Fish and Solar Cell Technology Research Trend

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ABSTRACT
The contribution of Indonesian fishery's GDP and the surplus of the foreign trade balance of fishery products continue to increase. The Gross Domestic Product (GDP) in the second quarter of 2019, at 2010 constant prices, reached Rp 2,735.19 trillion, which was an increase of around 5.05% compared to that in the same quarter of 2018 (y-o-y), and 4.20% from the previous quarter(q-o-q). The sector with the quarterly highest growth in the second quarter of 2019 was agriculture, livestock, forestry, and fishery's industry (13.80 percent). Indonesia's fishery's GDP growth needs to be supported by fisheries research on solar-cell renewable energy technology. Fish and solar-cell technology research is a world trend. There are 171 documents related to titles, abstracts, and keywords in Scopus publications. Fish and solar cell technology researches are available in 122 journals, which are five documents in the Journal of Aquatic Toxicology and Journal of Photochemistry and Photobiology Biology. The study is found in 160 affiliation documents, four papers each from the University of Innsbruck, and Miami University. Fifty countries/territories do research on the subject. There are 42 documents in the United States and 12 documents in China. Indonesia ranks 4th in the world with four papers. There are seven types of documents of the area, which are 111 documents in the form of Article and 29 Conference Papers. Fish and solar cell technology researches found in 22 subject areas, 45 documents on environmental science, and 40 documents on agricultural and biological sciences. Fish and solar cell technology researches receive 60 funding sponsors, one of which is three documents from the European Commission.

Keywords
Fisheries, Solar Cell, Research Trend, Article, Indonesia

1. INTRODUCTION
Indonesia's Gross Domestic Product (GDP) in the second quarter of 2019, at 2010 constant prices, reached Rp 2,735.19 trillion that was an increase of around 5.05% compared to that in the same quarter of 2018 (y-o-y), and 4.20% from the previous quarter (q-o-q). The sector with the quarterly highest growth in the second quarter of 2019 was agriculture, livestock, forestry, and fishery sector (13.80%), while the second-highest growth sector is other services (4.00%). At current prices, the GDP in the second quarter of 2019 was Rp 3,963.46 trillion, with the manufacturing industry sector as the primary contributor (19.52%), followed by agriculture, livestock, forestry, and fishery sector (13.57%), and wholesale and retail trade, cars and motorcycles reparations (12.95%). In terms of expenditure, the GDP in the second quarter 2019 was dominated by household consumption Expenditure with a proportion of 55.79%, while fixed capital formation expenditure and export of goods and services expenditure were around 31.25% and 17.61%, respectively. However, compared to the same quarter in 2018, at 2010 constant prices, NPISHs consumption expenditure increased by 15.27%, the government

expenditure increased by 8.23%, and fixed capital formation expenditure increased by 5.01% (Badan Pusat Statistik, 2019) (Badan Pusat Statistik, 2018a) (Badan Pusat Statistik, 2018b)

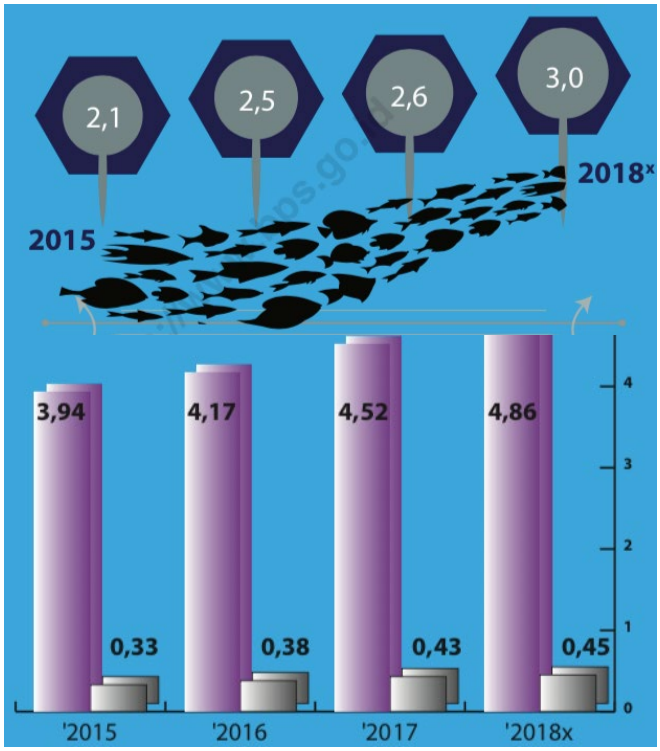

Figure 1. The contribution of Indonesian fisheries GDP and the surplus of the foreign trade balance of fishery products (billion US $) of exports/imports continue to increase (Badan Pusat Statistik, 2019)

China ranked first in terms of the quantities of fish captured. It was followed by Indonesia, India, the United States of America, and the Russian Federation. Nineteen countries caught more than one million tonnes each in 2017, which accounted for more than 72% of global catches. In 2017, the top ten aquaculture producers (excluding aquatic plants and non-food products) were China (46.8 million tonnes), India (6.2 million tonnes), **Indonesia** (6.2 million tonnes), Vietnam (3.8 million tonnes), Bangladesh (2.3 million tonnes), Egypt (1.5 million tonnes), Norway (1.3 million tonnes), Chile (1.2 million tonnes), Myanmar (1 million tonnes) and Thailand (0. 9 million tonnes). They collectively produced 71.2 million tonnes, which contributed 88.9% to the total world production by quantity in 2017 (FAO, 2017)

