



# Integrating Green Sports Infrastructure and Biopsychosocial Interventions: a Sino-Nigerian Framework for Youth Engagement and Environmental Resilience in the Niger Delta

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## Abstract:

**Background:** Speed and flexibility are important physical components that influence performance in basketball. Training methods such as plyometric training and mobility exercises are commonly used to enhance these abilities. However, the effectiveness of these training methods among collegiate male basketball players requires further investigation.

**Methods:** This study employed a randomized group experimental design involving 45 male basketball players aged 18–25 years from JAIN University. The participants were divided into three groups: plyometric training group, mobility exercise group, and control group, with 15 subjects in each group. The experimental groups underwent their respective training programs for eight weeks, while the control group did not receive any specific training. Speed and flexibility were measured using the 50-meter run test and sit-and-reach test, respectively. Data were analyzed using Analysis of Covariance (ANCOVA) and Scheffé's post-hoc test at a 0.05 level of significance.

**Result:** The results showed significant improvements in speed and flexibility among the experimental groups compared to the control group. The mobility exercise group demonstrated better improvement in speed, while both plyometric and mobility training significantly enhanced flexibility. The obtained F-ratios for post-test and adjusted post-test scores were found to be statistically significant.

**Conclusion:** It can be concluded that both plyometric training and mobility exercises are effective in improving speed and flexibility among collegiate male basketball players. Mobility exercises showed relatively greater improvement in speed, while both training methods were effective in enhancing flexibility.

**Keywords:** Biopsychosocial Model, Environmental Resilience, Green Sports Infrastructure, Niger Delta, Sustainable Sport Development, Youth Engagement

## 1. INTRODUCTION

Environmental sustainability and youth development have emerged as key issues across the world in the quest to have inclusive and resilient societies. The United Nations estimates that over 55 percent of the world population today reside in the urban or semi-urban areas where social inequality, environmental degradation, and unemployment play a major role in determining the outcome of youth development

(Ifeoma et al., 2025). According to reports by the United Nations Environment Programme, the degradation of the environment is one of the causes of deteriorated public health, food insecurity, and economic instability in most developing regions. To address these issues, the development agenda of the global community, including the United Nations Sustainable Development Goals, prioritize integrated strategies, which encompass environmental conservation, youth empowerment, and resilience of the community (Brown & Vacca, 2022). In this regard, sport has come to be considered as a strategic tool of development, which could help resolve social, environmental, and health-related issues at the same time.

Sport has been appreciated worldwide as a tool towards social development and empowerment of the youth. Research endorsed by the International Olympic Committee has shown that the involvement in organized sport has the potential to enhance physical health outcomes, psychological wellness, and social integration of the youth

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(Nwaozuru et al., 2021). The proportion of adolescents in the whole world who participate in any physical activity or recreational sport is over 70 percent, so sport is one of the most available locations, where youth can be exposed and the community can develop (Ottman et al., 2022b). In addition to encouraging physical fitness, sport has also been employed in community development initiatives to minimize youth delinquency, foster peace-building as well as environmental consciousness. The growing tendency of sport to be an element of the development policy has thus placed it as a multidisciplinary tool in tackling the intricate problems in the society (Ottman et al., 2022a).

In Africa, there has been growing interest in sport as a development instrument in the continent because of the young people in Africa. According to reports by the African Development Bank, about 60 percent of all the populations in Africa are young and below the age of 25 and thus the youth development has become one of the key policy priorities on the continent. Youth unemployment is however a big issue, and in some African nations, unemployment has been reported to be more than 30 percent (Khiatani et al., 2023). Insufficient organized leisure activities and programs to engage the youth have been associated with greater exposure to crime, social instabilities and drug abuse. In turn, sport-based interventions that development practitioners have started to investigate as the methods of youth empowerment, social cohesion, and community development are becoming common in the African societies (Ezeakunne & Unterrainer, 2025).

