Application of Knowledge Service in Integrated Supply Chain of Agricultural Products based on Knowledge Graph

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Abstract: Based on the review of the existing research, this paper summarizes the application of knowledge services in supply chain. Using CiteSpace software for visualization analysis, it can be found that there is a lack of cooperation between research authors and institutions of agricultural products integrated supply chain, but the research content is relatively relevant. "Internet+" and "fresh agricultural products supply chain" will be the frontier hot spots of agricultural products integrated supply chain in the future. Therefore, enterprises need to combine some big data technology to further integrate and optimize the agricultural product supply chain.

1. Introduction
As China's basic industry, the stable development of agriculture play an important role in promoting the development of national economy and maintaining social stability. In 2019, the Ministry of Finance and the Ministry of Commerce of my country jointly issued the "Notice on Promoting the Interconnection of Agriculture and Commerce to Improve the Supply Chain of Agricultural Products". In the notice, it was pointed out that the connection between agricultural products and commerce should be accelerated, the weak links to the supply chain system should be supported, and farmers’ income should be increased.

In the current environment of Internet information technology, big data and e-commerce, the Chinese government attaches great importance of the development of agricultural product supply chains. How to use Internet technology to integrate and optimize the supply chain of agricultural products and reconstruct the business model of the integrated supply chain of agricultural products has become the focus on research. In addition, more and more enterprises begin to provide supply chain integration services for users. To sum up, it is of great significance to explore the application of knowledge services in the field of integrated supply chain of agricultural products, which is the innovation of this paper.

Therefore, this paper refers to a lot of literature at home and abroad, through reviewing the existing research, summarizes the knowledge services related to agriculture, tries to explore the knowledge services in the integrated supply chain of agricultural products, and obtains the development trend and frontier hot spots, hoping to provide some new ideas to the related workers and enterprises in this field.
2. Literature review

2.1. Literature reviews of knowledge services

Knowledge service originated in the 1990s and is a new field derived from knowledge management. The related research on knowledge services abroad started in 1993. It is found that the foreign research on knowledge service does not tend to a certain field, but covers a wide range of fields. At that time, foreign scholars mainly studied knowledge-intensive services. The views of British scholar Miles were generally accepted in the industry. Miles believe that knowledge-intensive services refer to companies and organizations that rely significantly on professional knowledge in professional fields and provide the society and users with knowledge-based intermediate products or services.

The domestic research on knowledge service originated from the medical field. In 1994, Dai Guangqiang first proposed the concept of medical knowledge service, which laid a new era of the development of medicine. Ren Junwei (1999) put forward the concept of "knowledge service" in his article "knowledge economy and library knowledge service" with "knowledge economy" and "library work" as key words. This is the first time that the concept of knowledge service appeared in the field of Library and information. Zhang Xiaolin (2000) clarified the concept of knowledge service for the first time. Since then, knowledge service has become the growing point of Library and information. At present, the definition of knowledge services in the field of library and information is based on the knowledge and ability of searching, organizing, analyzing, and reorganizing information knowledge. According to the user’s problem and environment, it is integrated into the user’s problem-solving process, and it is proposed to effectively support knowledge Application and knowledge innovation services. With the continuous development of information technology, knowledge service is based on different technologies and methods, and its research content has also changed. Big data knowledge service has become a research hotspot, which requires mining and discovering knowledge from the perspective of users, and predicting their future needs.

2.2. Literature reviews on knowledge services related to agriculture

The literature on domestic agricultural knowledge services was first published in 2005. Zhou Guomin (2005) and others proposed a network-based agricultural knowledge services system. By adding a reasoning machine between the knowledge base and the user, and handing the inference resulted in the user. Xiong Dahong (2008) designed an agricultural knowledge service platform by using databases and program algorithms, which met consumers' personalized information needs and self-service information query needs. Yang Tao (2011) proposed a knowledge service system in the agricultural field, and constructed an OPMA personalized model to fully mine the personalized information about users. Zhao Ruixue (2016) and others actively explored a new form of knowledge discovery service in order to meet the new needs of users in the big data environment. In 2018, China's first agricultural professional knowledge service system was officially launched. Baidu had cooperated with China Agricultural Publishing House to create an agricultural knowledge service platform (2018), which could extract the core knowledge from China Agricultural Publishing House as soon as possible, and accurately push professional answers to users. In 2019, China launched the digital construction of rural bookstores, It increased the supply of digital reading products and services, and enriched farmers' daily knowledge needs and cultural life.

