Market Status and Growth Potential

September 2017
## Contents

- Executive Summary ............................................................................................................. 3
- Farm Machinery in China – Overview and Major Trends .................................................. 4
- Agricultural Drones Industry in China .............................................................................. 5
  - Efficiency and Cost-Effective Plant Protection ................................................................. 5
  - Application in Animal Husbandry ................................................................................... 6
  - Farmland Information Monitoring .................................................................................. 6
  - Types of Crops Assisted by Drones in Agriculture in China ........................................... 7
- Description of the Current Use, Costs and Forecast of UAV Operations in China .......... 8
- Products and Services ......................................................................................................... 9
  - Supply and Demand ......................................................................................................... 9
  - 2016 UAV China Drones Market Facts ............................................................................. 10
- Government Policy ............................................................................................................ 11
  - Interim Provisions on the Safety Management of Civil UAV in Sichuan Province .......... 11
  - Measures for the Administration of Civilian Unmanned Aircraft in Operational Flight Activities (Temporary) ................................................................. 12
  - Suggestions on the Industry Standard of Plant Protection UAV and the Construction of Inspection and Testing Organization ......................................................... 12
  - Civil UAVs “Real Name” Registration Regulations ....................................................... 13
  - Measures for the Administration of Air Traffic in Civil Unmanned Aircraft Systems ...... 13
  - Regulations for the Management of Civilian UAV Operators ........................................ 13
- Market Challenges ............................................................................................................. 13
- Disclaimer of Warranties .................................................................................................... 15
- Limitation of Liability ........................................................................................................ 15
EXECUTIVE SUMMARY

In this report, we overview the use of Chinese farm machinery with an emphasis on drones; we cover the different applications of drones for agricultural purposes, as well as crop growing by using drones in China. Furthermore, we describe the market challenges amid the use of drones in agriculture. Finally, we add the competitive market landscape and a future forecast of the use of drones in China.

The agricultural sector in China faces some major challenges due to the growing urbanization process. There is lack of manpower, thus the costs of employees increase. Along with the increasing demand for inland agricultural production, as well as the growing awareness of health concerns of toxins and pesticides in the production process, the agricultural drones’ industry constitutes a practical strategic solution in China. The Chinese government aims to revolutionize the production of agriculture and to reduce the manual use of pesticides fertilizers, to allow the development of environment friendly farming, while meeting the increasing domestic demand for agricultural production.

Currently, there are several thousands of agricultural drones used in China. The estimation is that by 2020, the number of drones that will be required to meet the demands of the farming sector will be 100,000.

Regulation of agricultural drones has not fully established. The government holds a general approach regarding drones, but has yet to adapt and implement clear policy and regulation on the subject matter.
Like many industries in China, the country’s agricultural market is in transition. Some sectors within the agriculture realm are barreling full speed into mechanization with impressive rates of technology adoption to match the latest in global production standards. Yet, the road to modernizing agricultural production complex.

China is the world’s second-largest economy, with some major constraints. There are 1.4 billion inhabitants in the country, one-fifth of the global population. Yet, the country has only nine percent of the world’s arable land, and seven percent of its fresh water.

Since the 1980s, the country has been urbanizing with astonishing speed, building up its cities at a rate unrivalled in world history, with 60 percent of the population expected to live in urban areas by 2020.

By comparison, 60 percent of the country’s population was considered rural only two decades ago. The urbanization has led to a mass exodus of workers from the countryside. Until 2005, 44.8 percent of China’s population worked in agriculture. By 2015, this figure dropped to 28.3 percent. This shows the transition in agriculture due to the continuing urbanization process.

The greatest challenges in the agricultural sector is the high demand of the booming middle class. The industry must meet this demand, while the number of laborers is decreasing. The government attempts to meet these challenges by leading to a technological revolution through modernizing mechanization and land consolidation. The government’s target is to reach a 95 percent self-sufficiency in food grains by 2020. This has resulted in the creation of large cooperative style farms.