Nigeria is the most populous nation in Africa which has great challenges in the development of youth even though it has a lot of natural and economic resources. National Bureau of Statistics, in its turn, indicated that youth unemployment in Nigeria has reached nearly 42.5 percent over the recent years, as the group of people between 15 and 34 years old represents the most vulnerable population in the country (Xiao et al., 2021). Such socio-economic problems are more evident in the Niger Delta region, where marginalization of youth in the area has been increased due to environmental degradation and economic disparity. The area has supplied more than 80 percent of the oil income of Nigeria but there are still low infrastructural advancement, large unemployment rates, and environmental susceptibility in the region (Josep et al., 2024).

The Niger Delta is considered to be one of the most sensitive in terms of the environment and socioeconomically in Africa. It is comprised of nine states that produce oil and has a population that is estimated to be over 30 million people. Although of economic significance, years of oil exploration processes have resulted in extreme environmental pollution, oil spills, gas flaring, deforestation and water pollution (Parsamyan & Orłowski, 2024). The United Nations Environment Programme environmental assessment of the Niger Delta reveals that the oil spill incidents have been in thousands in the last 50 years and they have polluted farmlands, rivers, and fishing communities (White et al., 2023). Such environmental destabilizations have had a devastating impact on the traditional ways of livelihoods e.g. fishing and farming and this has resulted in economic instability and social displacement among local communities.

The Niger Delta environmental crisis has also produced a lot of social and psychological effects especially among the youths (Ying et al., 2022). Youth unemployment, poverty and low educational opportunities at high levels have led to the high participation in the militancy, illegal oil refining and other antisocial behaviours. Research that is carried out by developmental agencies indicates that environmental stress and socio-economic marginalization have the potential to amplify psychological distress, decrease community cohesion, and weaken youth ambitions (Seidu et al., 2025). To resolve these issues hence, multidimensional interventions involving the integration of environmental sustainability strategy and the youth empowerment strategy are essential.

To address these issues, there has been the idea of green sports infrastructure that has come up across the world as a sustainable method of combining environmental responsibility and sport developmental development. Green sports infrastructure is a concept of design, construction, and operation of sports facilities with minimal environmental impact and enhancing ecological sustainability. This kind of infrastructure will include green energy installations, water preservation technologies, environmentally friendly building material, and sustainable disposal of waste (Hapriyanto & Azmi, 2025). The contemporary Olympic sports facilities are being built in a manner to minimize carbon emission, enhance environmental consciousness as well as community-based recreational activities as reported by the International Olympic Committee



sustainability reports (Taye, 2021). These trends underscore the increased interest in the sport infrastructure as a significant issue in sustainable urban development.

Some countries like the China have recorded impressive developments in the creation of sport infrastructure that is environmentally friendly. In the last twenty years, China has made massive investments in environmentally friendly stadiums, green sports parks as well as recreational facilities which are well integrated into the environment. The planning of sustainability sport infrastructure in major sporting events like the Beijing 2008 Olympic Games and the Beijing 2022 Winter Olympic Games showed how big sporting facilities could be planned to achieve the environmentally sustainable values. These developments included renewable energy facilities, recycled water technology and green architectural structures which had a great impact in minimizing on the environmental effects as well as encouraging community involvement in leisure activities (Dong, 2022).

Biopsychosocial model is another important dimension of sustainable youth development. The biopsychosocial approach was initially suggested by George L. Engel and it focuses on the fact that human activities and health are the results of biological, psychological, and social interactions. In the context of sport development program, this model emphasizes the need to consider physical activity, mental health support, and social integration as aspects of youth development. Sport psychology studies have shown that frequent engagement in physical exercise can ease the symptoms of anxiety and depression, improve cognitive abilities and improve self-esteem in adolescents and young adults (Xiao et al., 2021).

The inclusion of the psychological and social support systems in the sport programs thus offers a chance of holistic development of youth. With the environmental and socio-economic factors in the Niger Delta, it is high time to develop new development models that can both support the issue of youth engagement and sustainability of the environment (Zheng et al., 2024). The combination of green sports infrastructure with biopsychosocial interventions is a potential approach to the realization of these goals. By engaging in organized sports activities and environmental education, the youths will be in a position to lead healthier lives, improve their social networks and

be more knowledgeable on the conservation of the environment (Naseri et al., 2025). These initiatives may also help in prevention of crimes, reduction of conflicts as well as development of communities in the vulnerable areas.