2. LITERATURE REVIEW

The global aquaculture production in 2016 was 80.0 million tonnes of food fish, 30.1 million tonnes of aquatic plants, and 37.900 tonnes of non-food products. The food for fish farms production was 54.1 million tonnes of finfish, 17.1 million tonnes of mollusks, 7.9 million tonnes of crustaceans, and 938 500 tonnes of other aquatic animals. China, by far the primary producer of food for fish farms in 2016, produced more than the rest of the world combined every year since 1991. The other major producers in 2016 were India, Indonesia, Vietnam, Bangladesh, Egypt, and Norway. Aquatic plants farm is mostly seaweeds and a much smaller production volume of microalgae. China and Indonesia were the significant producers of aquatic plants in 2016. Global production of the aquatic plant's farm overwhelmingly dominated by seaweeds whose output volume grew from 13.5 million tonnes in 1995 to just over 30 million tonnes in 2016. The rapid growth in the farm of tropical seaweed species (*Kappaphycus alvarezii* and *Eucheuma* spp.) in Indonesia, as the raw material for carrageenan extraction, has been the major contributor to the growth in the production of aquatic plant's farm recently. Indonesia increased its seaweed output from less than 4 million tonnes in 2010 to over 11 million tonnes in 2015 and 2016. Asia had accounted for about 89% of world aquaculture production for more than twenty years. Over the same period, Africa and the Americas have lifted their respective shares in total world production, while those of Europe and Oceania have dropped slightly. Among major producing countries, Egypt, Nigeria, Chile, India, Indonesia, Vietnam, Bangladesh, and Norway have strengthened their share in the regional or world production to varying degrees over the past two decades. China has gradually weakened its share of the global output from 65 percent in 1995 to less than 62 percent in 2016 (FAO, 2018)

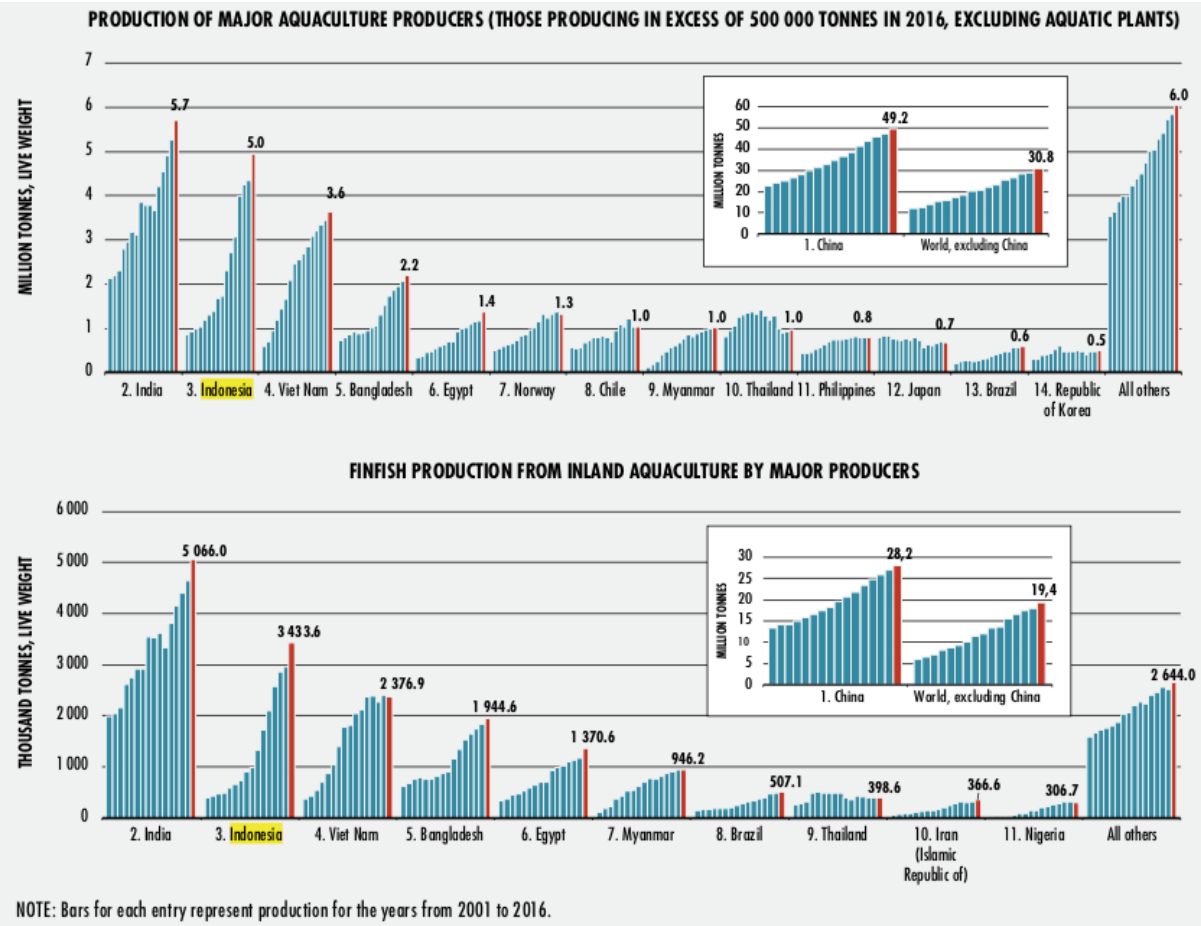

Figure 2. Indonesia and World Production of major aquaculture producers (those producing over 500.000 tonnes in 2016, excluding aquatic plants) and finfish production from inland aquaculture by major producers (FAO, 2017)

The value of the above USD 143 billion of fish and fish products in 2016, did not include the addition of USD 1.7 billion from the trade of seaweeds and other aquatic plants (57%), inedible fish by-products (32%), and sponges and corals (11%). The trading of the aquatic plants increased from USD 60 million in 1976 to more than USD 1 billion in 2016, with Indonesia, Chile, and the Republic of Korea as the major exporters, and China, Japan, and the United States of America, the leading importers. Owing to the increasing production of fishmeal and other products derived from the residue of the fish processing (see the previous section, "Fish utilization and processing"), the trade of inedible fish by-products has also surged, up from USD 9 million in 1976 to USD 0.5 billion in 2016. Bangladesh, Cambodia, the Gambia, Ghana, Indonesia, Sierra Leone, Sri Lanka, and some SIDS contributed 50% or more of the total animal protein intake (FAO, 2018)

