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Evaluation on Promoting Economic Development by Technology Entrepreneurship and Innovation Concept of Sports Industry under the Background of Artificial Intelligence

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Abstract: The economic advancement of the PE industry is the lifeblood of the PE industry. Adopting the concept of technology entrepreneurship and innovation can improve the economic advancement of the PE industry. The chaos theory of image security communication and DNA computing system can be used in the economic development of PE industry to improve and update it. In order to promote the economic development of PE industry under the background of artificial intelligence, this paper used chaos theory and DNA computing to analyze the strategy of PE industry enterprises, and finally drew a conclusion. In terms of the survey on the scientific and technological level of the PE industry, the scientific and technological level of the five sports related enterprises has been improved; in terms of the investigation on the innovation ability of the PE industry, it was concluded that the innovation ability of the five enterprises has improved after the adoption of the DNA computing system, maintaining the level of more than 80 points; in the aspect of the investigation of the economic level of the PE industry, it was concluded that the demand of the public for sports commodities is gradually expanding, and the sports commodity sales enterprises have driven the development of the PE industry; in terms of the survey on the changes in the scale of sports enterprises, it was concluded that the scale of each enterprise has expanded from July 2021 to December 2021; in the performance analysis of DNA algorithm, it was concluded that the performance of DNA algorithm using chaos theory of image security communication has been improved. To sum up, chaos theory and DNA computing can improve the technology entrepreneurship and innovation concept of PE industry and promote economic development.

1. Introduction

At present, the development of PE industry is a topic of public concern. The public believes that the development of PE industry has brought great convenience to people's lives. However, at this

stage, there is no research on the technology entrepreneurship and innovation concept of PE industry to promote economic development. In order to make up for this defect, it is extremely necessary to conduct research in this field.

The rapid development of the PE industry depends on many experts and scholars' dedicated research and unremitting contributions in this regard. Heydari Reza studied the PE industry under the COVID-19 epidemic and identified the impact of the coronavirus outbreak on the PE industry [1]. Wang Yile also analyzed the development of PE industry under the influence of the epidemic based on big data [2]. Zhang Bowen explored the dynamic evolution of the choice of policy tools for leisure PE industry and the modeling of influencing factors [3]. Popovic Stevo analyzed the attitude of sports organization officials towards the connection between sports departments, PE industry, knowledge organizations and sports innovation in Montenegro [4]. Weller Heather studied the strategic alliance considerations of professional PE industry and analyzed the fit between brand assets and partnership [5]. Ertekin Alpalan Baki took the PE industry as an example to analyze the relationship between job satisfaction and job performance [6]. Micelotta Evelyn studied the responsibility of women's alliances in the PE industry [7]. At this stage, most of the research on PE industry is based on the consideration of the background of the times and political factors. There is little research on new ideas driving PE industry.

Artificial intelligence technology has also been applied in the field of sports, and some scholars have carried out more in-depth research on it. Nadikattu Rahul Reddy studied a new approach to the implementation of AI in the field of sports [8]. Patel Devansh explored the quantitative analysis of how big data affects the sports system [9]. Alatas Bilal studied the computational intelligence algorithm of global optimization inspired by sports [10]. Wang Jun used AI to analyze the regression prediction model of competitive sports [11]. Li Bin analyzed the application of AI in basketball [12]. Huang Shouqing analyzed the application of AI assisted psychological teaching in physical training courses [13]. Xue Baohong studied the stadium emotion model based on AI emotion computing [14]. In many applications of artificial intelligence technology in the field of sports, it has not been found that it is applied to the research of PE industry.

In order to promote the economic advancement of the PE industry, this paper uses chaos theory and DNA computing system to study the technology entrepreneurship and innovation concept of the PE industry under the background of artificial intelligence to promote economic development. From the perspective of scientific and technological level, innovation ability and economic level, this paper makes a comparative analysis of five sports related enterprises, and finally draws a feasible conclusion.

