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Research Article

Islam and Natural Resources Technology

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ABSTRACT

This paper aims to understand the Islamic view of advanced technology and also presents examples of technology and its application in natural resource management.This paper uses secondary data from reference books, proceedings, national and international journals.The emphasis of the analysis is qualitative descriptive.The results of the analysis showed that Islam is a religion that does not reject the existence of modernity.Even Islam strongly encourages its people to master science and technology.One of these advanced technologies is remote sensing technology.The integration of remote sensing technology and geographic information systems has many benefits and uses for human life, such as for detect potential fish distribution area, mapping habitat benthic in small island, forest landcover change,large scale topographic mapping,and others.Science and technology developed in the order of the Islamic system will provide mercy for the whole world.

1. INTRODUCTION

Science and technology are one of the important foundations in supporting the building of a nation's modern civilization.Therefore, mastery of science and technology will determine the future of a nation.A nation will not have superiority and high competitiveness if it does not adopt and develop science and technology.Currently, the nations of the world are competiting fiercely in the mastery of science and technology, including in muslim countries.

Almost all muslim countries are developing countries. As a developing country, there are many problems faced, such as in the fields of science and technology. Among these Muslim countries, there are similarities when it comes to science and technology. Amhar et al, (2018) stated that there are 3 problems including 1) there is no independence, this indicates that most of the technology used comes from other countries (developed countries). The convoluted economic problems allegedly forced them to invite investors from developed countries. These investors will usually determine the terms that will benefit them, such as bringing the technology they have or a profit-sharing scheme for the exploitation of natural resources. 2) Research resources that are less productive or less well utilized. Developing countries tend to feel that everything that comes from developed countries, including science and technology, is better than the results of domestic researchers. The innovation of domestic researchers is considered to be of low quality and is considered to still have to "learn" so that not much of it flows into manufacturing or mass industry. 3) Although there is science and technology that has been successfully created, but not many are in accordance with their character and needs.

As a developing country, Indonesia has abundant natural resources, both on land and at sea. Indonesia is flanked by 2 continents, namely the Asian continent and the Australian continent and is flanked by 2 oceans, namely the Indian Ocean and the Pacific Ocean. This position makes Indonesia has a very strategic position and is also rich in natural resources. The sea in Indonesia is the largest marine mega-biodiversity in the world consisting of 555 types of seaweed, 950 types of coral reefs with a potential of 85,000 km^2, a potential aquaculture area of 24528178 ha and 8,500 species of fish. Fish resources consist of pelagic fish, demersal fish, reef fish, shrimp, lobster and squid (Kkp.go.id, 2016). Indonesian waters have 27.2% of all species of flora and fauna in the world. These types of flora and fauna include mammals 12%, amphibians 23.8%, reptiles 31.8%, fish 44.7%, mollusks 40%, and seaweed 8.6%

of all species in the world (Lumban-Gaol et al., 2019). There are 3,476 fish species that have been identified in the Indonesian Ocean (Postuma & Gasalla, 2010). The wealth of these aquatic resources makes Indonesia the second highest catch fish production in the world in marine fisheries, and the seventh highest capture fisheries production in the world in public waters (Sciences et al., 2009).

As the world's largest archipelagic country, Indonesia has a distance from west to east of approximately 6,400 km, while the distance between the northernmost region and the southernmost region is approximately 2,500 km (Rachmawati, Susilo, Wiadnyana, Puspasari, & Wijopriono, 2018).Indonesia's territory consists of 17,508 large and small islands, including the islands of Sumatra, Java, Kalimantan, Sulawesi (Celebes), the Maluku Islands (Maluku), and Papua.As an archipelagic country, the sea is the lifeline of the Indonesian people (Mugo, Saitoh, Nihira, & Kuroyama, 2010; Risdiyanto et al., 2017).The territory of Indonesia consists of a land area of approximately 1.92 million km^2, archipelagic waters and territorial sea of 12 nautical miles with an area of 3.1 million km^2, and an exclusive economic zone (EEZ) of 200 nautical miles covering an area of 2.7 million km^2 (Sulistiyono & Rochwulaningsih, 2013).Indonesia also has a coastline of 95,181 km (Acuña-Marrero et al., 2014). The length of this coastline is the second longest in the world.

The size and abundance of these natural resources should make Indonesia a great maritime country.However, (Rochwulaningsih, Sulistiyono, Masruroh, & Maulany, 2019)assessed that there were factors that prevented this from being realized.These factors include the failure to reform traditional products derived from abundant natural resources and the inability to develop advanced technology.One technology that is very important and has many benefits for humans is natural resource technology.Natural resource management requires science and technology to be utilized optimally while maintaining its sustainability.The application of appropriate science and technology is expected to contribute to the utilization of natural resources directed at zero waste, increasing income, circular economy and others.One of these natural resource technologies is remote sensing technology.

Considering the abundance of natural resources in Indonesia and the importance of natural resource technology to be able to manage them properly and wisely, it is very necessary to understand natural resource technology such as remote sensing technology.Therefore, this study aims to introduce one type of natural resource technology, namely remote sensing and its application in natural resource management.In addition, this study also aims to find out Islamic views on advanced technology, especially technology in the field of natural resources.

2. METHOD

As a perfect religion, Islam is not allergic to advanced technology. Even Islam encourages its people to master technology. One of the advanced technologies that has many benefits and uses is remote sensing technology. Therefore, in this study, descriptive analysis method is carried out by using references related to this advanced technology. In addition, to understand how Islam encourages its people to master technology, the Qur'an and the Sunnah of the Prophet Muhammad Shallallahu 'Alaihi Wa Sallam are used as reference sources.

3. RESULTS AND DISCUSSION

3.1. Remote Sensing Satellite

Advances in science and technology have succeeded in presenting sophisticated natural resource technology that can monitor objects on the earth's surface.One of the advanced technologies that provide many benefits and uses is remote sensing technology.Remote sensing technology has been known since the early 19th century, starting with the creation of the first aerial portraits of landscapes in 1838, which was then followed by the creation of aerial portraits in 1887 from aircraft in 1919. The era of satellite remote sensing began with the launch of ERTS-1(later renamed Landsat 1) containing the 1972 MSS satellite sensors and the 1980 space shuttle.Some experts have given the definition of remote sensing which in principle is the science and art of obtaining information about objects, areas, or phenomena by analyzing data obtained using tools without direct contact with the object, area, or phenomenon being studied.Remote sensing utilizes electromagnetic waves in analyzing an object (Lillesand and Kiefer, 1979;Curran, 1985).Remote sensing sensors are installed in several vehicles such as airplanes, air balloons, satellites and others.