Unlike many Western countries where land ownership lies in citizen level, it is the state who owns the land in China. Farmers may retain control of their land allocations themselves or they may transfer their allocation rights to a cooperative and become its employees. For example, the Beijing Xingnongtianli Agricultural Machinery Cooperative near Beijing, is composed of approximately 2,000 hectares and provides agronomy, equipment repair and cropping services for over 2,000 farms. Farmers who join cooperatives are granted 1,200 Yuan Renminbi/MU per year (roughly $1,500) per acre. In addition, farmers earn wages of 3,000 RMB/month ($585), and enjoy social insurance and paid leave.

More than 40,000 agricultural cooperatives of this type have been formed in China since 2006. The cooperatives work across multiple sectors, from crops and livestock to performing contract field work and providing agronomic training.

Moreover, The Agricultural Industry Mechanization Association works to boost mechanization in the countryside by educating both cooperatives and individual farmers about ways in which agronomy and technology can help increase yields and productivity.
Furthermore, there are also challenges that arise from the sheer size and geographic diversity of China. High-horsepower tractors and combine harvesters are widely used in the northern part of the country, where farm sizes are larger. However, this machinery is not suitable in the southern regions of the country where farms and field sizes are much smaller.

Also, it is important to keep in mind that the average size of China’s estimated 220 million farms remains at about one-sixth of an acre. Small farmers cling to non-modernized mechanisms and are reluctant to use new technology. Technology modernization seems a counter-intuitive challenge for a country with a labor force in the size of China, but it is a common element in the countryside.

For example, The Jianhu Lantian Agricultural Machinery Cooperative was established in 2007 near the city of Yancheng in Jiangsu Province north of Shanghai. It is composed of 30,000 MU (2,000 ha) in its home county of Jianhu and another 18,000 MU (1,200 ha) in nearby Lugoutown County. Additionally, it is considered a technology leader in the region, investing in a fleet of modern machinery which includes 15 harvesters, 28 tractors and one UAV. The latter is used to spray rice paddies and small strips of land alongside expressways, and costs 53,000 RMB ($10,000), an investment that can pay for itself in multiple ways. Considering that the cost of a laborer per day is 150 RMB ($30), farmers need 40 employees to spray the amount of land covered by a UAV in one day. In this case, the total daily cost of field labor is 6,000 RMB ($1,200).

**AGRICULTURAL DRONES INDUSTRY IN CHINA**

While the use of drones in agriculture is wide and developed in Western countries, it is still in its initial stage in China. However, the aim for technological advancement and self-sufficiency, among other reasons mentioned in this report, led to an increasing trend to apply UAVs in agricultural processes. The current drone applications in the agricultural industry in China are as follows:

**EFFICIENCY AND COST-EFFECTIVE PLANT PROTECTION.**

UAV plant protection has many advantages, mainly in terms of safety of spraying operations, efficiency and cost. There is definite influx in China’s drone industry, and manufacturers are catching on to the vast potential for drones in commercial agriculture. Drones can spray crops with pesticides, weed-killers, and growth regulators 30 to 60 times faster than field workers. Because of drones efficient, even spraying, they also use half as much chemical formula and 90 percent less water. In China, drones help in operating single digits percent of all farmland, though it is steadily rising.

Each year, large number of people are engaged in agricultural plant protection operations in mainland China, of which the annual pesticide poisoning amount goes up to 100,000 people.
APPLICATION IN ANIMAL HUSBANDRY

UAV aerial surveying technology provides services such as grassland vegetation monitoring, grassland water monitoring and pastoral monitoring, these effectively help in monitoring animal husbandry, planning and production.

FARMLAND INFORMATION MONITORING

The information monitoring of UAV farmland mainly includes monitoring of insect pests, irrigation condition and crop growth.

