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COMPARISON OF DRONE MARKET DEVELOPMENT IN OFFSHORE WIND FARM SECTOR BETWEEN JAPAN AND CHINA

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ABSTRACT

With the passage of time, the existence of drones became a common concept around the world and drones started to be introduced into civilian use. With their ability to collect data and transport loads, drones are re-shaping the way society thinks. Companies, organizations or individuals slowly respond to these new opportunities – using drones to help save time, increase revenue, and lower risks to workers in industries.

Overall, this study will concentrate on the topics of drone market development and offshore wind farms, including the use of drones in the offshore wind farm sector. Japan and China would be the area of this study because they have better prospects in the concept of energy compared to other countries in Asia and have intention to change into renewable energy. Thus, a comparison was made to see the results, and it can be concluded that in terms of the one that is more likely to develop, China has a better chance of being the leading drone market in the offshore wind farm sector.

Keywords: (Drones, Offshore Wind Farm, Porter Model, Japan, China)

BACKGROUND

Aircrafts have been around for centuries to assist human works and enhance the quality of life. Encouraged by human desire to work more efficiently and mitigate the danger of high – risk jobs, rapid innovation of technology then led into the development of unmanned aircrafts. These aircrafts include unmanned air vehicles (UAVs) ranging from those that are able to fly thousands of kilometers to the small ones that fly in narrow areas (Krijnen et al., 2014; Cavoukian, A., 2012). The term drone itself is to describe an unmanned aerial vehicle (UAV) with a certain degree of autonomy (Hazel & Aoude, 2015).

With the passage of time, the existence of drones became a common concept around the world and drones started to be introduced into civilian use. With their ability to collect data and transport loads, drones are re-shaping the way society thinks.

In May 2016, PwC indicated that the value for drone application's overall market estimation was at more than $127 billion (PwC, 2016). The second report found a $45 billion market for applications in the transport infrastructure sector. Drones are used to automate the transport of goods to provide faster, more flexible, and less expensive services compared to traditional means of transport (Roland Berger, 2020).

The global market in drone-powered solutions for the power and utilities industries is worth as much as USD 9.46 billion a year. This was caused by drone technology for infrastructure inspection and maintenance that became increasingly routine. Energy

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industry sectors like solar, wind, oil and gas, rely on inspections to maintain safety standards to effectively power the world, but those inspections can take large amounts of time and money to carry out. With drones flying overhead utility sites, damage on everything wind turbines can quickly be identified, preventing potential problems before they grow (DrDrone, 2016).

The growth of drones and offshore windfarm usage in the vast world encourage the development of this study especially in Japan and China. This is due to the potential given, especially the need in renewable energy, the safety implementation of work, and the benefits given of drones in Japan and China.

Overall, this study will concentrate on the topics of drone market development and offshore wind farms, including the use of drones in the offshore wind farm sector. Japan and China would be the area of this study because they have better prospects in the concept of energy compared to other countries in Asia and have intention to change into renewable energy. Thus, a comparison would be made to see which country is currently developing better and which country will most likely continue to develop the best.

THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Condition and Problem about Renewable Energy in Japan

Initially, Japan has been lacking in natural resources, especially oil and natural gas. The energy self-sufficiency ratio of Japan in 2015 was 7.4% which was a low level even compared to other OECD countries. It mostly depends on fossil fuels such as oil/coal/natural gas (LNG) imported from abroad. Dependence on primary energy supply was 81 % before The Great East Japan Earthquake in 2011, but it is now 89 % in FY 2016 because of the generation of thermal power plants and the shutdown of nuclear power plants. Japan imports 86 % of its crude oil from countries in the Middle East, such as Saudi Arabia and the United Arab Emirates. Natural gas and coal are likewise heavily reliant on imports from other nations in Japan. Renewable energy accounts for only 10% of Japan's total energy production (Hoganlovells, 2017).

China and The Problem about Renewable Energy

China has emerged as the world's single greatest investment in the clean energy transition, despite various efforts to shift to cleaner energy. China has also become a global leader in wind and solar photovoltaic (PV) energy over the last decade. In 2012, wind power provided only 2.1 percent of China's total electricity consumption, compared to 3.7 percent in the US and 9.4 percent in Germany. However, in 2019, China's wind-energy generation, has risen to 406 TWh, far ahead of the United States (298 TWh). As a result, China produced approximately 28.4 percent of worldwide wind energy in 2019. Now, China is the world's largest solar PV supplier and user. China is home to two-thirds of the world's solar-production capacity, thanks to rapidly reducing costs, robust regulatory incentives, and low-interest loans from local governments.

