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The Role of Space Technology to Telemedicine in Indonesia towards the Goal of Sustainable Development

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Abstract:- Satellite-based space technology mastery and utilization in Indonesia has been the centre of attention not only in Indonesia but also in international scope. Internet-based health care is an effort to reduce difference and to give easy Telemedicine Health Care (telehealth) in order to stop or at least reduce mortality rate. Indonesia has already had the capability of space technology research and development. Telemedicine is spin off of space technology which is benefit for Indonesia's human resources development. The purpose of this article is to (i) analyse the role of space technology in of telemedicine practice in Indonesia, (ii) identify the impact of telemedicine in Indonesia, and (iii) formulate the strategy of telemedicine practice in Indonesia. The method used in this article is descriptive qualitative by mapping, benchmarking, and SWOT. The results obtained are the identification of the role of national satellite technology for the development of telemedicine in Indonesia, and how telemedicine contributes to national development, so that strategies for implementing telemedicine can be formulated in Indonesia.

Keywords:- *Indonesia, Space Technology, Telemedicine.*

I. INTRODUCTION

The utilization of space technology to sustainability national development is not limited to economy but multi-dimension which involves social and political aspect (human change, social structure, society demeanour, and national institutions) (Razmi et al., 2012). The end product of development is welfare (Daiute; 2010; Alkire 2010; Alkire 2002), where human resources as the development subject, not influenced by economic aspect, but also education and health. Satellite-based space technology mastery and utilization in Indonesia has been the centre of attention not only in Indonesia but also in international scope. Internet-based health care is an effort to lessen discrepancy and to give easy Telemedicine health care (telehealth) in order to stop or at least reduce mortality rate (Ariyanti, Sri and Kautsarina., 2017), which influence the improvement of health quality, thus improving Indonesia's human development and decreasing Human Development Index (HDI) discrepancy of each regions. By improving better health quality, the third goal of sustainable development (SDGD) will be achieved in 2030.

Telemedicine programme framework for 5 years (2015-2019) is prioritized for Underdeveloped Regions and Islands where health facilities are difficult to access (Ministry of Health, 2015). One of the biggest challenges of telemedicine system (telehealth) in Indonesia, especially in remote areas outside Java Island, is slow internet connection (Ariyanti, Sri and Kautsarina, 2017), thus it is inevitable that satellite-based space technology is vital for the utilization of telemedicine since without such technology, this program would not be able to put in practice.

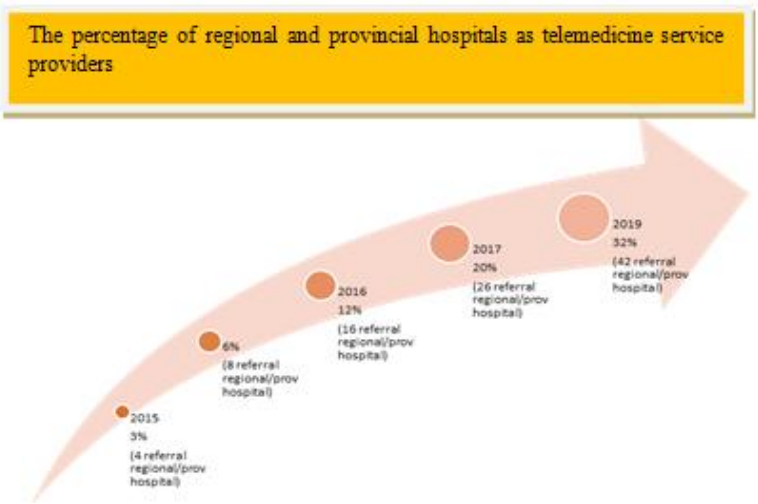

Fig 1:- Telemedicine Indicator Goal
Source: Ministry of Health (2015)

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The Ministry of Health has strategic plan to connect 32 percent or 42 Referral Regional/Provincial Hospital by the end of 2019. Therefore, space technology will play the role to actualize the target and the synergy mechanism of each sector, which is aviation and aerospace, can contribute in health sector. In some countries, telemedicine runs in line with their space technology mastery programs such as in Europe (ESA), India, and United Stated of America. Hence, it is important to conduct a research of how telemedicine in Indonesia is implemented by noting the environmental factors, both internally and externally.

