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Logistic growth curve method-based China football league one development research

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ABSTRACT

With the development of football globalization, all countries football culture, football operational management mode are intermingled with each other, which provides opportunity and challenge for China league one development. The paper carries on specific research on China league one's athletes, analyzes current Chinese main force athletes' average age,average height,average weight, and then compares to international stars evaluation criterion, points out that Chinese players have not yet possessed potentials of international stars, which reflects in Chinese players techniques and reaction capacity to be further improved; makes investigation on Chinese coaches' age,experiences,instructing time and other factors, it gets that among football coaches, Chinese coaches amount are more, foreign senior coaches are fewer, it suggests to introduce more foreign senior coaches so that will helpful for Chinese football development, finally by data table after logistic curve changes, it analyzes that Chinese football players team is growing stronger, especially in professional players amount that is constantly increasing and techniques are constantly promoting, which will impel Chinese football rapidly development, and meanwhile also conforms to strategy of reinvigorating China through human resource development.

KEYWORDS

Coach; Football; Logistic growth curve method; League one; Management mode.

INTRODUCTION

Though Chinese football is slightly inferior to other countries, China's reform in football has obtained remarkable achievements, so the paper mainly researches on Chinese professional football league development status.

Zhao Jing-Lun in "2006 Chinese super league goal characteristics study", combined with Chinese present social structure, looked up lots of documents, analyzed Chinese super league goal characteristics, made concrete investigation and research on some Chinese professional players, and proceeded with statistical analysis of their applied techniques in goal instant, got that the common points among them during goal instant was they could calm down, see to every player's moves, and were ready to make final preparation for passing, goal, approaching, and running.

Fang Li in the article "Chinese football professionalization reform and development measures study", by analyzing Chinese football professionalization reform measures, he got that the reason why Chinese football was weaker, it mainly because the shortage of technical talents. The paper pointed out that China should employ world excellent football coaches, let them to train Chinese youth from childhood, strengthen their fondness on football, deeply excavate their internal potentials to make preparation for building Chinese world star and then promote Chinese football development.

Cheng Zheng-Tao in the article "2008 to 2010 Chinese super league techniques application research", analyzed contemporary China league one, went deeper into study Chinese professional football players, and based on present social development, combined with sociological theory, put forward that in Chinese super league, some athletes techniques were normal, which caused Chinese super league quality could not be ensured, so it should make further specific evaluation on Chinese professional players' techniques, and collectively solve the problems of them.

The paper utilizes logistic growth curve method to establish model regarding Chinese football professionals amount prediction, specific evaluates and predicts on Chinese football, and then provides precious comments on Chinese football.

CHINESE PROFESSIONAL FOOTBALL PLAYERS AND COACHES BASIC CHARACTERISTICS

In order to make the paper to be persuasive, it carries out specific researches on Chinese professional football leagues' athletes and their techniques status through mathematical models.

Chinese professional football players' age structure

By interviewing,investigating Chinese large and medium-sized cities teams that participated in Chinese super league first division, it carries out analysis and researches on participants dominating athletes, relative data is as TABLE 1, TABLE 2 and TABLE 3, relative analysis is as Figure 1, Figure 2 and Figure 3.

TABLE 1 : 2011-2014 professional players' dominating athletes' average age

Year	2011	2012	2013	2014
Average age	25.6	26.3	26.6	26.5

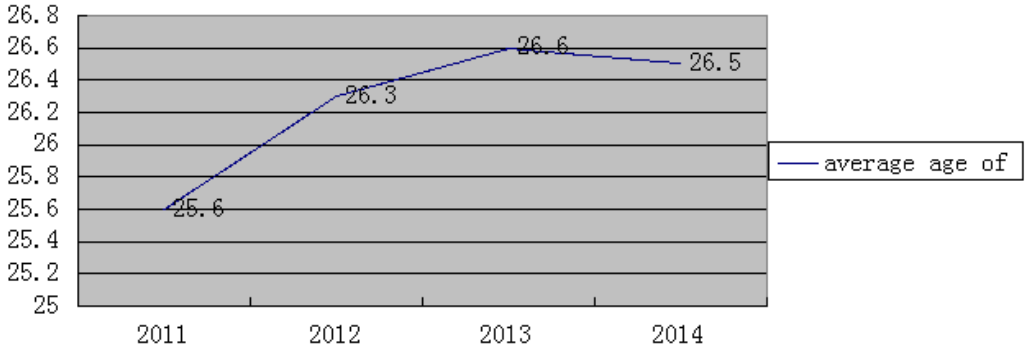

Figure 1 : professional players average age from 2011 to 2014

TABLE 2 : 2014 professional players dominating athletes' average age

Average age	18	19	20	21	22	23	24	25	26	27	28
Frequency	3	13	5	18	9	23	4	17	16	27	13

