



Space Economy: A Case Study on the Space Industry in the United Kingdom

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Abstract: Activities in the space sector have evolved in which the role of the private sector has increased so that it can accelerate growth. Attention to space activities continues to increase, as seen from the space sector budget continues to increase and it is predicted that in 2040 the space economic will be in the range of \$ 926 billion or \$ 1.1 trillion. This is the total of the global space economy (activities in the global space economy value chain), one of which is a contribution from the British space industry. This study describes how the model of the space sector company was developed, and examples of companies in the UK that run a business in the space sector. It is expected that the business expansion model developed by companies engaged in the space sector with the large-size category can be found out. The study method used a descriptive method. The results show that the Space industry in the UK is developing in each group of the value chain, including in the last cluster of the space economy value chain (downstream sector) - industries that are included in the spinoff category, as well as development in the upstream sector. The company's expansion was demonstrated by the establishment of subsidiaries interested in investing in the British space sector. The space industry in the UK has grown tremendously and this is an economic driving sector that can contribute to revenue for the country and play a role in the global space economy value chain.

Keywords: Space Economy, Space Industry, UK, Companies, Commercial.

INTRODUCTION

Government agencies play a key role in the space economy as developers, investors, owners, operators, regulators, and consumers of space infrastructure. In a large terrestrial infrastructure system, government involvement is a key point for safeguarding the overall space economic activity and for dealing with the strategic implications of complex systems (OECD,

2009). Currently, activities in the space sector are evolving in which the role of the private sector is increasing so that it also increases the growth of this sector to move forward faster (OECD, 2014; OECD, 2019). Startups engaged in the space sector also continue to emerge in the United States, Europe, Japan, China, and India with a total of more than 500 small companies in which their core businesses are new launch services, innovative Internet-of-Things services via small satellites, or other forms of services including data analysis.

The awareness of space activities continues to increase. The budget for the space sector followed it to increase by around 75 billion USD in 2017 and continues to increase in the following years in which the United States has the highest budget in absolute terms (more than half of its total), followed by China, Japan, and France. In 2016, the government space budget for U.S. Government expenditures was 46.4 billion USD (20.9 billion USD for non-military outlays and 25.5 billion USD for military outlays) and that for foreign government expenditures was 31.4 billion USD (20.4 billion USD for non-military outlays and 20.4 billion USD for military outlays) (NASA, 2017; Space Foundation, 2017). Interestingly, the space economy is estimated to grow by the Satellite Industry Association, UBS projects, that by 2040, the space economy will total 926 billion USD, up from 340 billion USD in 2016. Furthermore, Morgan Stanley projected that, by 2040, the space economy will be up to a total of 1.1 trillion USD, up from 340 billion USD in 2016 (UBS, 2018; Morgan Stanley, 2017). In addition, private funding of commercial projects has also grown with unprecedented private capital flows in the space sector from angel and venture capital investments.

The advancement of the space economy in these countries globally cannot be separated from the development of research in economics so that global space activities can be measured. However, there are still many limitations and obstacles in valuating them (OECD, 2012; Diana, 2018). As noted in OECD (2012) and Diana (2018), research and development (R&D) in the space sector is typically carried out by a large number of different public actors (e.g. space agencies and technology centers) in which they are not easy to identify. Furthermore, it is difficult to classify stakeholders or actors involved in the upstream to downstream sectors of the space industry.

In countries with an advanced space sector, they start with classification so that they can find out what strategies are appropriate for the development of commercialization of space for their country. Before discussing the classification further, the most basic thing is understanding how to define a “space company”. Companies involved in the manufacture of satellites, launchers, or sub-systems and even providing space-related services are sometimes also involved in other sectors of the economy, and perhaps only a fraction of their revenue is generated from space activities.

Therefore, it is clearly necessary to understand a description of the global space industry. Furthermore, this paper also discusses how the model of the space sector company was developed, and examples of companies in the UK that run a business in the space sector. It is expected that the business expansion model developed by companies engaged in the space sector with the large-size category can be found out. Specifically, it is also to find out whether the

overall core business of those companies is only in the space sector or they have other business portfolios. With this study, it is hoped that how the space business model is developed and the revenue of the company can be revealed including an overview of the dynamics of revenue which can be recognized as part of the quantification category in the global space economy activities.

