

Digital Inclusion for Sustainable Sports Development: An Empirical Investigation of the Challenges Affecting Para Athletes in India and the Need for a One-Stop Digital Support Ecosystem

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Abstract

The growing recognition of para sports in India has highlighted the extraordinary achievements of para-athletes despite persistent structural, institutional, and psychosocial barriers. While government initiatives and sports policies have expanded opportunities, the absence of an integrated digital support ecosystem continues to fragment access to essential information, training resources, welfare schemes, coaching, healthcare services, and career development opportunities. This digital gap not only restricts athlete performance but also contributes to social exclusion, unequal participation, and long-term sustainability challenges. This study empirically investigates the key barriers affecting the performance and growth of para-athletes in India while proposing a strategic digital management framework to enhance inclusivity. Adopting an exploratory mixed-method approach, the study employs a structured questionnaire administered to 174 para-athletes representing diverse disability categories and sporting disciplines. Principal Component Analysis identifies four major dimensions influencing athlete development: External Environment Barriers, Sports Ecosystem Deficiencies, Socio-Cultural Exclusion, and Psychological and Career Sustainability Challenges. Multiple regression analysis reveals that inaccessible sports infrastructure and stadium facilities significantly hinder training consistency and competitive preparedness. Participants further report shortages of specialized para-sports coaches, limited physiotherapy and wellness support, inadequate mentorship opportunities, fragmented information regarding government schemes, institutional delays, and uncertainty surrounding post-sport career pathways. Building upon these findings, the study proposes the development of a One-Stop Digital Para Athlete Support Platform (ODPSP) that integrates accessible information, athlete registration, government welfare schemes, coach and mentor directories, physiotherapy and rehabilitation services, mental health support, career guidance, scholarship opportunities, competition calendars, grievance redressal mechanisms, and AI-enabled personalized recommendations within a single accessible digital interface. Such a platform would reduce information asymmetry, strengthen strategic coordination among stakeholders, improve governance, and promote digital inclusion in India's para-sports ecosystem.

Keywords: Para Sports; Digital Transformation; Disability Inclusion; Athlete Support System; Policy Framework; Accessibility.

1. Introduction

Sport has increasingly been recognized as a powerful tool for promoting health, social inclusion, equality, and sustainable development. For persons with disabilities (PWDs), participation in sports extends beyond physical activity by fostering self-confidence, psychological well-being, social integration, and economic empowerment (Martin Ginis et al., 2021; World Health Organization [WHO], 2022). The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) and the Sustainable Development Goals (SDGs)

advocate equal participation in sports and recreation, emphasizing disability inclusion as a fundamental human right and an essential component of sustainable development (United Nations, 2006, 2015). Consequently, para sports have emerged globally as an important platform for challenging stereotypes, enhancing visibility, and promoting equal opportunities for athletes with disabilities.

India has witnessed significant progress in para sports during the past decade, with exceptional performances at the Paralympic Games, Asian Para Games, and other international competitions.

Government initiatives such as the Target Olympic Podium Scheme (TOPS), Khelo India, and increased financial support have strengthened athlete development and enhanced national recognition of para sports (Ministry of Youth Affairs and Sports [MYAS], 2023). Despite these achievements, the Indian para sports ecosystem continues to face numerous structural, institutional, financial, and socio-cultural challenges that limit athlete participation and long-term development. Studies have identified inaccessible sports infrastructure, inadequate specialized coaching, limited rehabilitation and physiotherapy services, financial constraints, and insufficient institutional coordination as major barriers affecting para-athlete performance (Dehghansai et al., 2021; Jaarsma et al., 2014).

In addition to physical and institutional barriers, para-athletes frequently encounter social stigma, limited awareness of welfare schemes, fragmented information, and uncertainty regarding career opportunities after retirement. Such challenges often reduce athlete motivation, restrict access to essential services, and hinder sustainable sporting careers (Martin Ginis et al., 2021). Although multiple government agencies, sports federations, and disability organizations provide support, information regarding athlete registration, competitions, scholarships, coaching, healthcare, rehabilitation, and grievance redressal remains dispersed across various platforms, creating significant information asymmetry and administrative inefficiencies.

Recent advances in digital transformation have demonstrated the potential of integrated digital platforms to improve governance, accessibility, stakeholder coordination, and service delivery across sectors (Vial, 2019). However, the application of digital governance within India's para sports ecosystem remains limited. Existing studies have primarily examined individual barriers such as accessibility, coaching, or policy implementation, with little attention given to developing a comprehensive digital support system that integrates athlete services within a single accessible platform. This represents a significant gap in both sports management and disability inclusion literature.

Addressing this gap, the present study empirically investigates the key barriers affecting the performance and growth of para-athletes in India using data collected from 174 para-athletes representing diverse disability categories and sporting disciplines. Principal Component Analysis (PCA) identifies the major dimensions influencing athlete development, while multiple regression analysis examines their impact on athlete performance. Based on these findings, the study proposes a *One-Stop Digital Para Athlete Support Platform (ODPSP)* that integrates athlete registration, government welfare schemes, coaching and mentorship, physiotherapy, mental health services, career guidance, competition calendars, grievance redressal, and AI-enabled personalized recommendations within a single accessible digital ecosystem. The proposed framework contributes to the literature by integrating digital transformation with disability inclusion and sports governance, offering a practical strategy to strengthen accessibility, institutional coordination, and sustainable development within India's evolving para sports ecosystem.