In July 2017, Jiangsu Academy of Agricultural Sciences and Nanjing University of Technology developed a micro-UAV, used to detect farmland and orchard pests and diseases, by inspecting crops in the area. The type of disease can be quickly determined in a certain plant in the region.
TYPES OF CROPS ASSISTED BY DRONES IN AGRICULTURE IN CHINA

Although in its early stage in the agricultural industry, drones are applied to various kinds of crops in China. Drones are used for:

- Treatments and protection of cereal grains such as corn, wheat and hybrid rice.
- Fruit.
- Vegetables.
- Plants such as apples, grapes, potatoes, lotus roots.
- Different types of greens.
- Cash crops such as cotton, roses and rapeseeds.

Beyond routine pest-control, drones are also used to fight occasional viruses and diseases such as plants fungi. Additionally, the wide use of drones across regions and sub-industries may be indicative of the large potential in China, including the national level established infrastructure to incorporate drones in agriculture.
DESCRIPTION OF THE CURRENT USE, COSTS AND FORECAST OF UAV OPERATIONS IN CHINA

In recent years, there have been many plant protection UAV research and development activities in China. The findings show that plant protection UAV programs are expected to take the lead in the formation of an industrial-scale market.

According to China Agricultural Machinery Circulation Association survey, the average annual growth of large grain and family farms cooperatives is at 15%. Some government experts believe that the market potential for agricultural drones in mainland China can reach 100 billion yuan (RM63.1bil) per year.

To better understand the landscape of drones’ acceptancy in China’s family farms landscape, it is worth examining a local farmer’s case study. Liu Xinzhu, is a 67-year-old farmer from Shaxi Linfen City in Jixian province. Liu’s son had found a job in the city, and his wife’s health condition is unsuitable for the farm’s intensive work. Liu could not take care of his one-acre apple orchard alone. Liu employed drones over his orchards to make up for rising labor shortage. He achieved remarkable increases in productivity in the process. For example, about a dozen of unmanned aerial vehicles sprayed pesticide on his apple tree orchard at the rate of about 10 minutes per orchard, which is 15 times the efficiency of manual labor. Liu also mentioned, that the drones' operating cost were significantly lower than hiring farm labor. Spraying his one-hectare orchard using drones cost up to 1,000 yuan (RM631), which is less than a farm worker. Another important added value of drones over manpower is the decreased exposure to accidental inhaling of toxic pesticide.

It is worth considering the additional case of Zhao Xifeng, who has a land in Pingdu City for over 30 years. He uses the local agricultural cooperative to purchase new drones, a multi-rotor plant protection UAV, that can carry maximum of 10 kg of water. Per Xifeng, the use of drones saves a full work day of fertilizing, and this enables him to complete a coverage of 3 acres in few minutes, while saving 20 percent of the amount of pesticides, improve the spraying effect, and minimizing the reliance on labor force.
Agri-drone companies now offer to spray chemicals on farmland from around eight yuan per mu. There are currently few thousand drones used for agriculture in China, and it is estimated that by 2020, one hundred thousand drones and four hundred thousand pilots will be required to meet demand from the farming sector.

Drones have the potential to boost efficiency through soil and field analysis, as well as crop dusting - spraying of chemicals. Local governments in China are keen to encourage the use of drones in agriculture. For example, in November 2016, Jiangxi’s provincial government started subsidizing agriculture drones with a 50 percent discount, and a maximum reimbursement of roughly US$29,000.

Furthermore, there are companies that offer crop protection services for farmers who are not interested in purchasing drones. These companies charge roughly US$1.50 per 0.16 acres of land sprayed, excluding pesticide counting. Chemicals cost roughly US$2.90. Currently, there are hundreds of farms using these services in many provinces of China, like Hubei, Henan, Shandong, Inner Mongolia, Heilongjiang, and Hainan province.

15 yuan per mu of work, will contribute nearly 35 billion yuan of operating income each year. Moderate scale of agriculture for plant protection UAV operation provides favorable conditions. China's land transfers fast, and the future of unmanned aerial plant protection needs will be more robust; and in accordance with China’s 18 million mu of cultivated land red line estimates, China’s agricultural unmanned aircraft plant protection market space more than 100 billion.