However, the future of China's solar business has been put into question. In June 2018, Beijing halted all new solar projects and decreased tariffs on imported clean energy due to an oversaturated local market. Concerns about human rights violations in Xinjiang

as one of the key players in global solar energy supply chains have decreased the possibility of China's dominance in the industry. This increases the exposure of both onshore and offshore wind farms in China.

The Environment of Offshore Wind Farm

Since 1991, Denmark has been deployed in the North Sea and Baltic Sea. Then wind farms developed primarily in Europe, but steadily expanded in Asia. UK By 2020, the United Kingdom has made a statutory goal to meet 15% of its energy consumption from renewable sources. Renewable energy generation (hydro, wind, solar, and biofuel) currently accounts for 12% of total demand, with wind energy contributing for 6%. (UK Government, 2020). The wind farm is in a growing state and will be more likely to develop in the future.

In 2021, The offshore wind market has grown from 4.5 GW in 2017 to 21.1 GW in 2021, bringing its market share in global new installations from 8.4% to 22.5%. This is three times higher than 2020 primarily due to the strong growth spurt of onshore wind in China. GWEC Market Intelligence expects the global offshore wind market to continue to grow at an accelerated pace.

Environment of Drone

The word "drone" has become frequently used to refer to any unmanned aerial vehicle (UAV) or aircraft that can fly without the presence of a pilot (Narayanan & Ibe, 2015). It may be classified in general terms based on their performance qualities. Essential characteristics such as weight, wing span, wing loading, range, maximum altitude, speed, endurance, and production costs can be used to identify different types of drones and help classification systems work more effectively. Shafiee (2015) divided unmanned aerial drones into three types: multirotor, fixed-wing, and single-rotor helicopters.

Drone in Offshore Wind Farm

The use of drones in offshore wind farms has received a great deal of attention in recent years. This is due to plenty of benefits that drone inspection can offer compared to rope access inspection or any other inspection.

According to Stout and Thompson (2019), inspection methods in the wind farm sector include rope-access, UAV access, elevated platform, and ground camera. Rope-access and UAV inspection are the two most widely-used methods in the wind industry to date (Stout and Thompson, 2019)

The cost-effectiveness and efficiency of the drones inspection method compared to traditional telephotography or other manual inspection methods made this method more favorable. Other benefits using a drone inspection solution for visual inspection of on- and offshore wind turbines: less threat working environment, less downtime, better quality photo and recording compared to traditional method, and gain access to the inaccessible areas.

With a drone inspection solution, it is possible to achieve both visual and thermal images on wind turbines for analysis and assessment regarding the condition of the rotor blades. (Forcetechnology, 2022)

Depending on the scope of the inspection work, the drone can be equipped with a digital camera, a thermographic camera, or a combination of the two while examining wind turbines. (Forcetechnology, 2022).

Porter Model as Model for Market Analysis

Porter's Five Forces can be used to determine the primary sources of market rivalry. According to Porter (1985), a strategist's goal is to understand and manage a competitive environment by looking directly at competitors or considering a larger viewpoint that competes against the business. The Porter model can be used to assess an organization's strengths and weaknesses, as well as to identify significant aspects that could impact profitability.

The industrial economics or industrial organizational (IO) approach is where Porter's five forces theory originated. Because market structure influences the behavior of market contributors, the IO method assumes that the attraction of an industry in which an organization operates is defined by the market structure. Market structure, in turn, influences organizational strategic behavior; for example, market success is determined by competitive strategy. As a result, the market structure has an indirect impact on organizational success. Furthermore, the five forces framework may be considered as a tool for doing an industry study.

RESEARCH METHODOLOGY

This paper is using the combination of literature reviews and an interview to gather the necessary information in order to approach relevant, accurate, and reliable results. The main method used in this research is a literature review, and an interview is used to answer sub-questions.

The study was conducted using popular professional academic databases as well as reputable institutions such as well-known corporations and scientific institutions. Search engines such as Google, Google Scholar, and plenty of journal databases were used in order to collect data.

