

# *Development Advantages and Application of Pharmaceutical Cold Chain Logistics in Xianyang City Based on Blockchain Technology*

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**Abstract:** According to the current development of the pharmaceutical industry in Xianyang city, this paper analyzes the new status quo of the development of the city's pharmaceutical cold chain logistics through investigation. On this basis, the advantages of block chain technology to the development of pharmaceutical cold chain logistics in Xianyang city were proposed and analyzed. Finally, from the perspective of economic benefits and social benefits, it explores the development and application advantages of Xianyang pharmaceutical cold chain logistics based on block chain technology.

## 1. Introduction

At present, blockchain technology is an emerging industry technology. This technology is the core technology of bitcoin, with the characteristics of safety, convenience and traceability, and is widely used in various industries, especially in the cold chain logistics traceability has played a considerable effect, so it can be seen that the broad development prospects of this technology can not be underestimated [1]. As a strong support for the development of the future science and technology industry, blockchain technology is expected to help the development of pharmaceutical cold chain logistics. Starting from the pharmaceutical cold chain logistics and combining with the new blockchain technology, this topic is expected to promote the development of the pharmaceutical industry in Xianyang City [2].

## 2. Current Situation of Pharmaceutical Industry Development in Xianyang City

Through the survey, it is found that Xianyang City has integrated and divided its industrial clusters in order to accelerate the development from 2013 to now, among which the pharmaceutical industry, as one of the three main industries, has a rapid development momentum. In July of the same year, Tasly Shaanxi Medical Logistics Center was located in Qin Du Science and Technology Park. At the beginning of 2014, "Xi Xian Smart Medical Industrial Park" was built, which was jointly built by Xi 'an Jiao tong University and Xianyang City. Pharmaceutical enterprises in Xianyang City mainly gather in the high-tech zone. In 2019, a survey of pharmaceutical enterprises in the high-tech zone showed that there were more than 50 standardized pharmaceutical enterprises in the zone, such as Bu Chang Group, Dong tai Pharmaceutical, Haitian Pharmaceutical, Kang Hui Pharmaceutical, etc. Among them, there are nearly 25 pharmaceutical enterprises, including Kang Hui Group, Revised Group, Momed, Shaanxi Pharmaceutical Group, Bu Chang Dong Tai, etc.; There are nearly 16 medical device enterprises in the district, including 16 enterprises such as Wei Gao, Dassault and Wilf. In addition [3], there are two specialized in the preparation and storage of "stem cells" in the life science industry encouraged by the state, including Zhong Gang Wan Hai and others; The enterprises surveyed above are expected to achieve a total output value of about 30 billion yuan [4].

## 3. New Development Status of Pharmaceutical Cold Chain Logistics in Xianyang City

Through investigation, the new status quo in the development process of pharmaceutical cold chain logistics in Xianyang City can be summarized into four aspects:

First, the market space continues to expand. With the application of the new model of "Internet + medicine" in the pharmaceutical field, the circulation of drugs is more rapid. According to the statistical report data of Chinese drug circulation, from 2010 to 2019, the scale of Chinese drug circulation market has steadily increased. Demand for vaccines across the country has soared from the first half of 2021 due to the outbreak and continuation of the COVID-19 pandemic. According to statistics, Xianyang is under the jurisdiction of 1 city, 2 districts and 10 counties, with a total of 169 townships and 3,707 administrative villages, with a total population of 4.898 million. If calculated by the number of people, Xianyang city alone for the vaccine number is very considerable. The storage, transportation and other links of vaccines must be distributed to each district and week through the cold chain Border counties, townships, towns and villages, so the demand for cold chain logistics is more urgent, and the demand for cold chain drug transportation is greater[5].

