Industrial Value Chain Model and Big Data Application for developing green agriculture in China

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Abstract. The rise of big technology gives a good way for transformation and upgrading of traditional agriculture to modern agriculture. It has great significance to enhance the competitiveness of the agricultural industrial chain, increase farmers' income and improve agricultural efficiency by applying it into management of agriculture industry chain. However, the utilization of big data in agriculture is not well, facing all kinds of negative conditions and challenges. To overcome this situation, this paper tries to combine the big data technology and value chain model to construct an efficient industrial chain for green agriculture with the case of Hubei Province in China.

1. Introduction
Over the past 40 years of China's reform and opening up, the economy has achieved great success. However, China's high consumption, extensive economic growth mode has brought serious ecological environment problems. China's long-term dual economic structure, heavy industry priority development strategy caused the gap between urban and rural areas, resulting in serious pollution in rural areas. Against this background, the rural revitalization was put forward by Chinese government. Green agriculture is one of the strategic goals of rural revitalization, it is not related to rural revitalization but also the green development in rural areas. However, how to improve the green agriculture becomes a challenge of rural areas. Optimizing the rural industrial value chain is undoubtedly an effective way to improve the development of green agriculture, since the competition of modern agriculture has become the competition of agriculture industrial value chain. Accelerating the integration of agriculture value chain can effectively promote the transformation of China’s traditional agriculture operation mode. It also helps Chinese agriculture to better participate in global competition. Big data, characterized with volume, variety, velocity, veracity, and value [1], has already been proven to be beneficial for improving the efficiency of industrial value chain. Utilizing the big data technology to improve the value chain of green agriculture can help integrate all kinds of resources and improve the efficiency. It has great significance for rural development but also the rural revitalization of China.
2. Industrial Value chain model and big data

2.1 Industrial Value chain model

Industrial chain theory stems from Adam Smith's division of labour theory. It refers to the chain of material flow of industrial production process, which includes material supply, intermediate manufacturing and final consumption and other sectors. During the process, the value of resources is transferred and passed on to the next step until reaching the final consumer. The concept of value chain was put forward by Harvard Business school professor Michael Porter in his book *Competitive Advantage* in 1985[2]. In his view, every enterprise’s activities include basic actives and auxiliary activities. These different but interrelated production and management activities constitute a dynamic process of creating value, that is value chain. The value chain can exist between the upstream and downstream related enterprises, or between the business units within an enterprise. The relationship between industrial value chain and industrial chain and value chain lies in using the analysis method of value chain to investigate the industrial chain.

Green agriculture industrial value chain involves upstream (enterprises producing agricultural production materials), midstream (farmers, large agricultural growers and new agricultural business), and downstream (enterprises that processing and selling agricultural products). It runs through the three stages of prenatal, mid-production and post-production of agriculture, covering many aspects of agriculture, such as production, processing, transportation and selling of agricultural products. It is an organic combination of agricultural value chain, information chain, logistics chain and organization chain.

![Figure 1 the green agriculture industrial chain](image)

2.2 Big data technology

In May 2011, McKinsey, the world's leading consulting firm, presented the concept of big data for the first time at its 11th annual EMC World conference in Las Vegas, USA, noting that data has penetrated into every industry and business function area and is becoming an important factor of production[3]. Though there is no unified definition of big data, big data needs to be full of three characteristics: volume, variety, and high speed(velocity). Besides, the International Data Corporation (IDC) recognizes that large data should also be sparse in value. IBM, on the other hand, believes that big data is necessarily real (veracity). Huge amount of complex real-time data are generated from the thousands of industrial sensors, which can afford us an unprecedented opportunity to obtain an in-depth understanding of industry and facilitate data-driven approaches for industrial optimization and scheduling.

2.3 Big data and green agriculture industrial value chain

As mentioned above, the green agriculture industrial value chain involved stages of prenatal, mid-production and post-production of agriculture. However, the links through the whole industry chain are not related so closely, presenting a kind of loose chain form, which result in imbalance of supply side and demand side[4]. However, if utilizing big data technology, the agriculture industrial chain will be integrated and optimized.

Firstly, it can help to create a precise industrial information chain. If building a big data application platform, using big data and cloud computing to improve the quality of agricultural information, accelerating the flow of agricultural information, and establishing a shareable agricultural information base, the supply and demand sides can communicate in time and without space limits. In this way, we can timely arrange agricultural production according to market changes and adjust the contradiction
between production and market so as to reduce the risk of agricultural production and improve the efficiency of agricultural industry.

![Figure 2 Big data application](image)

Secondly, it can help to create efficient industrial organization chain. It will help agricultural operators to establish real-time contact with the big market, establish a stable relationship between production and sales. At the same time, it is of great significance to drive the main bodies in all aspects of the organizational chain to intensify and specialize the production in large scale according to the market demand, and fully integrate scattered social resources, improve the efficiency of allocation of agricultural resources to enhance the organizational efficiency of the industrial chain[5].

