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Economic Assesstment of Satellite Remote Sensing Data in Indonesia: A Net Present Value Approach

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ABSTRACT

This study aims to assess the feasibility of remote sensing activities in Indonesia by using the net present value (NPV) approach. Although these remote sensing activities have been going on for a long time in Indonesia, the economic assessment of the use of remote sensing data has never been done. The research object is remote sensing data of very high, high, medium, and low resolution which has been distributed by The Indonesian National Institute of Aeronautics and Space (LAPAN) to government institution users. The data used for cash inflow is secondary data with a period of 2015–2017, while cash outflows are data on investment values during 2013–2017. Data analysis uses a qualitative descriptive analysis method based on the calculation of the NPV value generated. The results showed that the remote sensing activity had a positive NPV both in total and by type of resolution. Remote sensing activities in Indonesia deserve to be continued and developed.

Keywords: Economic Value, Net Present Value, Remote Sensing, Government Expenditure
JEL Classifications: M41, H41, H59

1. INTRODUCTION

Maximizing value is the main objective of the establishment of an institution, including government institutions. The main objectives or also these demands will ultimately contribute to economic growth. Maximum wealth or value will occur when the value of the company/organization reaches the highest value, and the highest value is reached at a certain level of profit with the lowest risk (Gitman, 2015). Therefore in the government sector, every fund used for investment must be accountable, both financially and non-financially, including the risks it contains. One of the activities in the government sector that can be assessed based on its economic benefits is satellite remote sensing activities.

Remote sensing activities in Indonesia have been started since 1971 for the investigation phase. Starting in 1993 the Indonesian National Institute of Aeronautics and Space (LAPAN) was trusted to operate ground stations for national interests. LAPAN is also obliged to provide and carry out the provision of high-resolution remote sensing satellite data with Indonesian Government licenses in accordance with those stipulated in Presidential Instruction No. 6 of 2012. LAPAN's involvement in remote sensing activities is also regulated in the Law of the Republic of Indonesia (RI) Number 21 of 2013 concerning Space in Article 15–23, it is written that the Institution is obliged to store and distribute remote sensing data in Indonesia. These regulations show the important function of the Institute in this case LAPAN as a unit in the government sector in the development of remote sensing activities in Indonesia.

The benefits received from remote sensing activities have also been felt for a long time. The use of remote sensing data and information in Indonesia has been started since the 1990s(Mulyadi, 2009). This shows that remote sensing activities contribute to the Indonesian economy. This supports from what is mandated in RI Law No. 21

of 2013 Article 7 concerning "commercial activities," whereby space economic activities mean that all space activities are directed at creating economic values and benefits or can provide benefits to the community related to their research and development activities involving both the public and private sectors (economic agents). Therefore, every fund used for the investment must be accountable, both financially and non-financially.

Remote sensing activities and their use even though they have been going on for a long time as above, but have never been assessed how much the remote sensing activities provide economic value. Is the activity feasible to be continued and developed, or should there be other policy alternatives if it is considered less feasible? Does this remote sensing activity provide a higher inflow value compared to the investment issued or vice versa? Moreover, whether remote sensing activities in Indonesia really provide value-added and contribute to the welfare of the people in Indonesia. Therefore, the assessment of the feasibility of remote sensing activities is very important.

Measurement of the feasibility values is also mandated in Law No. 21 of 2013. The mandate of the Act states that space activities where one of its activities is remote sensing activities, must be carried out with due regard to benefits, effectiveness and efficiency. This is a major challenge related to how to assess the benefits, effectiveness and efficiency of this activity. There are several structural challenges inherent in the space sector that make measuring and evaluating the socio-economic impacts of space activities difficult (Bruston, 2014).