Literature review

2.1 Evolution of Para Sports and Disability Inclusion

The global para-sports movement has transformed significantly over the past few decades, evolving from a rehabilitation-oriented activity to a highly competitive sporting domain that promotes inclusion, empowerment, and excellence among persons with disabilities (Brittain, 2016). The Paralympic movement has played a crucial role in changing public perceptions regarding disability and fostering opportunities for athletic participation across nations (Legg & Gilbert, 2011). In India, growing success at international events such as the Paralympic Games and Para Asian Games has increased awareness and recognition of para-athletes. However, despite these achievements, scholars argue that the development of para sports remains uneven and constrained by multiple systemic barriers (Misener & Darcy, 2014).

2.2 Infrastructure and Accessibility Challenges

Accessibility is frequently identified as one of the most critical determinants of sports participation among persons with disabilities. According to Darcy and Dowse (2013), accessible sporting environments are fundamental to ensuring equal opportunities in training and competition. Studies have highlighted that many sporting venues continue to lack ramps, adapted washrooms, accessible transportation facilities, and disability-friendly accommodation (DePauw & Gavron, 2005). In the Indian context, inadequate access to stadiums, training centres, and specialized equipment has been repeatedly cited as a major barrier to athletic participation and performance (Sharma & Deepa, 2020). The geographical concentration of sports facilities in urban centres further restricts access for athletes residing in rural and semi-urban areas. Research suggests that inaccessible infrastructure not only limits participation but also negatively affects athlete confidence and motivation (Rimmer et al., 2004).

2.3 Financial and Resource Constraints

The cost associated with participation in para sports is considerably higher than that of mainstream sports due to the requirement for adaptive equipment, prosthetics, wheelchairs, assistive technologies, and rehabilitation services (Howe, 2008). Several studies have identified financial constraints as a major challenge affecting training continuity and competitive participation (Patatas et al., 2018). Limited sponsorship opportunities further exacerbate these difficulties. Unlike mainstream sports, para sports often receive comparatively lower commercial attention and media visibility, reducing opportunities for corporate partnerships and athlete endorsements (Purdue & Howe, 2015). Consequently, many para-athletes rely heavily on family support or government assistance to sustain their sporting careers.

2.4 Coaching and Athlete Support Systems

The quality of coaching is widely recognized as a critical determinant of athletic performance. Effective coaching contributes not only to technical skill development but also to psychological

resilience and competitive preparedness (Côté & Gilbert, 2009). However, disability sport literature consistently reports shortages of coaches trained in adaptive sports and disability-specific training methodologies (Martin Ginis et al., 2016). Beyond coaching, athlete performance increasingly depends on access to multidisciplinary support services, including physiotherapy, sports medicine, nutrition, biomechanics, and psychological counselling (Rees et al., 2016). Research indicates that para-athletes often receive limited access to such services, resulting in suboptimal performance and increased injury risks (Patatas et al., 2018).

2.5 Social Attitudes, Stigma, and Inclusion

Social perceptions of disability significantly influence opportunities available to para-athletes. Peers (2012) argues that disability sport continues to operate within social environments shaped by stereotypes, prejudice, and ableist assumptions. Such attitudes may discourage participation and reduce societal support for athletes with disabilities. Families and communities often prioritize protection over participation, limiting opportunities for sporting engagement among persons with disabilities (Misener & Darcy, 2014). Women with disabilities face additional challenges due to the intersection of disability and gender-based discrimination, resulting in lower participation rates and fewer opportunities for advancement (Purdue & Howe, 2015).

2.6 Media Representation and Public Recognition

Media visibility plays a crucial role in shaping public awareness and attracting sponsorship support. While major events such as the Paralympic Games have enhanced recognition of para-athletes globally, media coverage remains significantly lower than that devoted to able-bodied sports (Brittain, 2016). Studies suggest that limited media representation contributes to lower public awareness, weaker sponsorship ecosystems, and reduced social recognition of athletic achievements (Howe, 2008). In developing countries such as India, this lack of visibility continues to restrict opportunities for athlete development and resource mobilization.

2.7 Psychological Well-being and Career Sustainability

The psychological demands of elite sport are substantial, and para-athletes often encounter additional stressors arising from disability-related barriers, social exclusion, and financial uncertainty (Martin Ginis et al., 2016). Psychological resilience has been identified as a key factor contributing to athletic success; however, access to sports psychology services remains limited in many sporting systems (Rees et al., 2016). Another emerging area of concern relates to career sustainability and post-retirement security. Wylleman et al. (2013) emphasize that athletes face multiple career transitions that require adequate planning and institutional support. For para-athletes, concerns regarding employment opportunities, financial stability, and future livelihoods can influence both performance and long-term engagement in sport.

