Agricultural SWOT analysis and wisdom agriculture design of chengdu

Qian Zhang¹, Xiangyu Chen², Shaoming Du³, Guowei Yin⁴, Feng Yu⁵, Guicai Liu⁶, Jin Gong⁷ and Fujun Han⁸

1Institute of Agricultural Information and Economics, Beijing Academy of Agriculture and Forestry Sciences, Beijing, China, zhangqianshuxue@126.com
2Institute of Agricultural Information and Economics, Beijing Academy of Agriculture and Forestry Sciences, Beijing, China, 31899100@qq.com
3Department of market and economic information, Ministry of Agriculture, Beijing, China, dushm@agri.gov.cn
4Department of market and economic information, Ministry of Agriculture, Beijing, China, guoweiyin@qq.com
5Institute of Agricultural Information and Economics, Beijing Academy of Agriculture and Forestry Sciences, Beijing, China, yuf@agri.ac.cn
6Department of market and economic information, Ministry of Agriculture, Beijing, China, liuge@agri.gov.cn
7Institute of Agricultural Information and Economics, Beijing Academy of Agriculture and Forestry Sciences, Beijing, China, gongj@agri.ac.cn
8Department of market and economic information, Ministry of Agriculture, Beijing, China, hanfj@agri.gov.cn

Abstract. According to the status of agricultural information, this paper analyzed the advantages, opportunities and challenges of developing wisdom agriculture in Chengdu. By analyzed the local characteristics of Chengdu agriculture, the construction program of Chengdu wisdom agriculture was designed, which was based on the existing agricultural informatization. The positioning and development theme of Chengdu agriculture is leisure agriculture, urban agriculture and quality agriculture.

1. Introduction

Wisdom Agriculture is a new direction for agricultural development, and it has not yet formed a unified definition at home and abroad [1-2]. Integrated the related literatures description [3-5], wisdom agriculture can be described as: the comprehensive application of internet of things, cloud computing, large data, mobile internet and other modern information technology. Combined with expert intellectual resources, it achieved intelligent production, network operation, digital management and precision service. Wisdom agriculture will lead the development of modern agriculture, and to be the inevitable trend of future agricultural development. At present, the focus of wisdom agriculture research only in the technical level [6-7], in the application, it was still in the experimental demonstration stage [8], and there were few mature regional applications.

Wisdom agriculture's regional application should base on the existing information facilities. How to develop wisdom agriculture in modern cities, which maximize used existing information technology and highlighted the advantages and own characteristics of different cities, was needed to think about before overall design.

2. Agricultural Informatization in Chengdu

Chengdu is located in the central of Sichuan province, belonging to the subtropical humid monsoon climate zone. It is rich in calories, abundant rainfall and four seasons distinct, and mainly by the plains, hills and mountains. In 2015, the city has a population of 14.482 million, land area of 18.185 million hectares and the total crop area of the crop is 683,900 hectares. Per capita disposable income of rural residents was 17747 yuan, and with an increase of 10.2%.

Chengdu is currently focusing on the development of modern agriculture, and accelerates the construction of national urban modern agricultural demonstration city. Agricultural informatization of
Chengdu has been greatly improved; however, it still has a big gap with the 2020 development goals. Therefore, Chengdu must seize the historical development opportunities, vigorously develop wisdom agriculture and improve the level of agricultural information, so as to speed up the realization of Chengdu urban agriculture modernization.

3. Agricultural SWOT Analysis of Chengdu

The SWOT analysis was proposed by the professor of management at the University of San Francisco in the early 1980s. “SWOT” is shorthand of Strengths, Weakness, Opportunity and Threat. SWOT analysis is a kind of situation analysis, that is, listed a variety of major internal advantages, disadvantages and threats which closely related with the research object by enumeration. And then, use the idea of system analyzed the various factors to match each other, from which a series of corresponding conclusions. The conclusion is usually with a certain degree of decision-making [9].

