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Policy Paper

# Improving Research Infrastructure in Indonesia through Public Private Partnership (PPP)

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**ABSTRACT**

The government continues to boost infrastructure development through different financing schemes, such as Public Private Partnership (PPP). The private sector is encouraged to participate in infrastructure development under this strategy, indirectly reducing the government's burden. National Research and Innovation Agency (BRIN), formerly known as the Indonesian Institute of Sciences (LIPI), as a government organization engaged in research, has chosen the PPP scheme for the Management and Development of the National Research Vessel Fleet to strengthen the capacity of the research infrastructure. This paper was written as a descriptive qualitative investigation using the literature study approach and relevant policy/regulatory literature. Also explains the need for research infrastructure, in this case, research vessels in Indonesia and provides an overview of the revenue potential and risk analysis in PPP projects. The result of this paper also provides an overview of BRIN's PPP implementation process. It can address issues such as whether the PPP scheme for research infrastructure development is of the PPP character, where the process is purely business-managed, how risk sharing is carried out in the PPP and how BRIN implements PPPs.

**Keywords**: PPP; Infrastructure; Research; Development; Vessel

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## 1. Introduction

Infrastructure development has been mandated in the 9 (nine) Nawacita programs of President Jokowi in the 2015-2019 period, further continued in the 2020-2024 period focusing on infrastructure development. The fulfilment of infrastructure is thus vital to ensure the progress and independence of the nation, thereby enhancing Indonesia's competitiveness worldwide. However, one notable question lies in how the government's budget capacity to actualize such a program. In addition, one of the major problems in terms of infrastructure development deals with financing. Bappenas (The National Development Planning Agency) reported in 2019 that Indonesia's total infrastructure investment needs between 2020 and 2024 amounted to IDR. 6,445 T.

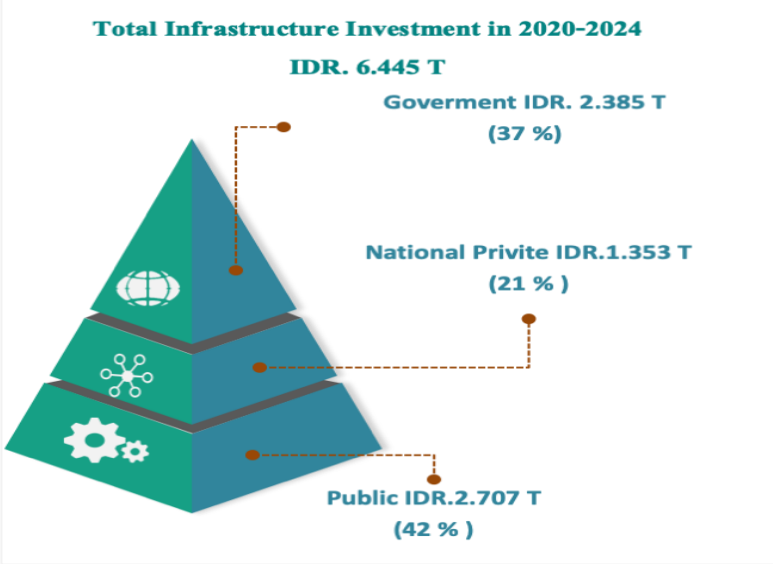


*Figure 1. Infrastructure Investment of Indonesia in 2020-2024*
*Source: Bappenas (2019)*

The infrastructure gap should be perceived as an opportunity for national growth, further explained in the 2020—2024 RPJMN document that an investment of IDR 35,212 trillion is required to achieve the annual target of average economic growth of 5.7—6.0 percent, or approximately IDR 4—35,455.6 trillion during the year 2020—2024. The government and SOEs are expected to contribute around 8.4—10.1 percent and 8.5—8.8 percent of the total needs, while the public or the private sector will fulfil the rest. Jin (2009) stated that the growing demand for PPPs in infrastructure financing was due to several factors, such as urbanization and lack of government funds.

PPPs have been internationally implemented as one of the alternative financing strategies in more than 85 countries to procure economic and social infrastructure projects (Regan et al., 2009). PPPs have developed promptly in recent decades to provide urban infrastructure and services in several countries (Doloi and Jin, 2007). Alternative financing through the Government Cooperation scheme with Business Entities in infrastructure development has been widely applied in several countries, including Indonesia. This scheme is perceived as much more efficient and effective because it involves the private sector in its implementation. Various problems that can arise include the debate of whether the PPP scheme for research infrastructure development is of PPP character, where the process is solely managed on a business basis, how the risk sharing is managed in PPP, and how BRIN (LIPI) implements the PPP. The activities conducted by BRIN provide a complete picture and recommendation to the Public Ministry and other institutions in implementing financing under the PPP scheme to develop research infrastructure.