The experience that China has had in eco-sport development can be helpful in the development of such developing regions like the Niger Delta. Community-based sport programmes, Strategic government investment and environmental sustainable infrastructure planning has helped China to incorporate sport into the larger urban development and environmental protection plans (Umoh et al., 2024). The partnerships between institutions in China and Nigerian stakeholders could thus support the exchange of knowledge, transfer of technology, and policy innovation to support the development of sport in the Niger Delta in a sustainable manner (Parra-camacho et al., 2023).

It is thus proposed in this paper that a Sino-Nigerian framework can be used to integrate the green sports infrastructure with biopsychosocial interventions in the Niger Delta. The framework will enhance youth participation and environmental awareness, as well as community resilience in regions with the environmental vulnerability. The proposed model will offer a comprehensive approach to the problem of environmental degradation, youth unemployment, and social instability in the Niger Delta region through the integration of sustainable sport infrastructure and psychosocial empowerment approaches.

### 1.1 Conceptual Foundations of Green Sports Infrastructure

#### 1. Concept and Principles of Green Sports Infrastructure

Green sports infrastructure can be described as the design, construction and management of sports facilities that have reduced environmental impact and maximize resource efficiency through renewable energy systems, water conservation technologies and environmentally friendly materials. The International Olympic Committee estimates that sustainable sports facilities are becoming more and more equipped with energy efficient systems, which can help conserve energy by up to 25-30 percent of that used in conventional sports facilities, and also encourage waste management and sustainable land use. In addition

to the environmental benefits, the infrastructure has also been used as a platform to educate the environment by incorporating the climate consciousness and conservation into the recreational areas. This two-fold role of ensuring sustainability in the ecological and behavioral change makes the green sports infrastructure an essential part of the world sustainable development plans (Lohmann, 2024).

## 2. Global Trends in Sustainable Sport Facility Development

The sport industry around the world has also acted in relation to environmental issues by implementing a model of sustainability-based infrastructure development, especially in mega sporting events. As a case in point, the 2008 Beijing Olympic Games and London 2012 Olympic Games proved that it was possible to construct eco-friendly stadiums with the help of renewable energy sources and water recycling systems and carbon emissions mitigation measures. According to reports by the international Olympic committee, the present-day Olympic amenities aim to achieve up to 30 percent of energy savings. Remarkably, China has been leading in terms of green sports infrastructure by making massive investments in eco-parks and recreational amenities that are friendly to the environment, which is an example of how sport infrastructure can help to ensure the sustainability of the city, the health of the population, and environmental management (Campillo-sánchez et al., 2025).

### 1.2 The Biopsychosocial Model in Sport and Youth Development

#### 1. Theoretical Overview of the Biopsychosocial Model

George L. Engel has developed the biopsychosocial model that offers a multidimensional approach to human health by combining biological, psychological, and social determinants. The model can be applied in the sport context to describe the role of physical activity in cardiovascular fitness and metabolic well-being, as well as psychological well-being in terms of decreased anxiety and elevated self-esteem. Socially, sport puts one in a state of teamwork, leadership and community integration. The World Health Organization also provides evidence to support the claim that regular physical activity is highly beneficial to decrease the risk of non-communicable diseases and enhance mental health outcomes, thus sport is a potent tool to help young

people develop holistically, especially in settings with limited resources (Allan et al., 2024).

#### 2. Application of the Biopsychosocial Model in Youth Sport Programs

The modern youth sport programs are progressively embracing biopsychosocial ideals to incorporate physical training with psychosocial programs like mentorship, counseling and life-skills education. Research on sport-for-development literature shows that organized sporting activities can be used to decrease youth delinquency as well as enhance school attendance and social conduct. The reports on sport-for-development by the United Nations have seen community-based sport projects have been attributed to quantifiable crime reduction amongst the youth and higher rates of civic engagement among the people. Such integrated programs can be used to strengthen the psychological and social stability of the youth in the region that is vulnerable such as the Niger Delta due to environmental and economic stressors (Fundin et al., 2025).

