

SUSTAINABLE MANAGEMENT MODEL OF UNIVERSITY BADMINTON ATHLETES CAREER MATURITY IN SICHUAN PROVINCE, CHINA

MODELO DE GESTÃO SUSTENTÁVEL DA MATURIDADE PROFISSIONAL DE ATLETAS UNIVERSITÁRIOS DE BADMINTON NA PROVÍNCIA DE SICHUAN, CHINA

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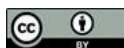
The authors declare that there is no conflict of interest

Abstract

In recent years, research on the career maturity of university badminton athletes has developed rapidly, but there are still many problems and shortcomings. The development of university badminton athletes career maturity in Sichuan Province, China, faces similar situations. This is closely related to the sustainable management model of university badminton athletes career maturity. Therefore, it is of great importance and crucial to conduct in-depth research and exploration on the factors influencing its development. The objectives of this study are threefold: First, to study the current situation of the sustainable management model of university badminton athletes career maturity in Sichuan Province, China; Second, to analyze the factors influencing this model; and Third, to examine and confirm the model. This study employed a mixed-methods design. Step 1: Qualitative research was conducted through structured interviews with 15 experts, focusing on the construction of the sustainable management model. Step 2: Quantitative research was performed using questionnaires, with data from 320 respondents analyzed through structural equation modeling (SEM). The sample size was determined based on the rule of 20 times the number of variables. Step 3: Qualitative and quantitative results were integrated, with 11 experts conducting focus group discussions and evaluations on feasibility, usefulness, appropriateness, and accuracy. The findings indicate that: First, the sustainable management model of career maturity in Sichuan Province is improving but still requires refinement; Second, proactive personality, social support, and career self-efficacy have significant positive impacts on

Resumo

Nos últimos anos, as pesquisas sobre a maturidade profissional dos atletas universitários de badminton têm avançado rapidamente, mas ainda existem muitos problemas e lacunas. O desenvolvimento da maturidade profissional dos atletas universitários de badminton na província de Sichuan, na China, enfrenta situações semelhantes. Isso está intimamente relacionado ao modelo de gestão sustentável da maturidade profissional desses atletas. Portanto, é de grande importância e crucial realizar pesquisas e análises aprofundadas sobre os fatores que influenciam seu desenvolvimento. Os objetivos deste estudo são três: Primeiro, estudar a situação atual do modelo de gestão sustentável da maturidade profissional de atletas universitários de badminton na província de Sichuan, na China; segundo analisar os fatores que influenciam esse modelo; e Terceiro, examinar e confirmar o modelo. Este estudo empregou um desenho de métodos mistos. Etapa 1: A pesquisa qualitativa foi realizada por meio de entrevistas estruturadas com 15 especialistas, com foco na construção do modelo de gestão sustentável. Etapa 2: A pesquisa quantitativa foi realizada por meio de questionários, com dados de 320 respondentes analisados por meio de modelagem de equações estruturais (SEM). O tamanho da amostra foi determinado com base na regra de 20 vezes o número de variáveis. Etapa 3: Os resultados qualitativos e quantitativos foram integrados, com 11 especialistas conduzindo discussões em grupos focais e avaliações sobre viabilidade, utilidade, adequação e precisão.



the model, with career self-efficacy serving as a mediating factor; and Third, model fit indices are within acceptable ranges, and all hypotheses are supported. Experts unanimously affirmed the consistency of qualitative and quantitative findings and confirmed the model's practical applicability. The findings provide transferable insights from Sichuan Province, highlighting psychological factors and support mechanisms essential for constructing sustainable management models of university athletes career maturity in China.

Keywords: Sustainable Management Model. University Badminton Athletes. Career Maturity. Proactive Personality. Social Support. Career Self-Efficacy.

Os resultados indicam que: Primeiro, o modelo de gestão sustentável da maturidade profissional na província de Sichuan está melhorando, mas ainda requer aperfeiçoamento; Segundo, a personalidade proativa, o apoio social e a autoeficácia profissional têm impactos positivos significativos no modelo, com a autoeficácia profissional atuando como fator mediador; e Terceiro, os índices de ajuste do modelo estão dentro de faixas aceitáveis, e todas as hipóteses são corroboradas. Os especialistas afirmaram unanimemente a consistência dos resultados qualitativos e quantitativos e confirmaram a aplicabilidade prática do modelo. Os resultados fornecem insights transferíveis da província de Sichuan, destacando fatores psicológicos e mecanismos de apoio essenciais para a construção de modelos de gestão sustentável da maturidade profissional de atletas universitários na China.

Palavras-chave: Modelo de Gestão Sustentável. Atletas Universitários de Badminton. Maturidade Profissional. Personalidade Proativa. Apoio Social. Autoeficácia Profissional.