2. Chaos Theory and DNA Computing

(1) Chaos theory for image secure communication

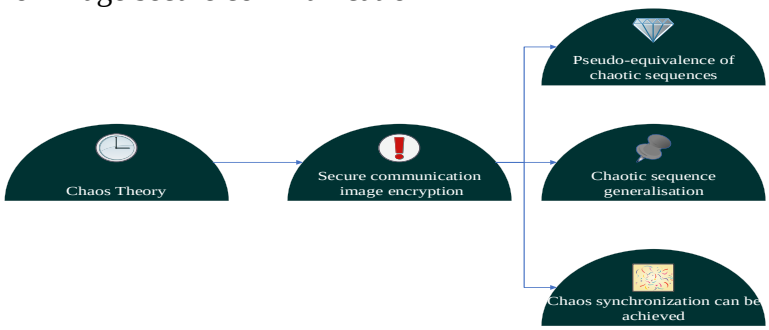

Figure 1 Principle of application of chaos theory

Chaos theory is one of the three most important scientific theories in the 20th century, and the

other two are relativity and quantum mechanics [15]. Since the discovery of chaos theory at the end of the 20th century, it has been at the center of scientific research, and many scientists in different disciplines are studying it. The biggest difference between these dynamic systems is that they are not only chaotic, but also have the same characteristics. The most obvious feature of this dynamic system is that its evolution is very sensitive to the initial conditions. Therefore, it is almost impossible to predict the future of the system. Based on the characteristics of chaos theory, it is very suitable for secure communication and image encryption. The principle of applying chaos theory to the field of secure communication and image encryption is recorded in Figure 1:

Chaos theory is very suitable for information transmission, especially information encryption and transmission, which benefits from the pseudo equivalence and broad-spectrum of chaotic sequences and the fact that chaos synchronization can be achieved. Information encryption under chaotic conditions is mainly a dynamic encryption method. The speed of this method is independent of the length of the encryption key, which makes its computing efficiency very high. The chaotic characteristics make it difficult to decode and decrypt the encrypted information, which makes it highly secure.

(2) DNA computing system

In order to improve the convergence speed of DNA genetic algorithm and realize the global search for the optimal solution, this paper adopts the dynamic mutation probability that the mutation probability changes with the evolution algebra. The first half and the second half of the individual DNA sequence in the PE industry are defined as high and low parts respectively, so the variation probabilities of high and low parts are:

$$p_{mh} = a_1 + \frac{b_1}{1+\exp\left[l\left(g-g_0\right)\right]} \tag{1}$$

$$p_{ml} = a_1 + \frac{b_1}{1+\exp\left[-l\left(g-g_0\right)\right]} \tag{2}$$

If the fitness value of the ith individual of PE industry in the k-generation population is F_k^i (l<i<n), N is the population size. $F_{k\_\max}$ represents the fitness value of the best individual in the PE industry in the population; $\overline{F}_k$ represents the average fitness value of the population; $\overline{F}_{k\_big}$ represents the average fitness value of all individuals in the PE industry that are greater than the average fitness value. The quantile fitness value $\hat{F}_k^{\alpha}$ is defined:

$$\hat{F}_k^{\alpha} = \begin{cases} F_k^{(N_a+1)}, & N_\alpha \notin Z \\ \dfrac{\left(F_k^{N_a} + F_k^{N_a+1}\right)}{2}, & N_\alpha \in Z \end{cases} \tag{3}$$

Three mean fitness is:

$$\overline{F}_{k\_ave}^{3'} = \frac{1}{4}\hat{F}_k^{0.25} + \frac{1}{2}\hat{F}_k^{0.5} + \frac{1}{4}\hat{F}_k^{0.75} \tag{4}$$

Early maturity index Pr is:

$$P_r = \left(F_{k\_\max} - \overline{F}_{k\_big}^{3'}\right) / F_{k\_\max} \tag{5}$$

In the formula, $\overline{F}_{k\_big}^{3'}$ refers to the average fitness of all PE industry individuals greater than the three mean fitness value.

The basic cross probability expression is:

$$p_c = (1+\exp(-\tau_c p_r))^{-1} \tag{6}$$

From the basic crossing probability, the execution probability of the corresponding replacement crossing can be obtained as follows:

$$p_1 = 0.75 p_c \tag{7}$$

The execution probabilities of transposition crossover are:

$$p_2 = 0.5 p_c \tag{8}$$

The execution probabilities of reconstruction cross operations are:

$$p_3 = 0.25 p_c \tag{9}$$

3. Economic Development of PE Industry

In recent years, the development of artificial intelligence has expanded the space for the development of PE industry and created a good development situation. The effective combination of PE industry and artificial intelligence has optimized the environment for industrial development and created favorable conditions for the application of big data in the development of PE industry. At the same time, the rapid development of mature PE industry and the trend of "technologies+sports" make the use of big data more important. For example, through the use of big data, sports and health, health and tourism are effectively combined. The development of such PE industry is supported by big data, which greatly expands the development space from traditional PE industry to modern PE industry. These big data based paths have greatly expanded the development space of the traditional PE industry and provided a guarantee for the multi-level and multi field development of the modern PE industry. Therefore, big data is an important factor to expand the development space of the PE industry, which provides a good foundation for the development of the PE industry and makes the PE industry more diversified and perfect.