### 1.3 Environmental And Youth Development Challenges In The Niger Delta

#### 1. Environmental Degradation and Community Livelihoods

The oil exploration has been going on in the Niger Delta and over the decades, it has been severely degrading the environment through oil spills, gas flaring, and industrial pollution. The United Nations Environment Programme environmental assessments indicate that there are more than 7,000 oil spill incidents over the last 40 years since the 1970s which have led to extensive contamination of water bodies, arable land, and ecosystem. Such environmental disturbances have compromised the ancient means of livelihood like fishing and agricultural activities, which have led to poverty and economic displacement. The ensuing ecological loss has been linked to both long term health hazards and reduced quality of life of the communities that are affected, further aggravating socio-economic vulnerabilities (Id et al., 2021).

#### 2. Youth Unemployment and Social Instability

The rate of youth unemployment in Nigeria is still critical, and according to the statistics of the National Bureau of Statistics, the unemployment rates among young people are even more than 40 percent. Environmental degradation and lack of economic opportunities exacerbate this problem in the Niger Delta where people are more likely to engage in militancy, illegal refining of oil, and



organized crime. Lack of institutional recreational and engagement opportunities only adds to youth marginalization. But there are indications of sport-for-development programs that access to organized sport may raise the level of youth engagement to up to 50 percent and decrease antisocial behaviours by a substantial percentage, which emphasizes sport as a promising intervention to social stability and youth empowerment (Chukwuemeka et al., 2023).

#### 1.4 A Proposed Sino-Nigerian Framework for Green Sport Development

##### 1. Strategic Components of the Framework

The framework suggested is going to combine green sports infrastructure, biopsychosocial youth development programs and environmental education into a single development plan. Community sports parks that use renewable energy systems are seen as a place where young people come to engage, promote their health and be environmentally conscious. The experience of sport sustainability projects funded by the International Olympic Committee all over the world indicates that these facilities can both minimise the environmental footprint and maximise the involvement of the community in physical exercise. Youth resilience, social cohesion, and long-term developmental outcomes are also increased with the inclusion of psychosocial interventions, including mentorship and leadership training (Aderibigbe et al., 2020).

##### 2. Opportunities for Sino-Nigerian Collaboration

The strategic partnership between Nigeria and China has a great potential of enhancing the development of green sport in the Niger Delta in terms of sharing knowledge and technology. The Chinese experience on sustainable urban planning and eco-stadium construction is a viable example on how to establish cost effective and environmentally friendly sport facilities. Academic institutions, government agencies, and development organizations can also team up in joint research, capacity building, and infrastructure development. These partnerships are congruent with global sustainable development priorities presented by the United Nations and can help to establish integrated sport ecosystems, which will

improve youth empowerment, environmental sustainability, and economic development (Peter et al., 2021).

## 2. MATERIAL AND METHOD

The analytical research design used in the study was conceptual and qualitative to establish a Sino-Nigerian framework that incorporates green sports infrastructure and biopsychosocial interventions to improve the youth engagement and environmental resilience in the Niger Delta. The research used mostly secondary data and synthesized the multidisciplinary evidence based on academic literature, institutional reports, and policy documents which were provided by the reputable organizations such as the United Nations Environment Programme, International Olympic Committee, African Development Bank, and the National Bureau of Statistics and peer-reviewed publications which were availed through major academic databases including Scopus, Web of Science, and Google Scholar. An analytical approach was taken in comparison to analyse the sustainable sport infrastructure projects and initiatives in China and evaluate their relevance to the Niger Delta socio-environmental context.

The thematic analysis helped the study to systematize knowledge based on major themes that include sustainable sport infrastructure, environmental resilience, youth engagement, biopsychosocial health promotion, and international collaboration that were used to build the intended conceptual framework. As much as the study is weak in terms of empirical validation due to the use of secondary data, it has strong theoretical underpinnings that can be used in subsequent mixed-method research and policy interventions to ensure sustainable sport development, youth empowerment, and environmental sustainability in the Niger Delta.