Currently there are various types of satellite imagery.Image is a description of the appearance of the earth's surface as a result of sensing on a certain electromagnetic spectrum that is displayed on a screen or stored on recording or print media.Some of the types of satellite imagery include:

Landsat TM Image

It is one type of remote sensing satellite imagery produced from a passive remote sensing system.Landsat has 7 channels where each channel uses a specific wavelength.Landsat satellite is a satellite with a sun-synchronous orbit type (orbiting the earth almost past the poles, cutting the direction of the earth's rotation with an inclination angle of 98.2 degrees and an orbital altitude of 705 km from the earth's surface. The coverage area per scene is 185 km x 185 km. Landsat has the ability tocovering the same area on the earth's surface every 16 days, at an orbital altitude of 705 km. The function of the Landsat satellite is for land cover mapping, land use mapping, land mapping, geological mapping, and sea surface temperature mapping. Figure 1 shows an example of sensing results using the Landsat Satellite.

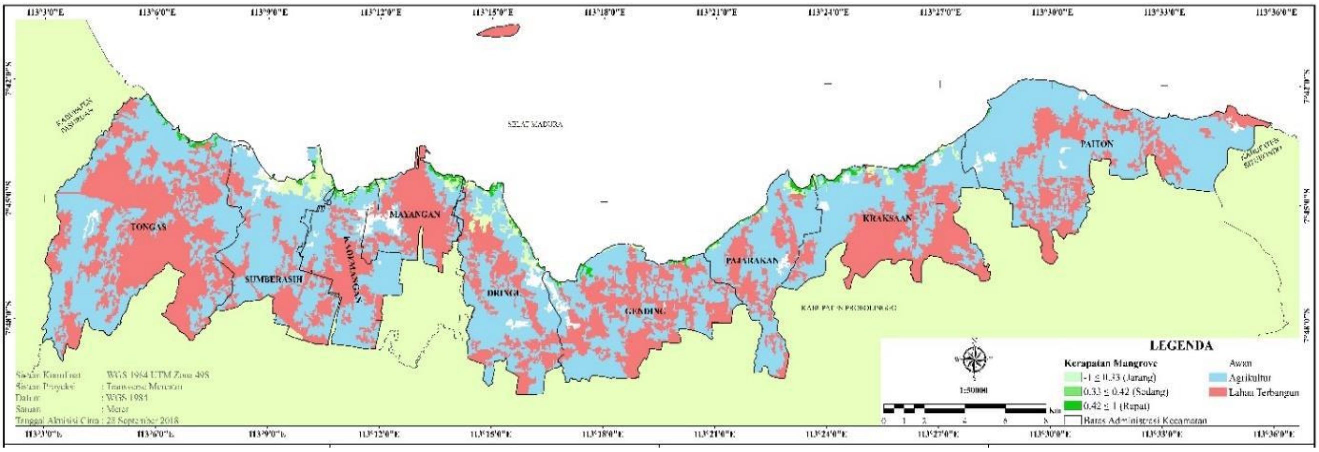

Figure1. Visualization of the distribution of mangroves, built-up land, and agriculture on the coast of Probolinggo Regency and City (Widyantara and Solihuddin, 2020)

SPOT (systeme pour I'observation de la terre) satellite

It is a French satellite that carries HRV (SPOT1,2,3,4) and HRG (SPOT5) sensors.This satellite orbits at an altitude of 830 km with an inclination angle of 80 degrees.The SPOT satellite has the advantage of its sensor system which carries two identical sensors called HRVIR (haute resolution visible infrared).Each sensor can be adjusted the axis of observation to the left and right to cut the direction of the satellite trajectory to record up to 7 areas of coverage.The function of the SPOT satellite is for globalearth monitoring accuracy.An example of sensing results using the SPOT satellite can be seen in Figure 2.

Figure 2. Mapping results using SPOT Satellite(Yuwono et al., 2015)

ASTER (advanced spaceborne emission and reflecton radiometer)Satellite

The satellite developed by Japan where the sensors carried consist of VNIR, SWIR, and TIR.This satellite has a sunshyncronus orbit, which is a satellite orbit that aligns the movement of the satellite in a precision orbit of the orbital plane and the movement of the earth around the sun in such a way that the satellite will pass a certain location on the earth's surface always at the same local time every day.Its orbital altitude is 707 km with an inclination angle of 98.2 degrees.One example of ASTER satellite imagery can be seen in Figure 3.

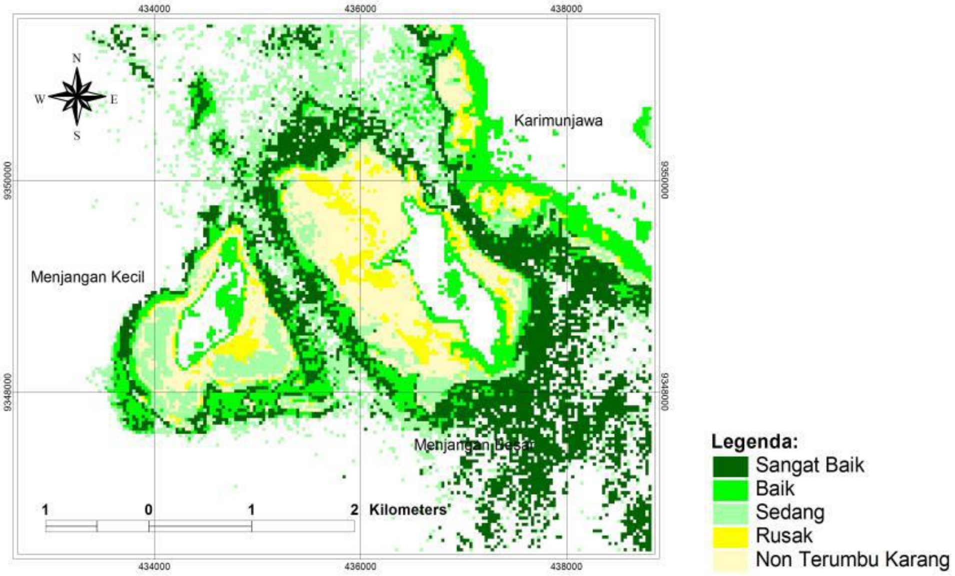

Figure 3.The results of coral reef health classification using ASTER image (Murti and Wicaksono, 2014)

QUICKBIRD Satellite

It is a high resolution satellite with a spatial resolution of 61 cm, orbiting at an altitude of 450 km in solar synchrony, this satellite has two main sensors, namely panchromatic and multispectral.Quickbird has four channels (bands).The function of the QUICKBIRD satellite is to support urban applications, recognition of settlement patterns, expansion of built-up areas, presenting a variety of phenomena related to cities, and for agricultural land, related to age, health, and density of annual crops, so it is often used to estimate production levels in general.regional.An example of a QUICKBIRD satellite image can be seen in Figure 4.

