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MARKET DEVELOPMENT OF AGRICULTURE DRONES IN NEW ZEALAND AND SINGAPORE

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ABSTRACT

The continuous improvement of technology brings drones as one of the widely technological tools used in human life. Applicable in many sectors, drones in agriculture have the benefits to help to collect and analyse data, monitor field conditions, also planting and watering the farm. The application of drones in agriculture increases the opportunity for farmers to reduce costs and maximize their time of work.
The analysis of this study was conducted using interview and literature reviews. This research focused on the topics of drone market development and the agriculture drone, where the main area of this study is in Singapore and New Zealand. These two countries are known for their advanced uses of technology and have an interest in agriculture. With the help of Porter's Five Forces Model and Business Model, a comparison was made to see the likeliness of which country to develop its agriculture drone market. The finding discusses that New Zealand has more opportunities in the development of the agriculture drone market.

Keywords: Agriculture Drones, Porter Model, Business Model, Drone Market

BACKGROUND

Agriculture is the practice of producing foods by growing crops and raising domesticated animals or livestock. The agriculture industry kept on developing, in line with the growth of population that is expected to grow to 8.5 billion in 2030 (United Nations, 2021). We are also facing a critical condition of food security due to climate change (Food and Agriculture Organization of the United Nations and the International Telecommunication Union, 2018). Therefore, the world needs to increase the supply of food contrary to the limited resources, such as land and water. The urge to fulfill the need for more foods, medicines, and other products from plants and livestock creates the development of agriculture to become more sustainable.

This expansion of agriculture comes with the development of tools and techniques. In the 1890s, the tractor was first used for agriculture in Germany as a stationary engine (Nair et al., 2020). They are now commonly used at power and manufacturing plants, water pumping, or generating electricity. Other tools used are automobiles and trucks, which

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significantly changed the agriculture industry. In addition to that the airplane has been used for agricultural purposes since the end of World War I as a result of aeronautical progress during that war.

The airplane has continued to develop, and the existence of unmanned aerial vehicles (UAVs) gives a comprehensive benefit for agricultural development. UAVs is non-human pilots onboard an aircraft controlled by a radio channel. The operation of drones has continuously expanded, and in recent years agriculture has been one of the areas that benefited from drones. The use of drones in the agriculture field can be seen in soil monitoring, plant infestation detection, pest control, fertilizer applications, and surveying at different spatial scales (Srivastava et al., 2019). Aside from that, Perz & Wronowski (2018) stated that UAVs are cost-effective and beneficial in the agriculture sector. It offers a less stressful environment, presents a safer environment, and stays in the air for long hours doing repetitive tasks (Ahirwar et al., 2019).

With the development of drones, some countries welcome the idea of UAVs to be used as a daily operation unit. According to Sagar (2017), the Government of Singapore believes in the role of the drone as a transformative device in various fields, such as urban infrastructure management, farming, also public safety and disaster response, followed by the approval by the Parliament of Unmanned Aircraft (Public Safety and Security) Bill which regulates drones' use. New Zealand is also one of the countries that have already established the use of drones. As implied by the Ministry of Transport of New Zealand (2019), drones give a huge opportunity to increase the productivity and efficiency of New Zealand’s economy. The country has already applied drones for commercial purposes in various sectors.

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THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

The Five Forces Porter Model

The Five Forces Model allows businesses to identify and analyze the industry’s condition to figure out an industry’s weaknesses and strengths. Analyzing the market condition of drones in both New Zealand and Singapore individually will help to identify a more promising country for drones to develop its market. This model provides a viewpoint where the weaknesses and strengths of drones' market in certain country. The Porter’s Model gives understanding about competitive environment with a larger viewpoint at the business. To achieve those, firms can analyze their competitors within the industry, the

bargaining power of customers, the bargaining power of suppliers, the threat of substitutes, and the threat of new entrants (Porter, 1985).

Business Models

Business models describe how a network of businesses intends to use technological opportunities to create and seize value (Ballon et al. 2003). This network allows a viewpoint beyond individual firms and considers the model for an enterprise, a collaborative effort of multiple companies to offer a joint proposition to their customers. Creating a business model might allow companies to adjust their strategy to the agriculture drone market in a specific country. It helps businesses to determine its variables position (technical, users, organizational, etc.) and its limitation by create a specific canvas for both New Zealand and Singapore.

Agriculture Drones

Drones are becoming more popular to incorporate in agriculture. According to a recent PwC report (PwC, 2016), the market for agricultural drones is estimated to be worth USD 32.4 billion. The general components included in drones, specifically for agriculture, are Global Positioning System (GPS), camera, multispectral camera, hyper-spectral camera, thermal camera, and others (Mogili, et al., 2018). These tools allow farmers to monitor changes or stress conditions on the farm that human eyes are unable to do (FAO of UN and ITU, 2018).

Economy in New Zealand

The treasury of New Zealand's government stated that the primary industry is agriculture, complemented by manufacturing and service sectors. International markets have a significant impact on how profitable land uses. This is since forestry and agriculture take over half the New Zealand's area, in which the majority of the products from these sectors are being exported.

Economy in Singapore

Singapore is limited in land but has powerful financial and industrial sectors. Compared to the other countries in South Asia, Singapore has an advanced economy and is rapidly growing. The government stated that manufacturing, which includes electronics,

chemicals, biomedical sciences, logistics and transport engineering is Singapore's largest industry. However, as the convergence of technology, engineering, and design, the physical limits for farming are being redefined. Singapore's government has the mission to produce 30% of its nutritional needs by 2030. They help local farmers, through Singapore Food Agency (SFA) transform and adopt technology to intensify output.