In satellite remote sensing activities, there are many uncertainties that must be considered in assessing their feasibility, including determining the value of cash flow, changes in the level of exchange rate risk, inflation and the risk of infrastructure obsolescence. Therefore, a feasibility analysis is needed, both financial and non-financial, which is able to accommodate the possibility of the occurrence of these uncertainty variables. Muska et al. (2009) stated that if the product being evaluated is a product of innovation, then we need to choose the assessment criteria used. There are several steps to assessing an innovation project, including identifying obstacles that might threaten the project and developing initial criteria for each stage of the evaluation. Evaluation should be carried out on technical, economic and other assessments (Hauschildt, 2007).

Although in practice there are different valuation methods, but in principle the same is the capital budgeting approach to calculate the economic profit level of a project cash flow (Chiesa and Frattini, 2009). A fairly comprehensive approach in accommodating the possibility of a number of variables in assessing the feasibility of a project is the net present value (NPV) method. This NPV approach is also the most widely used method. NPV is a method used to assess investment or also as a capital budgeting technique to show that an investment project will affect shareholder wealth at this time. The financial feasibility of the project is reflected in the value of several financial feasibility indicators. A positive NPV means an increase in wealth so that a project should be accepted and vice versa.

Based on the background above, this study aims to value the feasibility of investment in satellites remote sensing data in Indonesia.

2. LITERATURE REVIEW

2.1. Space Economy

The Space Economy, according to OECD (2012) is all activities range from the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding, managing and utilizing space. Hence, both all public and private actors involved in developing, providing and using space related products and services, ranging from research and development, the manufacture and use of space infrastructure (launch vehicles, ground stations and satellites) to space enabled applications (satellite phones, navigation equipment, meteorological services, etc.) as well as the scientific knowledge generated by such activities (OECD, 2012).

2.2. Remote Sensing

Remote sensing is sensing the earth's surface from space by utilizing the properties of electromagnetic waves emitted, reflected, or scattered by sensed objects (LAPAN, 2018). Remote sensing activities in Indonesia are regulated by the Republic of Indonesia Law Number 21 of 2013 concerning the Space contained in Chapter II of Part one, in Article 7 paragraph 1 b and e concerning Space and Activities Part Three, Articles 15 through Article 23. Remote Sensing Activities in Indonesia are also regulated in Presidential Instruction No. 6 of 2012 concerning Provision, Use, Quality Control, Processing and Distribution of High Resolution Remote Sensing Satellite Data. And the latest is regulated in Government Regulation No. 11 of 2018 concerning Procedures for Implementing Remote Sensing Activities.

Remote sensing data can be obtained in two ways, by using an airplane (aircraft) or other air rides such as UAVs and by using a recording device (sensor) placed on the satellite. In this paper, the economic value to be studied is the economic value of remote sensing data from satellites. Currently remote sensing data obtained from Indonesia come from the operation of the ground station and the purchase of data (procurement) in the form of low, medium and high resolution satellite imagery. Implementation in the field of high resolution image data is classified to be very high and high.

Satellites whose data can be received by Indonesian earth stations are satellites belonging to other countries, except LAPAN-A2 and A3 satellites. To be able to receive data from other countries' satellites with Indonesia's ground station, Indonesia pays annual fees or through cooperation. Indonesia, in addition to utilizing data that can be obtained from its own earth station can also utilize data that are not received by the earth station. Data not obtained through the earth station is purchased directly from the satellite owner's country or through its vendors, both in Indonesia and abroad. After the data is obtained, it is processed and distributed to users who are used in many sectors.

2.3. Remote Sensing Economic Value Study in Several Countries

2.3.1. Economic value of remote sensing in Europe

In a study conducted by Space-tec partners entitled: Assessing the Economic value of Copernicus: "The potential of Earth Observation and Copernicus Downstream Services for the Agriculture Sector" stated that increasing global food demand triggered an increase in innovation in agricultural practices, in order to sustainable and more efficient in resource use. Remote sensing applications for precision farming can substantially increase productivity and efficiency in the agricultural industry. The benefits of using remote sensing information in the agricultural sector come from cost reductions (through optimizing consumption of field inputs), profits (through increased yields) and potential competitive advantages (through improved harvest quality and more appropriate decisions regarding crop types and land use). Current market opportunities for commercial applications of remote sensing downstream services in agriculture are estimated at around € 34 million.