Second, the government attaches importance to it and supports it with relevant policies. The occurrence of the vaccine incident in Shandong Province in 2016 once aroused the attention of all sectors of society, which was traced back to the safety of drugs after analysis. After this incident, the media, as the main supervisor, urged the current pharmaceutical enterprises to elevate the safety problems in the process of drug circulation to a new level of supervision and management. At the same time, governments at all levels at the national level also attach great importance to this problem and have launched a series of relevant policies and measures to improve the quality assurance in the process of drug circulation and enhance the level of drug circulation management. Some policies and measures are shown in Table 1 below:

Table 1. Relevant policy contents

Time	Related Policies	Content of Implementation
May 3, 2018	Technical Specification for Performance Verification of Temperature Control Facilities and Equipment for Pharmaceutical Cold Chain Logistics	Effectively ensure the development of pharmaceutical cold chain logistics system
13 September 2018	“2018(theFourth)Pharmaceutical Cold Chain Industry Chain International Summit Forum held” in Wuxi	The intelligent transportation system of pharmaceutical cold chain logistics is put forward, and the contribution of pharmaceutical cold chain logistics in drug transportation is affirmed
released in August 2019 from March 2020 implementation	Logistics Packaging, Marking, Transportation and Storage of Refrigerated and Frozen Foods	The specific requirements of the vehicles and equipment used in the transportation of refrigerated frozen food are clearly stipulated

According to the introduction and implementation of the above policies, Xianyang City based on the development of the pharmaceutical industry, the government and surrounding counties, townships and other organizations actively cooperate with the implementation, so as to improve the quality control level of the whole Xianyang pharmaceutical circulation link.

Third, innovative technology and intelligent equipment continue to be launched. Through the investigation of logistics enterprises in Xianyang City, it is found that new technologies are gradually being used for the monitoring of the pharmaceutical cold chain. For example, Cloud, IoT monitoring[6], Real-time monitoring, Blockchain and Artificial Intelligence are involved in the application of automated and intelligent logistics equipment and technology in all links of warehousing and transportation. It has become the key to the upgrade and development of pharmaceutical cold chain logistics. For example, AGV, automated three-dimensional warehouse, drug delivery and human selection have been vigorously promoted and used in pharmaceutical logistics enterprises, so as to make the cold chain drug storage, selection, transportation and other processes more controllable and more intelligent. At the same time, the application of intelligent equipment and innovative new technology also helps enterprises optimize the storage location and logistics transportation routes, thus improving the operation and management efficiency of the cold chain supply process of drugs [7-8].

## 4. Analysis on the Development Advantages of Pharmaceutical Cold Chain Logistics in Xianyang City based on Blockchain Technology

### 4.1. Meaning and Characteristics of Blockchain Technology

#### 4.1.1. Meaning of Blockchain Technology

Blockchain technology is to form a data information ledger through the distributed block chain, all the data will be recorded in each block of the blockchain, through each node to the input data common identification analysis and verification of the correctness of the information, and then take the form of a smart contract obliges both parties to complete the contract, and finally uses cryptography to encrypt and protect specific data [9-10].

#### **4.1.2. Features of Blockchain Technology**

The characteristics of blockchain are mainly reflected in three aspects: first, it has the characteristics of decentralization; Second, it has the characteristics of openness; Third, the data is immutable and traceable. Combined with these three points, the technology uses the block chain data structure to verify and store the information recorded on each node. The input information needs to be judged by all the participating nodes on the system to determine whether the information is true or not. Once the information is verified and recorded on a node, it will be transmitted to other nodes through the chain structure. Blockchain uses cryptography and traceability technology to authenticate the time of data entry. Information of different nodes is searched and each node is cross-referenced to verify the authenticity of information, which further increases the difficulty of information tampering [11-12].

### **4.2. Analysis on the Development Advantages of Pharmaceutical Cold Chain Logistics in Xianyang City based on Blockchain Technology**

#### **4.2.1. Multi-Party Participation and Effective Supervision**

Blockchain technology uses a distributed ledger network, where multiple parties are required to maintain the same ledger, and the more nodes involved, the larger the ledger data is managed. Combined with the characteristics of blockchain technology, multi-party participation and real-time supervision can be realized, and multi-party regulatory authorities can be allied, from upstream pharmaceutical enterprises to downstream pharmacies, and then to the quality control department in the middle [13-14].