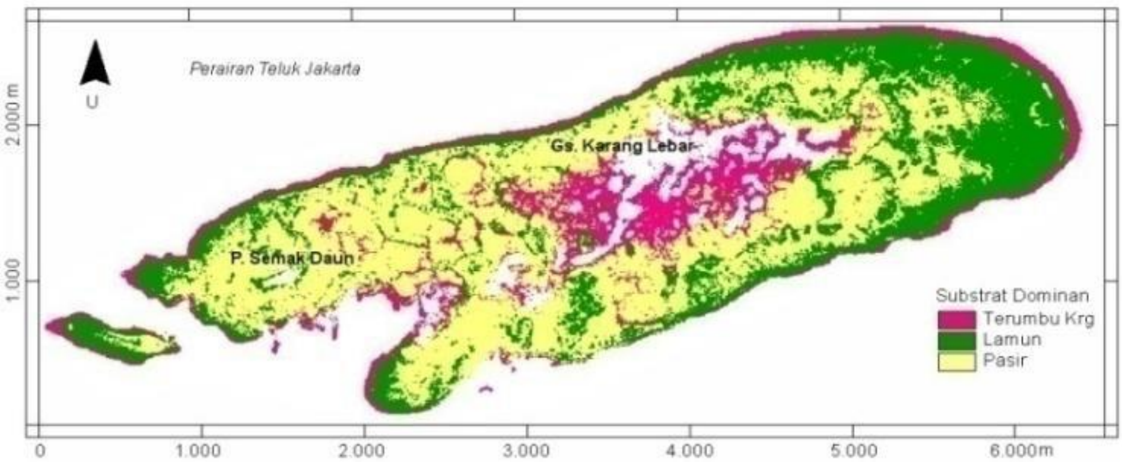

Figure 4. Base substrate map using QUICKBIRDimagery(Selamat et al., 2012)

IKONOS Satellite

Ikonos is a high spatial resolution satellite launched in September 1999. It records 4 channel multispectral data at a resolution of 4 m.Its orbital altitude is 681 km.High resolution images are very suitable for detailed analysis, such as urban areas but are not effective when used for regional analysis.The function of the IKONOS satellite is for topographic mapping from small to medium scale, generating new maps, updating existing topographic maps, and optimizing the use of fertilizers and herbicides.An example of an IKONOS satellite image can be seen in Figure 5.

Figure 5. Lapindo mud map using IKONOS image(Akbari and Hariyanto, 2011)

Terra satellite

Terra is a satellite imagery which is a high resolution image spectrometer that can observe the same place on the earth's surface every day.The function of this satellite image is for observation of vegetation, radiation of the earth's surface, detection of land cover, detection of forest fires, and measurement of the earth's surface temperature.An example of a TERRA satellite image can be seen in Figure 6.

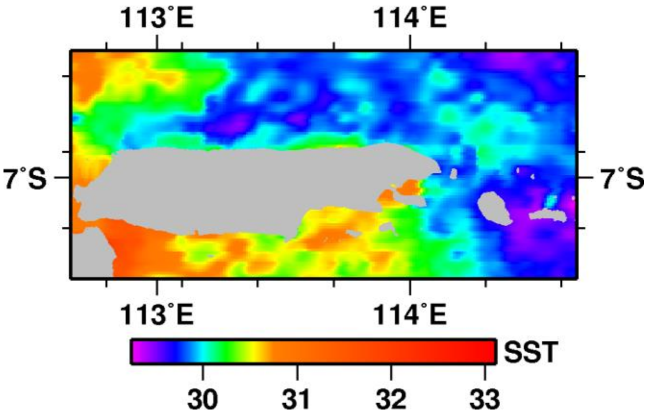

Figure 6. Mean sea surface temperature (SST) during the northeast monsoon around Madura Island (Syah & Sholeh, 2020).

GeoEyeSatellite

GeoEye-1 is an Earth observation satellite whose creation was sponsored by Google and the National Geospatial-Intelligence Agency (NGA) which was launched on September 6, 2008 from Vandenberg Air Force Base, California, USA.This satellite is able to map images with very high image resolution and is a commercial satellite with the highest image imaging currently in earth orbit.An example of a geoeye satellite image can be seen in Figure 7.

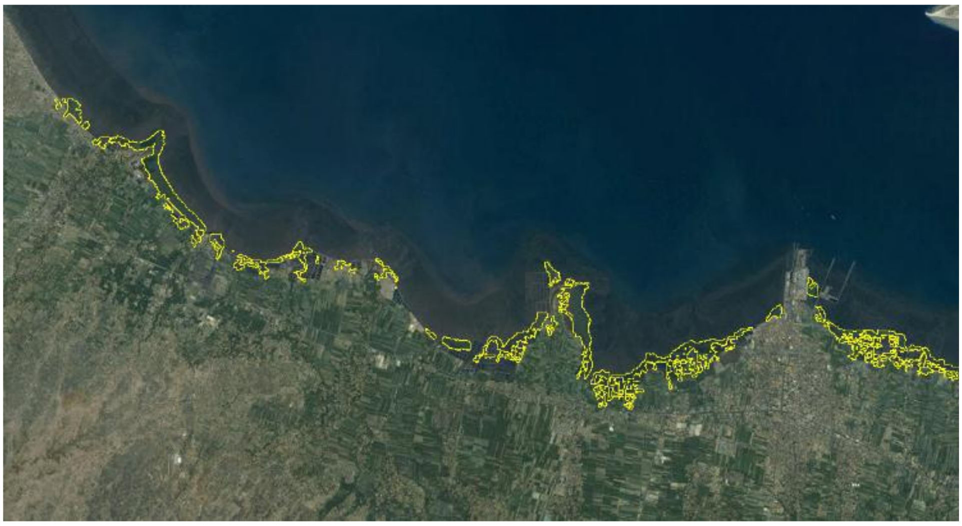

Figure 7. Mapping results using the GeoEye satellite (Yuwono et al., 2015)

The Indian Remote Sensing (IRS)

The IRS is a satellite system for providing valuable natural resource management information.The function of this satellite image is for urban planning and disaster management.An example of an IRS satellite image can be seen in Figure 8.