RESEARCH METHODS

In this study, the researcher applied a descriptive research method. It is a type of research aiming at describing and mapping facts based on a certain perspective or frame of mind (Mahmud, 2011: 100). The type of data in this study was secondary data. The data were collected using a literature study.

FINDINGS AND DISCUSSION

Industrial Mapping Classification

The segmentation based on a broad general industrial activity can be classified into three groups, namely space manufacturing, space operations, and space applications (OECD, 2012; London Economic, 2019). For the more detailed classification, it can be classified again as undertaken by Graziola, 2018, who divides it further into two groups, namely space industry and space economy.

There are many different types of actors involved in the space economy and it is often difficult to assess their role and activity. These actors are divided into public actors, higher education actors or academicians, large industrial groups, medium-sized companies, and small-sized companies. Smaller actors are active in specific segments (e.g. in the manufacture of components, sub-systems, equipment, or services). Interestingly, some small actors compete in the same market segment as large groups (e.g. OHB in Germany). In many countries with an advanced space sector, the small and medium-scale companies contribute to about 99% of firms in the OECD region.

As noted in the OECD (2005), countries with space programs have generally adopted a broad institutional model for carrying out space-related activities. This generic model involves 3 broad sets of actors, namely: i) public institutions that focused on space R&D and science in which they are usually space agencies that provide contracts with industry, universities, and laboratories; ii) public and/or private organizations that are responsible for the upstream segment of the space industry (e.g. manufacturing spacecraft and rockets or provision of rocket services); and iii) public and/or private bodies that are responsible for the operation of the space system and the development of downstream applications.

Like space applications, downstream services also vary. These services have traditionally been divided into 3 major application domains, namely: telecommunications, Earth observation (also known as remote sensing), and navigation. Value chains often involve public bodies as investors and end-users. The value chain begins with R&D, followed by the manufacture of satellites, launchers, and rocket systems. After that, it is the management and operation of the

satellite with the provision of actual service to the end-users (e.g. broadcasting or communications signals).

Downstream services have become very important because the space sector has improved to be involved in more commercial activities. These activities include specific information about technology products and services, such as GPS receivers, satellite television, or investment in tourism-related activities (e.g. space playgrounds or sub-orbital aviation). The communications satellite downstream also has grown and developed. The usefulness and benefits of this communication satellite have been widely used in various industrial sectors.

In this discussion, it is very clear that the wider community is already very dependent on space technology. Economic activities that can contribute to revenue for the country and play a role in the global space chain have grown. Industries involved in the application chain also play a role in downstream activities in which it is internationally recognized as a revenue contributor in this sector. The rapid development of computerized and miniaturized technology provides an opportunity and challenge at the same time in integrating technology to develop space applications. It is also a challenge to try to create statistical mappings for new downstream applications. This has implications for determining the best method to find out the involved technology.

New Commercial/Industrial Activities

In most countries, the space program is contracted to the industrial sector. Some examples of positive industrial and economic results that come from space investment can be seen not only in countries with large space manufacturing industries but also in countries with special space programs (OECD, 2011).

- a. Norway has a small but active space program. Through the Norwegian government and the European Space Agency (ESA), the Norwegian company in the space sector has an additional average turnover of 4.7 million NOK. This usually comes from new exports or activities outside the space sector (the advanced layer of the space industry/space economy). The turnover effect factor is expected to increase dramatically as long as the Norwegian space sector develops new products and services (Norwegian Space Center, 2010).
- b. In Belgium, the same type of multiplier has been detected. In 2010, for every million EUR of government support through the ESA, it is found that 1.4 million EUR comes from the Belgian space industry (Capron et al., 2010).
- c. In Denmark, 25 companies are active in the space sector. Each million EUR contribution for ESA has resulted in an average turnover of 3.7 million EUR. The increasing competence in space activities through involvement in the ESA project is considered by the industry as a facility for competency development in other sectors outside the space sector (Danish Agency for Science Technology and Innovation, 2008).
- d. R&D and innovation play an important role in many industries, although competitiveness is strongly influenced by the size of the domestic market. This also applies to the space sector. However, it sometimes has the same level of importance with direct impact. This condition is a strong argument for public support for R&D in private companies (Fagerberg, 1996).