The utilization of space technology in favour of telemedicine has become international attention, and Indonesia is an active country in UNOOSA forum and has been putting a lot of attention toward the goal for 2030 which is the third target in Sustainable Development Goals; Ensure Healthy Lives and Promotes for All at All Ages. Indonesia has its own space technology mastery programs as well as operating a number of satellites. The questions are how is the role of national satellite technology towards the development of telemedicine in Indonesia, and how is telemedicine contribution in national development. The purpose of this study is to: (i) analyse the role of national satellite technology for telemedicine in Indonesia; (ii) identify the impact of telemedicine towards national development, and (iii) formulate strategies to strengthen telemedicine in Indonesia.

II. TELEMEDICINE

A. Histrory

It begins from the utilization of telemedicine for space activities done by NASA (Menol, Anil S, et.al. 2017) to monitor astronauts' health while carrying the space mission. Telemedicine develops over time by utilization of satellite data for various types of health purpose, such as telehealth to diagnose and to give health service in remoted area. Telemedicine defined by WHO (2010) as "The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities". Meanwhile European Commissions defined telemedicine as 'the provision of healthcare services, through the use of ICT, in situations where the health professional and the patient (or two health professionals) are not in the same location. It involves secure transmission of medical data and information, through text, sound, images or other forms needed for the prevention, diagnosis, treatment and follow-up of patients.

Figure 2 shows that telemedicine formed as a part of spin off space technology, by utilizing telecommunication network and by using remote sensing data (satellite imagery, GIS). Telemedicine is a tool to connect user and health provider to efficiency and effectivity of healthcare service which involves the patients, health management, and professional staffs. Types of minimum healthcare service distribution with various purposes are (ATA, 2006):

- Special referral service
- Direct patient care
- Monitor long-distanced patients using tools to collect and send data to monitoring station to be interpreted.
- Medical education and accompaniment

Medical information and consumer health and internet usage to achieve specific health info and online group discussion to support each partner

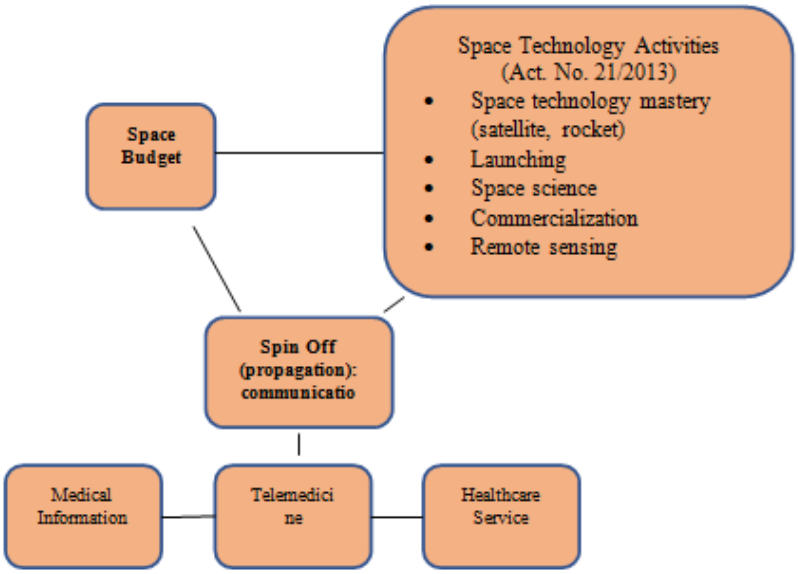

Fig 2:- Telemedicine cycles and components (Spin-Off Application) di Indonesia
Source: Goehlich, Robert A. et.al, (2005) modified (2018)

B. Achieving Sustainable Development Goals

The government has issued Presidential Decree No. 59 Year 2017 about Achieving Sustainable Development Goals. There are three factors as the absolute condition for Indonesia to successfully achieve SDGs, which are acceleration, funds, and inclusion (Bahuet, Christope, and Sopacua, Juliaty Ansye, 2018). SDGs have 17 purposes and 169 targets which aims various development issues, from poverty to international cooperation. SDGs perfected Millennium Development Goals (MDGs) 2000-2015. Though not all indicators successful, Indonesia is fairly successful in applying MDGs, with 47 points achieved from 67 indicators (Bappenas, 2018). There are 17 global purposes of TPB/SDGs, listed below:

- End any kinds of poverty.
- Eliminate hunger, achieving good food and nutrition security, and promoting sustainable agriculture
- Ensure a healthy life and improve the welfare of all residents of all ages
- Ensure the quality of inclusive and equitable education and increasing lifelong learning opportunities for all citizens
- Achieve gender equality and empower women
- Ensure the availability and management of clean water and sustainable sanitation for all citizens
- Guarantee access to affordable, reliable, sustainable, and modern energy for all citizens
- Promote inclusive and sustainable economic growth, productive and comprehensive employment opportunities, and decent work for all citizens
- Build resilient infrastructure, enhance inclusive and sustainable industries, and encourage innovation
- Reduce intra and interstate inequalities
- Make cities and settlements inclusive, safe, resilient and sustainable
- Guarantee sustainable production and consumption patterns
- Take quick action to tackle climate change and its effects
- Preserve and sustainably utilize marine and ocean resources for sustainable development
- Protect, restore, and enhance the sustainable use of terrestrial ecosystems, manage forests sustainably, stop desertification, restore land degradation, and stop biodiversity loss
- Strengthen inclusive and peaceful societies for sustainable development, providing access to justice for all, and building effective, accountable and inclusive institutions at all levels
- Strengthen the means of implementing and revitalize global partnerships for sustainable development

C. The Correlation between Telemedicine and Economic Growth

Previous studies shows that telemedicine activities give significant impact towards economy through multiplier creation for labour, welfare creation through community income and output (IQVIA, 2018). The economic benefits of telemedicine include improving the health services qualities, permission to use hospitals' resources and solving problems of gaps in access to good health services. Below are the kinds of working group under ESA related to telemedicine (ESA, 2018):

- telemedicine and the elderly;
- telemedicine for disaster relief and emergencies;
- telemedicine for hospitals in remote areas;
- teleconsulting, 2nd opinion and regulatory aspects;
- telemedicine, medical education and clinical research; and
- telemedicine technology development in satellite communications.

D. Practice in International

Telemedicine in India is developed by Indian Space Research Organization (ISRO). ISRO's Telemedicine network has covered about 384 hospitals with 60 specialized hospitals connected to 306 remoted / rural / regional / medicine University Hospitals and 18 units Telemedicine Cell phone. The Mobile Telemedicine Unit covers various fields of Ophthalmology, Cardiology, Radiology, Diabetology, Mammography, General Medicine, Women's and Children's Health (ISRO, 2018). The form of telemedicine in India is as follows:

- Teleconference: a means of long-distance consultation between doctors or nurses in remote villages with expert doctors throughout the hospital; and
- Telehealth: a means of education and training for health workers.

The National Health Portal in India is designed in service using their national language other than UN-recognized international languages, and can be accessed by a toll free and mobile application.

- *Europe Space Agency (ESA)*

Telemedicine was initiated by a number of countries in Europe in the mid-1990s nationally and internationally intended to demonstrate and in line with the use of communication satellites. The following table is the linkages between the ESA space program and the 17 SDGs objectives. Explicitly on the third goal of SDG, which is to guarantee a healthy life and improve the welfare of all residents of all ages, the role of the ESA program is mentioned, which is telemedicine using satellite communications.

SDG topic	Keywords	ESA programme
SDG 1: No Poverty	Supporting banking systems International development Sustainable production of food Supporting development banks	Support to development banks Earth observation for international development Herding from space Satellites for remote banking
SDG 2: Zero Hunger	Sustainable agriculture Monitoring food production and security	Agriculture and food security Global monitoring for food security Health of livestock
SDG 3: Good Health and Well-Being	Telemedicine Space for Health ISS research	Telemedicine using Satcoms Space aids Ebola patients Mapping deadly mosquitos Satellites helping to assess the risk of epidemics Space for Health
SDG 4: Quality Education	Tele-learning Tools for educators	Satcoms linking rural schools in South-Africa and Italy ESA kids e-Learning in rural areas ESA educational projects
SDG 5: Gender Equality	Attracting more women to science and technology careers	Space Girls-Space Women Women choosing STEM careers (video)
SDG 6: Clean Water and Sanitation	Recycling water Closed-loop systems Monitoring water quality	TIGER project GEO-Aquifer project (PDF) Worldwide water quality app MELiSSA
SDG 7: Affordable & Clean Energy	Solar energy Energy research	Energy research at ESA Electric propulsion innovation and competitiveness
SDG 8: Decent Work and Economic Growth	Regional development Job creation	Copernicus opportunities for economic growth and regional development First ESA facility in UK, catalyst for growth Job creation and growth with space Copernicus benefiting society and the environment
SDG 9: Industry, Innovation & Infrastructure	GPS Telecom satellites	Broadband for all Technology transfer and business incubation Protecting our infrastructure from space weather Tracking trains Satellites for remote banking Galileo-based solutions for transport and infrastructure
SDG 10: Reduced Inequalities	Supporting developing countries Providing applications and services	Providing energy, clean water, food, education, ... (see other SDGs)
SDG 11: Sustainable Cities and Communities	Living on the ISS/Concordia Urban areas Air quality Transport systems Cultural heritage	The international space station (ISS) Concordia, antarctic research station Mapping urban areas Monitoring air quality Mapping of global air pollution Integrated applications projects - Transport Satellites in support of world heritage
SDG 12: Responsible consumption and production	Recycling Closed-loop systems	The ISS as closed-loop system Concordia, antarctic research station MELiSSA, closed-loop ecological system
SDG 13: Climate Action	Research in arctic/antarctic Monitoring ice sheets Climate change initiative Desertification	Looking out for landslides Supporting the healthcare in emergency areas Desert watch SMOS: Monitoring the oceans and surface moisture