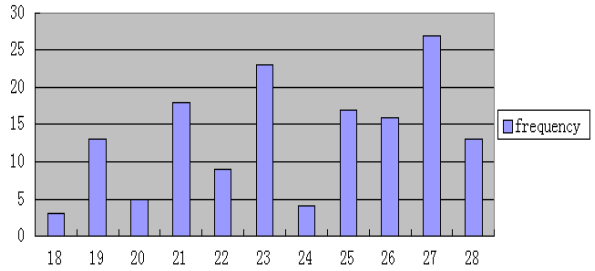

Figure 2 : professional players' average age from 2014

TABLE 3 : 2011-2014 average age maximum value and minimum value

Year	2011	2012	2013	2014
Maximum age	33	35	34	33
Minimum age	20	19	21	22

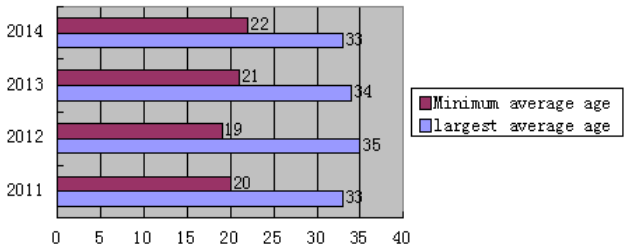

Figure 3 : 2011-2014 with an average age of values

According to above analysis of Chinese football dominating athletes' ages, it gets that Chinese dominating athletes' ages are generally 22 years old, the age group is just the period of vigorousness, and in the stage, athletes' learning ability, techniques application capacity arrive at their best.

Chinese professional football player's height and weight status

Athlete weight and height are linked to his technology performing in the sports fields, especially for their own energies reasonable utilization that is particular important, relative data is as TABLE 4, TABLE 5 and TABLE 6, relative analysis is as Figure 4 ,Figure 5 and Figure 6.

TABLE 4 : 2011-2014 professional players' heights characteristics

Year	2011	2012	2013	2014
Height(cm)	182.2	183.3	182.9	183.5

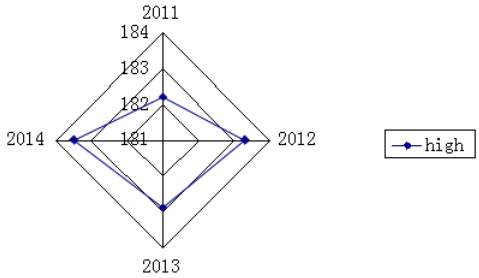

Figure 4 : professional player height 2011-2014 characteristics

TABLE 5 : 2011-2014 professional players' weights characteristics

Year	2011	2012	2013	2014
Weight(kg)	74.6	75.4	74.2	74.8

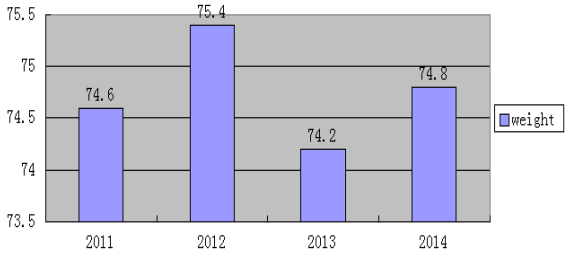

Figure 5 : Professional player height characteristics. 2011-2014

TABLE 6 : 2011-2014 four seasons dominating athletes' characteristics

Year	2011	2012	2013	2014
Height	183.2	183.1	183.9	183.4
Average age	26.3	25.9	24.7	24.8
Average weight	75.8	75.3	74.3	75.5

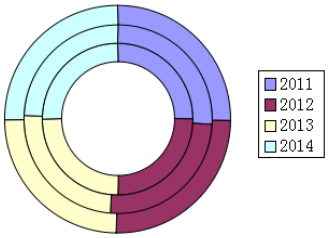

Figure 6 : 2011-2014. Characteristics of four main player of the season

By researching on athletes' weights,heights, it gets that Chinese main players heights are 183m,weights are 75, which also gets closer to experts one research on most suitable kicking stage,it shows Chinese football is on track.