Public Private Partnership (PPP), hereinafter referred to as PPP, refers to a collaboration between the government and business entities in providing infrastructure for the public interest by referring to the specifications previously determined by the Minister/head of institution/regional head/state-owned

enterprise/regional-owned enterprise that partially or exclusively utilize the resources from business entities with due observance of risk sharing between the parties (Republic of Indonesia, 2015).

It was further explained that PPP involved a collaboration between public and private sectors based on a long-term agreement to provide the services involving both private and public sectors and to maintain the infrastructure required for developing these services (Rudžianskaitė–Kvaraciejienė et al., 2015). PPP's core principle is to achieve the best value for the invested money based on the experience of the private sector and the sharing risk between the involved parties. PPPs have been implemented for various infrastructure projects worldwide. Further, the PPP approach will increase the economic value of the output generated by the established infrastructure (Zhang, 2005) and facilitate the overall infrastructure development (Li et al., 2016), such as the construction of transportation infrastructure, sports facilities, water conservancy facilities, waste disposal, and energy utilization. PPPs allow public and private sector investors to mutually work, based on contracts or institutional agreements, in designing, planning, financing, building, and operating infrastructure provided by the state (Cruz & Marques, 2013) as an alternative in building the country's infrastructure.

*Table 1: Differences in Alternative Financing with Conventional Schemes and PPP Schemes Based on Presidential Decree Number 38/2015*

| NO. | CONVENTIONAL SCHEME | PPP SCHEME |
|---|---|---|
| 1 | Inconsistency from planning, construction design to maintenance | Continuity of implementation as outlined in the Long-Term Contract |
| 2 | Implementation delay | Minimal project implementation risks |
| 3 | Not assessing the risk aspect | Risk aspect study |
| 4 | The risk is borne by 100% of the government | Risk sharing |
| | Project funding according to the contract value | Possibility for other infrastructure |

Source: Presidential Decree 38 of 2015

In the context of strategic research, PPP refers to a collaboration mode between publicly funded research organizations and service companies and is characterized by robust institutional collaboration over a long period to achieve complementary goals in mutually conducted research activities (Buckland, 2009). Likewise, the vessel research under the PPP project requires several other research institutions as stakeholders/users of vessel research services involving the private sector in investing in the management and construction of vessel research.

## 2. Methodology

This paper applies a descriptive qualitative study by utilizing the literature study method and policy/regulatory literature related to the observed problems. The author explains the need for research infrastructure, in this case, research vessels in Indonesia and provides an overview of the potential revenue and risk analysis in PPP projects. Further, the author conducted a more in-depth analysis of the PPP project run by the Indonesian Institute of Science, particularly the PPP scheme for the Management and Development of the National Research Vessel Fleet. In the end, it will produce recommendations related to alternative financing with the PPP scheme for developing research infrastructure in Indonesia that can be applied by other Ministries and Institutions that are engaged in research.

### 2.1 Data

BRIN (National Research and Innovation Agency) is one of the government research institutions generating numerous innovative products deemed reliable and beneficial to the community, inseparable from developing research infrastructure through various government funding schemes (APBN, PHLN,

PNBP, SBSN). To date, the fulfilment of research infrastructure through the PPP scheme in Indonesia has not been commonly conducted. Other ministries/institutions engaged in research have never used the PPP model to implement the funding scheme. Rakhel et al. (2021), using a bibliometric study, did not find articles/journals discussing the fulfilment of research infrastructure (Research and Development) through PPP schemes worldwide, including in Indonesia. They argued that infrastructure research n developing countries only took place in laboratories and hospitals. In contrast, research considering the management and development of research vessels was limited, indicating that the PPP scheme for fulfilling research facilities has been uncommon, despite the private sector's massive investment and government's commitment. Financing research vessels through the PPP scheme proposed by the Indonesian Institute of Science is deemed pivotal to supporting the development of marine research in Indonesia and worldwide.