1 INTRODUCTION

Currently, the Party Central Committee and the State Council place great importance on the employment of college graduates, introducing multiple policies to strengthen career education and career guidance for university students. Against this backdrop, university athletes, who must balance their academic studies with training, face additional challenges in their career development. Research indicates that they differ significantly from ordinary students in terms of career planning awareness, preparation levels, and career self-efficacy. With the rapid development of badminton in Sichuan Province, the number of university badminton athletes has been increasing annually, demonstrating significant development potential. However, their career development support system remains inadequate, necessitating systematic research and practical exploration to establish a scientific and sustainable management model to enhance their career maturity.

Recent studies on the career maturity of university athletes have increased significantly, achieving some progress in areas such as positive personality, social support, and career self-efficacy. However, existing research has primarily focused on macro-level analyses, lacking in-depth examinations of specific regions and sports. Additionally, research methods remain limited, with insufficient integration of qualitative and quantitative approaches, and the development of systematic models and empirical validation require further enhancement. In particular, research on the sustainable management model of university badminton athletes career maturity in Sichuan Province, China remains relatively weak, making it difficult to provide effective support for local policies and educational practices. Therefore, establishing a scientific, localized management model to promote the development of university badminton athletes career maturity has become an urgent and important issue that needs to be addressed.

Through a systematic study of the current status, influencing factors, and evaluation of the sustainable management model of university badminton athletes career maturity in Sichuan Province, China, this research aims to provide theoretical support and practical references for improving the career development and management efficiency of university athletes. Specifically, this paper first conducts an in-depth study on the current status of the sustainable management model of university badminton athletes career maturity in Sichuan Province, China, identifying its developmental stages and core challenges; secondly, it analyzes the factors influencing the sustainable management model of university badminton athletes career maturity in Sichuan Province, China, including the impacts of proactivity, social support, and career self-efficacy, and employs structural equation modeling for empirical validation; Finally, by integrating quantitative and qualitative research findings, this study explores the sustainable management model of university badminton athletes career maturity in Sichuan Province, China, proposing practical management pathways and sustainable development strategies. Through a comprehensive analysis of the above three research questions, we hope to provide insights and inspiration for the development of a management system for the career maturity of university athletes nationwide.

2 LITERATURE REVIEW

2.1 Policies on career maturity of university students

The 14th Five-Year Plan for Employment Promotion calls for strengthening career education and guidance on employment and entrepreneurship, increasing the organization of internships and apprenticeships, and carrying out large-scale, high-quality vocational skills training for college graduates, in order to improve the employability of college graduates. It implements regular employment information services for college graduates, accurately organizes online and offline employment service activities, and holds industry-specific, region-specific and specialty-specific recruiting sessions.

In order to conscientiously implement the "Notice from the General Office of the State Council on Further Strengthening the Guidelines for Athlete Education and Athlete Support Work issued by the General Administration of Sport and Other Departments" and the spirit of the National Television and Teleconference on Athlete Education and Support Work, to improve the social support system for athlete career transition, and to comprehensively advance athlete support work in the new era, promoting athletes' overall development and the sustainable development of sports, the General Administration of Sport of China has issued its opinions on further strengthening athlete career guidance work.

2.2 The concept of management of university badminton athletes career maturity

Hou (2024) pointed out in the article "Analysis of Influencing Factors of University Students' Career Maturity and Educational Countermeasures" that based on a comprehensive analysis of the literature, the concept of university students' career maturity is defined as the ability of an individual to make career choices and career planning based on his or her own abilities and perceptions at his or her own age that match his or her abilities.

Cao (2024) in the article "The effect of college students' emotional intelligence on career maturity and its intervention: comprehending the chain mediating role of social support and self-efficacy in career decision-making" pointed out that the sustainable

management model of college students' career maturity starts from cultivating emotional intelligence, strengthening social support and improving self-efficacy in career decision-making.

2.3 Management theories of university badminton athletes career maturity

The conceptual framework for the outcome variable career maturity in this study is derived from Super and Crites' career development theory. The subjects of the study were all college students between the ages of 18 and 26 and were also based on career development theory. Career development theory provides a systematic theoretical framework for the study of sustainable management of university badminton athletes career maturity, which helps athletes better understand their career development process, make scientific career decisions, and enhance career maturity.

2.4 Conceptualization of factors influencing the sustainable management of university badminton athletes career maturity

An extensive literature search was conducted to further elucidate the core influencing factors on the sustainable management model of university badminton athletes career maturity in Sichuan province, China. Three main factors influencing the sustainable management model of university badminton athletes career maturity in Sichuan province, China, have been identified: proactive personality, social support, and career self-efficacy.