Chinese professional football coaches status

Football coaches are leaders of China football, progress of coaches ideology will bring qualitative leap into Chinese football, so it studies Chinese professional football coaches status, relative data is as TABLE 7, TABLE 8, TABLE 9 and TABLE 10, relative analysis is as Figure 7 ,Figure 8, Figure 9 and Figure 10.

TABLE 7 : Proportions of Chinese and foreign coaches

Coach	China	Foreign countries
Proportion(%)	80%	20%

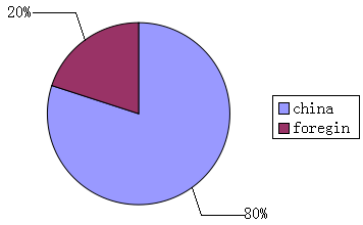

Figure 7 : The proportion of Chinese and foreign coaches

TABLE 8 : 2011-2014 Coaches' ages

Year	2011	2012	2013	2014
Maximum age	64	63	65	62
Average age	43	40	39	41
Minimum age	29	30	28	29

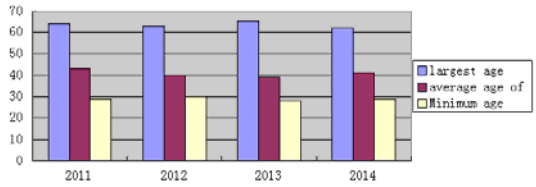

Figure 8 : In 2011-2014 ages of the coaches

TABLE 9 : 2014 Chinese coaches instructing time

Year	2011	2012	2013	2014
Longest	28	25	30	27
Average	15	15	17	13
Shortest	4	4	6	3

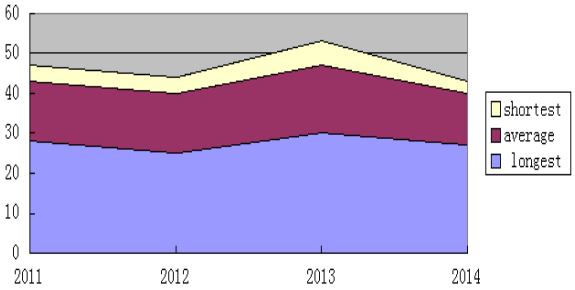

Figure 9 : In 2014, the teaching time of coaches

TABLE 10 : 2014 Foreign coaches average ages and instructing time

Coach	Average age	Average time
Time	53	9

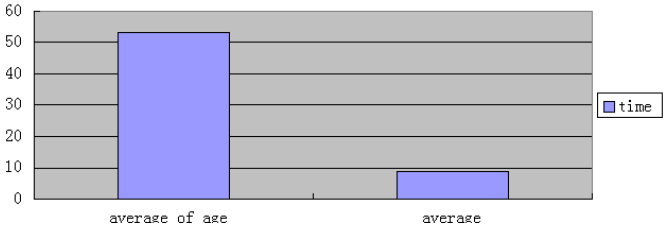

Figure 10 : In 2014 the average age of foreign coaches and coaching time

By above studying on coaches' nationalities, ages and instructing time, it gets that in coaches, Chinese coaches account for 80% and instructing time is longer, which is an advantage for athletes, and among the employed foreign coaches, moreover, they have world level instructing experiences.

LOGISTIC GROWTH CURVE-BASED PREDICTIONS ON NUMBER OF SPORTS SYSTEM INSTITUTION STAFF

On the basis of correlation analysis, it selects sports system institution that suffers maximum influences from athletes' technological levels to make predictions on number of people, which are professional sports schools, amateur sports schools and sports schools.

Logistic growth curve guiding thought

Chinese football education system institution staff amount change trend is uncertain with time passing, here, introduce Logistic curve (growth curve).

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,record 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, parameter estimation makes following changes: $y_t^{'} = \frac{1}{y_t}$, that:

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

Averagely divide time sequence n pieces of observation value into three parts, for every part; it has m periods, which is $n = 3m$.