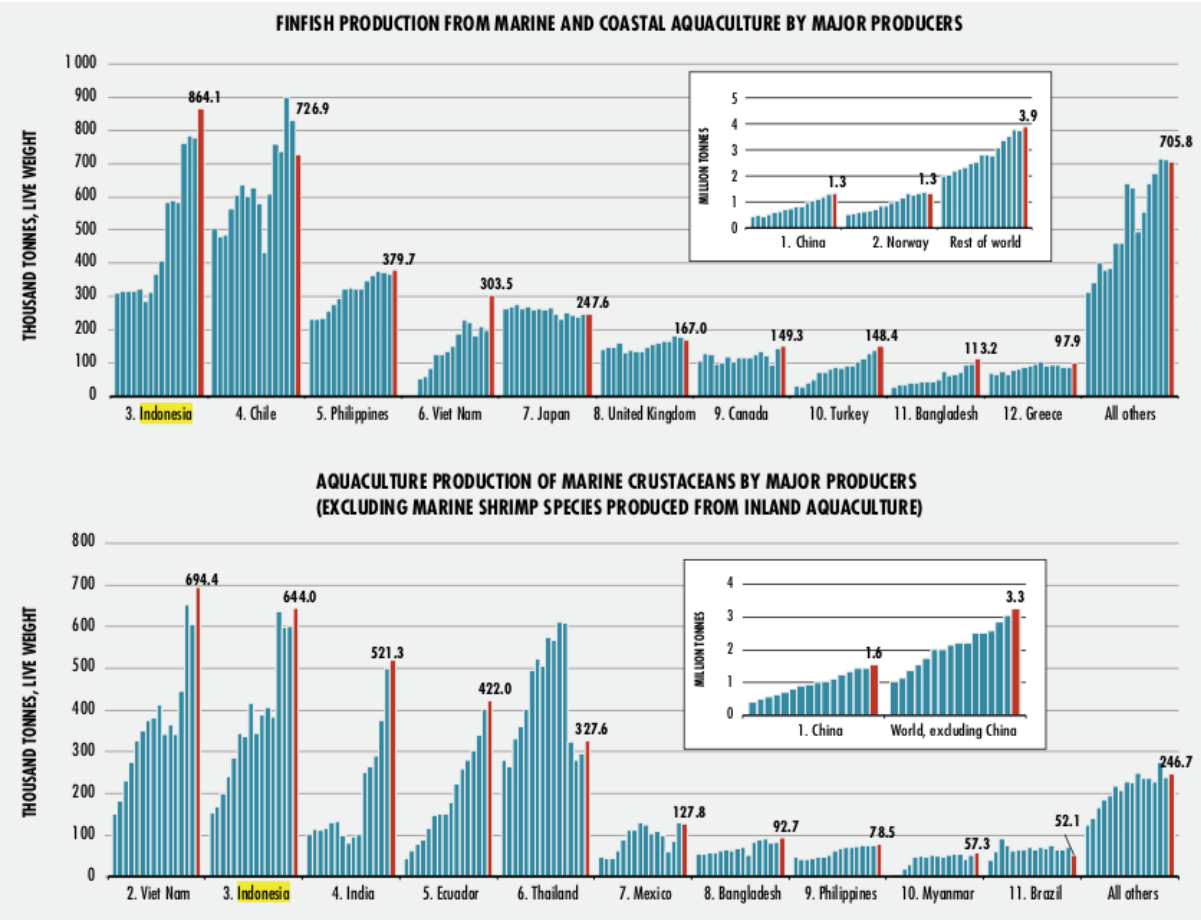

Figure 3. Indonesia and the world finfish production from marine and coastal aquaculture by major producers and aquaculture production of marine crustaceans by major producers (excluding marine shrimp species produced from inland aquaculture) (FAO, 2018)

The international community is seeking to ensure the involvement of stakeholders from the fisheries and aquaculture sector in the SDG discussions, to raise awareness and to promote policies and practices that will assure the sector's contributions to meet all ten relevant SDGs. Events and initiatives designed to reinforce and support the sector's role in achieving the SDGs include the series of Our Ocean conferences (hosted by the United States of America [2014], Chile[2015], Malta [2017], Indonesia [2018], Norway [2019] and Palau [2020]), the 2017 and 2020 United Nations Ocean Conferences, the new annual International Day for the Fight against Illegal, Unreported and Unregulated Fishing on 5 June, and the International Year of Artisanal Fisheries and Aquaculture in 2022. FAO has conducted two pilot projects to support the future implementation of the guidelines. The first one was on gillnet fisheries in Indonesia, which focused on the practical application of gear marking and lost gear retrieval in small-scale coastal fisheries. The other was a feasibility study that focused on the drifting fish aggregation devices (FADs) used by the purse seine industry. At an FAO technical consultation in February 2018, member countries agreed on a set of the draft voluntary guidelines on the marking of fishing gear, which was tabled for approval at the 2018 FAO Committee of Fisheries. The Southeast Asian Fisheries Development Center focused on HRBA, in a workshop on a regional approach for the implementation of the SSF Guidelines in 2017. HRBA is also emphasized at the national level. Indonesia adopts a legislative framework on the protection of human rights in the fisheries sector, with the technical assistance of FAO. Costa Rica developed a draft law on small-scale fisheries with specific reference to human rights (FAO, 2018)