The aforementioned commercial activities show that space revenues from space activities in Norway, Belgium, or Denmark emphasize the development of the downstream sector. This development is fully supported by those governments through the ESA.

The Space Industry in the United Kingdom

The following will describe how the space industry in the UK is.

a. **European Multinational Airbus Company**

It is a company that manufactures communication satellites and Earth observation. It is also the main contractor on ESA scientific missions such as Rosetta and Orion which provide value-added services for the exploitation of Earth observation data. It is headquartered in the Southeast with additional facilities in the Middle East and Northeast.

b. **Surrey Satellite Technology Limited (SSTL)**

This company comes from the University of Surrey. Currently, this company is a world leader in the manufacture of small satellites used for Earth observation, otherwise also created the first Galileo satellite for the European Union and ESA and continues to supply payloads for ongoing projects. This company is headquartered in Guildford, Surrey, and has been around for over 25 years with a large share of exports.

This company has more than 350 staff members. In 2009, EADS Atrium (which later became the Airbus Group) acquired 99% of this company. SSTL is headquartered in Guildford, Surrey, United Kingdom, and founded in 1985. The SSTL is a very export-oriented company and currently holds 40% of the global share of the small satellite export market. This company provides satellites to more than 30 countries around the world. Recently, this company had signed contracts with Algeria, Kazakhstan, and Taiwan.

The SSTL has grown with a growth rate of around 20% per annum since 2000 and 99% revenue was from exports (2014). Almost all of this growth has been driven by export operations. The SSTL does not rely on government funding. However, UK Trade & Investment provided support in the early 2000s by helping small businesses to become a global leader in the current small satellite sector. The 2002 MOSAIC, a small satellite program, financed by the UK's National Space Center enabled the SSTL to grow from only having 80 workers to a highly successful space company with 450 workers and generating over 500 million GBP in export orders.

c. **QinetiQ Group.**

This company manufactures micro-satellites, satellite payloads, and subsystems and is headquartered in Farnborough, Hampshire, United Kingdom. This company often has a fairly strong position in America by carrying out exports that generate 42% of annual revenue (1.2 billion GBP in 2014). This company currently employs 5,100 staff members in the UK and covers 5% of interns and scholars club members.

d. **Qioptiq Space Technology Ltd.**

This company was formerly known as Pilkington Space Technologies. This company is currently headquartered in Wales and supplies 80% of the global demand for solar cell protection glass and optical solar reflectors which are used on more than 2,500 satellites

worldwide. Furthermore, this company is also a part of an international company whose main headquarters is in Munich, Germany.

e. Inmarsat plc.

This company is headquartered in London, UK. Globally, this company is in a leading position in the field of satellite communications. It achieved a turnover of more than 700 million GBP in 2012/13 and employs 1,600 people from London and around the world. This company also supplies mobile phones up to 370,000 terminals worldwide and is currently expanding its portfolio by introducing a powerful new constellation. This company owns and operates 11 satellites that not only provide communications services to its customers but also carry cargo for the European Geostationary Navigation Overlay Service (EGNOS) and Veripos Ltd, a private party that provides the Differential GPS services and is located in the UK.

f. UK Airbus Defense and Space.

It is formerly known as Paradigm. This company offers satellite communication services to commercial and government users. The services offered are varied such as providing VSAT services for maritime and land use or selling Inmarsat broadband for spacecraft. This company (previously trading as Infoterra) also operates a fleet of Earth observation that sells Earth imagery directly to commercial users. The part of this company that organizes space activities is the European Multinational Airbus Company.

g. Arqiva.

This company is owned by the Australian Frequency Infrastructure company and provides the infrastructure enabling TV and radio broadcasting in the UK. The BBC, ITV, and BSkyB rely on the services of this company for sending and broadcasting a program. The history of Arqiva dates back to 1928 when it provided transmission services for the UK government's first broadcast. This company currently employs more than 2,000 people and has a turnover of more than 800 GBP per annum.

h. Commercial Space Technologies (CST).