3.1. Strengths Analysis
First, Chengdu has superior natural geographical conditions. It is located in the central region of Sichuan, with good terrain, diverse terrain and fertile soil, where the winter climate is warm, summer without heat, perennial air moist, and very suitable for crop growth. As a key city for regional development, Chengdu has obvious geographical advantages.

Second, Chengdu has broad prospects for agriculture. Chengdu insisted on taking agriculture as basic industries and strategic industries, and focused on changing the mode of agricultural development. Chengdu has formed a series of characteristic agriculture, such as vegetables, seasonal fruits, tea, kiwi, edible fungus, flower seedlings and aquatic products. Many agricultural and sideline products were exported to the country, renowned overseas.

Third, Chengdu has a huge market potential. As a large central city in the west China, Chengdu wisdom agriculture will drive more than 10 billion yuan market demand in future. Among them, farming, aquaculture and other production links will grow more than 3 billion yuan; Processing, marketing, logistics, distribution and other circulation will grow more than 6.5 billion yuan.

Fourth, Chengdu has plenty of intellectual resources. There were a lot of research institutes, such as Sichuan University, University of Electronic Science and Technology, and so on. It has a large number of local information technology enterprises, and also attracted many foreign information technology enterprises. In addition, there were high-quality enterprise resources, such as Intel, dell, Huawei, China Unicom and so on. All of these provided an intellectual resource reserves for the development of Chengdu wisdom agriculture.

3.2. Weakness Analysis
First, the level of Chengdu’s agricultural informatization is not high. The large data integration applications were low and had not yet established the innovative research and development application system of agricultural networking. Agricultural integrated information service should be further improved. Small-scale agricultural management subjects were lack of consciousness for information investment and their ability were not strong.

Second, the maturity of agricultural informatization technology was low. At present, Chengdu agricultural information infrastructure construction process was relatively slow, and cannot meet the needs of wisdom agriculture construction, especially in the information entry rate and computer penetration rate.

Third, Chengdu was lack of agricultural information technology complex talents. Wisdom agriculture is a new thing with high technological content, and there was an urgent need for a large number of complex talents, which understand modern information technology and agricultural technology, and good at operating and management.

3.3. Opportunity Analysis
First, the government attached importance to agricultural informatization. Vigorously develop agricultural and rural information was the urgent need of government to promote agricultural modernization and build a well-off society. In current and future period of time, promote the
construction of wisdom agriculture was the important measures to speed up the information and agricultural modernization.

Second, Chengdu has strong support of municipal government. The government put agricultural information work in an important prominent position and substantial support for it. The government has issued a number of documents to orderly advancement related work, which provided a strong policy support and financial protection.

Third, Chengdu has a complete agricultural information conditions. Since 2014, Chengdu has more than 30 cable connecting other provinces, and metropolitan area network export total bandwidth of more than 1.5T. The communication network transmission capacity ranked the forefront of the Midwest China. The 4.4 million city residents access to fiber, and wireless communication network coverage 100% administrative village.

3.4. Threat Analysis
First, the key technology of information technology and equipment depended on imports. In general, China was more or less depended on the import of information technology core equipment and software, in the internet of things, large data, cloud computing, 4G communications and other fields. Intelligent application technology research was needed to carry out in field planting, facilities cultivation and agricultural operations.

Second, the level of digitization of agricultural management needs to be improved. Big data is a necessary condition for the construction of wisdom agriculture. Although the level of informatization in Chengdu has been significantly improved in agricultural administrative examination and approval and management, the production data and business information of the enterprises and bases didn’t communicate with the outside and the government. Therefore cannot achieve data sharing and centralized management.

4. Positioning Analysis of Chengdu Wisdom Agriculture
Design of Chengdu wisdom agriculture should closely integrated with its agricultural production, highlight local features, so as to build the leading cities in China of wisdom agriculture. Chengdu wisdom agriculture will highlight three positioning of leisure agriculture, urban modern agriculture and quality agriculture.