SDG topic	Keywords	ESA programme
		ESA's climate change initiative Monitoring the atmospheric composition and climate Cryosat: monitoring the arctic/antarctic Sentinel 1A-radar monitoring of oceans and ice ESA and the arctic ESA and the antarctic
SDG 14: Life below Water	SAT-AIS Sustainable fishing Soil moisture and ocean salinity (SMOS) satellite	Tracking marine animals with satellites Vessel tracking from space SMOS Maritime security (video) ESA and oceans Copernicus - Marine projects
SDG 15: Life on Land	Forestry/deforestation Biodiversity Land use detection	Trees tell their own story Smart logging Tracking biodiversity Burned area land use change detection Monitoring forest degradation and deforestation Forest fires Land cover maps
SDG 16: Peace and Justice - Strong Institutions	Support to identify illegal actions Support of election processes	Detection of ship movements Maritime surveillance e-Training via satellite in support of African electoral cycles
SDG 17: Partnerships	Partnering with other space agencies Partnering with other companies Partnering with institutions	ESA partners

Table 1:- The Linkage of the ESA Program to the Objectives of the SDGs
Source: ESA (2017)

E. Conceptual Framework

Telemedicine is an effort to utilize information system (ICT) in medicine field, where its key to success is influenced by factors such as satellite network access conditions, human resource support, bandwidth requests, types of health and managerial services (security and standards and protocols). The success of telemedicine is to improve health quality, means decreasing mortality due to illness, accidents, disasters with easy access of patients and nurses in remote areas to conduct medical communication with specialist practitioners in big cities, so patients can be treated immediately. Through the increase of healthcare service, Human Development Index figures will increase, where healthy human resources can work, learn to do economic activities that have an impact on the economy. With increased productivity, people's income and prosperity will increases.

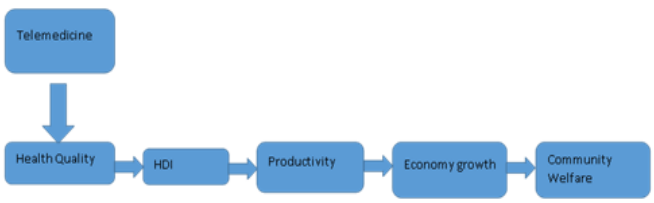

Fig 3:- Conceptual Framework Research

III. RESEARCH METHODE

This study uses a qualitative descriptive approach by mapping, benchmarking and SWOT, to be able to illustrate how space technology can play a role in supporting the implementation of telemedicine in Indonesia and how telemedicine contributes to national development. The data used are secondary data obtained from conducting documentation studies and literature searches. The analysis process goes through several stages:

- Mapping the capabilities and role of space technology at this time in supporting the implementation of telemedicine which is a priority program because it is in line with the achievement of Goal 3 (Good Health and Well-Being) in SDGs,
- Benchmarking with countries that have implemented telemedicine,
- Mapping the strengths, weaknesses, opportunities and challenges in telemedicine technology in Indonesia

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IV. RESULTS

➢ *The Role of Space Technology*

- *National Policy*

Indonesia has laws to regulate national space administration. Telemedicine activities in Indonesia are technology propagation activities regulated in:

✓ Act No. 21 (of) 2013 about Aerospace (paragraph Data Utilization and Information Dissemination (Article 22, 23), the mastery of space technology (article 24), Paragraph 3 in Satellite Technology Mastery and Development (Article 30))
✓ Act No. 36 About Communication
✓ Presidential Decree No. 74 (of) 2017 about Master Plan for the Implementation of Space 2016-2040
✓ Governmental Decree No. 11 (of) 2018 about Procedure for Organizing Remote Sensing Activities
✓ Governmental Decree No. 46 (of) 2014 about Health Information System

One of the urgency of the importance of national communications satellites ownership is the existence of restrictions: (i) Indonesia with 8 other countries (USA, UK, Egypt, Australia, Japan, Russia, UEA, and Mexico), according to Treaty on Principles Governing the Activities of States in Exploration and Use of Outer Space, in utilization of geostationary orbit slots. Indonesia has already had 7 orbital slot locations between 95 BT-142 BT and currently there is an orbit slot 123 BT (L-Band Spectrum) which must be maintained and managed, by either rent satellites or buy satellites forward strategies. On the other hand, LAPAN as an institution which doing research and development in aerospace field have the capacity to support telemedicine program in the form of human and satellite technology mastery support.