2.8 Mentorship and Athlete Development

Recent literature increasingly highlights the role of mentorship in athlete development. Experienced athletes often provide guidance, motivation, and practical support that contribute to performance enhancement and career progression (Purdue & Howe, 2015). Mentorship can also facilitate knowledge transfer regarding training strategies, competition preparation, and coping mechanisms. Despite its importance, structured mentorship programs remain underdeveloped in many para-sport systems. Several scholars argue that mentoring interventions can significantly improve athlete confidence, well-being, and long-term career sustainability (Bloom et al., 2008).

2.9 Digital Constraints and Para Athletes

Digital technologies have transformed the delivery of sports training, athlete monitoring, healthcare, education, and sports governance across the world. The increasing adoption of artificial intelligence (AI), wearable technologies, online coaching platforms, tele-rehabilitation, and digital athlete management systems has improved performance optimization and athlete welfare (International Paralympic Committee [IPC], 2023). However, the

benefits of digital transformation have not been equitably experienced by para-athletes, particularly in developing countries, where digital accessibility and institutional integration remain significant challenges. The concept of the digital divide extends beyond access to internet connectivity

of technology, and the ability to utilize digital services effectively (van Dijk, 2020). Persons with disabilities are disproportionately affected by this divide due to inaccessible websites, incompatible assistive technologies, lack of accessible content, and limited digital skills (United Nations, 2023). These barriers restrict access to essential services including education, healthcare, employment, and increasingly, sports participation and athlete development. Research suggests that digital exclusion significantly affects athletes with disabilities by limiting access to coaching resources, competition updates, athlete classification procedures, rehabilitation services, funding opportunities, and peer support networks (Jaarsma et al., 2014). Unlike able-bodied athletes, para-athletes often require highly specialized information regarding adaptive equipment, disability-specific coaching methodologies, classification guidelines, physiotherapy services, and assistive technologies. The absence of centralized digital information systems frequently forces athletes to rely on informal networks or personal contacts, resulting in unequal access to opportunities.

Table 1 (*Annexure 1*) synthesizes the key challenges faced by para-athletes identified in previous studies (Brittain, 2016; Chandrashakhar & Suryakant, 2025; Misener & Darcy, 2014; Patatas et al., 2018; Rani & Deol, 2024; Rees et al., 2016). The review of literature demonstrates that para-athletes face a wide range of challenges related to accessibility, financial resources, coaching support, wellness services, social inclusion, media visibility, and career sustainability. However, existing studies have largely examined these barriers in isolation. Limited research has attempted to identify the underlying dimensions that collectively explain these challenges or assess their relative impact on athlete productivity and development. Furthermore, empirical evidence from the Indian context remains scarce, particularly studies employing statistical

techniques such as Principal Component Analysis and Multiple Regression to identify and prioritize key determinants of para-athlete growth and performance. Therefore, the present study seeks to bridge this gap by empirically examining the challenges faced by para-athletes in India and identifying the most influential factors affecting their overall development and productivity.

2. Research Methodology

This study adopts an exploratory mixed-method research design to investigate the multidimensional barriers influencing the performance and growth of para-athletes in India and to develop a strategic digital management framework in the form of a One-Stop Digital Para Athlete Support Platform (ODPSP). The mixed-method approach was considered appropriate as it combines quantitative analysis with qualitative insights, enabling a comprehensive understanding of the structural, institutional, socio-cultural, and psychological challenges experienced by para-athletes while generating evidence-based recommendations for digital policy interventions.

The study employed a cross-sectional descriptive and exploratory research design. Initially, an extensive review of academic literature, government reports, policy documents, and publications related to para sports, disability inclusion, sports governance, and digital transformation was undertaken to identify key variables affecting para-athlete development. These findings were supplemented through informal discussions with para-athletes, coaches, and sports administrators to ensure the contextual relevance of the research instrument.

Primary data were collected using a structured questionnaire administered to 174 para-athletes representing diverse disability categories and sporting disciplines across India. Respondents were selected using purposive sampling, considering their active participation in national or state-level para-sports competitions. The questionnaire comprised two sections: the first captured demographic information such as age, gender, sporting discipline, disability category, and competitive experience, while the second assessed perceptions regarding

barriers affecting athletic performance using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The questionnaire included items related to sports infrastructure, accessibility, coaching quality, physiotherapy and rehabilitation services, financial support, awareness of government schemes, institutional coordination, social acceptance, psychological well-being, career opportunities, and digital accessibility. Prior to full-scale administration, the instrument was pilot-tested to ensure clarity, content validity, and reliability. Data were analysed using descriptive statistics, including frequencies, percentages, means, and standard deviations for computing respondent characteristics and perceptions. The internal consistency of the measurement instrument was assessed using Cronbach's Alpha, while sampling adequacy was evaluated through the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity.

To identify the underlying dimensions influencing para-athlete development, Principal Component Analysis (PCA) with Varimax rotation was performed. Components with eigenvalues greater than one were retained, and factor loadings of 0.50 or above were considered significant for interpretation. Based on the extracted components, composite variables were created representing the major dimensions affecting athlete performance.