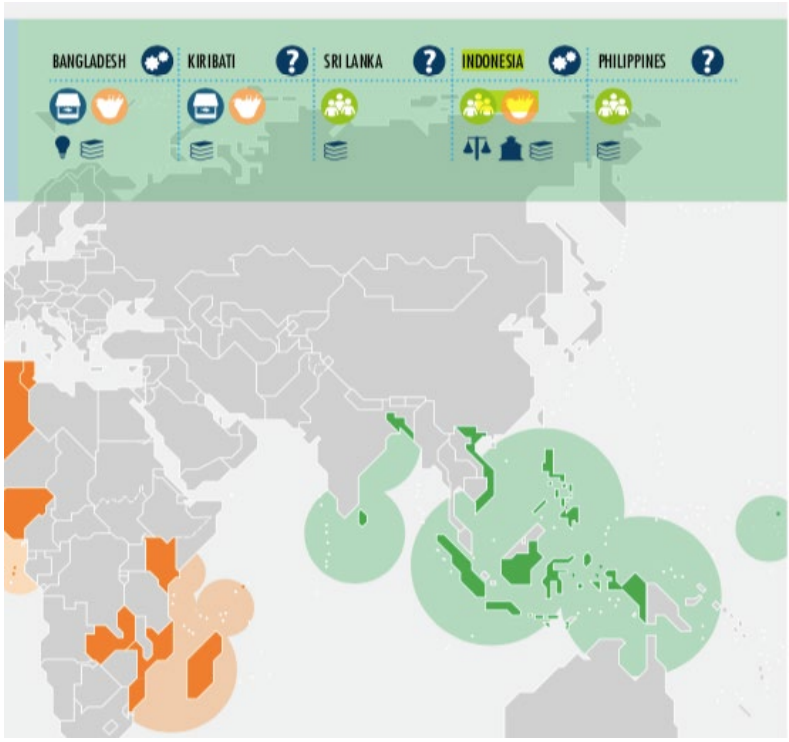

Figure 4. Indonesia and global distribution of blue growth initiative projects (FAO, 2018)

Scopus is a source-neutral abstract and citation database that is curated by the experts of the independent subject matters. Scopus includes more than 75 million records: (1) more than 68 million post-1970 records, including references; (2) more than 6.5 million pre-1970 records going back as far as 1788; (3) more than 8.5 million Open Access articles; (4) more than 9 million Conference papers. More than 24,600 active titles; (1) more than 23,500 peer-reviewed journals, of which more than 4,000 are Gold Open Access; (2) more than 740 book series; (3) more than 300 trade publications; (4) Articles-in-press (i.e., articles that have been accepted for publication) from over 8,000 titles from international publishers, including Cambridge University Press, the Institute of Electrical and Electronics Engineers (IEEE). Over 194,000+ books; (1) Including monographs, edited volumes, major reference works, and graduate-level textbooks; (2) Focuses on social sciences and arts & humanities, but also includes science, technology & medicine (STM). Scopus also provides features to help researchers go beyond search, which is into discovery and analysis (Scopus.com, 2019).

3. METHODOLOGY

Finding the trend of fish and solar cell technology research by using Scopus.com data, namely, Analyze search results data, the researchers found 171 document results from 1970 to 2019. There are seven types of documents that are 111 documents are in the form of articles, 29 conference papers, 16 review documents, nine conference reviews, four book chapters, one book, and a note.

Scopus search tools designed to help navigate across the over 75 million items indexed. Search: (1) Search by document, author or affiliation, or use Advanced Search; (2) Refine results by access type, source type, year, language, author, affiliation, funding sponsor and more; (3) Link to full-text articles your institution already subscribes to, along with other library resources; (4) Use the Document Download Manager to bulk retrieve results in .pdf format; (5) Export data to reference managers such as Mendeley, RefWorks and EndNote; (6) Stay up-to-date with Email Alerts, RSS and HTML feeds (Scopus.com, 2019)

3. DISCUSSION AND ANALYSIS

The analysis of the trend of the fish and solar cell technology research in the last 50 years, from 1970 to 2019, shows the fact that it has been increasing in the previous 20 years, from 1999 to 2019. The result shows the strengthening of sustainable mobility and transportation research throughout the world. Figure 1 is the descriptive visual display, documents by year, 1970 to 2019. Fish and solar cell technology research trends were also supported by the increased of citations on research documents, which help increase the popularity of the research in the world.

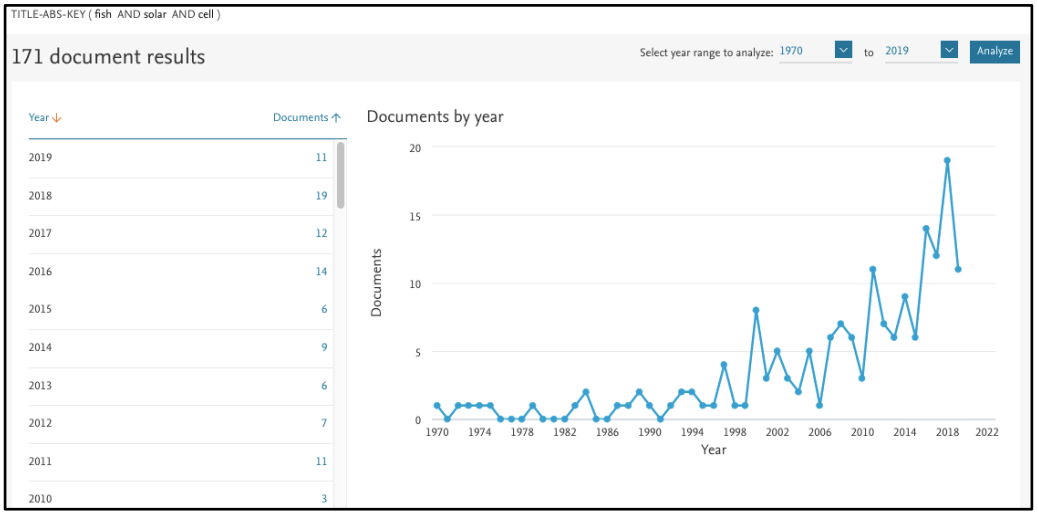

Figure 1. Scopus 1970-2019 Fish and Solar Cell Technology Research Trend, Documents By Year

