

# Logistic Growth Curve-based Chinese Professional Basketball Clubs Development Research

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**Abstract:** In contemporary society, so as to enhance Chinese basketball level, reform of Chinese basketball professionalization has been constantly deepened, while basketball clubs development is the internal impetus of Chinese basketball undertakings. The paper analyses specific situation of Chinese basketball clubs, and finds that most of Chinese sports clubs are sponsored and constructed by good corporate such as LuLu Group, Liaoning Bus Group, Wing On Company, Wanma Group and others, and they run through sports industry revenue, gate receipts and else; regarding Chinese basketball clubs coaches age, coaching time, experiences and others, it makes investigation and researches, and gets that though Chinese athletes basketball levels have some improvements, faculty is still deficient, which let Chinese basketball athletes technical levels not to be so high, amount of excellent athletes is not more, so China should increase investment in faculty so that propel to Chinese basketball development; by data sheet after logistic curve changing, it gets that the amount of Chinese basketball clubs will constantly increase in future years that provides training fields for Chinese more excellent athletes training and guarantees for their future development.

**Keywords:** Club, coach, logistic growth curve method, professional basketball.

## INTRODUCTION

The advancement and development of Chinese basketball levels cannot do without great support from Chinese professional basketball clubs, below are research achievement that Chinese relative experts obtain in the field.

Li Bing in “Teenagers professional basketball clubs management and operation mechanism research”, through analyzing Chinese national conditions, he carried out specific investigation and research on Chinese teenagers professional basketball clubs, found that China had a large population, teenagers that gifted in basketball were also more, Chinese basketball clubs developed teenagers’ basketball interests and reinforced their basketball skills through training so that made talent reserve preparations for Chinese basketball development [1]. The article thought that China should further increase investment in Chinese basketball clubs and facilitate their development [2].

Zhao Jinglun in the article “Athletics city’s junior high school basketball clubs development status investigation research”, by analyzing Chinese high schools basketball clubs development status, he got that athletics city’s junior high school basketball clubs development was relatively stable that provided lots of excellent basketball talents for the city, from which more outstanding talents were chosen by national basketball team, and their achievement in international games were particularly prominent.

It indicated that Athletics city’s reform of basketball clubs operation and management ways had good results that guaranteed for the city’s basketball undertakings greatly development [3].

Zhang Ji-Wen in the article “Beijing Shougang basketball clubs operation management empirical research”, she carried on investigation and research on Chinese Shougang basketball clubs development status, and got that Chinese Shougang basketball clubs’ operational ways and management concepts had further improved with years’ development, the purpose of Shougang clubs construction was to strengthen workers’ physical quality, enrich workers spare time life, let workers’ life to be more pleasant, only then can improve workers’ working efficiency and guarantee for Chinese undertakings greatly development [4].

The paper utilizes logistic growth curve method to establish basketball clubs’ amount prediction model, specific estimates and predicts on Chinese basketball undertakings so that propel to Chinese basketball undertakings development.

## MODEL ESTABLISHMENT

To make the paper more convincing, the paper uses mathematical models to further analyze and research on Chinese basketball clubs recent years’ operational ways and reformation results, and predicts on Chinese basketball clubs future development direction and operational management mode, puts forward reasonable development direction [5].

## Chinese Basketball Clubs’ Essential Features

With the implementation of globalization in economy, politics and culture, Chinese basketball culture carries on experience exchanges with other countries basketball, which