#### **4.2.2. Data Sharing for Easy Traceability**

Through the distributed ledger technology of blockchain, the information of different links is recorded according to the characteristics of the block, and then the information of each block is connected in series. This feature conveniently records the transmission process of real data of various enterprises and departments from the upstream to the downstream of the drug supply chain, and each department can share useful information of different links of the chain according to their own needs [15].

#### **4.2.3. Facilitate Data Transfer and Enhance Security and Trust**

Blockchain technology has a strong tamper-proof function. Once the valid data is recorded, the authenticity of the data on the chain is guaranteed. In addition, the data on the chain can be shared and transmitted, which ensures that the related enterprises of cold chain drugs can quickly establish a trust mechanism.

### **5. The Development and Application Benefits of Pharmaceutical Cold Chain Logistics in Xianyang City based on Blockchain Technology**

#### **5.1. Economic Benefits**

First, reduce the cost of cooperation among partners. One of the most important functions of the application of blockchain technology in the pharmaceutical cold chain logistics of Xianyang city is to solve the problem of data authenticity. It is because of these real data that the collaborative cost between pharmaceutical cold chain logistics partners can be effectively reduced.

Second, improve the efficiency of pharmaceutical supply chain in Xianyang City. Through blockchain self-service smart contract technology, the automatic payment and clearing content of supply chain finance is completed, thus greatly improving the efficiency of the entire cold chain supply of drugs.

Third, ease the financial risks of the pharmaceutical supply chain. Suppliers can form a blockchain network among banks, suppliers and medical institutions through the characteristics of blockchain technology, such as decentralization and immutable, and seek bank loans with accounts receivable to solve problems such as asymmetric credit information and weak anti-risk ability.

## 5.2. Social Benefits

First, blockchain helps trace the source of drugs and high-value consumables. For some special drugs and high value consumables, in order to ensure the safety of the transportation process, the whole circulation link is recorded, and the whole circulation environment of drugs is made transparent through the inquiry of end users, so as to realize the traceability and quality assurance of drugs and high value consumables.

Second, the construction of cold chain logistics system based on blockchain. Through the construction of the system platform, two advantages can be realized: on the one hand, the classification management of customer orders can be realized, and after the intelligent matching and combination of orders and vehicles in the same area, the human and material costs caused by improper vehicle arrangement can be optimized; On the other hand, GPS and GIS technologies are adopted to carry out digital management of cold chain transport vehicles in the whole region, especially the management mode of key monitoring is implemented for vehicles with high empty load rate, so as to improve the efficiency of vehicle full load transport, so as to maximize the utilization of resources.

## 6. Conclusions

According to the research in this paper, the pharmaceutical industry in Xianyang city is in the stage of rapid development, and the blockchain technology can play a role in promoting the development of the pharmaceutical industry in Xianyang City. Its advantages are mainly reflected in three aspects: multi-participation, effective supervision; Data sharing, easy to transfer; Enhance security and trust. After combining its advantages with the pharmaceutical cold chain in Xianyang City, the analysis from the perspective of economic benefits can reduce the cooperative cost of pharmaceutical cold chain supply, alleviate the financial risk of pharmaceutical supply chain and improve the efficiency of pharmaceutical supply in Xianyang City. From the perspective of social benefits, it is conducive to the traceability of drugs and high-value consumables and the construction of cold chain logistics system platform. Therefore, based on the development situation of pharmaceutical cold chain in Xianyang City, combined with the analysis and extension of the characteristics of blockchain technology, this paper summarizes the advantages that will be realized and the economic and social benefits generated by the application of pharmaceutical cold chain logistics using blockchain technology as an information development platform.

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### Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

### Conflict of Interest

The author states that this article has no conflict of interest.

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