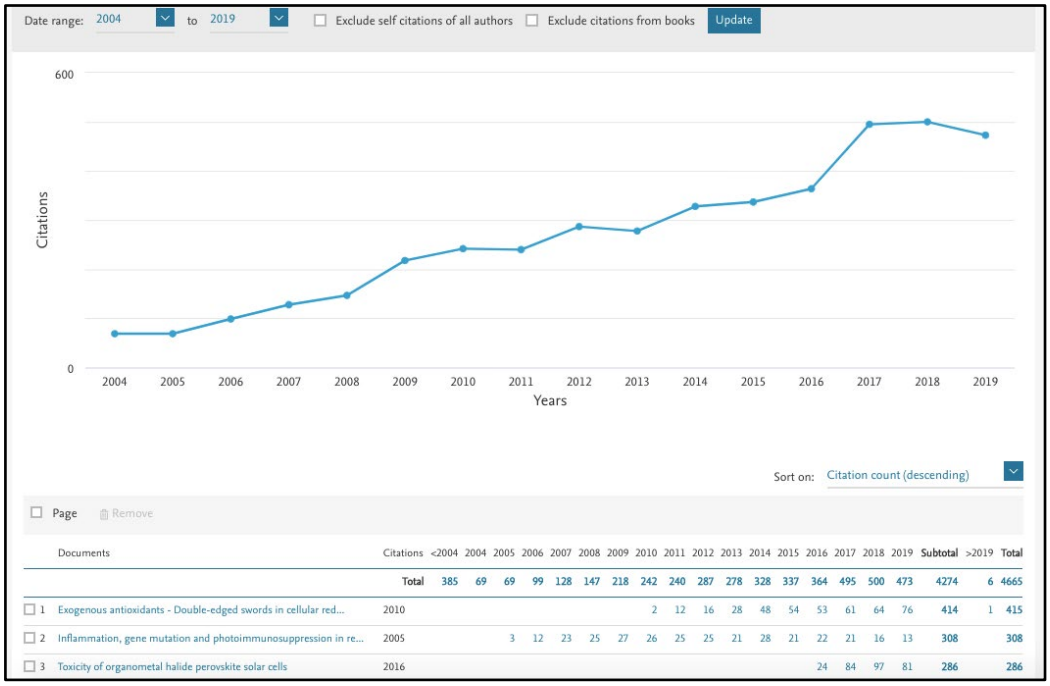

Figure 2. Scopus 2004-2019 Fish and Solar Cell Technology Research Trend, Citations By Year

By source, there are 171 documents on the fish and solar cell technology research from 1970 to 2019, which counts for up to 122 references. There are five papers each from Aquatic Toxicology, and Journal Of Photochemistry And Photobiology B Biology, three papers each from Cell And Tissue Research, IOP Conference Series Earth And Environmental Science, and Photochemistry And Photobiology and 2 documents each from Advances In Experimental Medicine And Biology, Applied And Environmental Microbiology, Aquacultural Engineering, Environmental Microbiology, Environmental Science And Technology, Environmental Toxicology And Chemistry, International Journal Of Hydrogen Energy, Journal Of Fish Biology, Nongye Gongcheng Xuebao Transactions Of The Chinese Society Of Agricultural Engineering, Proceedings Of SPIE The International Society For Optical Engineering, Renewable And Sustainable Energy Reviews, and Solar Energy. Figure 3 the descriptive visual display document by source, from up to 122 references.

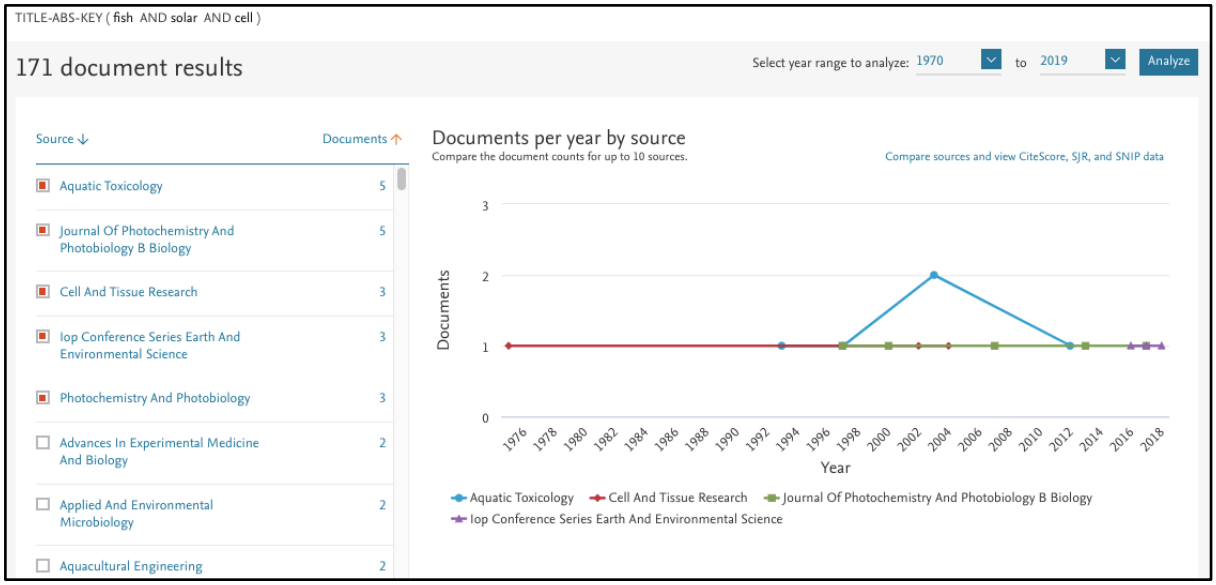

Figure 3. Scopus 1970-2019 Fish and Solar Cell Technology Research Trend, documents per year by source