**Table 1. Chinese partial basketball clubs situations.**

Clubs	Source enterprise (group)	Amount of funds (ten thousand Yuan)
Bayi Rockets basketball club	KRD Securities	300
Liaoning Bus basketball club	International management group	400
Shandong Buffalo Wing On basketball club	Wing On Company	500
Beijing city Shougang capital basketball club	Shougang group and sports teachers	300
Shanghai Sharks oriental basketball club	Oriental television	400
Guangdong Everest Southern Tigers basketball club	Everest group (solely invested)	500
Jiangsu Dragons basketball club	Nanjing Iron and Steel	250
Double Star JiJun Club	Double Star Group	190
Zhejiang Whirlwind Wanma Club	Wanma Group	500
Beijing Olympian Professional Club	Hanvey real estate	600
Sichuan Panda Club	Blue Sword Group	200
Jilin Northeast Tigers Club	Jilin foreign trade corporation	500
Tianjin Bay Pioneer basketball club	Peace Bay Group	120
Nanjing Troops Club	Huangshan Group	180
Advance Guard Zhen Yuan Club	Zhen Yuan Group	280
Hebei Lulu basketball club	Hebei Lulu Group	65
Jiangsu ZhongShan Club	ZhongShan Group	100
Shenzhen China Motion basketball Club	Shenzhen China Motion Group	600
Heilongjiang Ha Telecom Club	Ha Telecom Group	80
Chongqing Nordic Snow Club	Nordic Snow Club	230
Shanxi West Wind basketball club	West Group	80

**Table 2. Chinese professional basketball undertaken municipal worker average income situation.**

Name of province and city	Worker average income	Name of province and city	Worker average income
Beijing	28852	Liaoning	18390
Shanghai	33938	Shandong	18293
Jiangsu	17489	Jilin	12943
Zhejiang	23824	Guangdong	17283
Xinjiang	11674	Shanxi	12948

exerts a profound impacts on Chinese basketball important part basketball clubs development, and lets Chinese clubs operational ways to be greatly changed as Table 1.

Besides, Chinese professional basketball undertaken municipal worker average income situation also has a great impact on basketball clubs operational status [6].

Below Tables 2, 3 is Chinese professional basketball undertaken municipal worker average income situation, make statistical analysis on the table.

To further analyze Chinese clubs participants income situation and make analysis of basketball clubs development targeted at Chinese clubs participants income situation.

With the improvement of Chinese living standards, the proportion of Chinese education and cultural entertainment consumption is constantly increasing as Tables 4, 5, which shows Chinese habitants entertainment life is relative colorful and participants' investment in clubs is also constantly increasing.

Table 3. Chinese clubs main funds source situation.

Source	Named fee	Sports industry development revenue	Chinese basketball association	Company investment	Ticket sales revenue	Advertising Revenue
Amount	700 ten thousand	1000 ten thousand	200 ten thousand	570 ten thousand	300 ten thousand	25 ten thousand
Proportion	21%	27%	18%	17%	15%	2%

Table 4. Chinese clubs participants' income situation.

Year	2011	2012	2013	2014
Per capita disposable income	17283	21732	22849	28294
Average reserve balance per capita	17893	21837	23948	29849
Growth rate	24.1%	22.6%	29.9%	42.3%

Table 5. Chinese education and cultural entertainment services consumption proportion.

Source	2009	2010	2011	2012	2013	2014
Proportion (%)	25.32%	25.98%	26.43%	27.33%	27.68%	28.12%

**Chinese Coaches Situation Investigation**

Chinese coaches are main factors that affect Chinese basketball clubs development, so it makes specific research on Chinese coaches' coaching time, athletes' performance situation, relevant data is as Tables 6-9.

By interviewing and investigating on Chinese large and medium-sized cities basketball clubs' coaches situation, it points out that Chinese clubs coaches' coaching time and experiences are fewer, coaches are around 40 years old that have certain experience, coaches are relative satisfied with equipment evaluation, which is the advancement of clubs management mode.

**Logistic Growth Curve-based Sports Systematic Institution Population Prediction**

By Logistic growth curve method, it predicts amount of Chinese basketball clubs during 2015 to 2019, and then points out directions for Chinese clubs development.