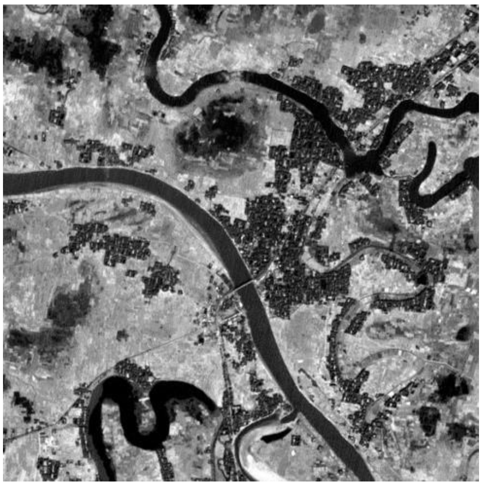

Figure 8. Results of the indian remote sensing

In addition, remote sensing satellites can also be used to map burned areas. In the last ten years, burned area detection algorithms have been enhanced by combining new processing methodologies, new sensors, and new integration methods, building on earlier developments. Table 1 shows a list of sensors from which the majority of accessible burnt area products were derived.

Table 1. Satellite sensors used for burned area mapping

Satellite	Operator	Operational dates		Temporal resolution	Spatial resolution
		Launch date	End operation		
ENVISAT (MERIS)	ESA	March1, 2002	May 9, 2012	2–3 days	300–1200m
JPSS (VIIRS)	NOAA	October28, 2011	Still operating	1–2 days	375–750m
Landsat 1–3 (MSS)	NASA/USGS	July 23, 1972	Sep. 7,1983	18 days	80 m
Landsat 4–5 (TM)	NASA/USGS	July 16, 1982	5 Juni 2013	16 days	30–120m
Landsat 7 (ETM +)	NASA/USGS	April 15, 1999	Still operating	16 days	15/ 30–60m
Landsat 8 (OLI/ TIRS)	NASA/USGS	February 11, 2013	Still operating	17 days	OLI:15/ 30m TIRS: 100m
NOAA-7-19 (AVHRR)	NOAA	October 19, 1978	Still operating	1–2 days	1100 m
PROBA V	ESA	May 7, 2013	Still operating	1–2 days	300 m
Sentinel 1A-B (SAR)	ESA	April 3, 2014 (1A), April 25, 2016 (1B)	Still operating	6 days	5–20m

Satellite	Operator	Operational dates		Temporal resolution	Spatial resolution
		Launch date	End operation		
Sentinel 2A-B (MSI)	ESA	Juni 23, 2015 (2A), March 7, 2017 (2B)	Still operating	5 days	10–20-60m
Sentinel 3A-B (SLSTR, OLCI)	ESA	Feb 16, 2016 (3A), April 25, 2018 (3B)	Still operating	1–2 days	300 m OLCI, 500mSLSTR
TITIK 1–7 (HRV)	CNES	February 22, 1986	Still operating	26 days	2,5 to 20m
TITIK 4–5 (VGT)	CNES	March 24, 1998	July 2013	1–2 days	1000m
Terra-Aqua (MODIS)	NASA	Dec 18, 1999 Terra 4 Mei 2002 (Aqua)	Still operating	1–2 days	250–1000m

Source : (Chuvieco et al., 2019)

3.2. Remote Sensing Application

In the field of marine and fisheries, several objects or marine phenomena that can be sensed using remote sensing technology include ship position, sea surface temperature, chlorophyll-a concentration, salinity, sea level, front, seagrass, coral reefs, mangroves, and so on.The following are some examples of image data processing results in the marine and fisheries sector (Figure 9 - Figure 11).

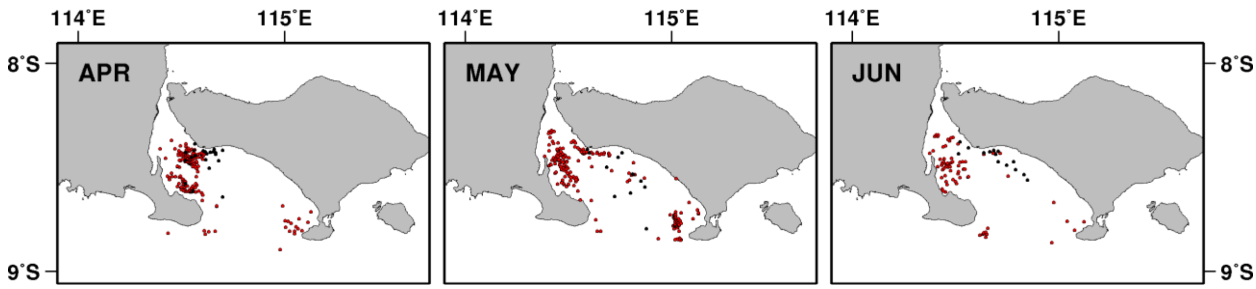

Figure 9. Spatial distribution of fishing location for *Sardinella lemuru* from Vessel Boat Detection (red dot) and in situ (black dot) data from April – June in the Bali Strait(Syah et al., 2019).

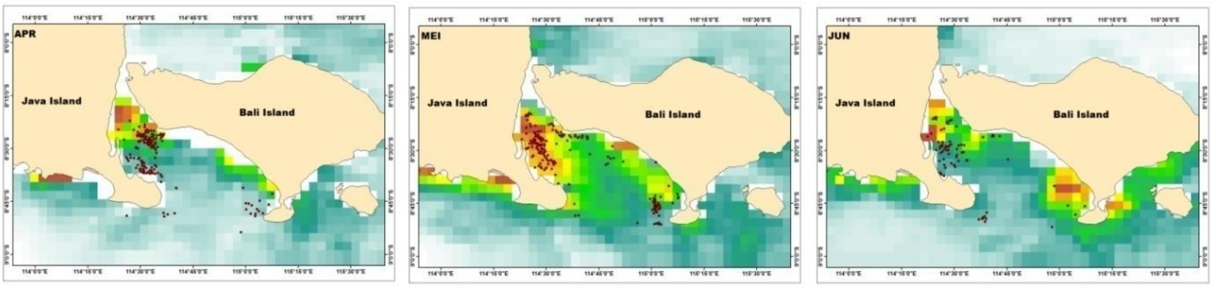

Figure 10. Distribution of fishing location for *Sardinella lemuru* from Vessel Boat Detection (red dot) overlaid on the monthly mean value of sea-surfacechlorophyll-*a*from April – June in the Bali Strait(Syah et al., 2019).