Even though mechanizing the agricultural industry is more efficient and solves many problems, many farmers are reluctant to use UAV. Between March and May 2017, among Jixian total agricultural population which includes 80,000 farmers, only 2-3% purchased UAV operation services.

According to Dajiang, a leading drone manufacturer in Shenzhen, approximately 200 professional drone operators presently offer services to farmers across the country.
As of early 2016, the market penetration of agricultural drones was only 3% in China, approximately 4,000 agricultural drones.

In mid-2016, approximately 5,000 Chinese farms owned agricultural drones.

The distribution of the national certification joint maintenance service points of Xinjiang
In September 2016, Chinese media reported that agricultural drones were being used on 26,000 mu [~1,733 hectares] of land in Ningxia Hui Region.

Agritech companies train thousands of people across China to operate agriculture-specific drones.

In January 2017, China’s Vice-Minister of Agriculture classified drones as agricultural machinery. As such, the use of agricultural drones will be subsidized in targeted pilot regions. At the time, under 2 percent of China’s 122 million hectares of arable land utilized agricultural drones.

**GOVERNMENT POLICY**

The Chinese government hopes the mass use of drones would reduce the manual use of pesticides and fertilizers, and thus will allow the development of more environmentally-friendly farming. The Regulation in China regarding agricultural use of drones is still in its early stages and has yet to be fully established. This indicates that there is a long way until the full adaptation of the new field into the regulation system. Below, are few summarized government policies regarding drones in China:

**INTERIM PROVISIONS ON THE SAFETY MANAGEMENT OF CIVIL UAV IN SICHUAN PROVINCE**

The Interim Provisions on the Safety Management of Civilian Unmanned Aircraft in Sichuan Province indicate that there is an implementation of civil UAV airspace authority in China. Reported airspace and self-flying airspace vehicles regulations are being put forward by the relevant departments of local government. Upon the approval of the airspace department, regulations are then publicly published. Generally, civilian UAV flights are under the control of the airspace, and would be strictly enforced in accordance with the office that will also monitor the process.
MEASURES FOR THE ADMINISTRATION OF CIVILIAN UNMANNED AIRCRAFT IN OPERATIONAL FLIGHT ACTIVITIES (TEMPORARY)

On August 7th, 2017, Civil Aviation Authority issued a notice regarding the measures for the Administration of Civilian Unmanned Aircraft in Operational Flight Activities. The notice aimed to meet the operational needs of enterprises, expand the application of UAV in the service area and guide the healthy and orderly development of the industry. The Civil Aviation Authority Transport Division specially drafted the Measures for the Administration of Civilian Unmanned Aircraft in Operational Flight Activities protocol.

SUGGESTIONS ON THE INDUSTRY STANDARD OF PLANT PROTECTION UAV AND THE CONSTRUCTION OF INSPECTION AND TESTING ORGANIZATION

In July 2017, the Ministry of Agriculture submitted its recommendations on the Introduction of Crop Protection UAV Industry Standards Building Inspection Agency. According to the document, the Ministry would further strengthen the promotion of agricultural plant protection UAV to support efforts for the following purposes:

i. Standardize the operation of agricultural plant protection drones: Ministry of Agriculture with the State Council Central Military Commission Air Traffic Control Committee Office and the Civil Aviation Administration of China will actively communicate and coordinate. Efforts will be made for the early introduction of UAV of the management requirements, to provide protection for aircraft operations.

ii. Improve industry standards by actively promoting the relevant departments to implement the Unmanned Aircraft System Standard System Construction Guide. Another objective is to accelerate the development of plant protection unmanned aircraft product standards, operating standards, inspection and testing standards, and gradually improve the plant protection unmanned aircraft standards. Future activities such as pilot subsidies and purchasing subsidies from the central government will be carry out. While supporting local use of local financial funds, the authorities will subsidize the purchase of plant protection unmanned aircraft for new operating entities, such as agricultural machinery cooperatives and specialized control organizations.

iii. Exploration subsidy trial based on reaching agreement with the relevant departments. Future activities such as pilot subsidies and purchasing subsidies from the central government will be carried out. While supporting local use of local
financial funds, the authorities will subsidize the purchase of plant protection unmanned aircraft for new operating entities, such as agricultural machinery cooperatives and specialized control organizations.