- *National Space Technology Mastery Program*

The roadmap for mastery of space technology, satellite technology, has been saved in the document on the Master Plan for " Rencana Induk". One of the basic capitals in this program is a resource that is a geostationary orbit slot, which is used to place communications satellites

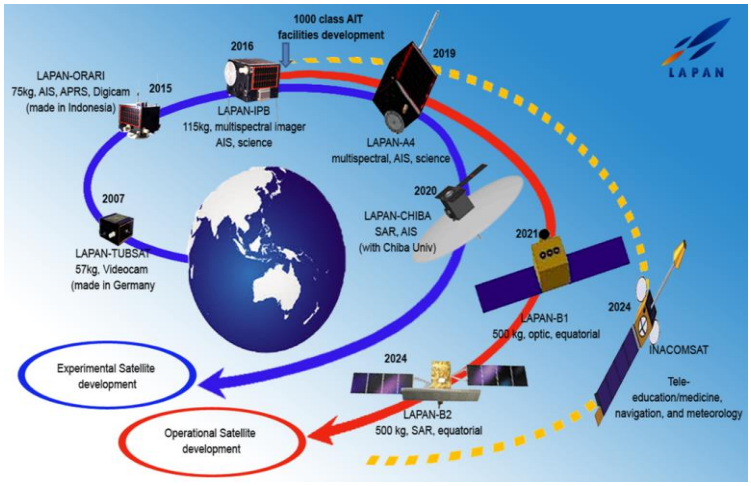

Fig 4:- Satellite Technology Mastery Roadmap
Source: Satellite Technology Center LAPAN (2018)

Now, LAPAN satellite mission operations are supported by earth control station network and data acquisition stations, located in Rancabungur (Bogor), Rumpin (Bogor) and Biak (Papua).

Fig 5:- Cycle of Satellite Control, Data Acquisition, and Data Dissemination of LAPAN
Source: LAPAN (2018)

- *Indonesia's Participation in International Forum*

Indonesia is active in activities under the United Nations called UNOOSA. LAPAN is national main point in the active space field in international activities and in the form of multilateral and bilateral cooperation. Below is a list of table of international forums where Indonesia takes role as the members and actively participating in space technology and application utilization

Multilateral	Opportunity
Intergovernmental Consultative Council-RESAP (Asia Pacific) UN Forum in Asia Pacific about the application of space technology	Dissemination
APSCO * Indonesia is in the ratification stage of the convention	One of the activities mentioned was the development of a communication satellite application for telemedicine
UNOOSA	*Remote-sensing education for university educators and on telecommunications and tele-health for professionals * provide technical advocacy services for member countries in various aspects related to applications and technology, etc. (adopt recommendations of UNSPACE III)
International Telecommunication Union (ITU) WSIS	Share Information ICT SUPPORT(Policy, Quidlines,
Sentinel Asia dan International Charter	Free of charge data sharing to access data (high spatial resolution and near realtime) needed during a disaster response

Table 2:- Map of Indonesia's Cooperation Opportunities in the International Space Forum
Source: LAPAN (2018), UNOOSA (2018), UNCTAD (2017)

Aorpimal, Manop (2017) mentioned that one of the cooperation projects of APSCO is the application of communication satellite for telemedicine. This is an opportunity to increase telemedicine in Indonesia if ratification of the convention has been accepted.

➢ *The Economic Impact of Telemedicine for Development*

The use of national satellite technology for telemedicine needed in Indonesia until now can be seen from the points below.

- *Utilization of Space Technology for Telemedicine*

LAPAN plays an active role in providing satellite data and information based on the location of disasters from earthquakes, droughts and forest fires, tsunamis, landslides, floods and volcanic eruptions. In addition, UAV technology and LAPAN Surveillance Aircraft (LSA) take aerial photographs such as taking photos of flood-affected areas in Jakarta. Therefore, it is possible for the role of this technology to support utilization for telemedicine applications such as monitoring, mapping of health locations and other analyses.