For more than 20 years, this company has provided launch brokerage services to the UK and international companies in which the first launch was conducted in 1995. In total, this company has launched 32 satellites collaborated with SSTL and other UK companies. This company has recently brokered the launch of TechDemoSat-11 and UKube-1. Apart from being a broker, it also provides consulting services. This company is headquartered in London and operates in Moscow.

i. SIS Live.

This company is the largest uplink supplier and delivers 80% of its contribution to the live news in the UK. This company also creates personal satellite uplinks to be used by single reporters in areas with poor connectivity.

j. BskyB.

This company is a supplier of DTH TV broadcasting to 11.5 million subscribers in the UK. This company rents out the satellite capacity to transmit the broadcast. This company is

also a commercial user of the satellite services needed to broadcast live domestic and international sporting events. This company earned a turnover of 7.6 billion GBP in 2014 and employs more than 26,000 staff members in the UK.

k. Cambridge Silicon Radio (CSR).

This company is a leading manufacturer of GNSS chips primarily used in applications like fitness trackers or automotive navigation solutions. In 2013, this company earned a turnover of 960 million USD of which 482 million GBP was earmarked for the space sector. Furthermore, this company employs 672 workers.

l. Pace plc.

This company is a leading manufacturer of set-top boxes for DTH broadcast receptors that can be used via cable or satellite. The turnover of this company in the space sector is estimated at 243 million GBP. This company has 734 employees and is headquartered in Yorkshire.

m. Laird plc.

This company is a manufacturer of multi-function antennas. The space activities of this company are centered on the utilization of GNSS signals for use in vehicles. Besides, it also manufactures the antenna that can receive satellite radio frequencies, thus allowing the driver to access a wider selection of radio programs than just terrestrial programs. This company is headquartered in London and its turnover in the space sector is estimated at 200 million GBP. This company employs 400 staff members in the UK.

n. Cobham.

This company is an equipment manufacturer and a value-added service provider in the satellite communications domain and particularly active in providing secure military communications solutions. Because of operating in many business areas, the space activities of this company are limited to 20%. However, this company has a turnover of 350 million GBP and employs 2,000 staff members in the space sector.

o. Honeywell Global Tracking.

It is an American company with a strong position in the southwest region of the UK. This company combines communications and navigation satellites. The company also manufactures equipment and provides value-added software and services for tracking vehicles and valuable goods. In addition, this company is a retailer of Inmarsat's communications services.

p. Atrium Space Insurance Consortium (ASIC).

This company provides a developed market in space insurance services for its clients and brokers. Insurance coverage is up to 38.25 million USD for single or satellite launches in the 2015 financial year. In addition, other services provided by this company are related to space weather.

q. Spirent Communications plc.

This company is a British subsidiary of an American company and headquartered in South West England. This company provides facilities and consultation to test GNSS

reception in different circumstances. The offered solution is to incorporate the full suite of GNSS. This company is also able to test specific requirements based on e-Call guidance from the EU.

r. **Sapienza Consulting.**

This company is headquartered in Surrey and is a leading provider of space missions and project support through its HR and software solutions. One of his most important clients is ESA (London Economics, 2015).

By considering the list of companies mentioned above, it indicates that the UK space industry has been highly developed. The wheels of economic activity are driven in a balanced way from their space activities in the fields of communication, remote sensing, broadcasting, and navigation. Not a few of these companies are classified as the end-layer of the space activity chain.

The development of the UK space industry can also be seen from the variety of foreign companies investing in the UK that are interested in the UK space economy. They are as follows:

a. Airbus Defense & Space.

Space Airbus has a vision to making space a universe of possibilities for everyone. Space portfolio are earth observation, telecom satellites, human spaceflight, launchers, satellite navigation, space exploration, spacecraft equipment, space data highway, on-orbit services. This company is registered in the Netherlands, headquartered in Stevenage, and operates in 12 locations in the UK.

b. COM DEV Intl. Ltd.