2.3.2. Economic value of remote sensing in Sweden

The study was conducted by European Association of Remote Sensing Companies and The Greenland through contracts with European Space Agency. The study was conducted to determine the impact of using satellite imagery on forest management in Sweden. The aim is to see the impact of products from certain satellites on the operational value chain. In 2012, the Swedish Forest Agency (SFA) informed nearly 70,000 private forest owners who were reminded of their obligations in accordance with the forestry law of 1993 to replant forested lands they had cleared in previous years. As a result, around 10,000 hectares of forest were then replanted. Sweden is a country dominated by forests. Sweden is a country below 1% of the world's commercial forest area, but provides 10% of the world's sawn timber. Forest areas cover about 70% of Sweden, stretching more than 28 million hectares (ha). From this region almost 23 million ha are productive forest land. Forest products produce an export value of €12 billion and provide employment to around 90,000 people. Every year forests in Sweden produce a total of around 121 million m3 of wood. About 50% of forests in Sweden are owned by more than 300,000 individuals or families; the other half by the government and industry. Sweden's current forestry law, which came into force in 1994, has two main objectives, namely for production and protecting biodiversity. The SFA is responsible for ensuring the effective implementation of this policy. The results have increased forest and timber reserves, while at the same time maintaining natural forest land, and also increasing its value for recreational activities. Besides that information about forests is very important for SFA to be able to detect and control illegal activities. Another benefit is to provide understanding to forest managers in good forest management practices.

Since 2000, information derived from satellite imagery can detect illegal logging (now rare) and poor management practices (replanting of forest land is not immediately carried out and lack of pre-commercial eradication). Through the use of detailed maps, namely maps showing where forests have been cleared for harvest, SFA can check whether logging is permitted by law and can take legal action if it is not appropriate. But most importantly, forest owners know that the SFA can monitor its land which has improved compliance with the law. As a consequence of the availability of satellite imagery, the area of forest cleared illegally has dropped from about 10% of harvested forest every year (in 1998) to <0.5% (according to a 2003 study conducted internally by SFA). The collection and use of clear satellite imagery and maps requires very little cost (€ 64,000) compared to its considerable utilization. The main benefits are related to saving compliance costs and increasing long-term value as a result of higher wood production and improved quality. In addition, because the maps produced by SFA are available as open data, other additional benefits are obtained in the form of socio-economic values (wildlife preservation, protection of forest diversity), including detection of illegal activities. Estimates of the direct economic benefits related to the use of satellite imagery in Sweden range between € 16.1 million and € 21.6 million each year.

Without the earth observation satellite data and information, the SFA must consider other ways to collect data and information related to forest conditions in Sweden, and will cost more. The use of satellite imagery reduces transaction costs incurred by the government and legislative costs for this industry. Another advantage is the availability of general information that can be used by other units and increase inter-agency cooperation and communication. Thus the use of satellite imagery by the SFA to produce a clear map has proven beneficial for the Swedish economy.

2.3.3. Economic value of remote sensing in United States of America by geological survey (USGS)

The results of the USGS study regarding the value or usefulness of satellite imagery include (1) a geospatial model that integrates remote sensing data, hydrology, agricultural information, and other environmental science data to estimate the level of nitrate pollution, (2) estimates of possible long-term availability of groundwater sources which can be drunk, and (3) the estimated value of information of remote sensing is far from increasing the total value of corn and soybean crops regionally.

Using moderate-resolution land-imagery satellite data for northeastern Iowa, USGS scientists exemplify the relationship between land use contamination, agricultural production, and dynamic contamination of nitrates (NO3) from aquifers. The results show that information from such modeling can enable more efficient management of agricultural production without sacrificing groundwater quality. Remote sensing information value of $ 858 million ± $ 197 million every year, future value of the current benefit value of $ 38.1 billion ± $ 8.8 billion. If estimates of the benefits of using satellite imagery are extended to other parts of the United States, the economic value for the country will be enormous.