✓ *Satellite Technology*

LAPAN-A2/ORARI Satellite activated post-earthquake in Centre Sulawesi to help telecommunications that are paralysed because hundreds of dysfunctional BTS, plus there was no electricity connection. The LAPAN-A2/ ORARI is a collaboration satellite of the National Aeronautics and Space Agency (LAPAN) with the Indonesian Amateur Radio Organization (Suminar, Agustina, 2018). Utilization of this satellite is also useful to minimize the impact or monitoring of disasters and coordination with the use of radio networks to mitigate casualties.

✓ *Remote Sensing Technology*

Act No. 21 (of) 2013 and Presidential Decree , 2018 about Remote Sensing is the basis that the Institute (i.e. LAPAN) provides a one-door policy in providing free of charge satellite-based data to Ministries/Institutions and Regional Governments and acts as a Remote Sensing Data Bank. The work unit that has the authority to provide remote sensing data licensed by Indonesia Government is the Remote Sensing Data and Technology Centre.

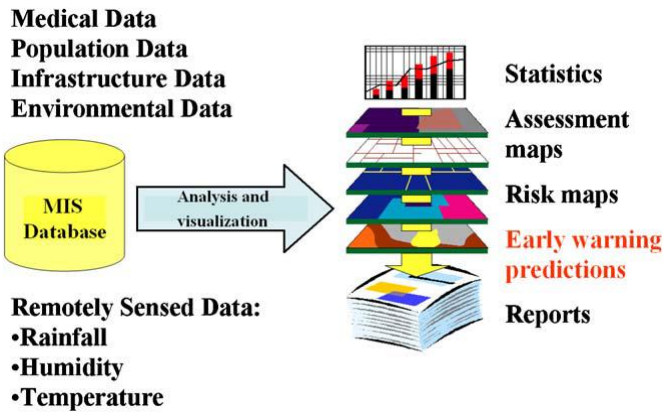

Fig 6:- HI-STAR's Malaria information system
Source : Kaya S, Piltz TJ,et all, 2002

Remote sensing provides a significant advantage in monitoring diseases that are influenced by environmental factors (for example vector-borne diseases) (Rubin CT, Xu G, Judex S, 2001). It can be seen through the figure how the added value of using satellite data is reduced to the policy output (statistical information, early warning predictions and reports) for HI-STAR Malaria information systems.

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No	Image Type	Total (Scene)		Total (Rp)	
		2016	**2017**	**2016**	**2017**
1	Public Health and Development Research Centre				
	Pleides	23	**0**	1,535,762,594	
	Geoeye	6	**0**	1,968,716,785	
	Wordview 2	32	**0**	5,666,560,747	
	Quickbbird	5	0	1,558,444,613	
	Total	66	0	10,729,484,739	
2	Health and Development Research Agency				
	Pleides	27	104	1,167,262,583	1,109,233,036
	Geoeye	0	160		5,328,211,447
	Wordview 2	241	338	6,330,709,324	4,233,468,601
	Wordview 3	0	123		5,220,252,904
	Quickbird	11	24	*	*
	Total	279	749	7,497,971,907	15,891,165,988
3	Disease Vectors and Reservoirs Research and Development Centre				
	Pleides		1100		1,008,207,329
	Geoeye		650		4,218,501,637
	Wordview 2		1000		9,557,664,066
	Wordview 3		600		2,723,852,554
	Quickbird		200		832,002,616
	Total				
Total (1+2+3)		345	749	18,227,456,646	15,891,165,988
	*(quickbird data is not included)				

Table 3:- Distribution of LAPAN Satellite Data Requests and Information to Users in the Health Sector
Source: data procesed

The table 3 shows the value of economic benefits from the provision of satellite image data to support the health sector in Indonesia through the procurement of satellite data through LAPAN. If the data is assumed to support the telemedicine program in terms of monitoring, research and policy, the budget needed in 2016 is Rp. 18,227,465,646, and in 2017 is Rp. 15,891,165,988. It shows decrease in 2017. The (*) symbol shows unavailable data. From the number of scenes, distributed data increased from 345 to 749. The role of space technology can be grouped in the country to support telemedicine in Indonesia