This company comes from Canada and is a global designer and manufacturer of space and land hardware and systems. This company has been operating in the space industry since 1974 and has been active in the UK through its subsidiaries since 1984. In December 2014, this company added its acquisition in MESL Microwave. In 2013, two subsidiaries of this company in the UK generated a turnover of 26 million GBP. Currently, this company employs 177 staff members (COM DEV, 2013).

c. Deimos Space UK Ltd.

This company is headquartered in Spain and specializes in the sectors of space engineering solutions, information systems, and telecommunications. Its main business areas are remote sensing, aerospace, air and maritime navigation defense systems, and satellite systems. This company is a wholly-owned subsidiary of Elcnor Deimos which was established in 2013 to target the UK market and is headquartered in Harwell, Oxford to be close to the British Space Agency, ESA, RAL-Space, Catapult, and other space companies. After acquiring UK Magellium (which is also a French subsidiary), this company has 15 employees.

d. Eutelsat.

This company is a French satellite operator and has been active in the UK through a subsidiary located in London.

e. Laser Light Global Limited UK.

On November 11, 2013, it was announced that Pegasus Holding (America) would establish a UK company that aims to become the holding company for Laser Light Communication LLC and The Halo Center LLC in which both are registered in Delaware as American companies. This company is in the process of launching an Optical Hybrid Terrestrial Satellite Network which will use a laser on the optical spectrum to provide satellite communication capabilities rather than traditional radiofrequency.

f. Lockheed Martin.

On July 15, 2014, this American space giant announced the opening of a space technology office in Harwell. It aims to accelerate space growth and innovation in supporting the identified targets of the UK Space Agency. This company is headquartered in London and has more than 3,000 employees in 20 locations. The new office of this company will only focus on the space sector, while its previous activities are much broader including space and security sectors.

g. Rhea Group UK Ltd.

This company was opened in Harwell, Oxford in 2013. It is currently headquartered in Belgium and provides space engineering consultancy. Its subsidiary in the UK is a software company and included in UK national programs (similar to Satellite Applications Catapult and ESA). Furthermore, it also provides a space hub for commercial customers at Harwell. At the beginning of its business activities, this company was only a startup.

h. Telespazio-Vega.

This company is a subsidiary of Telespazio SpA (a joint venture of Finmeccanica/Thales). It has been active in the consulting, software, and space services business for 35 years. Headquartered in Luton, Bedfordshire, this company employs approximately 100 staff members with an annual turnover of 15 million GBP.

i. Thales UK.

This company has been around for more than 40 years. It employs 7,820 people across all of its business areas and in multiple locations around the world. It is headquartered in French and is in partnership with Italian Finmeccanica (Thales Alenia Space - 67%/33%). This company has acquired British Systems Engineering & Assessment Limited which was completed in 2014 and added to Thales UK activity.

j. Viasat UK.

This company comes from America and active in the UK since 2010. Viasat, a producer of innovative satellite and other wireless communication and security systems (provider of satellite, wireless networks and other digital communications). Stonewood Group Limited has been acquired by ViaSat. In 2020, it has 5,900 employees with a total asset value of 4.88 billion USD. Viasat UK following the acquisition of Stonewood. Headquartered in Wareham, this company provides security data and communication systems for the Ministry of Defense, central and local governments, and commercial organizations in the UK and other European countries.

The space industry has grown rapidly and developed in which the expansion is developed by implementing business development using the acquisition model. This can be seen from the business model in the UK in which the subsidiaries of the company from this country have spread across several other countries. Besides the aforementioned expansion model, current business developments by using the method of increasing open ownership to the public are also being applied in several large companies. Related to new business startups, it can be developed by increasing the number of startups that have an interest in developing their business in the space sector.

CONCLUSION

The space industry is classified in two, namely into upstream and downstream sectors. Furthermore, it is also grouped into three major schemes, namely space manufacturing, space operations, and space applications. The space industry in the UK as discussed above shows that many industries grow in space service sectors which provide value-added (spin-off) from space technology (the end-layer of the space economy chain) besides in the upstream sector. The expansion of the company is also carried out by the establishment of subsidiaries that are interested in investing in the space sector. Therefore, the space industry has grown tremendously and becomes a driving force for the economic sector which can contribute revenue to the country and play a significant role in the global space chain.

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