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

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

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

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:

$$\begin{cases} S_1 = \sum_{t=1}^{m} \hat{y}_t = \sum_{t=1}^{m} (K+ab^t) = mK + ab(1+b+b^2+\cdots+b^{m-1}) \\ S_2 = \sum_{t=m+1}^{2m} \hat{y}_t = \sum_{t=m+1}^{2m} (K+ab^t) = mK + ab^{m+1}(1+b+b^2+\cdots+b^{m-1}) \\ S_3 = \sum_{t=2m+1}^{3m} \hat{y}_t = \sum_{t=2m+1}^{3m} (K+ab^t) = mK + ab^{2m+1}(1+b+b^2+\cdots+b^{m-1}) \end{cases} \tag{6}$$

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

And then it can get:

$$\begin{cases} S_1 = mK + ab\dfrac{b^{m-1}}{b-1} \\ S_2 = mK + ab^{m+1}\dfrac{b^{m-1}}{b-1} \\ S_3 = mK + ab^{2m+1}\dfrac{b^{m-1}}{b-1} \end{cases} \tag{7}$$

Therefore, it can get:

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

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

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

Logistic curve data processing and results

By $y_t^{'}=\dfrac{1}{y_t}$,it gets 2008~2012 data after changing as following TABLE 11:

TABLE 11 : Data table after logistic curve changes

	Year	2009	2010	2011	2012	2013	2014
$y_t^{'}/\times 10^3$	Professional, sports technical college	0.456	0.347	0.337	0.377	0.234	0.163
	Sports school	0.0851	0.0633	0.0430	0.0637	0.0591	0.0613
	Amateur sports school	0.0373	0.0375	0.0507	0.0410	0.0414	0.0462

According to formula(5),it gets: $S^1{}_1=0.682, S^1{}_2=0.614, S^1{}_3=0.478$

$S^2{}_1=0.1274, S^2{}_2=0.1256, S^2{}_3=0.1232$

$S^3{}_1=0.0778, S^3{}_2=0.0817, S^3{}_3=0.0766$

Then by formula(8),it gets: $b^1=1.867, a^1=-0.005111, K^1=0.35468$

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

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

So obtained sports system institution staff amount logistic growth curve mathematical model is:

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

When predicting Chinese sports system institution staff development changes in future five years after 2012,only need to input t value into above formula, as predict y_{2013},then it has $t=2013-2004+1=10$. Then it can get following TABLE 12 prediction results:

TABLE 12 : Chinese football players amount prediction

	2015	2016	2017	2018	2019
Professional sports school	6135	6219	6258	6301	6325
Sports school	9413	9725	9997	12105	13297
Amateur sports school	11579	13683	14432	16837	18693

Draw above predicted staff amount into following broken line Figure 11, it is better analyzing sports system institution staff amount trend:

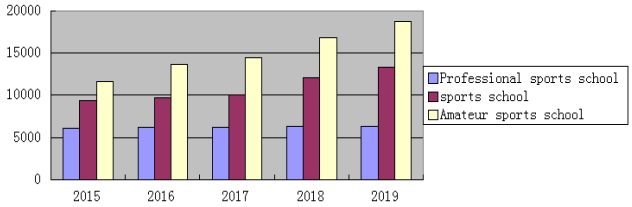

Figure 11 : The number of sports system institutions

By above broken line statistical Figure 11 analysis, it gets conclusions that national football athletes amount sharp increases in five years after 2014, which drives Chinese football to rapidly develop, from which China further strengthens professional players training to make preparation for China training a great deal of dominating players.

CONCLUSION

(1) The paper firstly makes specific investigation and analysis of Chinese football athletes' dominating players heights ,average age,average weight, it gets that Chinese dominating athletes ages are averagely 22 years old, weights are 75 kg, heights are 183cm,by investigating and studying on relevant articles, it thinks the result conforms to international professionals evaluation criterion.

(2) Secondly, the paper researches on Chinese coaches status, it gets that Chinese coaches account for around 80%,and among them,most of people instruction years are around 15 years, which indicates Chinese coaches instructing levels have already arrived at international standard, which provides faculty guarantee for Chinese football development.

(3) Finally,by data table after logistic curve changes, it gets that Chinese professionals amount is constantly increasing, and technical levels have qualitative leap, which provides talents guarantee for Chinese football development.

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