By affiliation, there are 171 documents on fish and solar cell technology research from 1970 to 2019, which counts for up to 160 affiliation documents. There are four documents each from the University of Innsbruck, and Miami University, 3 documents each from Universitetet i Oslo, Universitat DAlacant, Chinese Academy of Sciences, Cancer Registry of Norway, Institute of Population-based Cancer Research, University of Jyvaskyla, and Aker university hospital and 2 documents each from Assiut University, Universite de Liege, Universidad de Buenos Aires, Consejo Nacional de Investigaciones Científicas y Técnicas, University of Pennsylvania, Food and Drug Administration, Universiteit Hasselt, Technical University of Berlin, University of Hawaii at Manoa, Göteborgs Universitet, Universität Tübingen, Csic-Uib-Instituto Mediterraneo de Estudios Avanzados Imedea, Texas A&M University, UIT The Arctic University of Norway, Lancaster University, Havforsknings Instituttet, University of Chinese Academy of Sciences, the University of Georgia, Universidad Miguel Hernandez de Elche, Texas State, Universidad Nacional de la Plata, Universidad del Valle, Cali Institute for Materials Research, Hasselt University, and Chinese Academy of Fishery Sciences. Figure 4 the descriptive visual display documents by affiliation, for up to 160 affiliations

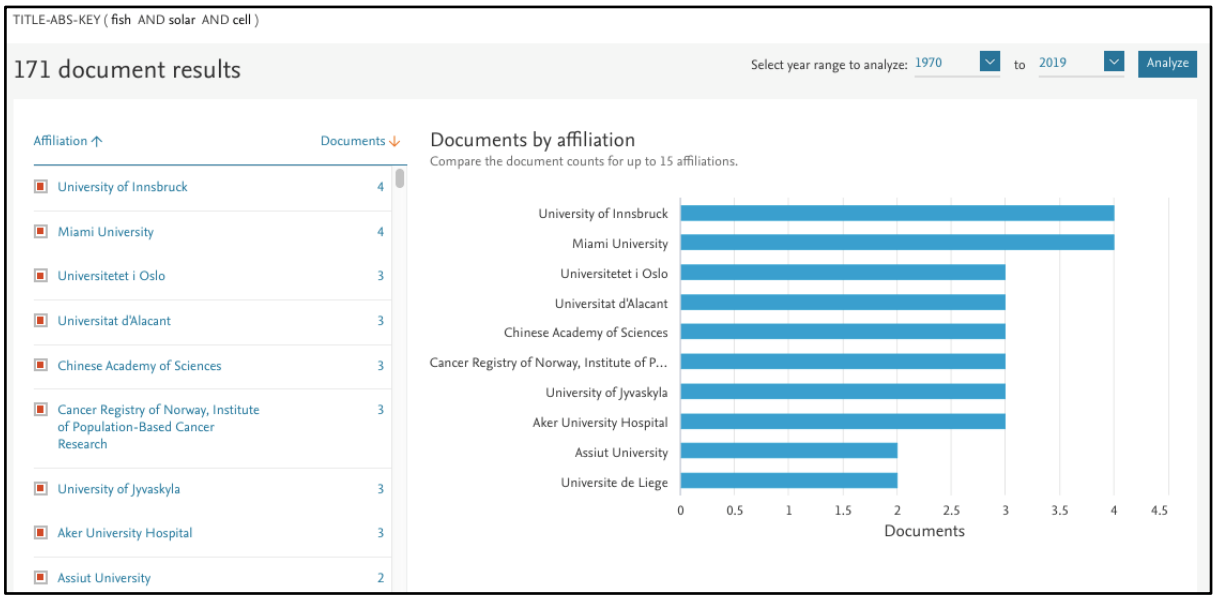

Figure 4. Scopus 1970-2019 Fish and Solar Cell Technology Research Trend, documents by affiliation

By country/territory, there are 171 documents on fish and solar cell technology research from 1970 to 2019, which counts for up to 50 country/territory documents. There are 42 papers from the United States, 12 reports from China, ten papers from the United Kingdom, nine documents each from **Indonesia** and Japan, eight

documents from Germany, seven papers from India and Spain, 6 papers from France, five documents from Norway, 4 papers each from Austria and South Korea, 3 papers each from Canada, Italy, Sweden; Argentina, Australia, Belgium, Egypt, Finland, Switzerland and Taiwan. Figure 5 descriptive visual display documents by country/territory of up to 50 countries/territories.