## 3. RESULT AND DISCUSSION

### 3.1 Result

#### 1. Environmental and Youth Development Indicators in the Niger Delta

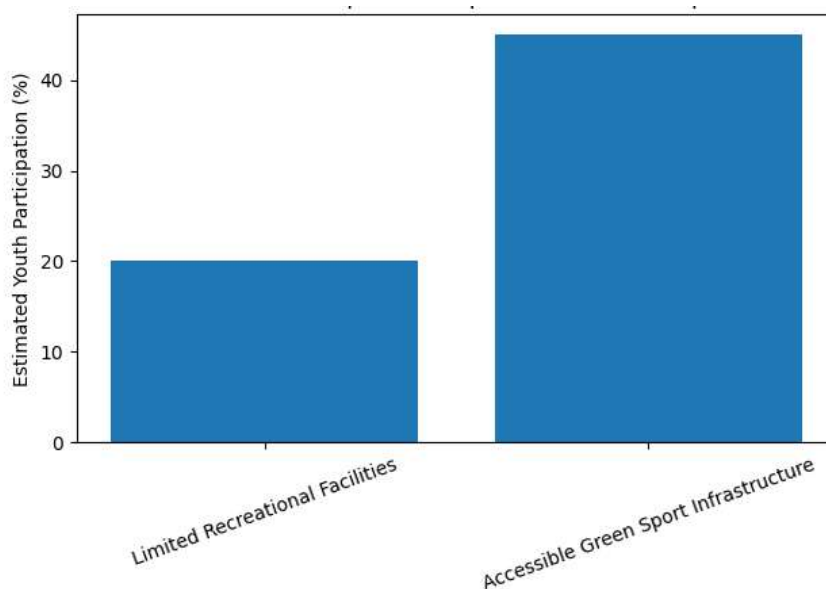
**Table 1.** Environmental and Youth Development Indicators

Indicator	Estimated Value	Source/Context
Documented oil spill incidents in the Niger Delta (since 1970s)	7000+	Environmental assessments of the Niger Delta
Youth unemployment rate in Nigeria	Above 40%	National labour statistics
Adolescents not meeting recommended physical activity levels globally	81%	Global health and physical activity reports
Potential increase in youth sport participation with accessible sport facilities	30–50%	Community sport development studies
Potential energy reduction in green sport infrastructure	25–30%	Sustainable stadium development reports

The table indicates that environmental degradation and youth unemployment remain critical development challenges, while sport infrastructure development presents significant opportunities for

improving youth participation and community engagement.

2. Youth Engagement Potential with Green Sport Infrastructure



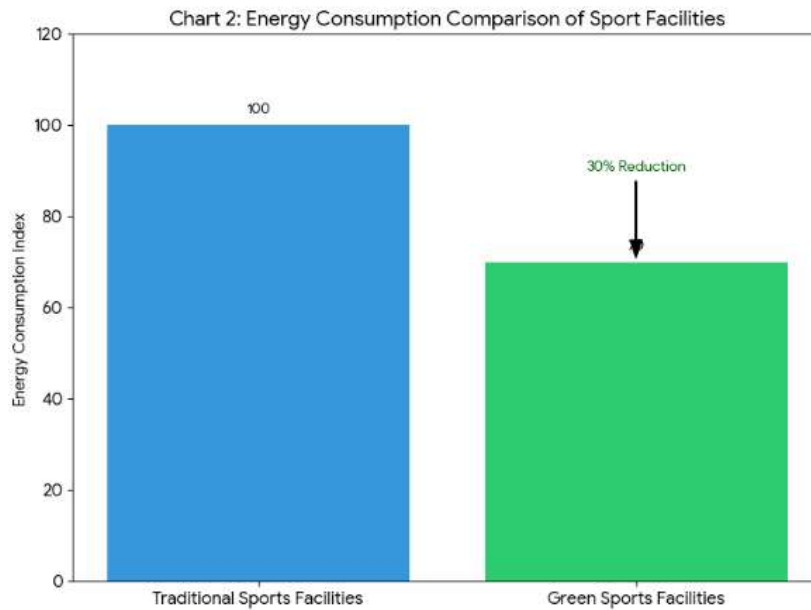
**Figure 1.** Estimated Increase in Youth Sport Participation with Green Sport Infrastructure

Communities with limited recreational facilities typically record youth sport participation levels of about 20%, whereas the introduction of accessible green sport infrastructure can increase participation to approximately 45%, representing more than a 100% increase in youth engagement. This highlights the critical role of safe and accessible community sport facilities in promoting youth

participation in organized sport programs and supporting broader youth development initiatives.