Drones in New Zealand

Unmanned aircraft in New Zealand are already widely used in the country. They are becoming increasingly popular for both business and recreational purposes. Industries, such as agriculture, dairy, forestry, and tourism also incorporate drones in their work. News reported that the local commercial drone manufacturers are successful in finding niche markets as the potential for unmanned aerial vehicles takes off (Theunissen, 2020). Despite being unable to compete on price with huge Chinese drone manufacturers, numerous local companies are developing specialized drone applications that are already established time and cost efficiency.

Drones in Singapore

The drone market in Singapore is growing, with more businesses turning to unmanned aerial vehicles or tasks such as infrastructure inspection and delivery. The number of members in the Singapore Unmanned Aircraft System Community, which represents the interests of this developing industry, has increase. Leading authorities of Singapore are pushing the country to become the world's first Smart Nation, where technology is leveraged to improve people's quality of life and open new commercial opportunities for businesses. Drones are applied in defense, agriculture, logistics and transportation, construction, entertainment, energy & power, also wildlife & forestry.

RESEARCH METHODOLOGY

The method used in this study is a qualitative approach where the author collected and analyzed non-numerical data. Collecting data through literature review and interview session help the author to analyze the drone market development in New Zealand and Singapore.

The following key words and abbreviations have been used in various combinations to help find relevant articles: *Agriculture drone, Unmanned Aerial Vehicles*

(UAVs), agriculture, drone, drone market, Porter model, Business model, New Zealand drone market, Singapore drone market, New Zealand, and *Singapore*.

The author uses descriptive research in this study to understand in-depth the drone market in New Zealand and Singapore. Therefore, a combination of interview and literatures will be the sources to complete this thesis.

The interview session was held as primary data with an open question that allowed the respondent to talk in width and depth about the condition of drone market in a specific country. The interview is conducted with Avirtech, a firm focused on precision agriculture technology company based on Singapore. They lead the digital transformation of large-scale agriculture for a sustainable future. Established in 2016, they provide crop intelligence including plantation control systems for monitoring sites conditions through aerial and ground information.

The study has analyzed relevant materials from various sources as secondary data. It includes relevant articles and journals, books, theses, news articles, and professional writings from government agencies and consultants. The reputation of the publishers and the writers is taken into consideration when selecting the relevant journals.

RESULT AND DISCUSSION

Policy

The idea of incorporating drones in agricultural practices was to gain benefits in terms of reducing costs and time efficiency. The accuracy of data collected was also becoming the advantage of using drones. Human labor can be reduced, and it can provide a more accurate and efficient way to finish the labor work. However, there are many alternative tools or systems that can be beneficial for agriculture. A lack of exposure to advanced technology also could be one of the reason farmers have not included drones in their work.

In this particular research, the geographical condition is very much affecting the choice to use the drone. Technology is not an issue for both New Zealand and Singapore. However, the availability of land area gives the biggest contribution to both countries to decide the use of drones.

Applying the business model for drone manufacturer company can be beneficial to them. In general, the business model canvas include details such as the goods or services they provide, target markets, and any estimated expenses. The primary content of this

model is the value proposition, in this case is the utilization of drone in agriculture work. The description of drone works they offer will differentiates the products or services from its competitors. This model will also explain their business processes to help investors assess their company and inspiring management and staff. It can attract the investors as well as the customers or in this case is the farmer that may aspire to join.

Limitation

Discussions about agriculture drones can be easily accessed by many through findings in research, journal articles, and other studies. However, the study about particular market development of drone is not quite accessible. There is also geographical barrier that leads to difficulty for obtaining the primary data, since the sources are located in New Zealand and Singapore.

Another limitation is that The Five Forces Porter Model cannot determine the market condition perfectly. This model is not universally applicable for every business. There are many other aspects that influenced the agriculture drone market condition such as the industrial growth, government intervention, economic situation, and technological innovation.

CONCLUSION

Each country has its own development toward the utilization and market situation of agriculture drones. In terms of agriculture drones, it has a high prospect to develop its market. As the United Nation projected that population growth will increase to 9.7 billion in 2050, in line with the rise of consumption at 69% between 2010 until 2050 (Insider Intelligence, 2022).

Agriculture drones are typically used for monitoring crops and livestock, irrigation management, soil analysis, and fertilization to seek time efficiency and reducing cost. There are not so many differences for agriculture drone works in each country. The finding in this study discusses that New Zealand market for agriculture drone is more developed than Singapore. As stated by the government of New Zealand, the agriculture sector as their main industries gives a bigger opportunity for New Zealand to develop the agriculture drone market. The availability of the field creates a big gap from New Zealand to Singapore, where the practices in Singapore can be very limited.

Referring to the analysis using the Porter Model, the substitute of drone in agriculture sector is easily accessed by all farmers. The manual work with tractors or the human works can still bring benefit for farmers, especially with a small farm area. The opportunity of New Zealand come from the condition of a big land area, with the use of agriculture drone, it can reduce the cost and save more time compared to do manual work.

As for Singapore, the agriculture land is still limited. The number of farmers is growing but it is still limited due to small land area. As described by Mr. Kwa, agriculture drones are more beneficial for large farm areas. In this case, farmers in Singapore found human work more beneficial than using drones.

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