Subsequently, Multiple Linear Regression Analysis was employed to examine the influence of these dimensions on the overall performance and growth of para-athletes. Regression diagnostics were performed to assess multicollinearity, normality, linearity, and homoscedasticity, ensuring the validity of the statistical model. Statistical significance was evaluated at the 5% significance level ($p < 0.05$).

4. Data Analysis and Key Findings

The objective of this section is to demonstrate the sequence of statistical analyses including descriptive statistics, reliability testing, sampling adequacy, exploratory factor analysis, and multiple regression analysis for a sample set of 174 Para Athletes. The

study also illustrates how the extracted dimensions may be interpreted for designing the proposed One-Stop Digital Para Athlete Support Platform (ODPSP).

4.1 Demographic Profile of Respondents

The demographic profile reveals that male para-athletes constituted 60.9% (n = 106) of the respondents, while female athletes accounted for 39.1% (n = 68). This indicates a continuing gender

disparity in para-sports participation in India, primarily due to socio-cultural barriers, limited family support, safety concerns, and fewer sporting opportunities for women with disabilities. Similar findings have been reported by Misener and Darcy (2014), emphasizing the need for gender-inclusive policies, targeted scholarships, and awareness programmes to enhance female participation. Table 4.1 presents the demographic characteristics of the respondents.

Table 4.1 Demographic Profile of Respondents

Variable	Category	Frequency	Percentage
Gender	Male	106	60.9
	Female	68	39.1
Age	18–25 years	61	35.1
	26–35 years	70	40.2
	36–45 years	31	17.8
	Above 45	12	6.9
Competition Level	State	62	35.6
	National	88	50.6
	International	24	13.8
Experience	Below 5 Years	73	42
	5–10 Years	64	36.8
	Above 10 Years	37	21.2

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

The majority of respondents belonged to the 26–35 years age group (40.2%), followed by 18–25 years (35.1%), 36–45 years (17.8%), and above 45 years (6.9%). This suggests that most athletes are in their peak competitive years, possessing the physical capability and experience required for high-level performance. The lower representation of older athletes may reflect career uncertainty, injury risks, and inadequate long-term support systems,

highlighting the need for structured athlete welfare and retirement planning (Legg & Steadward, 2011).

Regarding competition level, 50.6% of respondents competed at the national level, 35.6% at the state level, and only 13.8% at the international level, indicating that progression to international competitions remains challenging due to limited funding, specialised coaching, and international exposure (Jaarsma et al., 2014).

Figure 4.1 Demographic Profile of Respondents



Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

In terms of experience, 42.0% of athletes had less than five years of competitive experience, 36.8% had 5–10 years, and 21.2% had more than ten years. This reflects growing participation in para-sports but also highlights the importance of sustained financial assistance, mentoring, rehabilitation services, and career guidance to improve long-term athlete retention. These findings further justify the development of the proposed One-Stop Digital Para Athlete Support Platform (ODPSP) to provide personalized support throughout athletes' careers.

4.2 Descriptive Statistics

The perceptions of respondents regarding different barriers were measured using a seven-point Likert scale. Table 4.2 presents the descriptive statistics of

the major constructs influencing the performance and development of para-athletes in India. The results indicate that all constructs recorded mean scores above 3.50, suggesting that respondents generally agreed these factors significantly affect their sporting performance. Career Opportunities recorded the highest mean score ($M = 4.34$, $SD = 0.63$), followed by Financial Assistance ($M = 4.28$, $SD = 0.68$) and Institutional Coordination ($M = 4.18$, $SD = 0.71$). This reflects the athletes' strong concern regarding post-career employment, financial security, and effective coordination among sports federations and government agencies. Similar observations have been reported by Martin (2013) and Jaarsma et al. (2014), who identified financial constraints and limited career pathways as major barriers to sustained participation in para-sports.

Table 4.2 Descriptive Statistics

Construct	Mean	SD
Sports Infrastructure	4.12	0.73
Coaching Support	3.96	0.82
Financial Assistance	4.28	0.68
Institutional Coordination	4.18	0.71
Government Awareness	3.81	0.89
Digital Accessibility	3.67	0.84
Psychological Support	4.09	0.74
Career Opportunities	4.34	0.63

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

Sports Infrastructure ($M = 4.12$, $SD = 0.73$), Psychological Support ($M = 4.09$, $SD = 0.74$), and Coaching Support ($M = 3.96$, $SD = 0.82$) also received relatively high mean scores, highlighting the importance of accessible training facilities, qualified coaches, rehabilitation services, and mental health support in improving athletic performance. These findings are consistent with Legg and Steadward (2011) and Dehghansai et al. (2017), who emphasized that quality infrastructure and specialized coaching are fundamental determinants of elite para-sport success.

Conversely, Government Awareness ($M = 3.81$, $SD = 0.89$) and Digital Accessibility ($M = 3.67$, $SD = 0.84$) recorded comparatively lower mean scores, indicating that many athletes may have limited awareness of government schemes and face challenges in accessing digital platforms and online

services. The relatively higher standard deviations for these constructs also suggest greater variation in respondents' experiences, possibly reflecting regional disparities in digital infrastructure and information dissemination. Previous studies by Misener and Darcy (2014) and the World Health Organization (2011) similarly noted that inadequate institutional communication and digital exclusion often prevent athletes with disabilities from fully benefiting from available support mechanisms.