**CIVIL UAVS "REAL NAME" REGISTRATION REGULATIONS**

As of June 2017, any UAV civilian owner must be identified by his real formal name and register in accordance with the formal requirements. Civilian UAV owners who are not registered according to the provisions of the implementation of registration and attach their personal registration mark, will be considered by authorities to act illegally. As such, the supervisory authority shall impose sanctions in accordance with the relevant provisions.

**MEASURES FOR THE ADMINISTRATION OF AIR TRAFFIC IN CIVIL UNMANNED AIRCRAFT SYSTEMS**

Civil unmanned aircraft are only allowed to fly in isolated airspace, and are responsible for the implementation of organizational units and individuals, as well as for their safety. An event organizer is responsible for the safety of civil unmanned aircraft flying activities in isolated airspace.

**REGULATIONS FOR THE MANAGEMENT OF CIVILIAN UAV OPERATORS**

Provisions of the Civil Aviation Administration on the Management of UAV operators include license requirements, proficiency, physical examination certificate and aviation knowledge requirements. It also includes strict requirements for UAV captains’ flight skills and managerial requirements.

**MARKET CHALLENGES**

Currently, the main challenges for the agricultural drones’ industry in China are the gap between old methods, habits and unskilled manpower, and the need of new mechanized solutions. Many farmers are uneducated, and thus are reluctant to adopt new techniques. Moreover, the industrial chain of agricultural drones is not developing in a balanced manner. While the upper manufacturers and farmers share the bonus advantages of the market, plant protection service providers do not receive any profit, and might even experience financial deficits. The reason for
that lies on the geological difference across China, since Xinjiang and the northeastern part of China are the main agricultural centers, that cover a huge landscape. A multi-rotor drone is the main type in the market which fits for the coverage of these scales. Nevertheless, it covers a smaller area than the demand, and this results in two optional scenarios: the first is that farmers either need to own and maintain many drones simultaneously. The second is to operate only few drones that can fly for a longer time. These two are both time and money consuming, even before including other costs such as battery life and controller's cost.

Many identify the cost factor as the main challenge for the drone industry in the agricultural sector in China. Those who are willing to use drones and benefit from it are farmers who only need small scale of service with a high value of fieldling. They are more open to drones and willing to pay higher prices for the overall operation. However, this is not the case for the mainstream agricultural industry.

Since the agricultural drones' market is in its early stages in China, various aspects can influence future developments. Each crop and geographical area, has different and unique methods that drones - and the use of drones - should meet. The establishment of government regulation will give, with time, a clearer picture of the agricultural drone industry and will influence its future development.
DISCLAIMER OF WARRANTIES

The information contained in the Product has been obtained from sources believed to be reliable and are provided by Alpha Brown on an "as is" basis. To the full extent permissible by applicable law, Alpha Brown disclaims all warranties, express or implied, of whatsoever nature including, but not limited to any warranties as to the accuracy, completeness, quality or adequacy of any such information, any conclusions set out in the Product and any translations in the Product. The reader assumes sole responsibility for the selection of the Product to achieve its intended results. The opinions expressed in the Product are subject to change at any time without notice.

LIMITATION OF LIABILITY

To the extent permitted under applicable law, in no event will Alpha Brown be liable in any way for actions taken or not taken by any person or entity as a result of the review by such person or entity of the Product or information contained therein or as a result of the interpretation of the Product or information contained therein by such person or entity.