R^2 of .325 and an adjusted R^2 of .286. Thus, the four organizational components collectively accounted for approximately 32.5% of the variance in overall athlete participation.

Among the four organizational components, equipment maintenance was the only statistically significant predictor of overall athlete participation ($B = 0.393$, $\beta = .487$, $p < .001$). This indicates that, when the other organizational components were statistically controlled, higher scores in equipment maintenance were associated with higher levels of overall athlete participation. Recruitment and retention ($B = 0.237$, $\beta = .225$, $p = .087$), benefits and incentives



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($B = 0.109$, $\beta = .123$, $p = .380$), and sports facilities ($B = -0.159$, $\beta = -.224$, $p = .118$) did not significantly predict overall athlete participation.

Overall, the findings indicate that the organizational components collectively provided a statistically significant prediction of overall athlete participation, with equipment maintenance emerging as the only significant individual predictor in the model.

Regression Diagnostics

Regression diagnostics were conducted to assess the assumptions underlying the multiple linear regression model. The results indicated no serious multicollinearity among the four organizational predictors, with variance inflation factor (VIF) values ranging from 1.68 to 2.08 and corresponding tolerance values ranging from 0.48 to 0.59. The Durbin–Watson statistic was 1.761, indicating acceptable independence of residuals. The Breusch–Pagan test for heteroscedasticity was not statistically significant, $\chi^2(4) = 5.01$, $p = .287$, and the White test was likewise nonsignificant, $\chi^2(14) = 11.75$, $p = .626$, indicating no evidence of problematic heteroscedasticity. The model specification test was also nonsignificant, $F(1,69) = 0.63$, $p = .429$, providing no evidence of substantial nonlinear misspecification.

The Shapiro–Wilk test indicated a statistically significant but modest departure from normality of the regression residuals, $W = .962$, $p = .025$. However, the Jarque–Bera test was nonsignificant, $\chi^2(2) = 3.82$, $p = .148$, and the residual distribution did not indicate severe deviation. Influential-case diagnostics likewise did not identify an observation warranting exclusion. The largest Cook's distance was 0.201, while the largest leverage value was 0.260; no case exceeded a Cook's distance of 1.0. Given the minor departure from residual normality, HC3 heteroskedasticity-consistent standard errors were examined as a robustness check. The substantive conclusion remained unchanged, with equipment maintenance remaining the only significant predictor of overall athlete participation.

Discussion

The present study found that the organizational components of the Sports Development Program were implemented at generally high levels, with equipment maintenance receiving the



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highest implementation rating, followed closely by recruitment and retention. Benefits and incentives and sports facilities were likewise rated as highly implemented. In terms of athlete participation, respondents reported very high participation at the local and regional levels, while participation at the national level was high but comparatively lower. These findings indicate that the institution has established organizational practices and support mechanisms that are perceived by athletes to be substantially implemented across the major components of the Sports Development Program. The comparatively lower level of national participation, however, highlights a distinction in participation across competitive levels and suggests an area that may warrant further organizational attention.

These findings are consistent with the fundamental proposition of General Systems Theory (Bertalanffy, 1968), which views organizations as systems composed of interdependent components that operate in relation to one another. Within collegiate sports programs, recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance can be understood as interconnected organizational components that collectively constitute the athlete development environment. The relatively high implementation ratings across these components support a systems-oriented understanding in which organizational support is distributed across several complementary functions rather than concentrated in a single administrative area. Similar systems-oriented perspectives have been emphasized in contemporary sport management literature, where organizational performance is viewed as the product of integrated governance structures, strategic resource allocation, and collaborative institutional support (Kasale et al, 2024; Khursheed, 2025).