2.5 Research on the relationships between variables

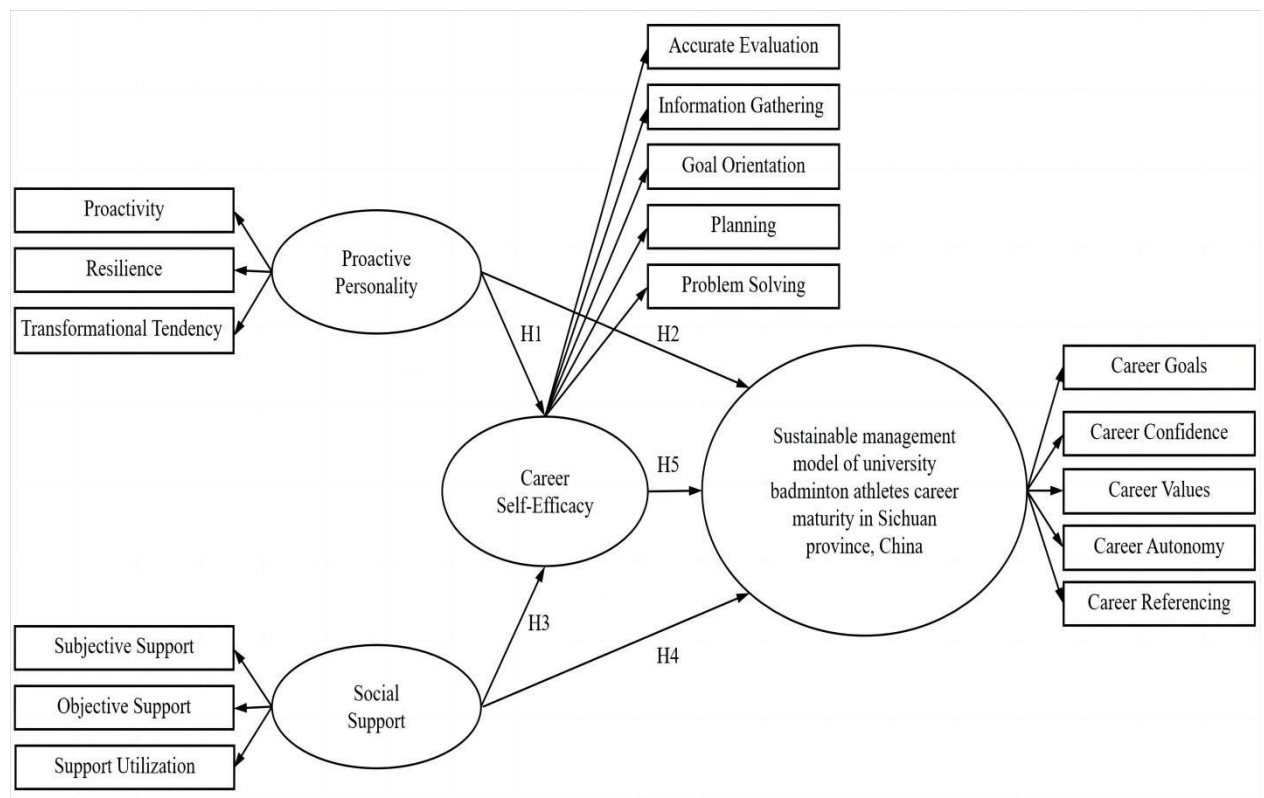
Bai (2021) in "The relationship between proactive personality and career maturity in medical students: the mediating role of career choice efficacy", after confirming the positive predictive effect of proactive personality on career maturity, the mediating variable of career self-efficacy was introduced to explore the specific mechanism of the role of proactive personality.

Zhu (2021) in "The Effects of Social Support and Career Decision Self-Efficacy on Career Maturity of Secondary School Students", showed that there is a close relationship between social support, career self-efficacy and career maturity of secondary school students. Both social support and career self-efficacy have a direct effect on career maturity, while social support can also affect career maturity by influencing career self-efficacy.

2.6 Conceptual framework

Figure 1

Conceptual model



Source: Constructed by the researcher

This study uses proactive personality and social support as independent variables, career self-efficacy as a mediating variable, and the sustainable management model of university badminton athletes career maturity in Sichuan province, China, as the dependent variable. Based on a literature review and research objectives, a model of the sustainable management model of university badminton athletes career maturity in

Sichuan province, China, was constructed. The figure shows a schematic diagram of the model.

The conceptual model illustrates the fundamental hypothetical relationships between proactive personality, social support, and career self-efficacy and the sustainable management model of university badminton athletes career maturity in Sichuan province, China. The hypotheses are as follows:

H1: The proactive personality factors influencing the career self-efficacy.

H2: The proactive personality factors influencing the sustainable management model of university badminton athletes career maturity in Sichuan Province, China.

H3: The social support factors influencing the career self-efficacy.

H4: The social support factors influencing the sustainable management model of university badminton athletes career maturity in Sichuan Province, China.