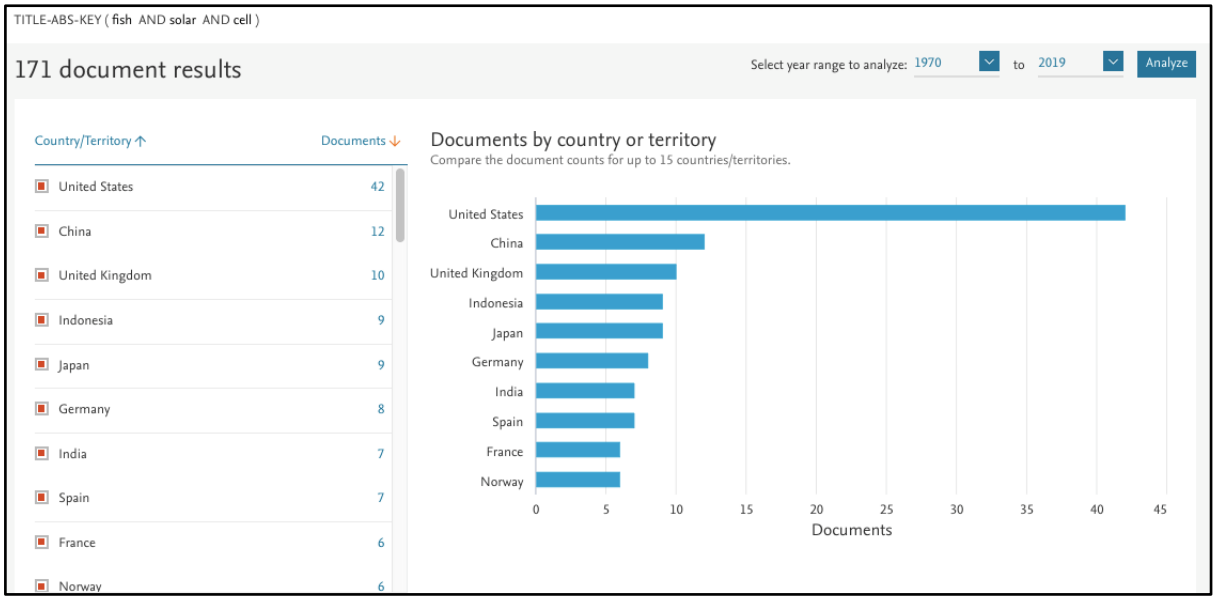

Figure 5. Scopus 1970-2019 Fish and Solar Cell Technology Research Trend, documents by country or territory

By type, there are 171 documents on the fish and solar cell technology research from 1970 to 2019, which counts for up to 7 types of documents. There are 111 articles, 29 conference papers, 16 reviews, nine conference reviews, four book chapters, one book, and a note. Figure 6 the descriptive visual display documents by type, up to seven types.

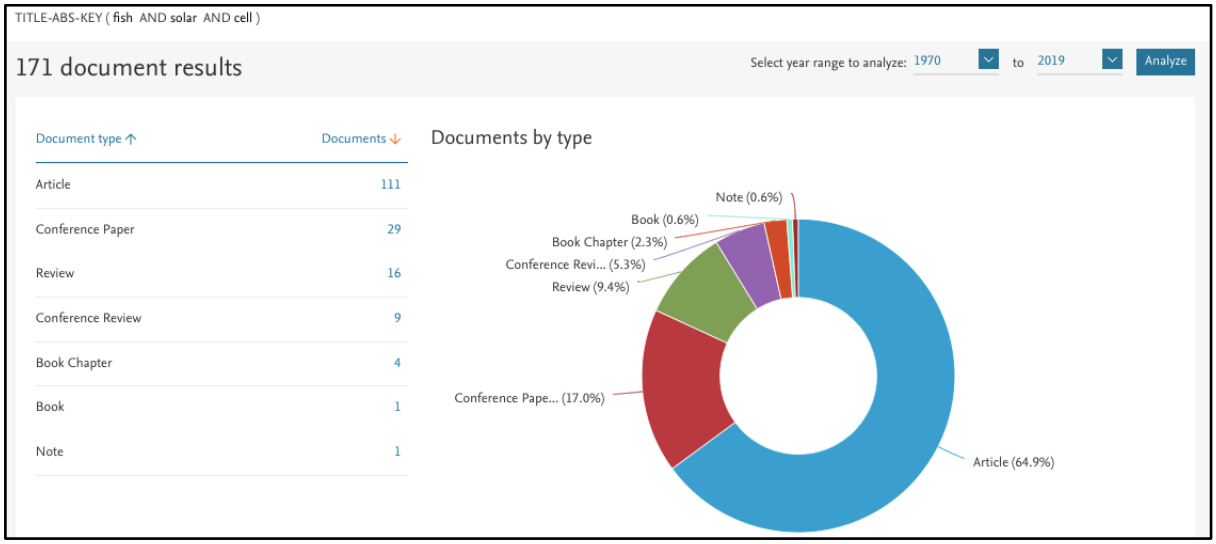

Figure 6. Scopus 1970-2019 Fish and Solar Cell Technology Research Trend, documents by type

By subject area, there are 171 fish and solar cell technology research from 1970 to 2019, which counts for up to 22 subject areas. There are 45 documents on environmental science, 40 documents on agricultural and biological sciences, 38 documents on biochemistry, genetics, and molecular biology, 34 papers on medicine, 27 papers on engineering, 20 papers on energy, 18 papers on physics and astronomy, 11 documents on chemistry, and materials science, ten documents on computer science, earth and planetary sciences, and immunology and microbiology, seven documents on toxicology and pharmaceutics, five documents on health professions, four documents on chemical engineering, mathematics, and veterinary, and three documents on multidisciplinary,

neuroscience, and nursing. Figure 7 the descriptive visual display documents by subject area, for up to 22 subject area