With the continuous development of social economy, people's demand for sports is growing, which also promotes the development of PE industry market. With the continuous development of the market, it is necessary to make use of big data to connect with the market to achieve benign coordination between market elements of the PE industry. Providing information resources for PE industry big data can effectively connect the market and enterprises, and integrate products and customers, and ensure better interoperability between market elements. Therefore, big data is an important factor in developing the sports market and revitalizing its elements.

(1) Economic development status of PE industry

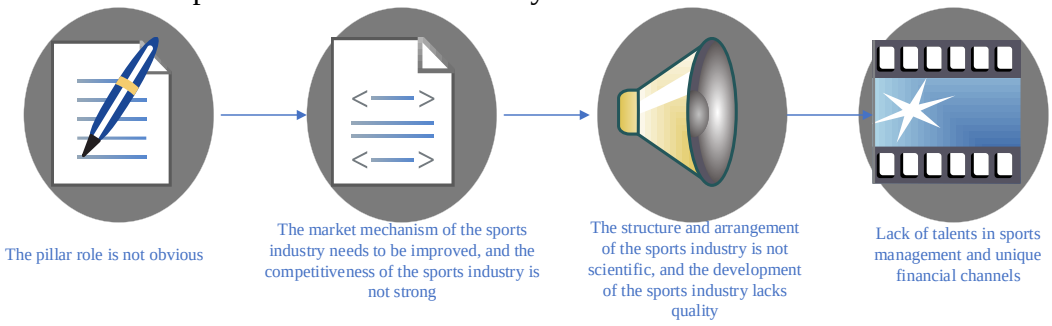

Figure 2 Current economic advancement of the PE industry

The economic advancement of the PE industry is sluggish, and the development prospect is not

clear, which is summarized in Figure 2.

1) The prop function is not obvious

The role of sports in economic development has made it achieve some success in the period of economic prosperity, but the role of sports in the whole economy is not clear. Its contribution to GDP is very small, and its contribution to economic development can also be ignored.

2) The market mechanism of the PE industry needs to be improved, and the competitiveness of the PE industry is not strong

Due to the long-term impact of the traditional planned economy, the PE industry faces administrative problems in the development process, and the degree of commercialization is low. This is inevitably related to excessive government intervention, which masks the role of the market in resource allocation. It is urgent to optimize and improve the market mechanism of PE industry in order to effectively manage its development and accelerate its market-oriented development. At the same time, under the overall framework of the development structure of the PE industry, the competitiveness of the PE industry is not strong, and it cannot effectively cope with the complex and changing social market environment, which hinders the comprehensive and coordinated development of the PE industry.

3) The structure and arrangement of the PE industry are not scientific, and the development of the PE industry lacks quality

Regional resources have not been optimized in the development process, and the developed PE industry lacks local characteristics. The PE industry planning is unscientific, and its layout does not adapt to the development of all aspects of the region, which is not conducive to the development of the PE industry scale, market concentration, scientific and technological content, etc. The market, market concentration and market content are not high, and the quality of sports products is not high. The competitiveness of local sports products is also insufficient. In addition, due to the development of the nationwide fitness campaign, sports has become the focus of public attention, and the demand for sports products has increased significantly, but there is a lack of characteristics. All kinds of sports products are similar but slightly different, which is not conducive to the formation of brand effect, the specialization of PE industry and its competitiveness. At the same time, most sports products have not been skillfully combined with tourism, real estate and other industries, which can not effectively meet the objective needs of all sectors of society for the development of PE industry. The objective needs of the society cannot be effectively met through the development of the PE industry, and the various functions of the PE industry cannot be effectively played.

4) Talents in sports management and unique financial channels are lacking

In view of the lack of talents, it is necessary to increase the training of talents in sports management, optimize the training methods of sports talents, and effectively solve the vacancy in the sports talent market.