3. Environmental Benefits of Green Sports Infrastructure

The chart comparing the energy consumption of traditional and green sports facilities has been generated.



**Figure 2.** Energy Consumption Comparison of Sport Facilities.

The data illustrates the significant environmental impact of adopting sustainable infrastructure:

- Traditional Sports Facilities:** These serve as the baseline with an energy consumption index of \$100\$.
- Green Sports Facilities:** These facilities consume significantly less power, with an index of approximately \$70\$.
- Efficiency Gain:** This represents an estimated \$30\%\$ reduction in energy consumption.

These reductions are achieved through the integration of solar energy systems, energy-

efficient lighting, rainwater harvesting, and the use of green building materials. This demonstrates that green sports infrastructure promotes both youth physical activity and long-term climate resilience.

#### 4. Integrated Impact of Green Sport Infrastructure and Biopsychosocial Programs

The combined analysis of environmental sustainability and youth development literature suggests that integrating green sport infrastructure with biopsychosocial interventions can generate three major developmental outcomes:

**Table 2.** Three Major Developmental Outcomes

Dimension	Impact on Youth Development
Biological	Improved physical health, fitness, and reduced risk of non-communicable diseases
Psychological	Reduced anxiety and depression, improved self-esteem and emotional resilience
Social	Enhanced teamwork, leadership skills, and community cohesion

When implemented within environmentally sustainable recreational spaces, these programs can transform sports facilities into community

resilience hubs that simultaneously promote health, environmental awareness, and youth empowerment.

**Table 3.** Comparison of China’s Green Sports Infrastructure and Potential Application in the Niger Delta

Dimension	Green Sports Infrastructure in China	Potential Application in the Niger Delta, Nigeria
Government Policy Support	Strong national policies promoting green urban development and sustainable sport infrastructure integrated into national development plans.	Federal and regional policies could integrate green sport infrastructure into youth development and environmental sustainability initiatives supported by agencies such as the Niger Delta Development Commission.
Sustainable Stadium Design	Construction of eco-friendly stadiums with solar energy systems, natural	Development of community sports parks powered by renewable energy (e.g., solar-powered recreational facilities).



Dimension	Green Sports Infrastructure in China	Potential Application in the Niger Delta, Nigeria
Environmental Integration	ventilation, and water recycling technologies. Sports parks integrated with green landscapes, biodiversity conservation zones, and urban ecological planning.	Creation of environmentally sustainable recreational parks that incorporate tree planting, wetland restoration, and environmental education spaces.
Community Participation	High levels of public participation in recreational sports supported by accessible infrastructure.	Community-based sport programs aimed at engaging unemployed youth and promoting healthy lifestyles.
Technological Innovation	Use of advanced building technologies, energy-efficient materials, and smart environmental monitoring systems.	Adaptation of affordable green construction technologies suitable for rural and semi-urban communities in the Niger Delta.
Environmental Education	Sports facilities used as platforms for promoting climate awareness and sustainable living practices.	Integration of environmental education programs within youth sport activities to promote conservation awareness.

The comparison highlights that China’s success in sustainable sport infrastructure development is largely driven by policy integration, technological innovation, and community participation. These

elements could be adapted to the Niger Delta context through localized community sports parks and environmental awareness initiatives.

**Table 4.** Components of the Proposed Sino–Nigerian Green Sport Development Framework

Framework Component	Description	Expected Outcome
Green Infrastructure	Sports Development of eco-friendly community sport facilities powered by renewable energy and designed using sustainable construction materials.	Reduced environmental impact and increased access to recreational infrastructure for youth.
Youth Participation Programs	Sport Structured sports activities, training programs, and community competitions aimed at increasing youth engagement.	Increased physical activity levels, improved health outcomes, and reduction in youth delinquency.
Biopsychosocial Interventions	Integration of mentorship programs, mental health support, leadership training, and life-skills education within sports programs.	Improved psychological resilience, self-esteem, and social cohesion among youth.
Environmental Education Initiatives	Incorporation of environmental awareness campaigns, conservation activities, and sustainability training in sports environments.	Increased environmental awareness and responsible ecological behavior among young people.
Community Development Programs	Collaboration between sport organizations, local communities, and development agencies to implement youth empowerment initiatives.	Strengthened community cohesion and local economic development.
International Collaboration	Partnerships between Nigerian and Chinese institutions to facilitate knowledge exchange, technical support, and infrastructure development.	Technology transfer, improved infrastructure planning, and sustainable sport development policies.