Overall, the descriptive statistics indicate that para-athlete development is influenced by multiple interrelated dimensions, with career development, financial assistance, and institutional support emerging as the most critical concerns. These findings provide a strong rationale for developing the proposed One-Stop Digital Para Athlete Support Platform (ODPSP), which could integrate financial support, career guidance, digital service delivery,

coaching resources, rehabilitation, and information on government schemes into a unified platform, thereby addressing the key challenges identified by the respondents.

4.3 Reliability Analysis

Table 4.3 presents the reliability analysis of the questionnaire using Cronbach's Alpha. All six constructs recorded alpha values above the recommended threshold of 0.70, indicating good to excellent internal consistency.

Table 4.3 Reliability Statistics

Construct	Items	Cronbach's Alpha
Infrastructure	5	0.882
Coaching & Training	4	0.864
Financial Support	4	0.901
Institutional Support	5	0.876
Social & Psychological Factors	6	0.913
Digital Accessibility	5	0.889
Overall Scale	29	0.924

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

The reliability coefficients ranged from 0.864 (Coaching & Training) to 0.913 (Social & Psychological Factors), confirming that the items within each construct consistently measured the intended dimensions. The overall Cronbach's Alpha

of 0.924 for the 29-item scale demonstrates excellent reliability, suggesting minimal measurement error and high consistency among responses. Therefore, the questionnaire was found reliable for assessing the factors influencing the performance and development of para-athletes.

Table 4.4 KMO and Bartlett's Test

Test	Value
Kaiser-Meyer-Olkin Measure	0.907
Bartlett's Chi-square	2634.53
Degrees of Freedom	406
Significance	0

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

The suitability of the dataset for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity, as shown in Table 4.4. The KMO value of 0.907 indicates excellent sampling

adequacy and confirms that the correlations among variables are sufficient for factor extraction. These results confirm that the dataset possesses strong inter-item correlations and is highly suitable for conducting Principal Component Analysis (PCA).

4.4 Principal Component Analysis using Varimax rotation

Table 4.5 Total Variance Explained

Component	Eigenvalue	Variance (%)	Cumulative (%)
1	8.47	29.2	29.2
2	3.82	13.17	42.37
3	2.64	9.09	51.46
4	1.91	6.58	58.04
5	1.52	5.24	63.28
6	1.18	4.07	67.35

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

Table 4.5 presents the results of the Principal Component Analysis (PCA), indicating that six components with eigenvalues greater than one were extracted following the Kaiser criterion. Collectively, these six components explain 67.35% of the total variance, suggesting that they adequately represent the underlying factors affecting the

performance and development of para-athletes. The first component accounts for the highest proportion of variance (29.20%), indicating its dominant influence, followed by the second (13.17%) and third (9.09%) components. The cumulative variance exceeding 60% demonstrates that the extracted factors sufficiently capture the multidimensional nature of the challenges faced by para-athletes.

Table 4.6 Rotated Component Matrix

Variable	F1	F2	F3	F4	F5	F6
Modern Sports Infrastructure	0.812					
Accessible Stadiums	0.785					
Training Equipment	0.773					
Qualified Coaches		0.844				
Regular Coaching		0.811				
Technical Guidance		0.782				
Government Funding			0.863			
Scholarships			0.831			
Institutional Coordination				0.804		
NGO Support				0.788		
Psychological Counselling					0.842	
Social Acceptance					0.798	
Digital Registration						0.834
Online Information						0.807

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

Table 4.6 presents the rotated component matrix obtained using Varimax rotation, which provides a clearer interpretation of the underlying factor structure. The factor loadings indicate that variables with similar characteristics are grouped under the same component. *Sports Infrastructure variables loaded strongly on Factor 1, while Coaching and Training variables were associated with Factor 2.*

Financial Support, Institutional Support, Social and Psychological Support, and Digital Accessibility emerged as distinct factors, represented by Factors 3 to 6, respectively. The high factor loadings (above 0.70) demonstrate strong associations between variables and their respective constructs, confirming the validity and interpretability of the extracted factor structure.

Table 4.7 Extracted Factors

Factor	Dimension
F1	Sports Infrastructure
F2	Coaching and Technical Support
F3	Financial Assistance
F4	Institutional Coordination
F5	Social and Psychological Support
F6	Digital Accessibility

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

Based on the rotated component matrix obtained through Principal Component Analysis (PCA), six meaningful factors were identified that restrict the growth of para-athletes and were named according

to the common characteristics of the variables with the highest factor loadings. As shown in Table 4.7, *these factors are Sports Infrastructure (F1), Coaching and Technical Support (F2), Financial Assistance (F3), Institutional Coordination (F4),*

Social and Psychological Support (F5), and Digital Accessibility (F6). The naming process enhances the interpretability of the extracted components and demonstrates that the questionnaire successfully captured the major dimensions influencing the performance, participation, and overall development of para-athletes in India.