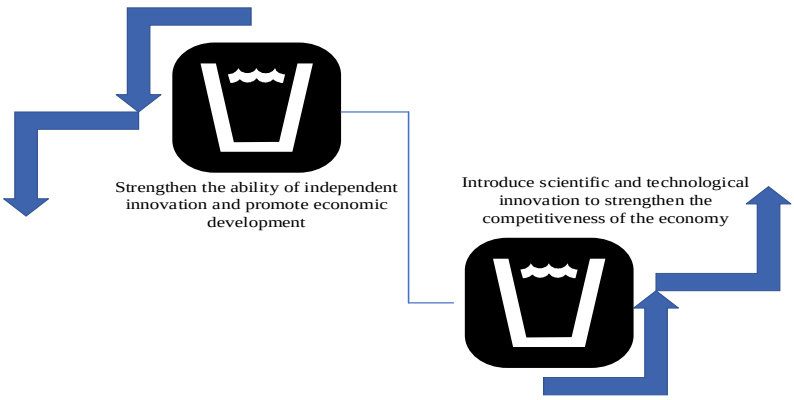

Figure 3 Economic development strategy of the PE industry

(2) The strategy of promoting the economic development of PE industry with the concept of technology entrepreneurship and innovation

In order to promote the economic advancement of the PE industry, this paper summarizes the strategies for the economic advancement of the PE industry as shown in Figure 3 from the perspective of technology entrepreneurship and innovation concepts:

1) Strengthening the ability of independent innovation and promoting economic development

Innovation is an inexhaustible engine of industrial prosperity. At present, many key equipment rely on imports, and the level of research and development capacity is insufficient, which is a constraint to future economic development. It is necessary to develop independent innovation and accelerate progress. Real key technologies cannot be bought. Only by actively promoting independent innovation can people gain advantages in the increasingly fierce competition, and effectively ensure the economic security of the PE industry, and make scientific progress practical. The ability of independent innovation is the key to an enterprise's competitiveness. The concept of scientific development is introduced to promote independent innovation. In order to realize the measures of economic development, it is necessary to improve the ability of independent innovation, remain invincible in commercial competition, maintain the economic security of the PE industry, strive for the initiative of economic development, get out of the situation where technology is monopolized by others, and strengthen independent innovation.

In general, the growth model is very unbalanced, which greatly increases the cost of managing the economy, and increases the pressure on resources and the environment, and worsens the situation of sustainable development. To promote structural transformation, change the growth mode, and build a resource conserving and environment-friendly society, people must rely heavily on scientific and technological progress, accelerate the transformation of traditional high-tech sports, actively develop high-tech sports, and gradually realize the transformation of economic development from investment oriented development to innovative development. In order to enhance the power and attraction of economic development, it is necessary to strengthen the ability of independent innovation. Economic growth is driven by exports, consumption and investment. In previous years, the development of regions and enterprises depends more on the application and innovation of systems and mechanisms. Now and in the future, the driving force for development is mainly scientific and technological progress, talents and knowledge, as well as the benefits of investment and systems and mechanisms.

2) Introducing scientific and technological innovation to strengthen economic competitiveness

People should implement the scientific and technological progress project, firmly consolidate the idea that technologies are the primary productive forces, truly put technologies first, and let technologies help solve practical problems and difficulties. The PE industry must actively adopt technologies, and arm itself with the latest scientific and technological knowledge, and constantly improve the ability and level of scientific decision-making.

High and new technology projects, high and new technology sports projects and high and new technology enterprises are selected. High and new technology enterprises with strong selection mechanism, advanced technology, certain scale and innovation ability would be given strong support. It has promoted development and innovation, widely exchanged scientific and technological information and materials, made full use of accumulated knowledge, and improved the ability of technologies to serve the economy.

4. Evaluation on the Strategy of Promoting Economic Development by Technology Entrepreneurship and Innovation Concept of PE Industry

The development of the PE industry has aroused widespread concern of the people at present.