By analyzing the literature, it can be found that 2008-2013 is the initial stage of agricultural knowledge services. During this period, the agricultural knowledge service model was gradually upgraded from primary agricultural information websites to agricultural information services. From 2017 until now is the development stage of agricultural knowledge services. After 2017, the research field of agricultural knowledge service is gradually approaching to the direction of big data and artificial intelligence. The mode of agricultural knowledge service has truly transit from agricultural information service to agricultural knowledge service. It can be seen that with the development of big data and artificial intelligence technology, agricultural knowledge services are also developing in a
more intelligent and professional direction, and the content of knowledge services is becoming more and more diversified.

2.3. Application of knowledge services in supply chain

In CNKI, "knowledge service of agricultural product supply chain" is used as the key word to search, there are few effective literatures. It shows that the application of knowledge services in the agricultural product supply chain is still a relatively new concept. The concept of agricultural product supply chain originated in the early 1990s. Foreign scholars believe that agricultural product supply chain presents a kind of nonlinear system of "two-way driving of upstream and downstream enterprises". And enterprises pay attention to active and two-way communication and deep development. Domestic experts and scholars mainly analyze the research status of agricultural product supply chain, find out the existing problems, and further study the management mode of agricultural product supply chain. However, the traditional supply chain of agricultural products still has some problems, such as low level of product standardization, low coordination efficiency of supply chain, asymmetric information, and difficult traceability of product quality and safety. With the increase in consumers' purchasing power and safety requirements for agricultural products, the existing market competitiveness is not enough to meet the needs of consumers. The agricultural product supply chain must be integrated and optimized in order to accelerate the industrialization process of agriculture and build a safe, efficient, and fully functional modern agricultural product supply chain.

Conducting related research on the knowledge service of agricultural product integrated supply chain can better understand the knowledge framework of agricultural product integrated supply chain, forming a user-centric knowledge network, and launching a series of personalized services. Yang Yongguang (2020) believes that the integrated supply chain of agricultural products focuses on the overall process of agricultural products from the field to the din table. It is to integrate and optimize the network chains structure of agricultural products of breeding, processing, packaging, distribution, sales terminal to consumers, including the scattered resources and links to agricultural products, and finally form an organic whole. The integrated supply chain of agricultural products optimizes the business efficiency of suppliers, manufacturers and retailers, so that agricultural products can be produced and sold in the correct quantity, quality, time and cost. The integrated network structure can connect many leading agricultural enterprises closely through the supply chain, and enable many enterprises in the supply chain to achieve common interests in the process of competing.

To integrate the agricultural product supply chain, managers must first carry out efficient product management and demand management for agricultural products, and actively promote the brand building of agricultural products to meet the ever-developing market and consumer needs. In addition, integrating advanced information technology into the integration process, using e-commerce, Internet + logistics thinking, and establishing corresponding agricultural product information service platform, fully mobilize enthusiasm for integrated supply chain management. Therefore, it is of great significance to explore the application of knowledge services in the field of integrated supply chain of agricultural products. On the one hand, knowledge services can strengthen the information sharing of the agricultural product supply chain, establish a relevant agricultural product integrated supply chain knowledge service platform, relying on the leadership of core enterprises and the support of the government. It can better serve consumers Provide agricultural product supply chain integration services, and ultimately realize the regional integration and optimization of agricultural product knowledge services. On the other hand, the integrated supply chain of agricultural products takes the knowledge demand of consumers as the goal, takes the user information as the guidance, and is committed to providing users with complete solutions and customized knowledge services.