4.5 Correlation Analysis

Table 4.8 presents the Pearson correlation coefficients between the identified factors and para-athlete performance. All six dimensions exhibit positive and statistically significant relationships ($p < 0.01$), indicating that improvements in these factors are associated with better athletic performance among Para Athletes.

Table 4.8 Correlation Matrix

Variables	Performance
Infrastructure	0.621**
Coaching	0.654**
Financial Support	0.703**
Institutional Coordination	0.672**
Psychological Support	0.589**
Digital Accessibility	0.547**

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026). $p < 0.01$

Among them, Financial Support shows the strongest correlation ($r = 0.703$), highlighting the importance of adequate funding and sponsorship. This is followed by Institutional Coordination ($r = 0.672$) and Coaching ($r = 0.654$). Infrastructure ($r = 0.621$) and Psychological Support ($r = 0.589$) also demonstrate moderate positive relationships, while Digital Accessibility ($r = 0.547$), despite being the weakest, remains a significant contributor. These findings suggest that enhancing all six dimensions can collectively improve the performance and long-term development of para-athletes.

4.6 Multiple Regression Analysis

A multiple linear regression model was estimated to determine the influence of the extracted challenges on the overall athlete performance using the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

Y = Overall Para-Athlete Performance (Dependent Variable)

β_0 = Constant (Intercept)

β_1 = Regression coefficient for Sports Infrastructure

β_2 = Regression coefficient for Coaching and Technical Support

β_3 = Regression coefficient for Financial Assistance

β_4 = Regression coefficient for Institutional Coordination

β_5 = Regression coefficient for Social and Psychological Support

β_6 = Regression coefficient for Digital Accessibility

X_1 = Sports Infrastructure

X_2 = Coaching and Technical Support

X_3 = Financial Assistance

X_4 = Institutional Coordination

X_5 = Social and Psychological Support

X_6 = Digital Accessibility

ε = Random Error Term

Table 4.9 presents the overall fitness of the multiple linear regression model examining the influence of the six major challenges faced by para-athletes—namely sports infrastructure, coaching and technical support, financial assistance, institutional coordination, social and psychological support, and digital accessibility—on overall athlete performance. The model produced a strong correlation coefficient ($R = 0.832$), indicating a high degree of association between these challenge dimensions and athlete performance. The R^2 value of 0.692 indicates that 69.2% of the variation in para-athlete performance is explained by these six

challenge dimensions, highlighting their substantial collective influence on athletic outcomes. Additionally, the relatively low standard error (0.382) suggests good predictive accuracy,

indicating that the identified challenges are significant determinants of the performance and development of para-athletes.

Table 4.9 Model Summary

R	R ²	Adjusted R ²	Std Error
0.832	0.692	0.681	0.382

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

Table 4.10 ANOVA

Source	SS	df	MS	F	Sig
Regression	41.284	6	6.881	47.386	0
Residual	18.022	167	0.108		
Total	59.306	173			

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

Table 4.10 presents the Analysis of Variance (ANOVA) results for the multiple linear regression model assessing the impact of the major challenges faced by para-athletes on their overall performance. The model yielded an F-statistic of 47.386, which is statistically significant ($p < 0.001$), indicating that

the identified challenge dimensions collectively provide a strong explanation of variations in athlete performance. The significant F-value confirms that the combined effect of challenges related to sports infrastructure, coaching, financial assistance, institutional coordination, social and psychological support, and digital accessibility is substantial.

Table 4.11 Regression Coefficients (Illustrative)

Variable	Beta	t	Sig
Infrastructure	0.214	3.91	0
Coaching	0.181	3.18	0.002
Financial Support	0.287	5.42	0
Institutional Coordination	0.192	3.57	0.001
Psychological Support	0.143	2.81	0.006
Digital Accessibility	0.127	2.34	0.021

Source: Authors' compilation based on primary data collected from 174 para-athletes (2026).

Table 4.11 presents the standardized regression coefficients showing the relative influence of the key challenges faced by para-athletes on their overall performance. All six challenge dimensions exhibit positive and statistically significant effects ($p < 0.05$), indicating that reducing these barriers and strengthening support systems can significantly enhance athletic performance. Among the identified challenges, Financial Assistance emerged as the most influential factor ($\beta = 0.287$), suggesting that inadequate funding and limited sponsorship opportunities pose the greatest obstacle to athlete development. This is followed by Sports Infrastructure ($\beta = 0.214$), Institutional Coordination ($\beta = 0.192$), and Coaching and Technical Support (β

$= 0.181$), highlighting the importance of accessible facilities, coordinated institutional support, and quality coaching. Although Social and Psychological Support ($\beta = 0.143$) and Digital Accessibility ($\beta = 0.127$) exert comparatively smaller effects, they remain significant determinants of performance. These findings indicate that addressing financial, infrastructural, institutional, technical, social, psychological, and digital challenges through integrated policy interventions is essential for improving the performance and long-term development of para-athletes in India.