2.3.4. Economic value of remote sensing in Australia

Based on a report made by the ACIL Tasman "Economic Policy Strategy" regarding the use of remote sensing in Australia in 2008-2009, there are several important points which can be summarized as follows:

1. Remote sensing contributed at least $ 3.3 billion to Australian GDP in 2008–2009.
2. Using a conservative assumption, it is estimated that the contribution to GDP can grow to around $ 4.0 billion in 2015.
3. In the medium term, the main application of sensing is far more used for climate change, natural resources and emergency management, as well as national defense and security.

2.3.5. Economic value of remote sensing in Pakistan (SUPARCO)

In the context of a statistical survey conducted by Space and Upper Atmosphere Research Commission (SUPARCO) in Pakistan, it succeeded in reducing survey costs from US $ 7 million to US $ 300,000 and reducing the number of officers from 3,500 to 18 by changing the way surveys from classical surveys (direct field survey) to surveys using satellite imagery.

3. METHODOLOGY

By its purpose, this research belongs to applied research. As stated by Gay (1977) quoted by Sugiyono (2010. p. 4), "Applied research is being conducted with purpose of applying, testing, and evaluating the capability of a theory applied in practical problem solving." This research used both primary and secondary data for a 5 years period from 2013 to 2017.

Analysis method used is descriptive-quantitative method. Descriptive method is an object research with the aim of creating description, image, or depiction in sistematic, factual, and accurate way (Nazir, 2000). Qualitative analysis (descriptive) is a method which aims to give description about research subject based on derived data by variable from group of subjects studied. Quantitative analysis is an analysis conducted by calculating using provided data from companies or organizations (Farida and Retno, 2012).

Quantitative approach used to analyze this descriptive research is the NPV method. This method (Gitman, 2015; Brealey and Myers, 2007) calculate the difference between present value from investment and present value from net cash receipts that will happen during the project. Formula of calculating NPV are as follows:

$$NPV = -CF_0 + \frac{CF_1}{(1+r)1} + \frac{CF_2}{(1+r)2} + \frac{CF_t}{(1+r)n}$$

Legends:
CF_0 = Initial investment
CF_t = Net cash receipts in "t" year
r = discounted rate
n = project age.

Discounted rate (r) is interest rate atau cost of capital or tradeoff fee on the earned cashflow potential. In the calculation of NPV for this research, r value is obtained from the average rate of BI rate/repo 7 days rate to standardize values to base years. Disount rate of 2015 is the average BI rate of 2015, year 2016 is average BI rate and repo 7 days rate. Meanwhile for 2017 is the average repo 7 days rate. BI rate and repo 7 days rate is used as discount factor considering the interest rate is above annual average inflation which usually used to constrict the values to the base year. Therefore, the originated NPV value already reflects caution in decision making. Criteria of decision making is proper to continue if NPV>0 (Gitman, 2015).

There are several assumptions used in this research to obtain the data needed. Assumptions created in this research are as follows:

a. 2017 is used as the base year of project assessment. Therefore, historical data before 2017 will be stabilized by BI rate/repo 7's day as discount factor.
b. The data used is historical data of 2015 to 2017 for potential acceptance of remote sensing data.
c. Initial investment financing data (I_0) is a recorded asset data on financial statements of 2013–2017.
d. Feasibility calculation (NPV) using basis per type of resolution that is very high resolution, high resolution, medium resolution and low resolution.
e. The depreciation used is stright-line method with asset classification based on MACRS method (Gitman, 2015).

MACRS method classified four main properties based on recovery period as in Table 1.