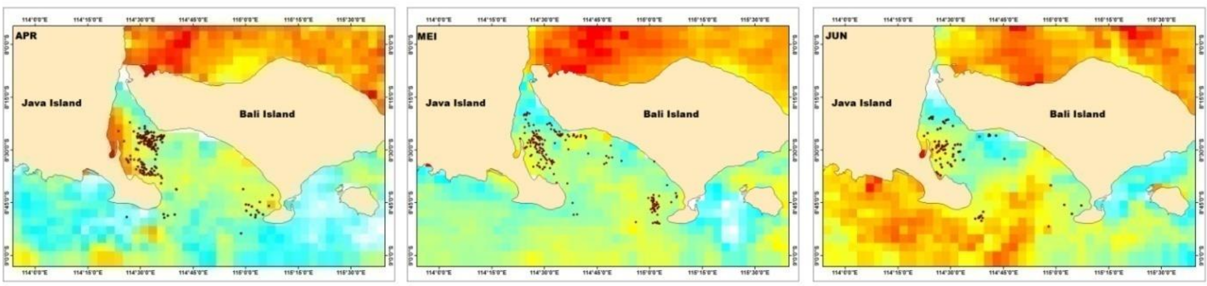

Figure 11. Distribution of fishing location for *Sardinella lemuru* from Vessel Boat Detection (red dot) overlaid on the monthly mean value of sea-surfacetemperature from April – June in the Bali Strait(Syah et al., 2019).

3.2.1. Potential Fish Distribution Area

Fish are not randomly distributed.However fish tend to congregate and move to a preferred environment.Each type of fish has a different behavior and preferred environmental conditions.One type of fish that has high economic value is tuna. Fishermen from several nations, including Indonesia, object to tuna (Thunnus.sp), which is one of the most important fishing sources (Nootmorn, 2004). Tuna has a high financial value on the global market. Because of the usage of purse-seine with fish-aggregating devices (FADs), global tuna production has increased from roughly 400.000 tons in 1950 to more than 4.000.000 tons in 2002 (Baylift et al., 2004). Bigeye tuna (*Thunnus obesus*) is a commercially important tuna species. In the early 1980s, Bigeye tuna production was at 20.000 tons per year, increasing to around 140.000 tons in the 1990s. However, between 2000 and 2013, the catch of Bigeye tuna decreased, with the lowest catch value occurring in 2010, when only 87,926 tons were caught (IOTC, 2014).One of the causes of tuna catch fluctuations is thought to be changes in oceanographic conditions (Howell and Kobayashi, 2006; Lehodey, et al., 2010; Briand, et al., 2011).

Bigeye tuna (*Thunnus obesus*) prefers to live near and below the thermocline, but they do come to the surface on a regular basis (Pepperell, 2010).Hanamoto (1987) and Mohri et al., (1996)discovered that isotherm 10 – 15 °C, below the thermocline depth, is the optimal water state for Bigeye tuna at hook depths. According to Mohri and Nishida (1999)and Howell et al., (2010), the main fishing depth range for Bigeye tuna in the Indian Ocean is 161–280 m during the day and 0–100 m at night. Furthermore, Hartoko (2010) andSukresno et al, (2015)said that fish might be found in depths of 150 m. Hartoko(2009) proved that sub-surface temperature can be used to indicate the presence of water development both vertically and on a level plane that transports supplements. These circumstances indicated that subsurface oceanographic influences can affect fish circulation.

To assess the possible distribution region of Bigeye tuna, Syah et al., (2020)combined a vessel monitoring system (VMS), habitat modeling, and oceanographic factors such as seawater temperature, chlorophyll-a concentration, and salinity. Remote sensing data was used to get these three oceanic parameters. Since 2003, the Ministry of Maritime Affairs and Fisheries has run a fishing vessel surveillance program known as VMS. VMS was deployed in the eastern Indian Ocean by putting transmitters on fishing vessels over 30 GT, such as angling vessels for Bigeye tuna. Data from vessel monitoring systems can provide information on the number of vessels present, as well as the vessel's profile, position, speed, and route.Their results showed that seawater temperature was the most influential factor on the distribution of Bigeye tuna, followed by chlorophyll-a concentration and salinity.The overall commitment of every parameter is appeared in Table 2.

Table2. Heuristic estimates of the environmental variables's relative contribution to models

Variable	% contribution
Sub_ST	43,1
Sub_SC	35,2
Sub_SS	21,6

Sub_ST=sub-surface temperature; Sub_SC=sub-surface chlorophyll-*a*; Sub_SS=sub-surface salinity

Furthermore, they also reported that the waters south of Bali - Nusa Tenggara Island are areas with great potential for Bigeye tuna, especially during the southeast monsoon season (Figure 12).Understanding the right time and right location of fishing activities, will be able help fisherman in catching fish.Fishermen will be able to save time, cost and effort in catching fishing.Thus, this is expected to improve their welfare.

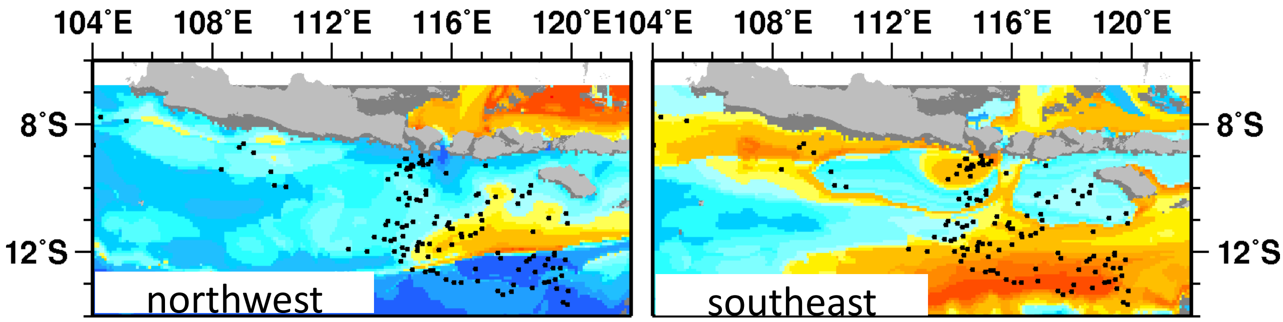

Figure 12. The spatial conveyance of angling areas (black spots) for Bigeye tuna from VMS, overlays the habitat suitability map during two different monsoons.The suitability is shown as Habitat Suitability Index (HSI) value ranging from 0 to 1, representing of "poor" to "good" habitat(Syah et al., 2020).