4.1. Leisure Agriculture
The geographical and climate environment have provided a unique condition for the development of leisure and tourism in Chengdu. In recent years, rural tourism in Chengdu has also developed rapidly: in 2015, Chengdu total received 191 million domestic and foreign tourists, and achieved total tourism income 2040.19 billion yuan. Among them, 95,191,800 rural tourists were received, which accounting for 49.75% of the total number and income of 20.06 billion yuan. Chengdu held 117 various rural tourism events, built 1489 new villages, operated 93 star country hotels and 10 agricultural theme parks.

| Year | Rural visitors (million) | City visitors (million) | Rural tourism revenue (million yuan) | City tourism revenue (million yuan) |
|------|--------------------------|-------------------------|-------------------------------------|------------------------------------|
| 2012 | 8427.2                   | 12200                   | 12849                               | 1050.78                            |
| 2013 | 8559.5                   | 15500                   | 14294                               | 1330.66                            |
| 2014 | 8896.43                  | 18600                   | 16097                               | 1663.37                            |
| 2015 | 9519.18                  | 19100                   | 20006                               | 2040.19                            |

Leisure agriculture is a new type of agricultural production and management, which used of agricultural landscape resources and agricultural production conditions to develop agriculture. Develop leisure agriculture in Chengdu can full use its human history, natural resources and other prominent advantages. The leisure agriculture can also effectively promote the rural industry interaction, the
agricultural production efficiency, farmer employment income and new rural scientific development. Therefore, leisure agriculture is one of the positioning of wisdom agriculture in Chengdu.

4.2. Urban Modern Agriculture
The urbanization rate of Chengdu was 71.5% in 2015, which was higher than the province 23.8% and higher than the national average 15.4%. The rural labor output was 200.2 million, and non-agricultural employment increased by 87,000. According to the relevant evaluation system [9], Chengdu has a certain potential to develop urban agriculture.

Urban modern agriculture a kind of modern agriculture, which closely rely on the city's various advantages, and provide agricultural products for the market and good ecological environment for the public. Chengdu citizens have been pursuit the health and leisure lifestyle, which is very fit for the development of modern urban agriculture. Chengdu wisdom agriculture, on the one hand, should protect the quality and supply of agricultural products, on the other hand, should be fully satisfied citizens’ spiritual needs and ecological demands.

4.3. Quality Agriculture
Chengdu agricultural products have always focused on quality and brand building. By the end of 2015, the certification of pollution-free agricultural products, green food and organic agricultural products has totaled 1213. Among them, there were 378 pollution-free agricultural products, 246 Green food and 589 organic agricultural products. The green ecological agriculture was based 50 million mu, with output value of 5 billion yuan. Chengdu has a total of 450 agricultural products brand.

![Figure1. Chengdu quality certification distribution in 2015.](image)

Quality agriculture is a kind of high yield, high quality and efficient modern agriculture, which based on the agriculture scale and regionalization. It focused on famous brand and product quality, and took agricultural products quality and safety as the core. The key tasks of Chengdu wisdom agriculture one was to strengthen the quality and safety of agricultural products, and strengthen the source management with information technology, so as to ensure the quality of agricultural products and seize the future of agricultural development.

5. Chengdu Wisdom Agriculture Design
The overall design of Chengdu wisdom agriculture highlighted the regional agricultural characteristics, and focused on the key areas of intelligent agriculture. Through the further application of information technology, it achieved intelligent management and services which covering the whole industry chain. The chain included breeding, planting, purchasing, storage, processing, transportation, sales and so on. The overall structure of Chengdu wisdom agriculture was summed up as three "one": one data center, one integrated application and one supervision map.
5.1. One Data Center
Build Chengdu wisdom agriculture cloud data center. Through data fusion and data self-built, build a cloud data center that brings together all the agricultural data in Chengdu, so as to achieve unified management of data resources and open sharing. These data included production data, environmental data, circulation data, technology data and service data.