Indonesia owns only 23 research vessels. The Indonesian government owns 18 research vessels of these vessels while private parties own the remaining five. The Joint Inter-Ministerial Team, coordinated by the Ministry of Communication and Informatics, reported that of the 18 research vessels owned by the government, only nine vessels were able to conduct surveys in deep sea waters, and the remaining three were only able to conduct surveys in shallow waters. Regarding function, only five research vessels have multi-purpose functions, while the remaining seven have special functions. Meanwhile, research vessels owned by the private sector have been dominantly devoted to conducting geological and mining surveys.

The demand for marine research vessel infrastructure is unavoidable. In 2019, based on a study from the Coordinating Ministry for Maritime Affairs, Indonesia had 15 ocean research vessels managed by several Ministries/Institutions with an average age of 26 years, thereby lacking technological aspects. Indonesian research vessels have been anchored at public ports or fishing ports such as KR Baruna Jaya I-IV . KR Baruna Jaya VIII docked at the Nizam Zachman Archipelago Fisheries Port in Muara Baru Jakarta along with other ships, including national fishing vessels. Likewise, the KR Geomarin III of the Ministry of Energy and Mineral Resources is anchored at the Container Port in Cirebon. These conditions are far from ideal due to several following factors, including:

a. High operational costs and standards
b. Vulnerability aspects of locations that are prone to fire, theft, and collisions.
c. Uncontrolled harbour pool depth
d. Provision of fuel and clean water supply
e. Unsupported warehousing, storage, and sample processing facilities.

### 2.2 PPP in Indonesia

PPPs are considered more effective in improving the quality of planning, spending, and maintaining public assets (Wulyono & Perwitasari, 2017). In addition, other factors that determine the success of infrastructure development in using the PPP scheme include a stable macroeconomic environment; shared responsibilities between the public and private sectors; a transparent and efficient procurement process; a stable political and social environment; and prudent government control (Chan et al., 2010). The factor of shared responsibility between the government and the private sector enables sustainability and guarantees the proper implementation of infrastructure development. According to the PPP issued by Bappenas in 2020, several PPP projects have been successfully implemented in Indonesia, illustrated in the following table:

*Table 2: List of PPP Successfully Implemented Projects*

| NO | PROJECT NAME | GCA | INVESTMENT (USD) | CONCESSION PERIOD |
|---|---|---|---|---|
| 1 | Balikpapan – Samarinda Toll Road | BPJT | 767.0 Million | 40 years |
| 2 | Batang - Semarang Toll Road | BPJT | 850.0 Million | 45 years |
| 3 | Pandaan-Malang Toll Road | BPJT | 461.0 Million | 35 years |

| NO | PROJECT NAME | GCA | INVESTMENT (USD) | CONCESSION PERIOD |
|---|---|---|---|---|
| 4 | Jakarta – Cikampek II Elevated Toll Road | BPJT | 1,249.0 Million | 45 years |
| 5 | Manado-Bitung Toll Road | BPJT | 396.0 Million | 40 years |
| 6 | Cileunyi – Sumedang – Dawuan Toll Road | BPJT | 617.9 Million | 40 years |
| 7 | Serang – Panimbang Toll Road | BPJT | 391.6 Million | 40 years |
| 8 | Serpong-Balaraja Toll Road | BPJT | 464.0 Million | 40 years |
| 9 | Jakarta – Cikampek II South Toll Road | BPJT | 1,718.8 Million | 35 years |
| 10 | Krian-Legundi-Bunder-Manyar Toll Road | BPJT | 940.0 Million | 40 Years |
| 11 | Development Of Bandar Lampung Water Supply System | PDAM | 82.6 Million | 25 years |
| 12 | Development Of Umbulan Water Supply System | PDAM | 140.7 Million | 25 years |
| 13 | Development Of West Semarang Water Supply System | PDAM | 28.97 Million | 27 years |
| 14 | Nambo Regional Waste Management System | West Java Provincial Government | 44.4 Million | 25 years |
| 15 | Construction Of Palapa Ring West Package | Ministry of Communication and Information | 87.6 Million | 15 years |
| 16 | Construction Of Palapa Ring West Package | Ministry of Communication and Information | 71.5 Million | 15 years |
| 17 | Construction Of Palapa Ring East Package | Ministry of Communication and Information | 386.5 Million | 15 years |
| 18 | Central Java Power Plant | PT PLN | 4,200 Million | 25 years |

Source: PPP Book 2020

The table indicates that the dominant infrastructure development involves the construction of dispersed toll roads in several cities in Indonesia and public facilities such as clean water, electricity and telecommunications. However, other ministries and institutions have not considered infrastructure in the field of research.