3. Visual analysis of knowledge graph

This paper uses "agricultural product supply chain" as the key word in CNKI, adds four word frequencies of "integration", "optimization", "integration" and "innovation" for advanced retrieval, and gets 597 related literatures. After eliminating the invalid literature, 215 valid literature data have been
obtained. Figure 1 is the overall trend analysis chart, the search time span is 2009-2020, and the time interval is set to 1. It can be seen that the integrated supply chain of agricultural products was in its infancy in 2009, with a small amount of publications. The amount of publications increased steadily to 2012, showing an upward trend. The distribution of journal sources is shown in Table 1.

| Number | Periodical                              | Length |
|--------|----------------------------------------|--------|
| 1      | "Business Economics Research"          | 24 (12.0%) |
| 2      | "Modern Business"                      | 8 (4.0%)  |
| 3      | "Logistics Engineering and Management" | 6 (3.0%)  |
| 4      | "Agricultural Economy"                 | 6 (3.0%)  |
| 5      | Other sources                          | 133 (66.5%) |

3.1. Author co-occurrence analyses

The author's co-occurrence graph actually reflects the cooperative relationship between authors. In the author's co-occurrence graph, the number of nodes is N=199, the connection between nodes is E=89, the distribution of authors is relatively scattered, and there are many authors of individual nodes. It shows that the cooperation between the authors is not close. In addition, the number of articles published per capital by the core authors is not enough, including Dan Bin (4 articles), Liu Dongying (4 articles), Sui Bowen (3 articles), Chen Jiahao (2 articles) and Huo Hong (2 articles), indicating that scholars should pay attention to strengthening cooperation with other authors when carrying out academic research.

3.2. Institutional co-occurrence analyses

As shown in Figure 3, research institutions of agricultural product supply chain integration are mainly from many domestic universities, which the School of Economics and Business Administration of Chongqing University issued the largest number of papers. In the institutions co-occurrence map, the
number of nodes \( N = 194 \), and the number of connections between nodes \( E = 39 \). Like the co-authors' map, these institutions are scattered and lack certain cooperative connections. Therefore, universities and institutions need to strengthen academic exchanges and cooperate more closely in the future research.

![Institutions co-occurrence map](image)

**Figure 3 Institutions co-occurrence map**

### 3.3. Keyword analysis

The keyword co-occurrence map is mainly used to study the relationship between various topics in the literature. Generally speaking, the larger the keyword node, the more frequent the keyword co-occurrence. As shown in Figure 5, the number of key nodes is \( N = 250 \), and there are 418 node connections. This shows that although the cooperation between the authors and institutions is very small, the research content is very relevant.

![Keyword co-occurrence map](image)

**Figure 4 Keyword co-occurrence map**

This article selects keyword with a frequency of more than 7 to draw a keyword frequency table. As shown in Table 2, fresh agricultural products have the highest frequency, followed by Internet + and supply chain optimization. As a result, future research hotspots will focus on "Internet +" and "fresh agricultural product supply chain", and use big data technology to further to integrate and optimize the agricultural product supply chain.

| Number | Key word                     | Frequency | Centrality |
|--------|------------------------------|-----------|------------|
| 1      | Fresh agricultural products  | 64        | 0.57       |
| 2      | Internet+                    | 25        | 0.17       |
| 3      | Supply chain optimization    | 12        | 0.15       |
| 4      | Supply chain management      | 11        | 0.09       |
| 5      | Advantages of resources      | 11        | 0          |

**Table 2 Keyword frequency table**
4. Conclusion
With the wide application of artificial intelligence technology, the agricultural product supply chain in China also needs to use the Internet as a new medium and core enterprises as the main body to integrate and optimize, so as to realize the integration of supply chain and maximize economic benefits. To this end, this paper uses the knowledge graph technology to study the integrated supply chain of agricultural products, and makes a visual analysis of the key words of the core authors, publishing institutions and literature, clearly showing the current development status of the integrated supply chain of agricultural products, and mastering the future research direction and frontier hot spots at the same time. By integrating knowledge service into the integrated supply chain of agricultural products, users can start from their own needs and indirectly participate in each process of the supply chain of agricultural products. It can realize the two-way interaction with the knowledge of agricultural products, and effectively solve the information asymmetry in the supply chain of agricultural products. In the future, enterprises will integrate some big data technology in the process of supply chain integration, design a more perfect agricultural product knowledge services system, predict users' interests and preferences, and quickly transfer the agricultural product knowledge that users need.

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