H5: The career self-efficacy factors influencing the sustainable management model of university badminton athletes career maturity in Sichuan Province, China.

H6: The career self-efficacy plays an intermediary role in the relationship between proactive personality and the sustainable management model of university badminton athletes career maturity in Sichuan Province, China.

H7: The career self-efficacy plays an intermediary role in the relationship between social support and the sustainable management model of university badminton athletes career maturity in Sichuan Province, China.

3 RESEARCH METHODOLOGY

First, using qualitative methods research, structured interviews were conducted on the current situation of the sustainable management model of university badminton athletes career maturity in Sichuan province, China. Through literature review and current situation investigation, combined with interview content, to understand the current situation of the sustainable management model of university badminton athletes career maturity in Sichuan province, China.

Second, using quantitative methods research, a questionnaire survey was conducted on the influencing factors of the sustainable management model of university badminton athletes career maturity in Sichuan province, China. Statistical software was

used to analyze the collected questionnaire data, establish a structural equation model, and verify 7 hypotheses.

Third, using qualitative methods research, discuss opinions and information with experts through group discussions, examine and confirm the factors affecting the sustainable management model of university badminton athletes career maturity in Sichuan province, China.

4 RESEARCH RESULTS

The research on the sustainable management model of university badminton athletes career maturity in Sichuan province, China. This paper adopts a mixed method research of qualitative and quantitative research. In the article's tables and models, the term "Sustainable management model of university badminton athletes career maturity in Sichuan Province, China" is abbreviated as SUBCAM.

4.1 The current situation of the sustainable management model of university badminton athletes career maturity in Sichuan province, China

This section aims to explore the current development status of the sustainable management model of university badminton athletes career maturity in Sichuan province, China. This is a qualitative study. The researchers developed an interview outline based on textbook materials, domestic and international academic achievements, and relevant theories. During the research design phase, they conducted keyword searches such as "career maturity", "university badminton athletes career maturity", and "sustainable management model" to extensively collect Chinese and English literature, theoretical documents, and practical cases related to this topic. To ensure the scientific rigor and applicability of the interview content, domain experts were invited to review the interview outline, focusing on evaluating the accuracy of language expression, the alignment of content with the theme, applicability, and consistency. Concurrently, the researchers combined field research findings with internal materials to screen and integrate frequently occurring key concepts and core dimensions, and ultimately conducted structured in-depth interviews with the interviewees.

This study selected 15 interviewees for in-depth interviews, systematically analyzing the current state of the sustainable management model of university badminton athletes career maturity in Sichuan province, China. It explored the specific implementation pathways of the sustainable management model of university badminton athletes career maturity in Sichuan province, China, analyzed the key factors influencing such models, established corresponding management standards and evaluation indicator systems. Specific recommendations were proposed to enhance the level of the sustainable management model of university badminton athletes career maturity in Sichuan province, China, including clear guidelines for budget preparation and fund usage, with particular emphasis on the importance of building safety assurance mechanisms. Through a multi-dimensional perspective, this study provides innovative ideas and practical references for the sustainable development of the university badminton athletes career maturity in Sichuan province, China.

4.2 Analyze the factors influencing the sustainable management model of university basketball league in Sichuan province, China

4.2.1 Basic demographic characteristics

This study organized and analyzed the basic information of the survey participants, describing the overall distribution of the sample in ten aspects: gender, age, job type, athletic level, future career plans, place of birth, father's education level, mother's education level, father's occupation, and mother's occupation.

4.2.2 Questionnaire indicator description statistics

This survey involves four variables: Proactive personality, Social support, Career self-efficacy, and SUBCAM (Sustainable management model of university badminton athletes career maturity in Sichuan Province, China). These variables cover 16 dimensions. Their skewness and kurtosis values are less than 2 and 7, respectively, indicating that the normality analysis results meet the requirements.

4.2.3 Reliability test

This paper uses the alpha coefficient to represent the internal consistency reliability of a scale. The higher the alpha value, the more consistent the results of the items within the questionnaire, indicating better reliability of the scale. Based on the reliability test results of the 16 dimensions of the four variables—proactive personality, social support, occupational self-efficacy, and SUBCAM—the Cronbach's alpha coefficient ranged from 0.850 to 0.960. From the Cronbach's alpha coefficient values, it can be seen that all variables exhibited good reliability. For specific data, please refer to Table 1.