3.2.2. Benthic Habitat

One of the outermost small islands in the eastern part of Indonesia is Liki Island.This island is also the foremost island in the Pacific Ocean.Liki Island is located in Sarmi District, Sarmi Regency, Papua Province with a population of 209 people (Batubara et al., 2014). As one of the outermost small islands, this island has strategic potential in terms of economic, defense and security aspects and has an ecosystem with high biodiversity productivity.

Utilization of small islands resources must be done wisely and sustainably because in general shallow waters in small islands are very vulnerable and sensitive to climate change (Setyawan et al., 2014)and have the potential to experience habitat damage, changes in natural ecosystem processes and pollution(Marasabessy et al., 2018).Among the natural resources owned by Liki Island are benthic habitats consisting of coral reef ecosystems, seagrass ecosystems and sand.

Benthic habitat is a place to live for various types of organisms composed of seaweed, seagrass, algae, live coral, dead coral with substrate types such as sand, mud, and coral rubble (Anggoro et al., 2015; Zhang et al., 2013).Coral reef and seagrass ecosystems are very important constituent components as spawning grounds, foraging areas, marine biota habitat, as coastal protection from waves, stabilizing sediments, water purification, carbon sinks, sources of industrial and pharmaceutical materials, and tourism (Prawoto & Hartono, 2017).

The development of science and technology makes it easier to monitor the conditions and changes in a natural resource by using remote sensing technology.One of the relatively new satellite imagery is Sentinel-2A Image.Using Sentinel-2A Imagery, (Sari et al.,2020) reported that Sentinel-2A Imagery was able to map benthic habitats on Liki Island well. Furthermore, they also reported that Liki Island is surrounded by 3 benthic habitats namely coral reefs (153.64 ha), seagrass (143.35 ha), and sand (70.24 ha)(Figure 13)

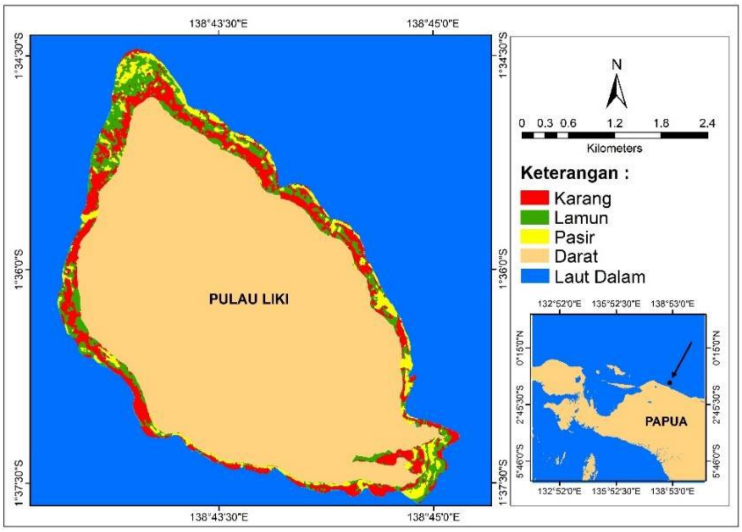

Figure 13. Liki Island Benthic Habitat (Sari et al.,2020)

3.2.3. Forest Landcover Change

The major natural resource on land is forests. Whether by planned or unplanned timber harvesting, even by illegal logging and fires, land cover in forest areas is constantly changing. To monitor these changes, multi-temporal remote sensing images are used. In the past, Landsat TM optical imagery was the standard. For decades, the continuous existence of Landsat TM has played a role in mapping changes in land cover in forest areas with the same standard. The disadvantage of optical images such as Landsat TM is that they are not able to penetrate clouds. Meanwhile, in Indonesia above forest areas there are almost always clouds more than the minimum “cloud-free image” limit. Therefore, various studies have been carried out to use cloud-translucent radar images, such as ALOS-Palsar (Amhar & Wijanarto, 2012) to calibrate the extraction keys from multitemporal radar images to relevant optical images (Figure 14).

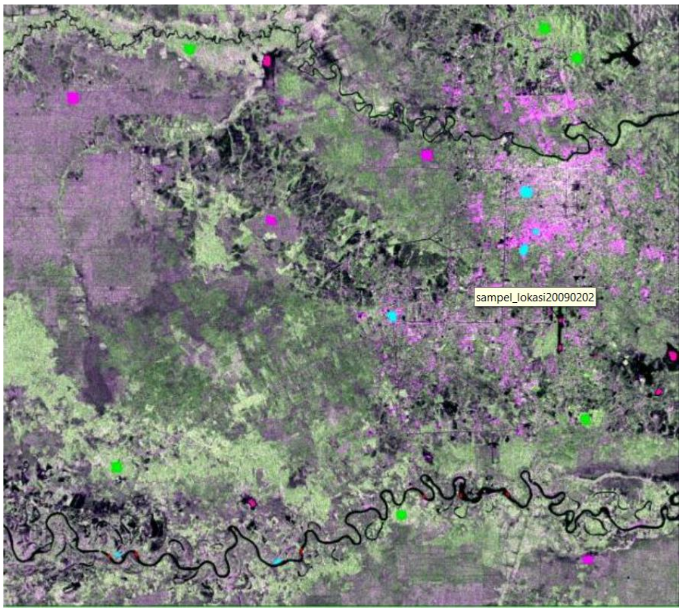

Figure 14. Forest Landcover from ALOS-Palsar (Amhar & Wijanarto, 2012).

3.2.4. Large Scale Topographic Mapping

High resolution Remote Sensing images such as Pleiades and Worldview have become the minimum standard for large-scale mapping of urban and rural areas (Amhar et al., 2017). However, to obtain 3D topographic contours, stereo optical images such as ALOS prism (Amhar& Mulyana, 2009) or Cartosat (Syafiudin & Amhar, 2009)or processing of interferometric radar results such as TerraSAR-X (Amhar, 2016). Figure 15 shows a pair of Cartosat images processed into a Digtial Elevation Model and an ortho image over Jakarta.