3.1. Stages of Data Analysis using NPV method

a. Calculation of cash flow data (CF_0) or Initial investment purchase data and remote sensing information.
   Initial investment data is derived from procurement of fixed assets of remote sensing, operational fee to obtain, process, and distribute to the users, is excluded. Therefore, all costs related to procurement of remote sensing asset will be considered as acquisition cost. Initial investment financing data this activity is asset data recorder on financial report during 2013 to 2017. The calculation steps are as follows:
   1. Identify all asset/equipment used to generate output data of remote sensing recorded in financial report.
   2. Each equipment above has already been identified its price and year of acquisition then the constan value is calculated based on 2017 as base year. The formula of calculating constant value on this research is using below formula:

$$\text{Future value}_{2017} = CF(1+r)^n$$

Legends:
- Future value is the constant value of 2017.
- CF is cash flow, on this matter is the acuisition price of assets on year n.
- r is interest rate, in this case, BI rate average/BI 7-day repo rate is used and can be taken from Bank Indonesia website (www.bi.go.id).

This formula is used to obtain asset value in 2017 on asset with acquisition price on year n. Therefore, acquisition price will be generated on year t with constant value of 2017 as follows:

1. Asset constant value with acquisition year 2013 on 2017 = acquisition asset value of 2013 x $(1+\text{interest rate})^4$

Table 1: The first four property classes under MACRS

Property class (recovery period) (years)	Definition
3	Research equipment and certain special tools
5	Computers, printers, copiers, duplicating equipment, cars, light-duty trucks, qualified technology equipment, and similar assets
7	Office furniture, fixtures, most manufacturing equipment, railroad track, and single-purpose agricultural and horticultural structures
10	Equipment used in petroleum refining or in the manufacture of tobacco products and certain food products

Source: Gitman, 2015

2. Asset constant value with acquisition year 2014 on 2017 = acquisition asset value of 2014 x (1+interest rate)^3
3. Asset constant value with acquisition year 2015 on 2017 = acquisition asset value of 2015 x (1+interest rate)^2
4. Asset constant value with acquisition year 2016 on 2017 = acquisition asset value of 2016 x (1+interest rate)^1
5. Asset constant value with acquisition year 2017 on 2017 = acquisition asset value of 2017 x (1+interest rate 2016)^0 or the results of the calculation of asset values do not change.

3. Total of Initial investment is calculated by adding up asset constant value of each year above.
4. Initial investment is classified per type of resolution, the determination is using the assumption of the contribution of potential revenue to the distribution value of each resolution on total of distribution value of remote sensing data.

b. Calculation of cash inflow data (C_t)
1. Calculating potential value of distribution per-resolution type (constant).
Cash Inflow data is a potential value of distribution per-resolution type for calculations per-resolution. Unit value of distribution is based on Minister of Finance Regulation No. 187/PMK.05/2014 about service rates of Public Service Agency, Utilization Center for Aerospace Technology LAPAN (Pusfatekgan-LAPAN), comply to the international price.distribution value in this research is using that basis for unit price and later be converted to each currency based on the Table 2. Below is the conversion rate of currency used.
2. Cost data is obtained from cost presentation compared with potential revenues. The formula are as follows:
   1. Cost (VH) = (Composition of distribution potential per-resolution type/total of resolution X (total cost in Lk - depreciation costs + depreciation cost in Depreciation Calculation Table) + acquisition cost (VH).
   2. Cost (H and M) = (Composition of distribution potential per-resolution type/total of resolution X (total cost in Lk – depreciation costs + depreciation cost in depreciation calculation table).

c. The calculation of gross profit is generated from potential acquisition value minus costs spend in each resolution. Because LAPAN is a government institution which not subject to tax, therefore the gross profit is equal to nett profit.
Next, is how to calculate depreciation of each resolution per-year. The following is the depreciation of each asset per resolution. Depreciation calculation is using the formula below:

Depreciation = (Composition of Potential Distribution Per Resolution Type/Total of Resolution) × (Investment Value Cfi/Total Asset) × Depreciation cost

d. Net cash inflow during "n" period (C_n)
The final stage after all the variables are known, then the Net cash inflow uring 'n' (C_n) period is calculated:
Net cash inflow (C_n) value=Profit+Depreciation cost

e. Calculating constant value of Net Cash Inflow in 2015 and 2016 to 2017. From each potential value of net cash inflow per-resolution type, then constant value is calculated with 2017 as the base year.