Table 1

Reliability testing of each variable

| Variable | N | Cronbach's Alpha |
|---------------------------|---|------------------|
| Proactivity | 5 | 0.889 |
| Resilience | 5 | 0.899 |
| Transformational Tendency | 5 | 0.867 |
| Subjective Support | 4 | 0.873 |
| Objective Support | 5 | 0.923 |
| Support Utilization | 3 | 0.850 |
| Accurate Evaluation | 5 | 0.879 |
| Information Gathering | 5 | 0.886 |
| Goal Orientation | 5 | 0.862 |
| Planning | 5 | 0.857 |
| Problem Solving | 5 | 0.906 |
| Career Goals | 4 | 0.940 |
| Career Confidence | 3 | 0.939 |
| Career Values | 4 | 0.940 |
| Career Autonomy | 5 | 0.924 |
| Career Referencing | 5 | 0.960 |

4.2.4 Validity analysis (exploratory factor analysis)

Exploratory factor analysis confirmed good construct validity of the scale. All variables met the criteria for factor analysis, with KMO values above 0.6: Proactive Personality (0.930), Social Support (0.908), Career Self-Efficacy (0.943), and SUBCAM (0.942), indicating strong inter-variable correlations. Bartlett's sphericity test results were also significant ($p < 0.001$) for all variables, with respective degrees of freedom of 105, 66, 300, and 210. These findings demonstrate the scale's suitability for principal component analysis and its strong construct validity. For detailed statistics, see Table 2.

Table 2

KMO and Bartlett's tests for each variable

| Variable | KMO | Bartlett's Test of Sphericity | | |
|-----------------------|-------|-------------------------------|-----|-------------|
| | | Approx. Chi-Square | df | sig |
| Proactive Personality | 0.930 | 2835.761 | 105 | $P < 0.001$ |
| Social Support | 0.908 | 2489.116 | 66 | $P < 0.001$ |
| Career Self-Efficacy | 0.943 | 4662.789 | 300 | $P < 0.001$ |
| SUBCAM | 0.942 | 6950.816 | 210 | $P < 0.001$ |

4.2.5 Validity analysis (confirmatory factor analysis)

Confirmatory factor analysis (CFA) is a statistical method used to verify the degree of fit between a theoretical model and actual data. It is primarily used to test the construct validity of measurement models, including convergent validity and discriminant validity.

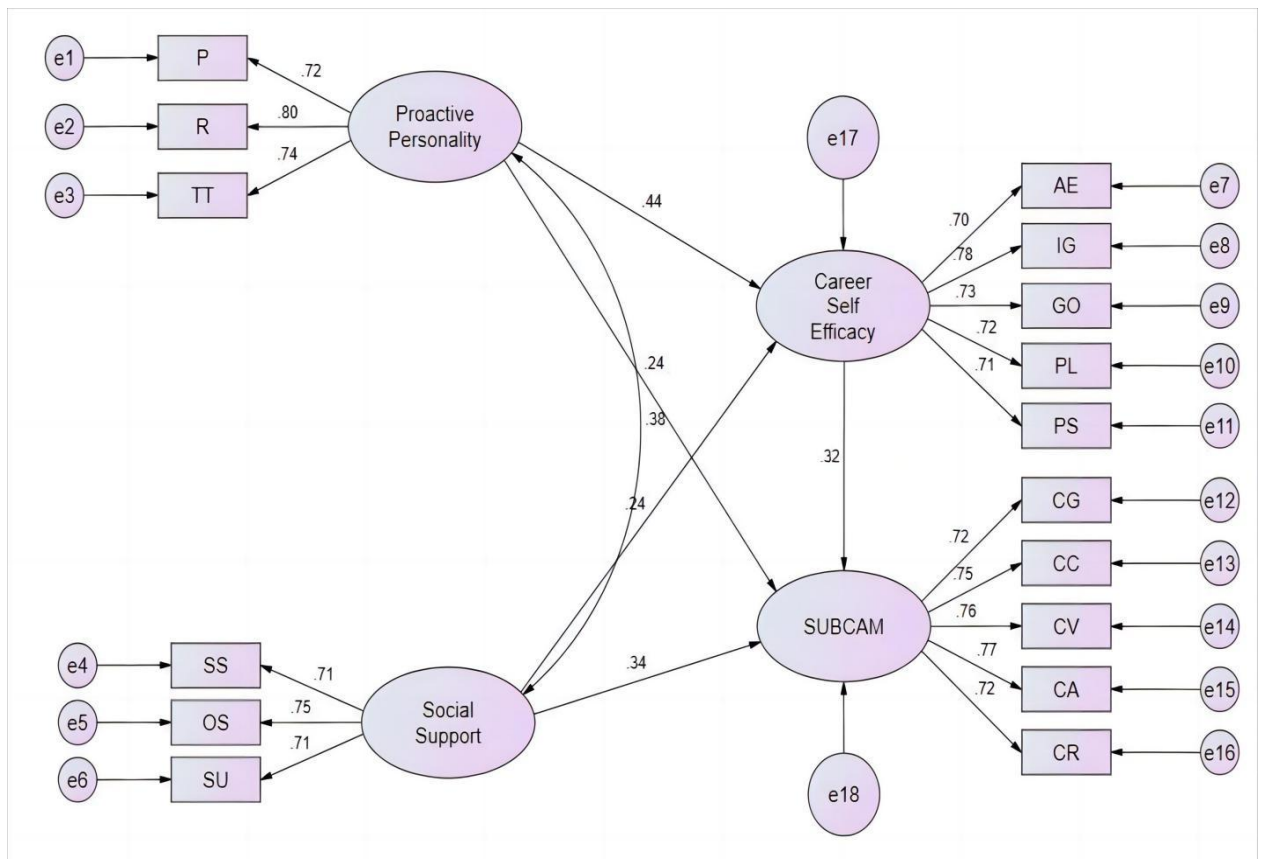
(1) Model fit indicators for each variable. The model fit indices for proactive personality, social support, career self-efficacy, and SUBCAM all satisfy accepted thresholds: $\chi^2/df < 5$, GFI, AGFI, IFI, TLI, and CFI > 0.9 , RMSEA < 0.08 . Specifically, χ^2/df ranges from 1.265 to 2.032, and RMSEA from 0.029 to 0.057. Although SUBCAM's AGFI (0.878) is slightly below 0.9, overall results confirm good model fit, supporting strong structural validity and reliability across constructs.