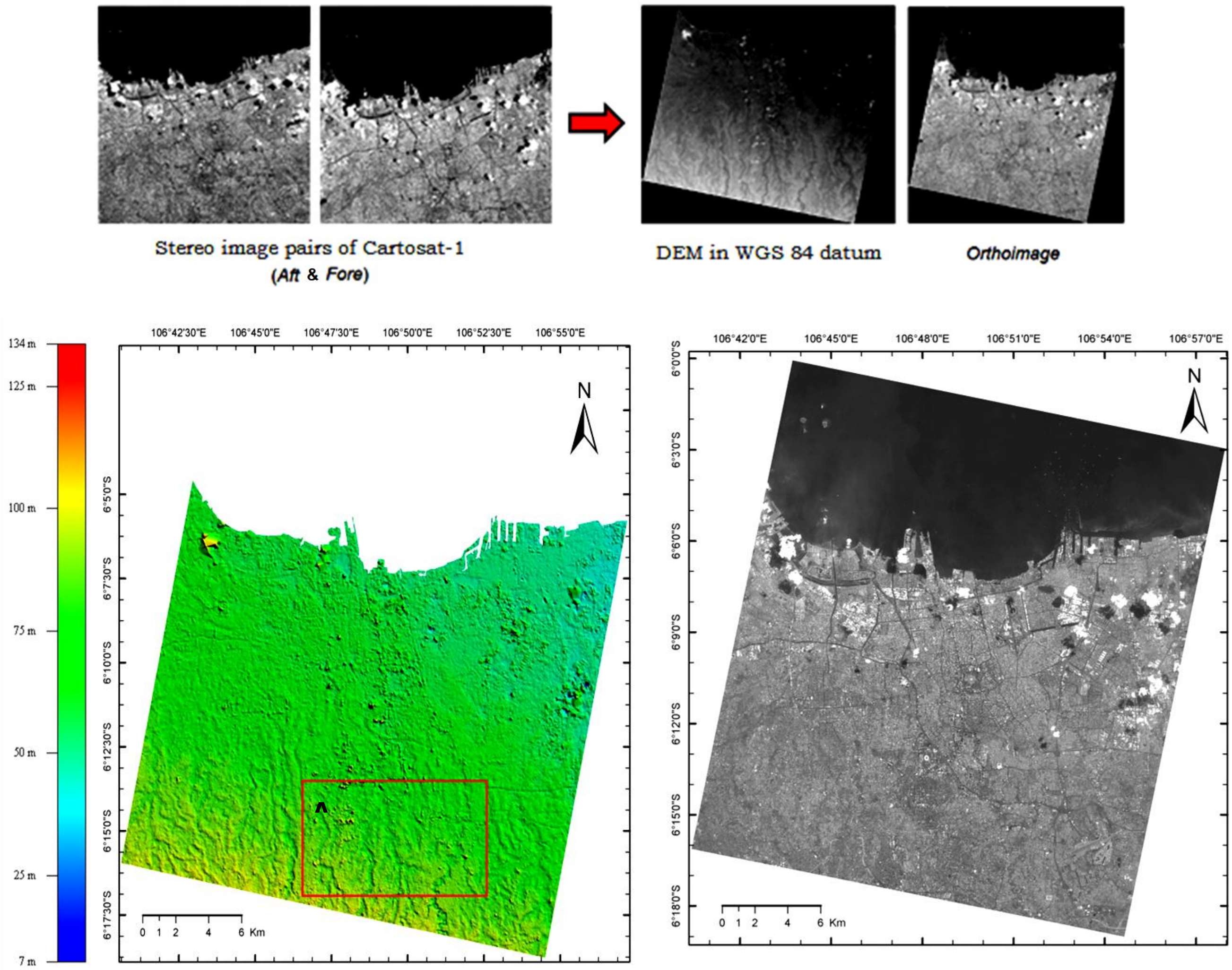

Figure 15. DEM & Orthoimage from Cartosat Imagery (Syafiudin & Amhar, 2009)

3.2.5. Intertidal Ecosystem

As an archipelagic country, Indonesia has a lot of resources on the coast, where the land ecosystem meets the ocean. Sea salt fields, shrimp ponds and mangroves exist in areas like this. The potential for tidal power generation is also here. Meanwhile, if settlements are made, the area must be protected against tidal flooding at all times. Therefore, mapping the area is very important.

Tides are influenced by astronomical events, namely the regular movement of the sun and moon. From the recordings of many tidal stations that are evenly distributed, that the average sea level height at a certain time is obtained. The times at which satellite imagery is recorded are often at times of different tidal conditions. By using at least two images at the same location but with large tidal differences, it is possible to model the lowest and highest sea levels in the area (Figure 16). Thus, we get an intertidal ecosystem zone (Amhar & Subagio, 2012).

Figure 16. Intertidal zone from imageries of different tidal conditions (Amhar & Subagio, 2012)

3.3.Natural Resources Technology in Muslim Country

As a developing country, Indonesia keeps growing and enhancing its naturalresources, ranging from agriculture, plantation, fishery, mining, forestry, and also its infrastructure and urban development.To improve the efficient and cost-effective management on the development of these activities, technology capable of providing timely and accurate spatial information of natural resources and environment is a critical need. Satellite remote sensing integrated with geographical information system (GIS) can play a major role in all geographic and spatial aspects. These technologies are useful for facilitating rapid decision-making process and supporting the government in achieving its targets.

The National Institute of Aeronautics and Space (LAPAN) is an Indonesian Non-Ministerial Government Institution that carries out government duties in the field of research and development of aerospace and its utilization.LAPAN's four main areas are remote sensing, aerospace technology, space science, and aerospace policy.LAPAN has experience in remote sensing field. LAPAN Ground Station has capacities for receiving, processing, and distributing satellite data. The Ground Stations are located at Parepare-South Sulawesi, Rumpin-West Java, and Pekayon-Jakarta. It currently received remote sensing data satellites from LANDSAT-7/8, SPOT-6/7, PLEIADES-1A/1B, TerraSAR-X, TanDEM-X, Suomi NPP, Aqua/Terra, NOAA-18/19, Metop-A/B, Himawari-8(USGS,2020).

LAPAN launched a new satellite under the name Lapan A2. The satellite that was made in Bogor, West Java, was launched on 20th August 2015 from India. This satellite was the first satellite designed and integrated in Indonesia. The satellite weights 70 kilograms and will be aired at an altitude of 650 km, can do marine monitoring by using Automatic Identification System (AIS). The satellite can also do mapping through digital camera. The satellite orbit in equatorial area and receieve information 14 times a day. So that it can take pictures in all areas in Indonesia(Marbun,2015).