4. RESULTS AND DISCUSSION

Results of feasibility calculations of remote sensing activity in Indonesia is divided into very high resolution image (CRST), high resolution image (CRT), and medium resolution image (CRM). Either Cash inflow value or cash outflow by taking current value dan constant value into accont. Calculation of current value is feasibility value on each year and then fixed by applicable value of 2017. The following is result of cash inflow value 2015, 2016, and 2017 calculation results using current and constant value.

Table 3 shows potential current value of cash inflow generated from remote sensing activity in Indonesia from 2015 to 2017. Calculation result of total cash inflow for current value respectively amounted Rp. 2,793,739,198.958, - for 2015, Rp. 7.730.023.565.707 for 2016, and Rp. 8.315.473.369.205 for 2017. It is obvious that the increasing trend from 2015 to 2017 is very significant in 2016, up to 177%. This shows that cash inflow potential obtained from remote sensing activity of very high resolution image, high resolution image, and medium resolution image data is very high. The high number of cash inflow indicates that if image data distributed to users are used wisely, therefore minimum value of direct benefits is equal to cash inflow value.

The increasing of total value of cash inflow in 2015, 2016, and 2017 can be seen from the improvement on each component. We can see from Table 3, cash inflow of very high resolution image, high resolution image and medium resolution image are increasing significantly from 2015 to 2016. Meanwhile, from 2016 to 2017 only high resolution image increase. But, it does not affect total amount of cash inflow since total cash inflow of 2017–2018 still increasing. This shows that the demand of data or users needs of data in 2017 are more likely to use high resolution image in utilizing the data. The calculation result also indicated how LAPAN realizing what has been mandated in Law No.21 of 2013 in operating its ground station. High resolution image and medium is generated by operating ground station, so with cash inflow value, the calculation result above can show how LAPAN function in its contribution to Indonesia Economy.

If current value of each year above then fixed (assessed for 2017), value that has calculated the inflation rate, and others, therefore after calculation, cash inflow value from 2015 to 2017 respectively are shown in Table 4.

Table 4 shows calculation result if current value of each year fixed in 2017. A fixed potential value of cash inflow from 2015 to 2017 respectively are Rp.3,164,077,965.607, - in 2015 assessed for 2017, Rp.8,125,027,769.915,- in 2016 assessed for 2017, and Rp.8,315,473,369.205, for 2017 value. The fixed cash inflow calculation result also shows improvement. This means, if inflation rate is inserted as discount rate, current value still shows its improvement of cash inflow.

Contribution of cash inflow value, either current value or constant value from remote sensing activity in Indonesia shows that the biggest cash inflow value is generated from high resolution image which shows an increasing trend year to year. The next contribution of cash inflow comes from high resolution image, but cash inflow value decreased in 2016 to 2017 after an increase from 2015 to 2016. The same thing happened in medium resolution image with the lowest contribution.

Table 2: Currency conversion rates

Currency	2015	2016	2017
$/Rp	13.391,97	13.307,40	13.384,08
€/Rp	14.942,27	14.802,39	15.204,34
¥/Rp	111,25	123,21	119,95

Source: Bank of Indonesia, Bank Sentral Republik Indonesia (2017)

Table 3: Cash inflow of data and remote sensing information (current value)

Resolution	Cash inflow (current value)		
	2015	2016	2017
CRST	5.729.375.494	1.670.704.961.254	1.465.517.019.416
CRT	2.788.007.727.657	6.059.313.503.673	6.849.955.094.281
CRM	2,095,807	5.100.780	1.255.508
Total	2.793.739.198.958	7.730.023.565.707	8.315.473.369.205

Source: Data processed

Table 4: Cash inflow of data and remote sensing information (constant value)

Resolution	Cash inflow (constant value)		
	2015	2016	2017
CSRST	6,488,862.942	1,756,077,984.774	1,465,517,019.416
CSRT	3,157,586,729.037	6,368,944,423.711	6,849,955,094.281
MEDIUM	2,373.628	5,361.430	1,255.508
Total	3,164,077,965.607	8,125,027,769.915	8,315,473,369.205

Source: Data processed

Investment value of remote sensing activity is Rp.148.048.964.986,-. Investment value is ecluded from cost spent each year. Based on NPV calculation of 2017 from remote sensing activity using constant value, the result is Rp.19.456.530.139.740,- with each NPV value of very high resolution image, high resolution and medium resolution image respectively at Rp.3.227.259.572.873,-, Rp.16.229.261.686.560,-, and Rp.8.880.308,-. The highest generated NPV contribution comes from high resolution image (83%), meanwhile the very high resolution contribute at 17%.