(2) Convergent validity test of each variable. Convergent validity was assessed using Composite Reliability ($CR > 0.7$) and Average Variance Extracted ($AVE > 0.5$). All dimensions across proactive personality, social support, career self-efficacy, and SUBCAM met these standards. Specifically, CR values ranged from 0.850 to 0.961 and AVE values from 0.547 to 0.837, confirming strong internal consistency and convergent validity for all constructs within the measurement model.

(3) Discriminant validity test of each variable. Discriminant validity was assessed by comparing the square root of AVE with inter-dimensional correlations. For proactive personality, social support, career self-efficacy, and SUBCAM, the square root of AVE consistently exceeded correlations across dimensions. Intra-dimensional correlations ranged from 0.740 to 0.915, while inter-dimensional correlations were lower (0.415–0.665). These results demonstrate low construct overlap and confirm that all measurement models exhibit strong discriminant validity.

4.2.6 Assessment of structural model

Establish a schematic diagram of the structural model as shown in Figure 2 to test the comprehensive influence relationship between variables. The specific test results of each parameter are as follows.

Figure 2*Schematic diagram of the structural model*

Source: Constructed by the researcher

(1) Model fit indices for structural equation models. The model fit indices for the structural equation model are shown in the table 3: χ^2/df is 1.395, meeting the requirement of less than 5; GFI is 0.950, meeting the requirement of greater than 0.9; AGFI is 0.930, meeting the requirement of greater than 0.9; IFI is 0.982, meeting the requirement of greater than 0.9; TLI is 0.977, meeting the requirement of greater than 0.9; CFI is 0.982, meeting the requirement of being greater than 0.9; RMSEA is 0.050, meeting the requirement of being less than 0.08. Overall, all indicators meet the criteria, indicating good model fit.

Table 3*Model fit indices for structural equation models*

| Index | χ^2/df | GFI | AGFI | IFI | TLI | CFI | RMSEA |
|-----------------------|-------------|-------|-------|-------|-------|-------|-------|
| Reference value | <5 | >0.9 | >0.9 | >0.9 | >0.9 | >0.9 | <0.08 |
| Actual measured value | 1.395 | 0.950 | 0.930 | 0.982 | 0.977 | 0.982 | 0.050 |
| | √ | √ | √ | √ | √ | √ | √ |

(2) Structural equation model path analysis. This study utilized statistical software to conduct path analysis of structural equation models, thereby obtaining path coefficients and critical ratio (C.R.) values for the structural equation model. As shown in the table 4, proactive personality has a significant positive impact on career self-efficacy ($\beta = 0.441$, $P < 0.001$); social support has a significant positive impact on career self-efficacy ($\beta = 0.243$, $P < 0.001$); proactive personality has a significant positive impact on the SUBCAM ($\beta = 0.240$, $P < 0.001$); Social support has a significant positive impact on the SUBCAM ($\beta = 0.339$, $P < 0.001$); Career self-efficacy has a significant positive impact on the SUBCAM ($\beta = 0.320$, $P < 0.001$).

The overall model demonstrates good explanatory power, with the coefficient of determination (SMC) for career self-efficacy being 0.335, indicating that proactive personality and social support together explain 33.5% of the variance in career self-efficacy; The coefficient of determination (SMC) for SUBCAM is 0.508, indicating that proactive personality, social support, and career self-efficacy together explain 50.8% of the variance in SUBCAM. The model demonstrates strong explanatory and predictive power.