Among the organizational components, equipment maintenance obtained the highest implementation rating, underscoring the importance of maintaining functional and appropriate training resources within collegiate sports programs. Properly maintained equipment may support safe and consistent training environments and provide athletes with resources necessary for technical practice and preparation. This interpretation is consistent with the view that equipment management is an important component of the broader organizational environment in which athletes train and compete. Previous investigations have likewise demonstrated that investment in sports equipment and infrastructure contributes to improved athlete satisfaction,



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enhanced training quality, organizational credibility, and better competitive preparation (Bruder et al, 2024; Huang & Yongquan, 2025; Ahmad & Hussain, 2024). The present findings therefore reinforce the importance of equipment management as a prominent organizational component of collegiate sports development.

Similarly, the high implementation rating for recruitment and retention indicates that respondents perceived established practices for attracting and maintaining student-athletes within the Sports Development Program. Recruitment represents an important organizational process for developing the athlete population, while retention is concerned with sustaining athlete involvement over time. Effective recruitment strategies, together with academic support, mentoring, and athlete-centered policies, may contribute to program continuity and organizational stability. Previous studies have reported that institutions implementing comprehensive recruitment and retention systems are more likely to develop sustainable athletic programs characterized by greater athlete satisfaction, stronger organizational commitment, and improved competitive performance (Pineda & Nabor, 2025; Mitchell et al, 2024). In the present study, the high implementation rating for this component suggests that recruitment and retention constitute an important part of the institutional sports-program environment.

Although benefits and incentives and sports facilities were also rated as highly implemented, their mean ratings were comparatively lower than those of equipment maintenance and recruitment and retention. This finding may indicate areas where further strengthening of institutional support could be considered. Financial assistance, scholarship opportunities, academic flexibility, recognition programs, access to sports medicine services, and psychological support have been recognized as important organizational mechanisms that encourage sustained athlete participation and improve competitive readiness (Fransen et al, 2021; Hong et al, 2022). Likewise, modern and well-maintained sports facilities provide athletes with safe, accessible, and competition-oriented environments that facilitate technical development, physical conditioning, and overall training effectiveness. Adequate sports infrastructure has consistently been associated with higher levels of athlete engagement, organizational satisfaction, and program quality across collegiate sports settings (Madhu & Murthy, 2023; Sharif et al, 2025). Thus, while the present findings indicate generally high



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implementation, continued attention to benefits, incentives, and facilities may further strengthen the institutional support environment.

The correlation findings provide additional insight into the relationships between the organizational components and athlete participation. Recruitment and retention, benefits and incentives, and equipment maintenance were positively and significantly associated with local, regional, and national participation, whereas sports facilities were significantly associated with local and regional participation but not with national participation. Equipment maintenance demonstrated the strongest and most consistent associations across the three participation levels, particularly with regional participation ($r = .561$, $p < .001$). These findings suggest that organizational components do not demonstrate identical relationships with athlete participation across competitive contexts. Rather, the strength of association varies according to the organizational component and level of competition. Because the study employed a cross-sectional design, these relationships should be interpreted as statistical associations rather than evidence of causal effects.

The positive associations among the participation dimensions also provide an indication that athletes who reported higher participation at one competitive level tended to report higher participation at other levels, although the relationship between local and national participation was not statistically significant. The stronger association between local and regional participation may reflect the closer relationship between these levels of competitive involvement, while the association between regional and national participation indicates that participation at the regional level may coexist with greater participation at the national level. However, these relationships should not be interpreted as evidence that participation at one level directly produces participation at another level.

The multiple regression analysis further clarified the relative contribution of the organizational components when considered simultaneously. The overall regression model was statistically significant and explained 32.5% of the variance in overall athlete participation. Importantly, equipment maintenance was the only organizational component that significantly predicted overall athlete participation, whereas recruitment and retention, benefits and incentives, and sports facilities did not demonstrate statistically significant unique predictive



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effects in the simultaneous model. This finding is particularly important because the correlation results showed significant associations between several organizational components and participation. The regression results indicate that some of these bivariate associations may overlap with the effects of other organizational components, while equipment maintenance retained a significant unique statistical contribution when the four components were considered together.