The third-generation LAPAN-A3/LAPAN-IPB satellite was launched from Sriharikota, India.The satellite is on an experimental remote sensing mission to monitor food resources and to evaluate the governments programs in the maritime sector. With weighing of 115 kg, the satellite is able to identify land use and land cover as well as monitor environmental developments.The remote sensing satellite has a four-band multi-spectral imaging camera, with a resolution of 18 meters and a swath width of 100 kilometers(Purwanto,2016).

Other muslim country that is also trying to continue to develop their natural resources technologyis Iran. National Cartographic Center (NCC) is the main organization for cartography in Iran. It is administered and funded by the Government of Iran, as part of the Plan and Budget Organization. The NCC was established in 1953. At present, through using maps and spatial information offered NCC, many databases with numerous applications have been built throughout the country. In terms of the activities and services provided, NCC caters to a wide spectrum of users and clients while also laying the groundwork for the government to support the private sector in surveying activities. NCC also undertakes the chairmanship of the Iranian National Committee on the Standardization of Geographical Names which its task is to coordinate and standardize the nomenclature of different places of the country.Other missions of NCC as a policy maker include completing the establishment of National Basic Location Information System and National Spatial Database Infrastructure, which elevates its role from that of a mere spatial information producer to that of a coordinating and supervising organization that provides the necessary infrastructure for standardization of spatial information as well as the foundations for sharing and exchanging spatial information on a national level.Iran has a strong position and potential in the development of maps and geographical data when compared to other developing and developed countries.The fabrication and updating of 9000 sheets of coverage maps of the country at a scale of 1: 25000, as well as the production of digital maps of most of the country's cities at a scale of 1: 2000, can be used to substantiate the claim(NCC,2020).

3.4. Islam and Natural Resources Technology

Tafakur has a special position.This is evidenced by the many verses of the Koran that motivate people to *tafakur*. By *tafakur* it will make people think more broadly about God's creations and matters related to them, including natural resource technology.These verses include:"And Allah has sent down rain from the sky and given life thereby to the earth after its lifelessness. Indeed in that is a sign for a people who listen. And indeed, for you in grazing livestock is a lesson. We give you drink from what is in their bellies – between excretion and blood – pure milk, palatable to drinkers" (QS An Nahl [16]: 65-66). In another surah, Allah *Subhanahuwata'ala* also says which means"Will they not regard the camels, how they are created? And the heaven, how it is raised?And the hills, how they are set up? And the earth, how it is spread?"(QS Al Ghaasiyah [88]: 17-20).

At this time, practically only developed countries are able to have sovereignty over remote sensing satellites.Developed countries are always characterized by two things: (1) having a large percentage of intelligent human resources, such as scientists, engineers, researchers or inventors; and (2) mastering the most advanced science and technology, because of their innovation.Without the superiority of science and technology, a country that dreams of becoming a developed country will depend on the intelligent human resources of other countries, and that will erode its strength.

When the new Islamic state was founded like in the time of the Prophet, they almost did not have intelligent human resources in science and technology. But the spiritual power has energized them to hunt science and technology to all corners of the world. They are equipped with the motivation to be the best people in the world who will carry out a mission to bless the entire universe.This vision makes Islamic education instill a great curiosity, then know where the sources of knowledge are and how to obtain them effectively. They understood that paper-making technology had to be studied in China, astronomy had to be studied in Egypt, and medicine was learned from the Greeks. They are aware that the Qur'an only contains general things about science and technology, even though the Qur'an is a guide to life.After that they are directed to further develop the technology learned in order to realize various obligations and apply them according to shari'ah.Islamic countries may make agreements to bring in teachers or science and technology experts from abroad as long as they are bound by the Islamic state curriculum.

A country is said to be sovereign in science and technology if it has formed research and innovation capabilities that are able to solve every problem it faces and form an industrial system that applies it.Their intelligent human resources learn not only because they want to be employees of an international corporation, or simply being known as scientists with global indexed publications, but more importantly, being able to prepare the foundation for a superpower. With the provision of mastery of science and technology, the industry will accelerate and the economy of a country will be lifted.No country becomes a superpower just because of its military strength, the number of soldiers or the sophistication of its weapons. Without the economic power behind it, the army would be hungry and the weapon would either go untreated or run out of fuel.Therefore, every country that builds a superpower must prepare a solid economy. The economy is strong when there is a strong industrial base, which is supported by sustainable natural resources. These natural resources include sources of food, energy, and minerals needed by industry. If these sources have to be imported from outside, then the country's economy will be unstable, prone to embargoes, pandemics, and also world instability, for example if there is a disaster, economic crisis or war in the supply line.The largest added economic value is generated by the industry. Therefore, the industry must be built and directed to address all the needs of the people, fulfill the vital needs of the state, and establish the independence of the state.

The entire Islamic economic system must be implemented both in terms of investment, ownership and management. Vital sectors remain under state control. And certain sectors are specially prepared for da'wah and jihad strategies. A number of heavy industries which in peacetime produce means of transportation, for example, can be turned into weapons industries if needed.Remote Sensing can be used for many things. From the search for natural resources such as oil, gas, coal and other minerals(Do et al., 2017), forest biodiversity monitoring (Wijanarto & Amhar, 2010),marine resource monitoring, precision agricultural planning(Jafar & Woertz, 2016), national mapping (Amhar &Mulyana, 2009), urban planning, to defense, security and counter terrorism(Do et al., 2018).All these things are needed by Islamic countries which are currently rich in natural resources, but are also threatened by various natural disasters and terrorism. For this reason, Islamic countries must allocate sufficient human resources, academicians, researchers and engineers to develop remote sensing technology, to make it more useful for Islam and its people. Otherwise, they will only become a market for foreign countries, which will make greater profits from their natural resources.

Several muslim countries such as Egypt, UAE, Turkey, Iran, Malaysia and Indonesia have been very enthusiastic in developing remote sensing in their country. Malaysia has been quite advanced in the development of remote sensing processing software.Iran is known to have been quite advanced in the development of rocket launchers that can reach orbit. Indonesia has several times succeeded in making small remote sensing satellites launched by Indian rockets. Meanwhile, Turkish scientists have even led the world remote sensing organization, namely the International Society of Photogrammetry & Remote Sensing (ISPRS). However, what is needed is closer cooperation from them as one ummah.

4. CONCLUSION

Remote Sensing as a technology has many uses for Muslim countries. But Muslim countries need to build their capacity to have technological sovereignty in this field. Thus, the various benefits of this technology in maintaining and managing the wealth of these countries are entirely in the hands of Muslims

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