5. Conclusion and Policy Implication

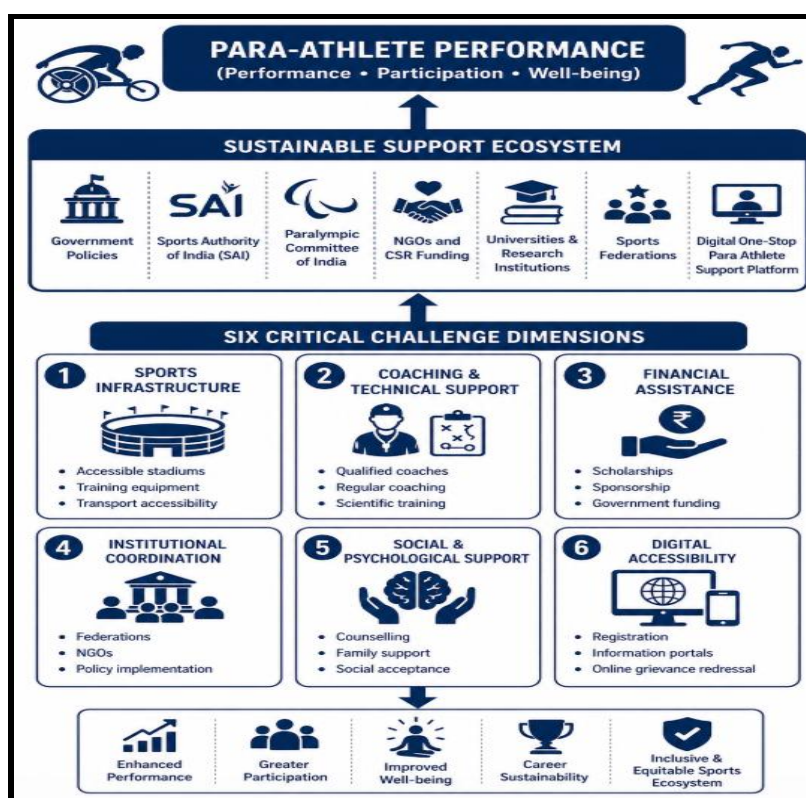
The present study identified six critical challenge dimensions that significantly influence the

performance and long-term development of para-athletes in India: Sports Infrastructure, Coaching and Technical Support, Financial Assistance, Institutional Coordination, Social and Psychological Support, and Digital Accessibility. Together, these six dimensions explained 69.2% of the variation in para-athlete performance, demonstrating that athlete success depends not only on individual talent but also on the availability of an enabling support ecosystem. The regression analysis further revealed that all six challenge dimensions significantly predict athlete performance, with financial assistance emerging as the strongest determinant, followed by infrastructure, institutional coordination, coaching support, psychological support, and digital accessibility. These findings indicate that barriers encountered by para-athletes are multidimensional and require integrated policy interventions rather than isolated solutions.

Based on these empirical findings, this study proposes *the Integrated Para-Athlete Performance*

Empowerment Framework (IPPEF) (Figure 5.1), which conceptualizes para-athlete development as a three-layered ecosystem. At the foundation of the framework are the six critical challenge dimensions identified through Principal Component Analysis. These dimensions represent the primary barriers restricting athlete participation, performance, and career progression. The second layer comprises a Sustainable Support Ecosystem, integrating the roles of government policies, the Sports Authority of India (SAI), the Paralympic Committee of India, sports federations, universities and research institutions, NGOs, CSR initiatives, and a Digital One-Stop Para Athlete Support Platform (PARAPLAY). Rather than functioning independently, these stakeholders are envisioned as an interconnected support network responsible for addressing the identified challenges through coordinated policy implementation, funding mechanisms, technical expertise, capacity building, psychological services, and digital service delivery.

Figure 5.1: Integrated Para-Athlete Performance Empowerment Framework (IPPEF)



The proposed **Digital One-Stop Para Athlete Support Platform** serves as the central coordinating mechanism within the framework. The platform can integrate athlete registration, scholarship information, coach and mentor databases, rehabilitation and physiotherapy services, psychological counselling, competition calendars, grievance redressal, career guidance, and performance monitoring into a single digital ecosystem. Such an integrated platform (*in Pilot assessment stage with 30 para-athletes*) can reduce administrative fragmentation, improve service accessibility, strengthen institutional coordination, and ensure timely dissemination of information to athletes, coaches, and support organizations.

The final layer of the framework represents the expected outcomes of successfully addressing these challenge dimensions through coordinated institutional support. These outcomes include improved athletic performance, greater participation, enhanced psychological well-being, career sustainability, and the creation of a more inclusive and equitable sports ecosystem. Unlike conventional approaches that focus on isolated interventions such as infrastructure development or financial assistance alone, the proposed framework emphasizes that sustainable para-athlete development requires simultaneous improvements across physical, institutional, financial, psychological, and digital domains.

Overall, the proposed framework extends existing literature by empirically validating the key challenges faced by para-athletes and translating them into a practical governance model for policymakers and sports administrators. This study therefore provides a structured roadmap for designing integrated interventions capable of enhancing athlete performance while promoting long-term inclusion, accessibility, and sustainability within India's para-sports ecosystem.