The framework demonstrates that environmentally sustainable sport infrastructure combined with psychosocial youth development programs can create multifunctional community spaces that promote health, environmental sustainability, and youth empowerment simultaneously.

### 3.2 Discussion

The results of Tables 2 and 4 are significant in understanding how sustainable sport infrastructure and biopsychosocial youth development programs may help to make the Niger Delta environmentally

resilient and get young people interested in the area. The discussion explains the relative analysis between the model of China in terms of developing green sport and the suggested Sino-Nigeria model, as well as policy implications to sustainable community development.

#### 1. Policy Integration and Institutional Support.

As the comparative analysis in Table 2 shows, the key factor that has sustained the success of the green sports infrastructure in China is the extensive government policies that have incorporated sport



development with the sustainable development of the environment and urban planning. There has been a shift in the national development policies of China where ecological civilization and sustainable development of infrastructure especially in the construction of environmentally friendly sports facilities are of central focus. As an illustration, the sustainability efforts that were adopted in the 2008 Olympic Games in Beijing have set up renewable energy generation technologies, water recycling systems, and eco-friendly building materials in some of the Olympic facilities. These facilities were aimed at minimizing on the environmental impact with long term community usability (Hapriyanto & Azmi, 2025).

Conversely, the development of sport infrastructure in Niger Delta region of Nigeria in the past has been constrained by lack of proper investment, bad maintenance of facilities, and lack of integration between sport development policies and environmental management strategies. Despite the fact that the regional bodies like the Niger Delta Development Commission have adopted a number of youth empowerment and infrastructural projects, a few attempts have been made to incorporate the green sport structure into the environmental sustainability programmes. Co-ordination of policies among environmental bodies, sport development agencies, and programs to empower the youth may therefore improve the effectiveness of sport-based development programs in the area.

## 2. Sustainable Sport Infrastructure and Environmental Benefits

Another important environmental advantage of green sports infrastructure is also pointed out in Table 2. The contemporary environmentally friendly sporting facilities are developed with renewable energy sources, water saving material structures and sustainable buildings that contribute to a considerable amount of energy-saving and environmental loss. Sustainability reports by the International Olympic Committee state that green sports infrastructure can save on energy use by a range of about 25 to 30 percent as compared to the conventional sports infrastructure (Taye, 2021). These environmental efficiencies lead to the fact that sustainable sport facilities have the potential to help mitigate climate change and conserve the environment.

In the case of the Niger Delta, where the problem of environmental deterioration has long been a

thorn in its flesh, the implementation of environmentally-friendly community sports parks may help to restore the environment and to create awareness of the problem among the population. The reports of environmental assessment prepared by the United Nations Environment Programme, report that there have been thousands of oil spill incidents in the Niger Delta over the decades leading to the worst form of contamination of the wetlands, rivers, and even farmlands (Umoh et al., 2024). The creation of green recreational areas which would be inclusive of tree planting programs, ecological landscape and environmental education programs would thus contribute to the ecological recovery and environmental awareness among the communities.

## 3. Youth Engagement and Social Development through Sport

The other significant outcome of the analysis is associated with the contribution of sport infrastructure to youth engagement and social development. Lack of available recreational facilities in most communities in the Niger Delta has curtailed the chances of youths engaging in any form of organized sporting activities. This disengagement has been linked to heightened susceptibility to antisocial tendencies, joblessness and social instability.

Table 4 shows the significance of organized youth sport involvement programs as one of the key elements of the suggested development model. Through sport programs, young people get a chance to learn how to be physically fit, how to work as a team, and how to be a leader. Studies on sport-for-development programs show that organized sport programs are capable of reducing the level of youth participation in crimes by a significant margin and enhance social integration and achievement in education (Campillo-sánchez et al., 2025). In addition, community engagement and social inclusion can be achieved through youth sport initiatives. Sports contests, recreational leagues and sport programs on the grassroots provide the means of interaction among different social groups enhancing social cohesion and community identity.