Target		Program	Output	Activities
SDG 3: Good Health and Well-Being	Telemedicine	Project Multifunction satellite (Kominfo)	Communication Satellite (launch plan 2019?)	Telecommunications Network
		Brisat	Communication Satellite (launched 19 Juni 2016)	NOTE: Has a capacity of 36 C-Band transponders and 9 Ku-Band transponders
		LAPAN 2 /ORARI (LAPAN)	Satellite	Radio Network
		LAPAN One-Roof Service Remote Sensing Data Bank	Satellite image data	• Remote Sensing Technical Guidance • Provision of paid and non-paid satellite data • Map, information • etc.
		BPPT	Telemedicine Technology Application Innovations	

Table 4:- The role of Space Technology in supporting Telemedicine
Source: data processed

➢ *The Need of Telemedicine*

Priyono, Sigit (2018) states that Indonesia's geographical depended on satellite infrastructure, where the availability of telecommunications infrastructure will support equitable development. National satellite development is in the public interest (Education, health, defences and security, etc.) as well as commercial, where remote sensing data based on satellite imagery data is the most prestigious tool for photographing remoted areas.

- *Infrastructure*

Satellite technology is the main driving force in Telemedicine activities in Indonesia, which is an inter-island connector and provides internet-based telecommunications services. The importance of this internet infrastructure is connecting more than 145,500 public locations (schools, hospitals, central/regional government offices) (See Figure). The availability of internet network access is still limited. In order to support this, a feasibility study has been carried out for the procurement of multi-functional communication satellites that are expected to provide benefits to support the education and health sectors.

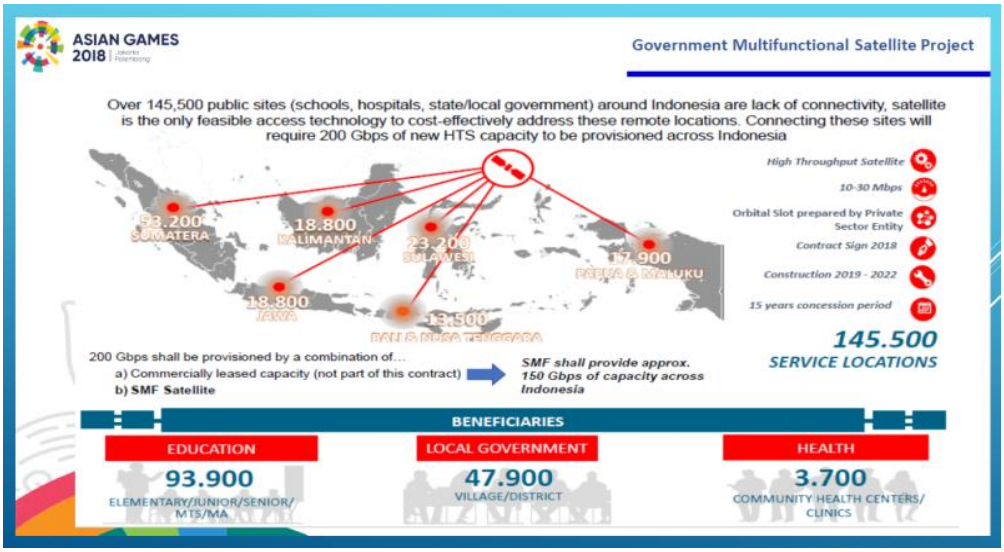

Fig 7:- Government Multifunctional Satellite Project
Source: BAKTI (2018)

It is hoped that this project is to be able to connect the central and regional government offices to 93,200 public locations on the island of Sumatra, 17,900 public locations on the island of Papua, and 18,800 public locations on the island of Sumatra with access to the internet network.

- *Budget*

The development of telemedicine requires a large budget, from infrastructure to human resources to operations financing. The following is an illustration of budget spending in a telemedicine program.

Client Patient	Provider	Other Stakeholder
	Fixed cost	
Time cost Medical cost	• Equipment/ technology (capital investment) • Depreciation • Facilities (office space)	▪ Cost to taxpayer from expanded coverage and payment of telemedicine service in Medicare and Medicaid ▪ Cost to private insurers from expanded coverage
	Variable cost	
	Maintenance and repair Telecommunication cost (connections, etc.) Training Wages to technicians Wages to staff Other expenses	
	Other cost: program setup	
	Travel Training Other (promoting the programme, etc.)	