The investigation and analysis of the development of the entire industry can not simply say whether the industry is good or bad, but should proceed from the actual situation to study the closely related enterprises in the entire industry chain, and use the overall situation of each enterprise to characterize the development of the entire PE industry. Based on this, this paper analyzes five related enterprises in the sports chain and records their basic information in Table 1:

Table 1 Basic information on sports enterprises

Enterprises	Main work	Size of business
Enterprise 1	Responsible for the construction of venues in the PE industry	Very large
Enterprise 2	Responsible for the sales of sports products	Large
Enterprise 3	Responsible for sports insurance promotion	Medium
Enterprise 4	Responsible for connecting with sports sponsors	Small
Enterprise 5	Responsible for the management of sports match tickets	Micro

Enterprise 1 is a super large enterprise, responsible for the construction of sports venues; Enterprise 2 is a large enterprise, responsible for the sales of sports products; Enterprise 3 is a medium-sized enterprise, responsible for the promotion of sports insurance; Enterprise 4 is a small enterprise, responsible for docking with sports sponsors; Enterprise 5 is a small and micro enterprise, responsible for the management of sports tickets.

(1) Scientific and technological level of PE industry

The scientific and technological level of the PE industry reflects the competitiveness of the PE industry to a certain extent, which has played a role in promoting the rapid development of enterprises. The analysis of the scientific and technological level of the PE industry has considerable reference value for the analysis of enterprises. Based on this, this paper investigates the scientific and technological level of the PE industry, and records the results to Figure 4:

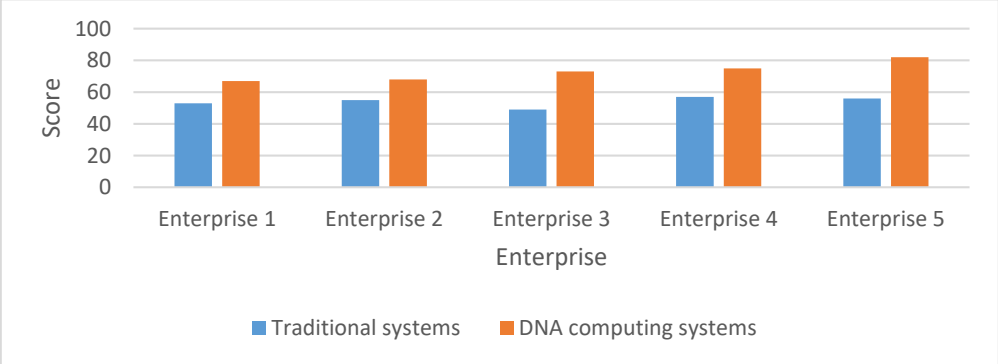

Figure 4 Level of technology in the PE industry

The scientific and technological level score of Enterprise 1 has increased from 53 under the traditional system to 67 under the DNA computing system; the scientific and technological level score of Enterprise 2 has increased from 55 under the traditional system to 68 under the DNA computing system; the scientific and technological level score of Enterprise 3 has increased from 49 under the traditional system to 73 under the DNA computing system; the scientific and technological level score of Enterprise 4 has increased from 57 under the traditional system to 75 under the DNA computing system; the scientific and technological level score of Enterprise 5 has increased from 56 under the traditional system to 82 under the DNA computing system. To sum up, the scientific and technological level scores of the five sports related enterprises have improved, so the scientific and technological level of the PE industry has greatly improved with the support of DNA computing technology.

(2) Innovation ability of PE industry

In order to improve the innovation ability of the PE industry, this paper analyzes the innovation ability of the PE industry and records the results to Figure 5:

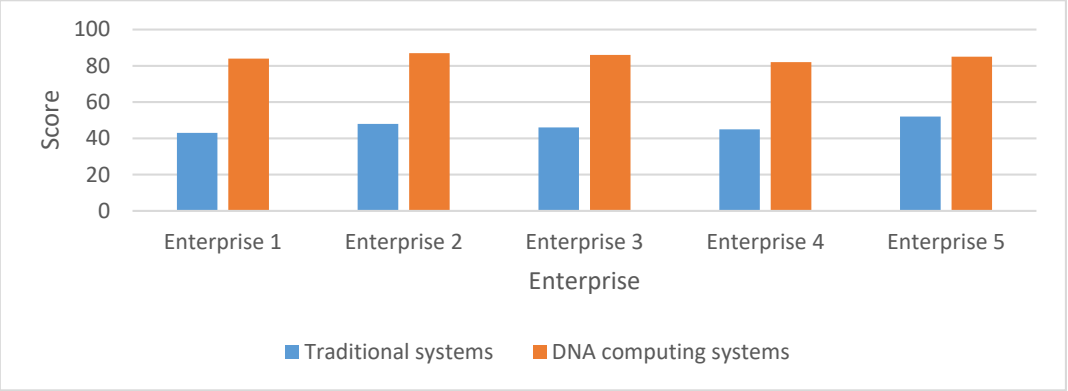

Figure 5 Innovation capacity of the PE industry

Under the traditional computing system, the innovation ability of the five enterprises has remained below 60 points. However, after the adoption of DNA computing system, the innovation ability of the five enterprises has improved, and remained above 80 points. This shows that DNA computing system has injected innovation ability into enterprises, enabling them to maintain the power of innovation and development, thus promoting the improvement of commercial competitiveness of sports enterprises and maintaining the rapid development of PE industry.

(3) Economic level of PE industry

The ultimate purpose of improving the technology and innovation ability of the PE industry is to improve the economic situation of the PE industry, and promote the economic level of the PE industry, so as to achieve the expansion of the scale of the PE industry and attract more people to enter the construction of the PE industry. This paper investigates the economic advancement of the PE industry and records the results in Figure 6:

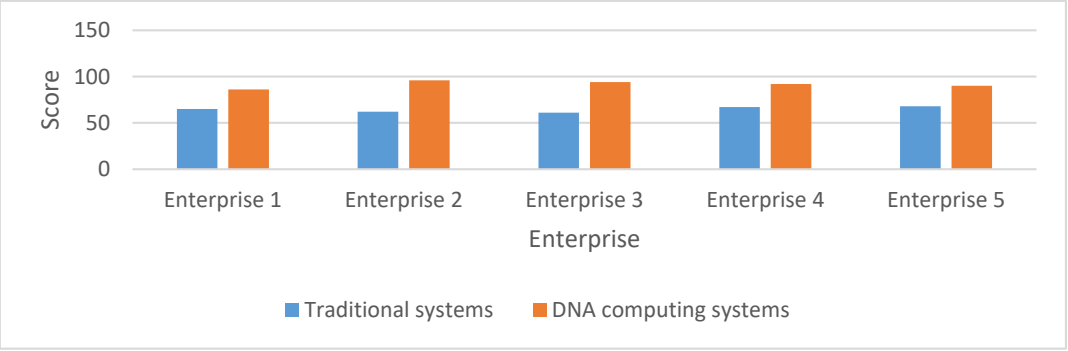

Figure 6 Economic advancement of the PE industry

The economic level of the PE industry is 65 points under the traditional computing system, but 86 points under the DNA computing system, an increase of 21 points; under the traditional computing system, the economic level of Enterprise 2 is 62 points, while under the DNA computing system, the economic level of Enterprise 2 is 96 points, an increase of 34 points; under the traditional computing system, the economic level of Enterprise 3 is 61 points, while under the DNA computing system, the economic level of Enterprise 3 is 94 points, an increase of 33 points; under the traditional computing system, the economic level of Enterprise 4 is 67 points, while under the DNA computing system, the economic level of Enterprise 4 is 92 points, an increase of 25 points; under the traditional computing system, the economic level of Enterprise 5 is 68 points, while under

the DNA computing system, the economic level of Enterprise 5 is 90 points, an increase of 22 points. To sum up, Enterprise 2 has the fastest growth rate, which shows that the public's demand for sports commodities is gradually expanding, and sports commodity sales enterprises have driven the development of PE industry.

(4) Changes in the scale of sports enterprises

The scale changes of five enterprises from July 2021 to December 2021 are recorded in Figure 7:

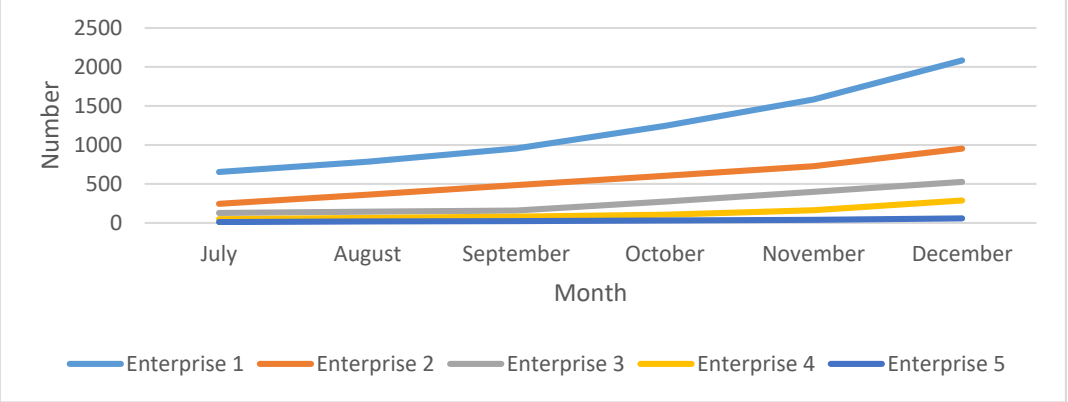

Figure 7 Changes in the size of sports enterprises

From July 2021 to December 2021, the scale of each enterprise has expanded. From July to September 2021, all enterprises would grow at a steady rate. However, the scale of Enterprise 1 and Enterprise 3 would expand faster from September 2021, and the scale of Enterprise 2, 4 and 5 would expand faster from October 2021 to achieve rapid growth.

(5) Performance analysis of DNA algorithm

Because DNA algorithm combines the chaos theory of image security communication and applies it to the image security communication of PE industry, in order to analyze the security of DNA algorithm, this paper investigates the performance of DNA algorithm and records the results to Figure 8:

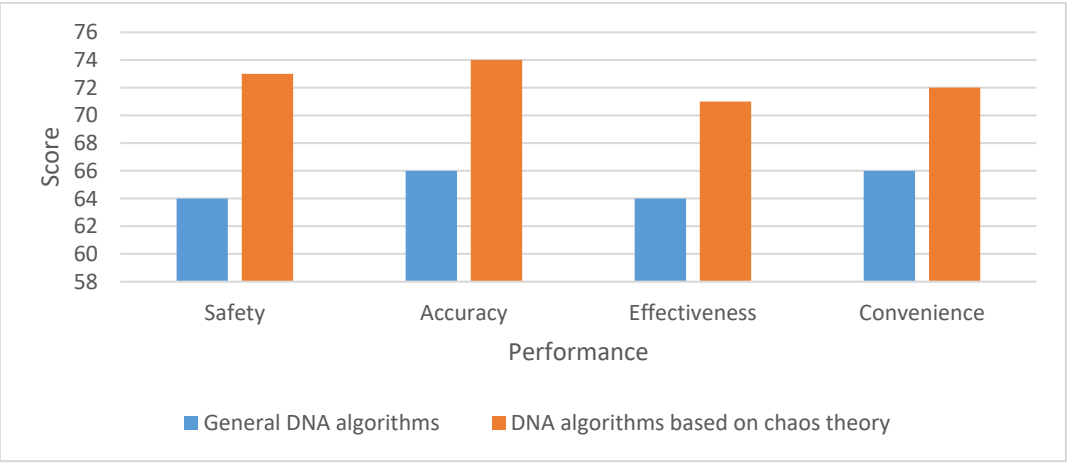

Figure 8 Performance analysis of the DNA algorithm

Compared with the traditional DNA algorithm, the performance of DNA algorithm based on chaos theory of image security communication is improved. The security of DNA algorithm based on chaos theory of image security communication is 9% higher than that of traditional DNA algorithm; the accuracy of DNA algorithm based on chaos theory of image security communication is 8% higher than that of traditional DNA algorithm; the effectiveness of DNA algorithm based on chaos theory of image security communication is 7% higher than that of traditional DNA algorithm;

the convenience of DNA algorithm based on chaos theory of image security communication is 6% higher than that of traditional DNA algorithm. Therefore, using chaos theory of image security communication can improve the performance of DNA algorithm.

5. Conclusions

In order to improve the economic advancement of the PE industry, this paper first introduced the chaos theory and DNA computing, and then analyzed the economic advancement of the PE industry from the current situation and strategies of the economic advancement of the PE industry, and finally analyzed the proposed economic development strategies and draws a conclusion. After the adoption of DNA computing system, the scientific and technological level, innovation ability and economic level of the PE industry have been improved to varying degrees, and the scale of sports related enterprises is also expanding. Using chaos theory of image security communication can improve the performance of DNA algorithm, so its application in PE industry can promote the development of PE industry.

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