![Architecture diagram of cloud data center.](image)

5.2. One Integrated Application
On the basis of the cloud data center Chengdu wisdom agriculture achieved the integration application of all related agriculture activities, which with comprehensive application of a variety of information technology, such as mobile information service, 3S technology, wireless awareness, internet of things, location based service and so on. These applications were covered agricultural industry chain, the whole industry type and all agriculture-related services. The integration applications were divided into three categories: agricultural production information application, agricultural products circulation and transaction information application, agriculture-related services information application.

5.3. One Supervision Map
In order to improve supervision, command and dispatch management level of Chengdu agriculture, real-time master the city's agricultural production, management and service dynamics, Chengdu wisdom agriculture was needed to achieve a map of supervision. The map real-time and intuitive showed the entire Chengdu agricultural production situation, which provided users with agricultural resources display, statistical data analysis, agricultural disaster warning, production commanding, agricultural scheduling and other services. The map improved the agricultural early warning response and emergency command capability, and provided scientific basis for leadership decision-making and command.

6. Conclusion and Suggestions
The construction of Chengdu wisdom agriculture needed to be based on the local location advantages, urban characteristics and information technology foundation. To promote the adjustment of agricultural structure with information technology, and further optimize the mode of agricultural development, so as to constantly promote the new form of agricultural industry. Through strengthening the overall planning, do top-level design, develop relevant favorable policies, while encouraging multi-capital access, All-round promoted Chengdu wisdom agriculture development.

7. References
[1] Qin Huabin, Li Daoliang, Guo Li. “Recent Advances in Development and Key Technologies of Internet of Things in Agriculture”, Research on Agricultural Mechanization, vol. 4, 2014, pp. 246-248.
[2] Wang Yujie, “Internet of Things and Wisdom Agriculture”. Beijing: China Agricultural Publishing House, 2014, pp. 61-68.
[3] Li Daoliang, “Internet of Things and Wisdom Agriculture”, Agricultural Engineering, vol. 2, no. 1, 2012, pp. 1-6.
[4] Sun Zhongfu, Du Keming, Zheng Feixiang, Yin Shouyi, “Perspectives of Research and Application of Big Data on Smart Agriculture”, Journal of Agricultural Science and Technology, vol. 15, no. 6, 2013, pp. 63-71.
[5] Zhang Songmao, “Research on Construction of Modern Intelligent Agricultural System”. Nanjing: Nanjing University of Posts and Telecommunications, 2013.
[6] Zhang Xin, Chen Lansheng, Zhao Jun, “Design and Application of Intelligent Agricultural Greenhouse Based on Internet of Things Technology”, Journal of Chinese Agricultural Mechanization, vol. 36, no. 5, 2015, pp. 90-95.
[7] Peng Gaili, “Application and Research of IOT in Intelligent Agricultural”. Zhengzhou: Zhengzhou University, 2012.
[8] Ding Jing, Bai Ling, Zhu Jing, “Development Strategy and Development Mechanism of Wisdom Agriculture in Anhui Province”, Journal of Anhui Agriculture University (Social Sciences Edition), vol. 25, no. 2, 2016, pp. 14-20.
[9] Wen Hua, Jiang Cuihong, Wang Ailing, Jia Jinsong, “Establishment of Evaluation Index System of Metropolis Modern Agriculture and Its Diagnosis in Beijing”, Research of Agricultural Modernization, vol. 29, no. 2, 2008, pp. 156-158.
[10] Chengdu Tourism Bureau, “2015 Chengdu Tourism Economy Analysis Report”, March 2016.
[11] Chengdu Tourism Bureau, “2014 Chengdu Tourism Economy Analysis Report”, March 2015.
[12] Wu ronghui, Yang jianbo, Wang yao, “Thoughts on the Development of Leisure Agriculture of Chengdu Under the New Situation”, Sichuan Agriculture Science and Technology, vol. 2, 2017, pp. 71-74.