**Logistic Growth Curve Guiding Thoughts**

Logistic curve general mathematical model is:

$$\frac{dy}{dt} = ry(1 - \frac{y}{L}) \tag{1}$$

$$y = \frac{L}{1 + ce^{-rt}} \tag{2}$$

In the following, it records Logistic curve general form as:

$$y_t = \frac{1}{K + ab^t}, K > 0, a > 0, 0 < b \neq 1 \tag{3}$$

Among them, in Logistic curve, for parameter estimation, it makes following changes:  $y'_t = \frac{1}{y_t}$ , that is:

$$y'_t = K + ab^t \tag{4}$$

For time sequence  $n$  pieces of observation values, it average divides them into three parts, and for every part, it has  $m$  periods, and then it has  $n = 3m$ .

Part one:  $y_1, y_2, y_3, \dots, y_m$ ;

Part two:  $y_{m+1}, y_{m+2}, y_{m+3}, \dots, y_{2m}$ ;

Part three:  $y_{2m+1}, y_{2m+2}, y_{2m+3}, \dots, y_{3m}$

Among them, every part trend sum is equal to corresponding observation values sum, therefore provide parameters estimation, three sums method steps are as following:

Record observation values each part sum is:

$$S_1 = \sum_{t=1}^m y'_t, S_2 = \sum_{t=m+1}^{2m} y'_t, S_3 = \sum_{t=2m+1}^{3m} y'_t, \tag{5}$$

And it has:

$$\begin{cases} S_1 = \sum_{t=1}^m y'_t = \sum_{t=1}^m (K + ab^t) = mK + ab(1 + b + b^2 + \dots + b^{m-1}) \\ S_2 = \sum_{t=m+1}^{2m} y'_t = \sum_{t=m+1}^{2m} (K + ab^t) = mK + ab^{m+1}(1 + b + b^2 + \dots + b^{m-1}) \\ S_3 = \sum_{t=2m+1}^{3m} y'_t = \sum_{t=2m+1}^{3m} (K + ab^t) = mK + ab^{2m+1}(1 + b + b^2 + \dots + b^{m-1}) \end{cases} \tag{6}$$

Among them:  $(1 + b + b^2 + \dots + b^{m-1})(b - 1) = b^m - 1$

Table 6. Chinese coaches coaching time.

Coaching time	4 years	5-8 years	9-12 years	13-16 years	17-20 years
Number of people	3	3	2	6	1
Proportion	20%	20%	18%	27%	15%

Table 7. Sports performance situation when coaches teach athletes.

Performance situation	Frequency	Percentage
Master sportsman in international level	1	6%
Master sportsman in national level	12	81%
National first grade sportsman	2	13%
National second grade sportsman	0	0

Table 8. Coaches' age group.

Age	26-30 years old	31-35 years old	36-40 years old	41-45 years old	46-50 years old	52-55 years old
Frequency	28	46	43	84	28	28
Proportion	7%	21%	20%	39%	7%	7%

Table 9. Coaches team members setting satisfaction.

Attitude	Very satisfied	Satisfied	Basic satisfied	Not satisfied	Very dissatisfied
Frequency	6	7	2	0	0
Proportion	40%	47%	13%	0	0

And then it can get:

$$\begin{cases} S_1 = mK + ab \frac{b^{m-1}}{b-1} \\ S_2 = mK + ab^{m+1} \frac{b^{m-1}}{b-1} \\ S_3 = mK + ab^{2m+1} \frac{b^{m-1}}{b-1} \end{cases} \quad (7)$$

Therefore, it can get:

$$\begin{cases} b = \left( \frac{S_3 - S_2}{S_2 - S_1} \right)^{\frac{1}{m}} \\ a = (S_2 - S_1) \frac{b-1}{b(b^m - 1)^2} \\ K = \frac{1}{m} \left[ S_1 - \frac{ab(b^m - 1)}{(b-1)} \right] \end{cases} \quad (8)$$

Besides, when predict data, it should test data, test method is:

$$\frac{y_{t+1} - y_t}{y_t - y_{t-1}} \approx b \quad (9)$$

Logistic curve data handling and conclusions

By

$$y_t' = \frac{1}{y_t}$$

it gets year 2008~2012 data after changing is as following Table 10:

According to formula(5), it gets:

$$S_1^1 = 0.682, S_2^1 = 0.614, S_3^1 = 0.478$$

$$S_1^2 = 0.1274, S_2^2 = 0.1256, S_3^2 = 0.1232$$

$$S_1^3 = 0.0778, S_2^3 = 0.0817, S_3^3 = 0.0766$$

Then according to formula (8), it gets:

$$b^1 = 1.867, a^1 = -0.005111, K^1 = 0.35468$$

$$b^2 = 1.6999, a^2 = -0.0001453, K^2 = 0.1281$$

Table 10. Data sheet after logistic curve changing.