Table 4*Path coefficients between variables in structural equation models*

| Regression path | | β | b | S.E. | C.R. | P | SMC |
|-----------------------|-------------------------|---------|-------|-------|-------|-----|-------|
| Career Self- Efficacy | ← Proactive Personality | 0.441 | 0.367 | 0.062 | 5.911 | *** | 0.335 |
| Career Self- Efficacy | ← Social Support | 0.243 | 0.217 | 0.064 | 3.407 | *** | |
| SUBCAM | ← Proactive Personality | 0.240 | 0.223 | 0.066 | 3.392 | *** | 0.508 |
| SUBCAM | ← Social Support | 0.339 | 0.339 | 0.069 | 4.886 | *** | |

| Regression path | β | b | S.E. | C.R. | P | SMC |
|--------------------------------|---------|-------|-------|-------|-----|-----|
| SUBCAM ← Career Self- Efficacy | 0.320 | 0.358 | 0.081 | 4.409 | *** | |

Note: ***, $P < 0.001$; b: non-standardized coefficient; β : standardized factor coefficient

4.2.7 Mediated effects test

Based on the results of the structural equation model path analysis, the hypothesis test was valid. In order to explore whether there was a mediating effect in these significant paths, we ran the Bootstrap method in statistical software, selecting 5,000 repetitions, a 95% confidence interval standard, and a bias correction method for testing.

Table 5

Results of the mediation effect test

| Regression path | Effect type | Effect | SE | 95% Lower | 95% Upper | P |
|---|------------------|--------|-------|-----------|-----------|-------|
| Proactive Personality → Career Self-Efficacy → SUBCAM | Indirect effects | 0.141 | 0.044 | 0.066 | 0.249 | 0.001 |
| Proactive Personality → Career Self-Efficacy → SUBCAM | Direct effects | 0.240 | 0.089 | 0.075 | 0.424 | 0.005 |
| Proactive Personality → SUBCAM | Total effect | 0.381 | 0.077 | 0.233 | 0.533 | 0.001 |
| Social Support → Career Self-Efficacy → SUBCAM | Indirect effects | 0.078 | 0.032 | 0.022 | 0.146 | 0.003 |
| Social Support → Career Self-Efficacy → SUBCAM | Direct effects | 0.339 | 0.071 | 0.193 | 0.471 | 0.002 |
| Social Support → SUBCAM | Total effect | 0.417 | 0.072 | 0.269 | 0.563 | 0.002 |

As shown in the table 5: Mediation analysis shows that career self-efficacy significantly mediates both paths. For Proactive Personality → Career Self-Efficacy → SUBCAM, the indirect effect of this path is 0.141 (SE = 0.044, 95% CI [0.066, 0.249]), with the confidence interval not including 0, indicating that career self-efficacy plays a significant mediating role between proactive personality and the sustainable management model of university badminton athletes career maturity in Sichuan Province, China. The direct effect is 0.240 (SE=0.089, 95% CI [0.075, 0.424]), which remains significant, indicating that this path represents a partial mediating relationship. The total effect is 0.381 (SE = 0.077, 95% CI [0.233, 0.533]), indicating that proactive personality has a significant overall effect on the SUBCAM. For Social Support → Career Self-Efficacy

→ SUBCAM, the indirect effect of this path is 0.078 (SE = 0.032, 95% CI [0.022, 0.146]), with the confidence interval not including 0, indicating that career self-efficacy also plays a significant mediating role in the path of social support influencing the sustainable management model of university badminton athletes career maturity in Sichuan Province, China. The direct effect is 0.339 (SE=0.071, 95% CI [0.193, 0.471]), which remains significant, indicating that this path also exhibits partial mediation effects. The total effect is 0.417 (SE = 0.072, 95% CI [0.269, 0.563]), indicating that the overall impact of social support on the SUBCAM, is significant. These results confirm that career self-efficacy is a key mediating variable in both pathways.

4.2.8 Results of hypothesis test

The reliability and validity analysis, structural equation model path analysis and mediation effect analysis are carried out to test the hypothesis proposed in this paper. This indicates that hypotheses H1, H2, H3, H4, H5, H6, and H7 have been validated.

4.3 Examine and confirm the sustainable management model of university badminton athletes career maturity in Sichuan Province, China

This stage adopts a mixed method research of qualitative and quantitative research, using focus group and questionnaires to evaluate the feasibility, appropriateness, usefulness, and accuracy as the main data collection tool.

The focus group results obtained through interviews were highly consistent with the actual situation, and a consensus was reached on the factors affecting the sustainable management model of university badminton athletes career maturity in Sichuan province, China. These factors primarily include proactive personality, social support, and career self-efficacy.