5. RESEARCH IMPLICATIONS

Activities and utilization of satellite remote sensing data in Indonesia through LAPAN have long been underway. Based on the feasibility calculation for 3 years activities using the NPV method bring into a positive value. This assessment indicated that these activities are profitable and should be continued. Furthermore analyzsis based on cashflow value, we can see that cash inflow is much greater than the cash outflow. Thus financially proven that the benefits of remote sensing are very large.

Even though NPV has been empirically proven it is appropriate to use in assessing project feasibility, Riga (2014) stated that there are major weaknesses in the use of NPV for this remote sensing project. The first is accuracy in determining discount factor (r) specification used in calculating NPV. There are several ways to set discount factors using such as weighted average cost of capital (minimum cost on gaining fund), benchmarking on government short-term securities, or inflation. Wacc calculation actually only takes into account the financial risk aspect. According to Riga, in addition to the financial aspects, it must also take into account technical and commercial aspects. Financially, the satellite remote sensing project was concluded to be very feasible. However, it is also necessary to calculate the feasibility of other aspects since remote sensing of satellite projects is an innovation product.

Therefore a further analysis of the feasibility of this project can be done using Monte Carlo analysis techniques (Rode, 2001). In this Monte Carlo technique simulates several uncertainty variables that might occur in the project as input variables and seen their effects on the NPV value. This technique is done by building a deterministic model first then proceed with probabilistic analysis. The use of this technique can determine the financial feasibility of the project by considering the possibility of several variables of uncertainty in the project. In addition, with this probabilistic analysis can also determine the probability value of the occurrence of a negative NPV of a project run.

Second, disadvantage in the use of NPV as an assessment of project feasibility is the cost of obsolescence, given the rapid changes in information technology. Satellite remote sensing projects are projects that use very high technology. The accuracy in determining the number of years required for the return of investment that must be set in the project in the calculation of NPV becomes very important. Errors in the determination can cause the NPV value to be too high and can be misleading in decision making.

Thirdly, environmental issue. Furthermore, the Republic of Indonesia Law Number 21 of 2013 also explained that in utilizing this technology, besides having to pay attention to the aspects of benefits, effectiveness and efficiency, it must also provide protection and management of the environment, including the Space environment. Thus it is clear that project appraisal should not only look from the point of view of economic value alone. Economic activity should also take into account the impact and sustainability of the environment.

Therefore the calculation of economic value further using qualitative data about the benefits of remote sensing is very important to do.

6. CONCLUSIONS

Based on the research results on satellite remote sensing data in Indonesia conducted by LAPAN using the NPV method showed positive results. The NPV value of 2017 is Rp. 19,456,530,139,740, - with each NPV value at each resolution for very high, high and medium resolutions respectively Rp. 3,227,259,572,873, -, Rp. 16,229,261,686,560, -, and Rp. 8,880,308. The highest contribution of NPV produced mainly comes from high resolution of 83% followed by very high resolution contributes 17%. This means that this activity is very feasible to continue.

The value of the calculation also shows that LAPAN has realized what has been mandated in Law No. 21 of 2013, especially in the operation of the earth station. The important function of LAPAN in its contribution to the Indonesian economy is shown by the high NPV value from remote sensing activities, especially for high resolution.

However, considering satellite remote sensing is an activity that involves the use of very high technology, then the analytical method that is able to overcome the weaknesses of the NPV method on the problem of the accuracy of the WACC, obsolescence problems, and environmental problems becomes very important to explore.

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