The prominence of equipment maintenance in the regression model is consistent with its highest implementation rating and its strongest pattern of bivariate associations with the three participation dimensions. Properly maintained equipment may provide athletes with consistent access to appropriate training resources and support the continuity of practice and preparation. Previous investigations have likewise emphasized the contribution of equipment and infrastructure to athlete experiences, training quality, and competitive preparation (Bruder et al, 2024; Huang & Yongquan, 2025; Ahmad & Hussain, 2024). Nevertheless, the present cross-sectional design does not establish that equipment maintenance causes greater athlete participation. Rather, the finding indicates that equipment maintenance was the organizational component most strongly associated with and statistically predictive of overall athlete participation within the examined model.

The fact that recruitment and retention, benefits and incentives, and sports facilities were not significant unique predictors in the multiple regression model should not be interpreted as evidence that these components are unimportant. Their descriptive ratings were high, and several demonstrated significant bivariate relationships with athlete participation. Instead, the regression results indicate that their unique statistical contributions were not sufficiently strong after the organizational components were considered simultaneously. This distinction is important because organizational systems operate through interconnected components, and the contribution of one component may overlap with or be shared by other organizational functions. The systems perspective provided by General Systems Theory (Bertalanffy, 1968) is therefore useful for interpreting these findings because it emphasizes the interdependence of organizational components rather than treating each component as an isolated function.



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The consistently high levels of local and regional athlete participation further indicate that the Sports Development Program provides substantial opportunities for competitive involvement. Participation in organized competitions represents an important aspect of athlete development because it provides opportunities for athletes to apply training, gain competitive experience, and remain engaged in collegiate sports. Participation at the national level, although still rated high, was comparatively lower than participation at the local and regional levels. This difference may reflect the greater competitive demands, qualification requirements, resource requirements, and limited opportunities associated with higher-level competition. Similar observations have been reported in collegiate sports systems where limitations in organizational resources and institutional support restrict athletes' opportunities to advance despite successful participation in lower levels of competition (Griesinger et al, 2025; Thompson et al, 2022; Coombs & Bagley, 2025).

Overall, the findings support a systems-based interpretation of collegiate sports-program management, while avoiding the stronger claim that a statistically validated organizational efficiency model was established. The results demonstrate that the four organizational components were generally implemented at high levels and that their relationships with athlete participation varied across competitive levels. More importantly, equipment maintenance emerged as the only significant unique predictor of overall athlete participation in the multiple regression model. These findings highlight the importance of maintaining functional training resources while recognizing that athlete participation is associated with a broader organizational environment involving recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance. Universities may therefore consider continuing to strengthen these interconnected organizational functions while giving particular attention to equipment maintenance as an empirically supported area associated with athlete participation.

Limitations of the Study

Several limitations should be considered when interpreting the findings of this study. First, the study employed a cross-sectional design, which captures organizational conditions



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and athlete participation at a single point in time. Although this design is appropriate for examining associations and identifying statistically significant predictors, it does not permit causal inferences regarding the relationships between organizational components and athlete participation. Longitudinal research is recommended to examine how changes in program implementation are associated with changes in athlete participation over time.

Second, the study was conducted within a single public university and involved varsity student-athletes from selected team sports. While the use of total enumeration ensured comprehensive representation of the target population, the findings may not be directly generalizable to other higher education institutions, individual sports, or different organizational contexts. Replication across multiple universities and diverse collegiate sports programs would strengthen the external validity and applicability of the findings.

Third, the study relied on self-reported questionnaire data, which may be influenced by response bias, social desirability, or individual perceptions of program implementation and athlete participation. Because the organizational components and athlete participation were assessed from the same respondents using the same questionnaire and response format at a single point in time, the findings may also be subject to common-method bias, which may have influenced the magnitude of the observed associations. No independent objective participation records or separate data sources were incorporated to formally assess this potential bias. Although the instrument underwent expert evaluation and demonstrated satisfactory to excellent internal consistency across its seven constructs, the absence of the original completed questionnaires limited the ability to independently verify the out-of-range entries identified during data screening. Future studies may address these limitations by incorporating multiple data sources, temporal separation of measurements, institutional performance records, athlete retention statistics, competition results, coach evaluations, and direct observations to provide a more comprehensive assessment of collegiate sports-program implementation and athlete participation.