$y_t^i / \times 10^3$	Year	2009	2010	2011	2012	2013	2014
	Professional basketball club		0.578	0.447	0.437	0.477	0.244
Teenager basketball club		0.0841	0.0533	0.0330	0.0537	0.0591	0.0613
Amateur basketball club		0.0378	0.0365	0.0567	0.0612	0.0414	0.0462

Table 11. Prediction on amount of Chinese basketball clubs.

	2015	2016	2017	2018	2019
Professional basketball club	67	75	77	79	86
Teenager basketball club	94	101	106	112	123
Amateur basketball club	116	136	144	168	186

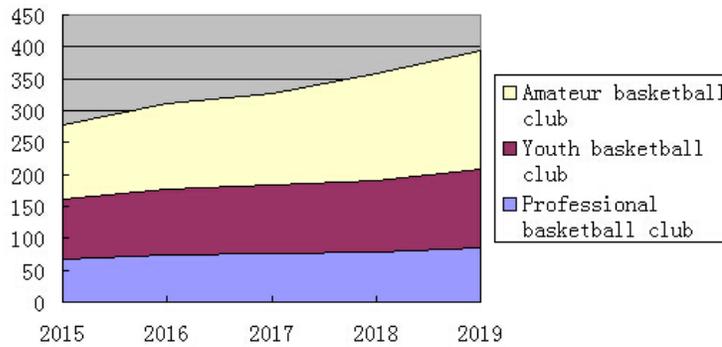


Fig. (1). The number of basketball clubs in China.

$$b^3 = 1.5128, a^3 = 0.000786, K^3 = 0.0758$$

So obtained sports systematic institution population's logistic growth curve mathematical model is:

$$\begin{cases} y_t^1 = \frac{1}{0.35468 - 0.00511 \times 1.867^t} \\ y_t^2 = \frac{1}{0.1281 - 0.0001453 \times 1.6999^t} \\ y_t^3 = \frac{1}{0.0748 + 0.000796 \times 1.5128^t} \end{cases}$$

When predicting on Chinese sports systematic institution population development changes in future five years after 2012, only need to input  $t$  value into above formula, as predict  $y_{2013}$ , then it has  $t = 2013 - 2004 + 1 = 10$ . And then it can get following Table 11 predicted result:

Draw above predicted population into following broken line Fig. (1), it better analyzes sports systematic institution population trend:

By above broken line statistical Fig. (1) analysis, it gets conclusion that in five years after 2014, the amount of national different types basketball clubs will be sharply increased, which let Chinese basketball undertakings to be rapidly developed, from which players techniques would be

further strengthened that makes preparations for China great deals of lead players training.

**CONCLUSION**

The paper firstly makes specific research and analysis of Chinese basketball clubs distribution, income situation, it gets that Chinese basketball clubs are mainly set up by large enterprises sponsorship, and they maintain clubs normal operation through sports industry revenue, gate receipts, named fee, games and other incomes. Secondly, the paper researches on Chinese coaches' situations, it gets that Chinese coaches' coaching time is shorter; experiences are deficient that hinders Chinese basketball clubs development. Chinese should increase investment in Chinese basketball faculty so that let Chinese basketball clubs to run normally. Finally, by data sheet after logistic curve changing, it gets that amount of basketball clubs is constantly increasing, nation and enterprises investment increase, which offers commitment and support for Chinese basketball development.

**CONFLICT OF INTEREST**

The author confirms that this article content has no conflict of interest.

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