Table 5:- Budget needs for Telemedicine fulfillment
Source : Primary data is processed

- *Regulation*

The Telemedicine program is a priority program because it is in line with the achievement of target 3 in the SDGs. Health sector activities are under the authority of the Ministry of Health, so the implementation needs to involve synergy with relevant agencies. There are some impacts issued from the development of telemedicine which needs regulation in every activities done, one of the factors is consumers' security and safekeeping. Telemedicine has consequences for legal problems (Anwar, Arman, Anomous) such as licensing, accreditation, privacy and confidentiality of patient's electronic medical records, malpractice accidents, insurance etc. There are no uniform rules in practice in European countries in telemedicine arrangements (Marcoux, Rita M and Vogenberg, F Randy, 2016). As an illustration of telemedicine arrangements in several countries :

No	Country	Legal Product	Information
1	Malaysia	Act	Telemedicine Art 1997
2	California States, USA	Act	Telehealth Advancement Act of 2011 replacing Telemedicine Development Act of 1996
3	India	Act	Telemedicine Act 2003
4	Indonesia	-	-

Table 6:- Bechmark Telemedecine Legal Product
Source: Anwar, Arman (2016)

In relation to LAPAN as a national space agency, the practice of telemedicine matters related to ownership and the existence of space objects must be reported. The role of LAPAN in the registration of objects or spacecraft, has the consequence that every satellite launch or other space object from **Indonesia's territorial territory** must be reported to LAPAN and will be registered with the United Nations (judicial procedures and mechanisms), including reports from Ministries/Institutions regarding the ownership of earth stations in Indonesian territory must also be registered at LAPAN.

➢ *SWOT*

From the previous review, it can be mapped as the strengths, weaknesses, opportunities and challenges in telemedicine technology in Indonesia. Telemedicine requires access to communication and information technology to carry out operational activities, where participants are scattered in remote area, so the proposed strategies are:

- Strengthen national telemedicine policy so that it becomes a national priority program;
- Increase space R&D budget support (especially LAPAN) in accelerating the mastery of communication satellite technology for national independence;
- National synergy between government-industry and academia to realize telemedecine and create a coordinating forum between R&D-industry-regulator-academics and consumers; and
- International cooperation to strengthen national capacity in telemedicine

Strengths	Weaknesses
1. Act No. 21 of 2013 about Space as legal peoduct in support to telemedicine implementation with satellite 2. LAPAN has operated an experimental satellite that can be utilized to support Telemedicine activities 3. The Master Plan for the Space Implementation, specifically the mastery program leading to the mastery of communication satellites 4. Adequate human resources to support activities in the ground segment 5. LAPAN serves the provision of free of charge remote sensing data for Ministry or Institution and Local Government	1. Currently, Indonesia is still renting or buying communication satellites to support national development in various sectors (including health) 2. Electricity network limitations, internet access that has not yet reached the broadest in the outermost, remote area of Indonesia 3. Limited human resources to support the operation of telemedicine 4. The telemedicine program has not yet reached services to the Community Health Centre (Puskesmas) or the lowest level of the village (Village Service Assistance Post), it is still a pilot project 5. Limited budget in the field of space R&D 6. The low spaceminded and spaceeducation in Indonesia, towards health awareness, the importance of space technology. 7. The space ecosystem is not yet developed nationally in Indonesia
Opportunities	**Threats**
1. There is an international collaboration, where Indonesia is actively involved which can be utilized in supporting Telemdicine 2. There are targets in the SDGs to realize effective and efficient health services.	1. There are competitors of foreign telecommunications service providers in the case of satellite communication technology providers 2. Mastery of domestic industry domestic local content to support mastery of satellite technology 3. Data storage require security and a large capacity.

Table 7:- SWOT Mapping

V. CONCLUSION

Utilization of Space Technology is a necessity in supporting the implementation of the application of telemedicine in Indonesia, given the scattered geographical conditions of Indonesia, especially for remote areas outside Java where the internet connection is very slow, so remote sensing data based on satellite image data is the most prestigious tool for photographing hard-to-reach areas.

LAPAN can play a role in assisting the implementation of telemedicine in Indonesia through current space technology and assisting in providing satellite data, which has been utilized to assist in disaster mitigation both regionally and nationally, as well as Remote Sensing satellite data and information that is used to support activities in the health sector, so it is expected that the application of telemedicine can be realized because this is very useful for providing efficient and effective services including health services - long distance health education with radio and telecommunications networks.

Therefore a cross-sectoral strategy is needed that needs to be strengthened between actors involved in telemedicine in Indonesia: Strengthening national telemedicine policies so that they become national priority programs, increasing the support of space research budgets (especially LAPAN) in accelerating the mastery of communication satellite technology for national independence, synergy national government-industry and academia to realize distance health education and create a coordinating forum between R&D-industry-regulator-academics and consumers, as well as international cooperation to strengthen national capacity in the field of telemedicine.

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