Finally, the study examined only four organizational components—recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance—in relation to athlete participation. Other organizational and contextual variables, including coaching



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leadership, organizational culture, financial sustainability, institutional governance, athlete well-being, and psychosocial support, were beyond the scope of the present investigation but may also be associated with athlete participation. Future research should consider incorporating these variables and examining their relationships with athlete participation across multiple institutions and competitive contexts.

Practical Implications

The findings of this study provide an empirical basis for strengthening collegiate Sports Development Programs through a systems-oriented approach to organizational planning and management. The results indicate that recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance are interconnected organizational components that are generally implemented at high levels and are associated with different dimensions of athlete participation. Consequently, university administrators and athletic directors may consider a systems-oriented approach when planning, implementing, and evaluating sports development initiatives.

Particular attention may be given to equipment maintenance, which obtained the highest implementation rating among the organizational components and emerged as the only significant predictor of overall athlete participation in the multiple regression analysis. Universities may therefore consider strengthening preventive equipment maintenance, regular inspection, timely replacement of worn or damaged equipment, and systematic resource allocation to support safe and consistent training environments. Although the cross-sectional design does not establish that equipment maintenance causes greater athlete participation, its significant statistical association and predictive contribution indicate that it is an important organizational area for institutional attention. Recruitment and retention, benefits and incentives, and sports facilities should likewise continue to be maintained and strengthened given their high implementation ratings and their significant bivariate associations with selected participation outcomes.

The findings may also inform institutional program assessment and strategic planning. Sports offices and athletic administrators can use the four organizational components examined



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in this study as areas for periodic assessment, allowing institutions to identify organizational strengths and areas requiring improvement. Such assessment may be complemented by athlete feedback, participation records, competition results, and other institutional indicators to support evidence-based decision-making. Rather than serving as a statistically validated organizational efficiency model, the findings provide an empirical basis for understanding organizational components associated with athlete participation and for strengthening collegiate sports development practices that support sustained athlete involvement and development.

Conclusion

This study examined the implementation of four organizational components of the Sports Development Program—recruitment and retention, benefits and incentives, sports facilities, and equipment maintenance—and their relationships with athlete participation among collegiate varsity student-athletes. The findings showed that the organizational components were generally implemented at high to very high levels. Equipment maintenance obtained the highest implementation rating, followed by recruitment and retention, while benefits and incentives and sports facilities were also highly implemented. Athlete participation was very high at the local and regional levels and high at the national level.

The correlation findings demonstrated that the organizational components were generally positively associated with athlete participation, although the strength and statistical significance of the relationships varied across competitive levels. Equipment maintenance demonstrated the strongest and most consistent associations with local, regional, and national participation. The multiple regression analysis further showed that the four organizational components collectively explained 32.5% of the variance in overall athlete participation, with equipment maintenance emerging as the only significant predictor when the organizational components were considered simultaneously. Recruitment and retention, benefits and incentives, and sports facilities did not demonstrate statistically significant unique predictive effects in the regression model.

From the perspective of General Systems Theory (Bertalanffy, 1968), the findings support the value of examining collegiate sports programs as interconnected organizational



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systems in which multiple components operate within a shared institutional environment. However, the findings should be interpreted as evidence of associations and statistical prediction rather than causal effects or structural model validation. The study therefore provides an empirical basis for understanding how selected organizational components relate to athlete participation without claiming that any individual component causes changes in participation.

The findings have practical relevance for university administrators, athletic directors, coaches, and sports program managers. Particular attention may be given to equipment maintenance because it demonstrated both the highest implementation rating and the strongest unique predictive contribution to overall athlete participation. At the same time, recruitment and retention, benefits and incentives, and sports facilities remain important organizational components that should be continuously maintained and strengthened. A coordinated approach to these organizational functions may support the continued development and sustainability of collegiate Sports Development Programs.

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