## 4. Biopsychosocial Benefits of Sport Participation

Another important aspect of the proposed framework is the integration of the biopsychosocial interventions into the youth sport programs. As

Table 3 shows, the biopsychosocial model focuses on the interdependent role of biological factors, psychological factors, and social factors in human well-being. The model was first introduced by George L. Engel, and it highlights the fact that biological factors are not the only ones that affect the health outcomes, but also the psychological experiences and the social environment (Xiao et al., 2021).

Regular engagement in physical exercises in the case of youth sport development enhances the cardiovascular health, muscle strength and metabolic processes. Sport involvement has been psychologically linked to lower anxiety and depression, higher self-confidence, and higher emotional coping. Sports participation socially encourages teamwork, cooperation and development of leadership. These psychosocial advantages are especially relevant to young people who may be residing in an environmentally stressed area like in the Niger Delta. The social dislocation and psychological stress can be caused by environmental degradation and economic hardship. Mentorship and counseling programs in conjunction with structured sport programs are thus able to assist the young people in acquiring coping mechanisms, resilience, and positive social relationships.

#### 5. Environmental Education and Youth Environmental Stewardship

The analysis also brings out the importance of green sport infrastructure as a platform through which environmental education can be done. Most of the eco-friendly sporting parks use educational posters, recycling systems and conservation education programs that promote environmentally friendly behavior by the visitors. These programs turn recreational areas into learning areas where the youth are taught on biodiversity conservation, global warming and sustainable management of resources. Sport environments can therefore be used to impart environmental education, which would have the effect of producing an environmentally conscious generation of youth. Through sporting activities being conducted in ecologically-friendly facilities, the youth get to be more informed about environmental issues and the need to take good care of the environment.

These efforts may be of great help especially in the Niger Delta where there has been a great impact on the livelihood of the communities due to environmental degradation. Environmental awareness programs on youth related to sport

activities could be useful in the long-term involvement of the community in environmental protection and sustainable development programs.

#### 6. International Collaboration and Knowledge Transfer

Lastly, the suggested Sino-Nigerian framework brings to the fore the relevance of international cooperation towards sustainable sport development. Alliances between Chinese organizations and institutions in Nigeria would support the transfer of knowledge in the areas of environmentally-friendly stadium construction, renewable energy integration and sustainable city recreation planning, as shown in Table 4.

The experience of China in creating environmentally friendly sport infrastructure proves that the strategic investment and policy alignment could show how recreational facilities could be turned into the centers of community development and environmental education. Joint research schemes, technical training schemes and infrastructure development schemes between Chinese and Nigerian institutions could thus be used to facilitate the green sport infrastructure initiatives in the Niger Delta.

These partnerships might also help in capacity building amongst the local sport administrators, urban planners and environmental managers. With the adoption of knowledge and technological collaboration, the Niger Delta has the potential to come up with new sport infrastructure designs that would help to tackle the issue of youth unemployment, growth of the environment, and development of communities.

#### 4. CONCLUSION

Based on the research results that have been obtained, it can be concluded that there is a significant influence of the gymnastics of the great Indonesian children on the cardiorespiratory level of class X students of SMKN 1 Bengkulu City, proven by the truth of the calculation results of the experimental group  $t$  count of -8.158 which is outside the  $H_0$  acceptance area of -1.695 to 1.695. This means that  $-8.158 < -1.695$  indicates that there is a significant influence of the Gymnastics of the Great Indonesian Children (SAIH) on the cardiorespiratory level of class X students of SMKN 1 Bengkulu City. Then from the results of the mean Pretest and Posttest on the increase with a difference of 0.256 with a percentage of 17.07%. This shows that there is a significant influence of



the gymnastics of the great Indonesian children on the cardiorespiratory level of class X students of SMKN 1 Bengkulu City.

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## 6. AUTHOR CONTRIBUTION STATEMENT

T.A.P. contributed to the conceptualization, research design, supervision of the study, and final review of the manuscript. M.P.R. contributed to data collection, implementation of the training programs, and preparation of the initial manuscript draft. G.D. contributed to data analysis, interpretation of results, and manuscript editing. All authors have read and approved the final version of the manuscript.

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