Since comparing drone markets in offshore wind farm fields is an uncommon field among journals and reports, a diverse range of media was chosen as reference data: (1) Journal articles, (2) Websites, (3) Videos, (4) Books, and (5) Reports. Furthermore, some keywords will be mentioned to ensure that the articles are filtered and receive the necessary information: (a) UAVs, (b) Drones, (c) Offshore Wind Farms, (d) Market Trends, (e) China, and (f) Japan.

The interview was conducted with Mr. Keitaro Hamamura, the representative of LEBO ROBOTICS Co., Ltd. The company is. They have been providing the service of inspection of offshore wind farm turbines using drones since 2021 in Japan, one of the few companies that engage in this business line. Therefore, the aim of this interview is to find the current condition of inspection of offshore wind farms using drones in Japan.

RESULT AND DISCUSSION

Policy

The concept of an offshore wind farm drone system was developed with the goal of easing inspection activities during the development phase and explaining the benefit or profit gained, demonstrating that offshore wind farm inspection can be a profitable business that will expand the drone market in society. The drone will aid in the administration of field operations and complicated detection systems. Furthermore, because drones can do some of the life-threatening activities, the risk of occupational accidents can be lowered. However, the lack of social awareness of both offshore windfarms and drones hinders the sector's expansion.

As a result, the market for drones for offshore wind farms is limited in terms of human resources. Professional technicians in the offshore windfarm area are relatively scarce, particularly in eastern nations. Lack of desire to acquaint society with drones and offshore wind farms. Drones and offshore wind farms are still seen as unusual, complicated applications in life. This is due to the high cost of drone applications, which discourages middle- to low-income people from participating in drone social awareness. As a result of the high value of resources, higher money is required to examine offshore wind farms.

Furthermore, drone technology development aspects such as battery and lifting capacity are still insufficient. With a low payload, the average professional drone can fly for around 30 minutes on a single charge. Also, high-end cameras and communication devices are required for drones to complete a useful examination that produces actionable data, both of which increase weight and pressure on battery life.

Recommendation

Drone applications are set to be widely used in the drone inspection business, according to study, and investors should view it as an impending investment potential. Furthermore, drone applications reveal that drones are used to improve cost efficiency and safety in infrastructure development operations. Drone developer companies should understand that investing in drones will have a significant positive impact on the company's security and cost efficiency.

Limitation

Drones may be well-known as the object of discussion and research and a lot of research has been done on drones, but finding data on drone inspections on offshore wind farms is quite difficult. Lack of previous studies in the same field and the drone as new existence in the world of commerce and inspection, also the new existence of offshore wind farms lead into the struggle in finding data.

Furthermore, this research is limited because of the language barrier and the number of companies that are willing to be interviewed. This leads to main difficulties coming from obtaining the primary sources that are located in China or Japan. The interviewee can be reached through email and other communication media yet the language barrier discourages the fluentness in information exchange.

The data provided by the interviewee that is willing to participate is also very limited. The answers are brief and have insufficient description. However, the answers are relevant for the decision making as they were able to give the authors rough sketches on

what is currently going on in offshore wind farms in Japan. It illustrates the condition of power buyers in Japan. More interviews are needed in order to specify the answer and get closer to the real condition of the drone market for offshore wind farms in Japan.

Also, there are limitations to utilizing the Porter Model as indications to determine the market condition. Porter's model does not place an emphasis on variable factors like industrial growth rates, government intervention, or technological improvements, resulting in a lack of precision. Porter considers these components to be temporary elements, while the Five Forces are permanent components of an industry's structure.

CONCLUSION

Both countries, similar to the others, have taken initiative to implement drones in the offshore wind farm sector. However, there is no difference in the application of drones in the offshore wind farm sector between Japan and China. Both countries implement the usage of drones to inspect offshore wind farm turbines.

However, based on the data and analysis that has been assessed, China has a larger opportunity to develop the drone market in the future. According to the Porter Model, the drone market in China indicates a higher consumer opportunity, compared to Japan's. Information from the interviewee also implied that the lack of buyers in Japan, which lead to less opportunity for a local company to develop drone solutions. The other factors show less significant differences, hence cannot be considered to affect the current analysis. As a result, global corporations are looking to China rather than Japan. Furthermore, due to the large number of drone suppliers, drone startups, and drone companies in China, the country offers more opportunities for the growth of drone services.

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