Thirdly, it can help to upgrade agricultural industry logistics chain. The circulation of agricultural products is the most urgent problem to be solved in the agricultural industrial chain. However, due to the poor quality and low level of standardization of agricultural products, the price of agricultural products cannot go up. In addition, too many circulation links, multi-level distribution, and price increases in every link make the final consumers bearing high cost of the purchase. The big data technology can analyze the customers’ needs, the specific requirements for agriculture products. Therefore, it can help to promote the standardization of agricultural products, improve the quality of agricultural production and brand awareness of farmers [6]. It can also enhance the traceability and pricing power of agricultural products to protect the interests of consumers and the interests of agricultural producers by using e-commerce technology.

Fourthly, it can help to maximize the agricultural industry value chain. According to Michael Porter's theory of the value chain, the agricultural value chain is a collection of activities of producing, marketing and selling agricultural products. It includes basic value chain and auxiliary value chain. The basic value chain is a value chain that includes activities such as plowing up a land, planting, growth, fertilization, harvesting, processing and marketing of agricultural products. Auxiliary value chain is a value chain that includes auxiliary activities such as agricultural research service, agricultural technical support, agricultural production supply, raw material supply, agricultural equipment supplies and human resource management. By using big data can not only realize the value added of key links in the value chain of agricultural industry, but also expand and extend the agricultural chain so as to enhance the efficiency of the chain. Such as making full use of e-commerce, deep processing products according to market demand, accelerating the development of green organic agricultural products to increase the added value of agricultural products. Making full use of e-commerce to promote agricultural brands, regional agricultural public brands, developing agritourism can increase the profit margins and create value.
3. The present situation of big data application in Hubei's agricultural industrial chain

Hubei is a major agricultural province. The diversity of natural conditions gave birth to a wide variety of species and resulted in a diversified agricultural composition that included farming, forestry, livestock husbandry and freshwater aquaculture. Therefore, Hubei Province has plentiful agricultural chains. However, overall, at present, the degree of organization of agricultural industrial chain in Hubei Province is not high, the main reason is the poor application of big data technology.

Without the building of big data application platform, the infrastructure services in the upstream of the industrial chain are poor. Modern agricultural service industry cannot provide enough research support especially for comprehensive farming plan and design. And it also cannot provide scientific and effective information resources for the majority of agricultural producers and managers in the mid-stream, which directly leads to the unplanned and experienced production mode. As a major agricultural province, agricultural service industry only occupies a very low proportion, with the traditional agricultural service as its mainstay.

Utilizing the big data technology can help the small farmers develop into big agriculture growers or join into agriculture cooperatives. In this way, the scale effects can be achieved. However, the main body in the mid-stream of Hubei's agriculture industrial chain are still small-scale farmers. Large-scale farming households account for only 2.1% of the households in farming. Without the important force, the development of modern agriculture is relatively poor compared to other strong agriculture province.

In recent years, the "four batches of projects" implemented in Hubei Province have made remarkable achievements in the agricultural products processing industry. As of 2017, the ratio of the province's agricultural products processing industry output value and agricultural output reached 2.5:1. However, the problems still exist, such as the low value of agricultural products and the urgent need to strengthen brand development. The supply of agricultural products in Hubei Province is dominated by low quality products, and the proportion of high-quality rice, brand-name products, fine fruit and tea, high-quality farm products and aquatic products is relatively low.

In addition, the selling channel of agricultural products in Hubei Province is long. Agricultural products will go through different stages, such as traders, suppliers, supermarkets, or cooperatives and leading enterprises, and then reach to final consumers. No matter what kind of sales channels is, the price will go up, resulting in high production costs.

4. Conclusion

Utilizing big data has great significance to enhance the competitiveness of the agricultural industrial chain, increase farmers' income and improve agricultural efficiency by applying it into management of agriculture industry chain. Especially for agriculture province like Hubei, it should fully utilize the big data technology to build a platform that all parties along the industrial chain can share the information and integrate the resources.

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References:
[1] Luo, M. (2020). Analysis of big data visualization technology and tools. Science and Technology vision. Vol.9:159-161.
[2] Porter, M. (1997). Competitive advantage. Huaxia Publishing House, Beijing.
[3] Liu Z, Zhang Q. (2014). Research overview of big data technology. Journal of Zhejiang University (Engineering Science), Vol.48 No.6:957-969.
[4] State Council of the CPC Central Committee and State Council. (2017) Several Opinions on Further Promoting the Structural Reform of the Agricultural Supply Side and
Accelerating the Cultivation of New Motive Power for Agricultural and Rural Development.
http://www.chinacoop.gov.cn/.HTML/2017/02.
[5] Xiao Y, Jiang H. (2016). The Development Elements and Upgrading Ways of China's Agricultural Industry Chain. Academic Forum, Vol.1: 80-83.
[6] Dai X. (2016). China's agricultural industry value chain status quo, problems and countermeasures. Agricultural Economics, Vol.1: 6-8.