5 CONCLUSION, DISCUSSION AND SUGGESTION

5.1 Conclusion

The construction of the sustainable management model of university badminton athletes career maturity in Sichuan Province, China, is transitioning from an "initially established" phase to a "systematically optimized" phase. Although the overall development trend is positive, further improvements and enhancements are still needed in areas such as educational resource allocation, career support mechanisms, psychological intervention systems, social collaboration and participation, as well as policy implementation capacity.

A survey of 320 university badminton athletes in Sichuan Province found most were young males (65.3%) aged 18–23, mainly athletes (86.9%) from rural or small-city backgrounds. Most planned badminton-related careers. The data met normality assumptions. Hypotheses testing confirmed that proactive personality and social support positively influence career self-efficacy and SUBCAM. Career self-efficacy also directly impacts SUBCAM and mediates the effects of proactive personality and social support on it, supporting all seven hypotheses and identifying key influencing factors of career maturity's sustainable management.

Focus group interviews confirmed that proactive personality, social support, and career self-efficacy are key factors influencing the sustainable management model of university badminton athletes career maturity in Sichuan Province, China. Quantitative data further validated these influences and revealed the mediating role of career self-efficacy between proactive personality, social support, and SUBCAM. The consistency between qualitative and quantitative findings strengthens the reliability of results. Additionally, the structural equation model demonstrated good reliability and validity, indicating that the proposed sustainable management model is sound and can be applied in practice for athlete career development in the region.

5.2 Discussion

The study confirms that proactive personality, social support, and career self-efficacy all have significant positive effects on the sustainable management model of university badminton athletes career maturity in Sichuan Province, China. Proactive individuals are more likely to engage in active career exploration, build confidence, and develop strong career self-efficacy, which contributes to their career maturity. Similarly, social support enhances individuals' confidence and access to resources, boosting their career self-efficacy and positively impacting career development. Structural equation modeling showed statistically significant path coefficients among proactive personality, social support, career self-efficacy, and the SUBCAM model. These findings align with previous studies showing that psychological traits and external support systems both play critical roles in shaping career readiness and maturity in student-athletes.

Career self-efficacy plays a significant mediating role in the relationship between both proactive personality and social support with the sustainable management model of university badminton athletes career maturity in Sichuan Province, China. Mediation analysis revealed that individuals with proactive traits or strong social support are more likely to develop higher levels of career self-efficacy, which in turn positively influences their career maturity. The indirect and direct effects of both paths were statistically significant, validating the mediating function of career self-efficacy. These results suggest that enhancing career self-efficacy is a key mechanism through which internal personality traits and external social resources jointly foster sustainable career development. Prior studies further support this model, demonstrating that career self-efficacy acts as a bridge between psychosocial factors and career outcomes. Therefore, promoting proactive behaviors and strengthening support systems are essential for cultivating sustainable career paths in university badminton athletes.

5.3 Suggestion

(1) Research suggestion. To enhance the sustainable development of career maturity in university badminton athletes in Sichuan, the study proposes targeted strategies in three areas: Proactive Personality: Encourage personalized development

planning, self-motivation training, and practical learning platforms to foster initiative, resilience, and adaptability to change. **Social Support:** Build strong subjective support networks through mentoring, family communication, and team culture. Improve objective support via resource platforms, partnerships, and career information systems. Enhance athletes' ability to utilize support through training, feedback mechanisms, and real-scenario application. **Career Self-Efficacy:** Strengthen accurate self-evaluation using assessments, mentoring, and simulations. Improve career information access through education, databases, and industry engagement. Develop goal orientation and planning through structured training camps, visual tools, and dynamic tracking systems. Foster problem-solving skills through expert guidance, structured thinking models, and simulated challenges. These recommendations aim to create a comprehensive support system combining personal traits, social resources, and self-management capabilities to promote athletes' sustainable career development.

(2) Suggestions for further research. Future research should adopt comparative case studies, long-term follow-up, and quantitative methods to deepen understanding of career maturity in university badminton athletes in Sichuan. Content-wise, studies should refine influencing factors, expand to other sports, and examine emerging technologies. Practically, stronger collaboration with university sports departments is needed to translate findings into targeted strategies. Interdisciplinary research combining psychology, education, and management should be encouraged. Lastly, international exchange and collaborative research can introduce advanced practices to localize and innovate the sustainable management model of university badminton athletes career maturity in Sichuan Province, China.

(3) Future suggestion. This study, limited to Sichuan Province, used surveys and interviews, which may introduce bias and restrict generalizability. Influencing factors like proactive personality, social support, and career self-efficacy were explored, but emerging variables need deeper analysis. Future research should expand to cross-regional or international comparisons, adopt advanced methods such as SEM or big data analytics, and incorporate longitudinal studies. It should also explore the impact of AI tools, online learning, and new career expectations among student-athletes to enhance adaptability and innovation in the sustainable management model of university badminton athletes career maturity in Sichuan Province, China.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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