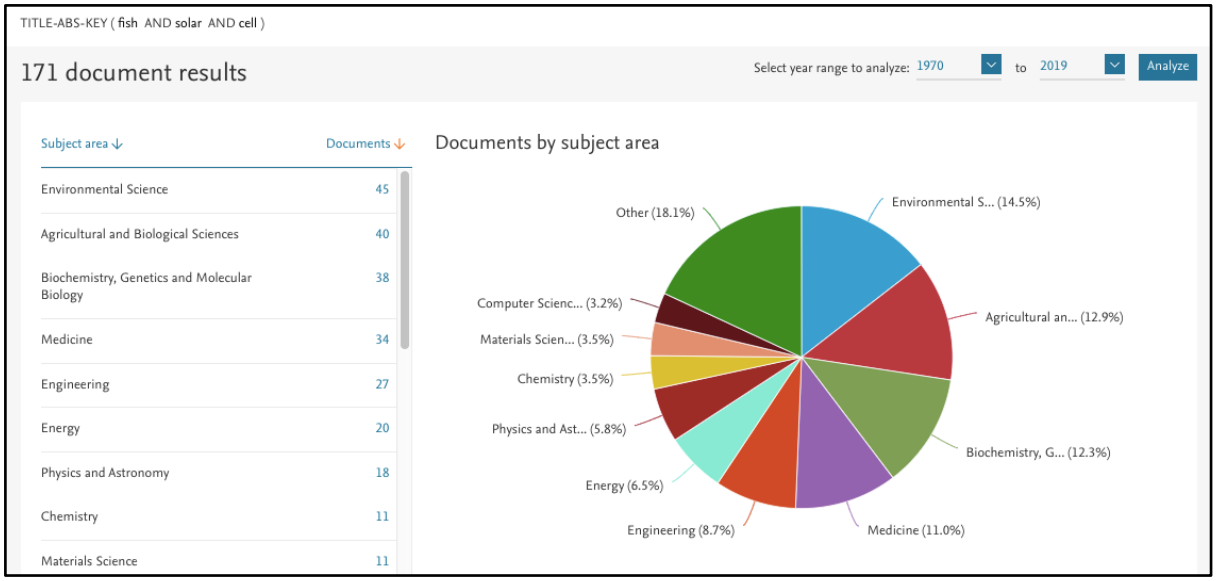

Figure 7. Scopus 1970-2019 Fish and Solar Cell Technology Research Trend, documents by subject area

By funding sponsors, there are 171 documents of the fish and solar cell technology research from 1970 to 2019, which counts for up to 60 funding sponsors. There are three documents each from the European Commission, European Regional Development Fund, Fonds Wetenschappelijk Onderzoek, Fundação Para a Ciência e a Tecnologia, the Ministry of Education, National Institutes of Health, and two documents from Texas Parks and Wildlife Department. Figure 8 the descriptive visual display documents by funding sponsors for up to 60 funding sponsors.

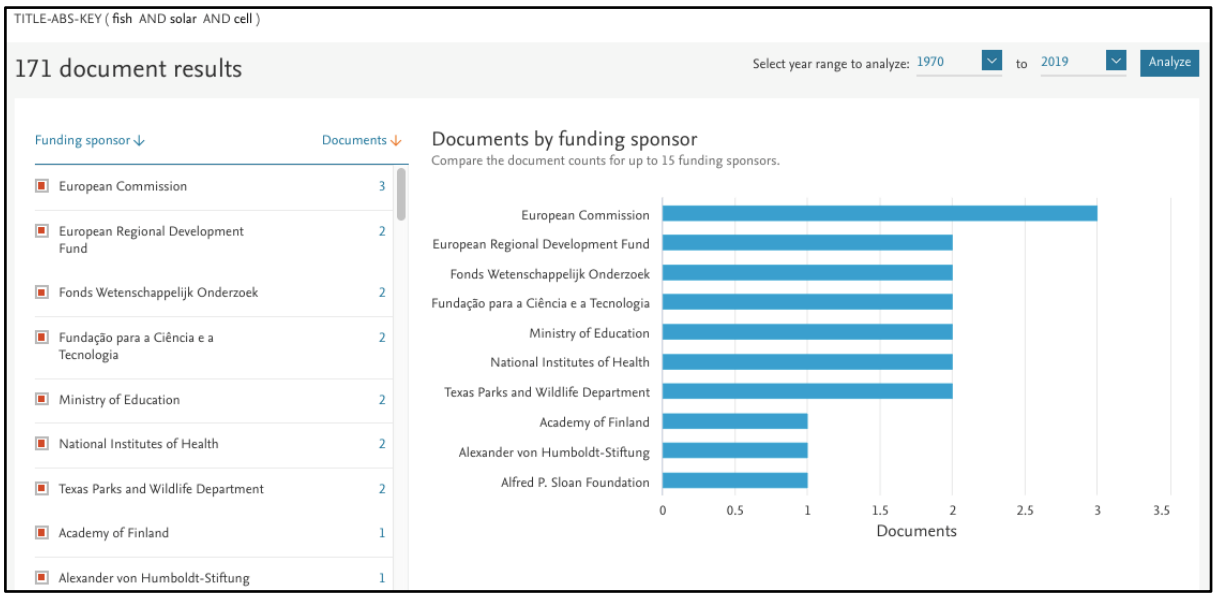

Figure 8. Scopus 1970-2019 Fish and Solar Cell Technology Research Trend, documents by funding sponsor

4. CONCLUSION

The contribution of Indonesian fishery's GDP and the surplus of the foreign trade balance of fishery products continue to increase. The Gross Domestic Product (GDP) in the second quarter of 2019, at 2010 constant prices, reached Rp 2,735.19 trillion, which was an increase of around 5.05% compared to that in the same quarter of 2018 (y-o-y), and 4.20% from the previous quarter(q-o-q). The sector with the quarterly highest growth in the second quarter of 2019 was agriculture, livestock, forestry, and fishery's industry (13.80 percent). Indonesia's

fishery's GDP growth needs to be supported by fisheries research on solar-cell renewable energy technology. Fish and solar-cell technology research is a world trend. There are 171 documents related to titles, abstracts, and keywords in Scopus publications. Fish and solar cell technology researches are available in 122 journals, which are five documents in the Journal of Aquatic Toxicology and Journal of Photochemistry and Photobiology Biology. The study is found in 160 affiliation documents, four documents from the University of Innsbruck, and Miami University. Fifty countries/territories do the research on the subject, which are 42 documents in the United States and 12 documents in China. Indonesia ranks 4th in the world with four papers. There are seven types of documents of the area, which are 111 documents in the form of Article and 29 documents in the form of Conference Paper. Fish and solar cell technology researches found in 22 subject areas, 45 documents on environmental science, and 40 documents on agricultural and biological sciences. Fish and solar cell technology researches receive 60 funding sponsors, one of which is three documents from the European Commission.

Acknowledgment

The trend in the fish and solar cell technology research is a part of the research on the technology of the inflated portable solar power cold storage house, which is a supporting facility to increase the production and marketing of fisheries. The research is financed by the Directorate of Research and Community Service of the Director-General of Strengthening Research and Development at the Ministry of Technology, Research, and Higher Education in 2019.

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