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Annexure 1

Table 1: Challenges Affecting the Growth and Performance of Para Athletes in India-Degree of Severity, Implications, and Evidence from Literature

Challenge Faced by Para Athletes in India	Degree/Intensity of Difficulty	Key Implications	Key Sources
Inadequate Sports Infrastructure and Accessibility	Very High	Limited access to training facilities, reduced participation, increased injury risk, lower performance outcomes, restricted competition exposure	Darcy & Dowse (2013); DePauw & Gavron (2005); Sharma & Deepa (2020); Chandrashakhar & Suryakant (2025); Disability Rights India Foundation (2024); Times of India (2024a); Misener & Darcy (2014)

Financial Constraints and High Cost of Equipment	Very High	Inability to afford adaptive equipment, prosthetics, wheelchairs, coaching, nutrition, travel, and rehabilitation; increased athlete dropout rates	DePauw & Gavron (2005); Howe (2008); Legg & Steadward (2011); Chandrashakhar & Suryakant (2025); Republic World (2024b); Patatas et al. (2018)
Limited Sponsorship and Commercial Support	High	Reduced training opportunities, fewer international competition opportunities, financial insecurity, limited professional development	Legg & Steadward (2011); IPC (2024b); Republic World (2024b); Brittain (2016); Patatas et al. (2018)
Shortage of Specialized Coaches	Very High	Inadequate skill development, poor technical training, slower performance improvement, lack of athlete nurturing	Côté & Gilbert (2009); Martin Ginis et al. (2016); Patatas et al. (2018); PLOS One (2025); Purdue & Howe (2015)
Lack of Sports Science, Physiotherapy and Wellness Support	Very High	Poor injury prevention and management, reduced recovery rates, compromised performance, athlete burnout	Martin Ginis et al. (2016); Rees et al. (2016); Patatas et al. (2018); PLOS One (2025); Misener & Darcy (2014)
Social Stigma and Discrimination	Very High	Low participation rates, reduced confidence, social exclusion, family discouragement, diminished self-esteem	Peers (2012); Howe (2008); Brittain (2016); Rani & Deol (2024); PLOS One (2025); Misener & Darcy (2014)
Gender-Based Challenges among Women Para Athletes	Very High	Double discrimination due to gender and disability, lower participation and retention rates, restricted access to opportunities	UN Women (2024); Purdue & Howe (2015); Rani & Deol (2024); Peers (2012); Brittain (2016)
Limited Grassroots Talent Identification	High	Potential athletes remain undiscovered, delayed sports participation, weak athlete development pipeline	Patatas et al. (2018); Legg & Gilbert (2011); Chandrashakhar & Suryakant (2025); Sports Authority of India (2024)
Poor Awareness of Para Sports Opportunities and Schemes	High	Eligible athletes remain unaware of competitions, scholarships, support schemes, and development opportunities	Chandrashakhar & Suryakant (2025); Rani & Deol (2024); Misener & Darcy (2014); Sports Authority of India (2024)
Administrative and Governance Issues	Moderate to High	Delayed funding, selection controversies, reduced athlete trust, inefficient resource allocation, policy implementation gaps	Misener & Darcy (2014); Howe (2008); Rani & Deol (2024); IPC (2024b)
Classification Challenges	Moderate	Delays in participation, athlete dissatisfaction, eligibility disputes, uncertainty in competition placement	IPC (2024a); Howe (2008); Brittain (2016)
Transportation and Mobility Barriers	High	Difficulty attending training camps and competitions, increased physical strain, higher financial burden	Disability Rights India Foundation (2024); Darcy & Dowse (2013); Sharma & Deepa (2020); Times of India (2024a)
Psychological Stress and Mental Health Concerns	High	Anxiety, burnout, reduced motivation, lower competitive performance, withdrawal from sports participation	Rees et al. (2016); Martin Ginis et al. (2016); PLOS One (2025); Wylleman et al. (2013)

Limited Media Coverage and Public Recognition	High	Lower sponsorship opportunities, weak public awareness, lack of role models, reduced social recognition	Brittain (2016); Peers (2012); Republic World (2024a); IPC (2024b); Howe (2008)
Educational and Career Uncertainty	Moderate to High	Difficulty balancing education, employment and sport; concerns regarding post-retirement livelihood and career transitions	Wylleman et al. (2013); Rees et al. (2016); Chandrashakhar & Suryakant (2025); Rani & Deol (2024)
Rural–Urban Divide	Very High	Athletes from rural regions face greater barriers to facilities, coaching, competitions and support services	Sports Authority of India (2024); Chandrashakhar & Suryakant (2025); Times of India (2024b); Sharma & Deepa (2020)
Limited Representation in Policy Decisions	Moderate	Policies may not adequately reflect athlete needs, resulting in ineffective interventions and low stakeholder engagement	Misener & Darcy (2014); Rani & Deol (2024); Howe (2008); IPC (2024b)
Lack of Mentorship and Role Models	Very High	Reduced motivation, limited career guidance, slower athlete development, weaker psychosocial support systems	Purdue & Howe (2015); Rees et al. (2016); Legg & Gilbert (2011); Brittain (2016)

Source: Authors' compilation from existing literature.