## 3. Results and Discussions

National Planning and Development Agency (2020) stated that the BRIN-PPP Project called "Construction of National Maritime Research Zone" has been included in the Under Preparation Projects. BRIN plans to build a National Research Vessel Fleet by implementing the Government Cooperation with Business Entity (PPP) mechanism as regulated in Presidential Regulation 38 of 2015 concerning PPPs in infrastructure provision. In Presidential Regulation No. 38/2015 Article 5 paragraph 2 point m, the National Vessel Fleet Management and Development project can be categorized as an educational

infrastructure facility. Further, Permen PPN 4/2015, Article 3, states that one of the education infrastructures is research and development facilities, which is a collaborated type of infrastructure.

In conducting the PPP project, BRIN is encouraged to create healthy competition and reduce market risk by conducting an open and competitive selection of business entities as stated in Institutional Regulation No. 29 of 2018 concerning Procedures for Procurement of Entities Implementing Business of Infrastructure Provision through Government Cooperation with Business Entities on the Initiative of the Minister/Head of Institution/Head of Region.

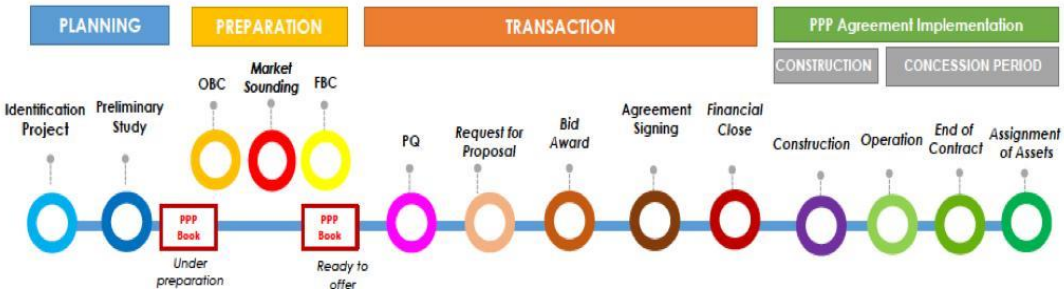


*Figure 2. PPP Process*

The aforementioned figure describes the PPP process in general, starting from planning, preparation, transactions, and infrastructure development, ending with the concession period and handover of assets by private parties.

The cooperation form of infrastructure for research facilities and supporting equipment is conducted with the following scheme:

- Baruna Jaya VIII Retrofit and Baruna Jaya IX Ships : Operate-Maintenance-Transfer

*BJ VIII Research Ship to be Retrofit*

*BJ IX Research Ship Plan (Illustration)*

The two illustrated types of ships above are research vessels owned by BRIN, applying another financing scheme, such as Foreign Loans from the World Bank. The Baruna Jaya VIII Vessel research will be rehabilitated/retrofitted thoroughly to maximize its function and usability. The research vessel of Baruna Jaya IX will be under construction in the next few years; thereby denoting that the PPP scheme for the two research vessels above is Operate-Maintenance-Transfer, comprising vessel research management and maintenance and handover to BRIN at the end of the concession period.

- Litoral Ship Procurement (0-200 m and 200-1000 m): Finance-Design-Build-Operate-Maintenance-Transfer

*Litoral Ship 0-200 M (Illustration)*

*Litoral Ship 200 - 1000 M (Illustration)*

The two illustrated ships are small littoral research vessels that will be used in coastal areas. The PPP scheme offered is Finance-Design-Build-Operate-Maintenance-Transfer. The private sector (BUP) will invest in building the two vessel types of research, carrying out ship design in accordance with needs, construction, research vessel, and maintenance and transferred to BRIN as Implementing Agency. This activity is expected to be accomplished in the third year after completing the PPP. Hence, in the first two years, BUP focuses on managing and maintaining research vessels through a financing scheme of Overseas Loan. By prioritizing the management of research vessels, BUP is expected to have experience in managing and maintaining research vessels, encouraging the readiness of new research vessels and BUP in all aspects**.**

Under a user tariff payment scheme with a payback period of up to 20 years, cooperation in the construction of a research vessel fleet is expected for:

a. Efficiency and effectiveness management. Management of marine research vessels will be more professional if carried out with PPP, considering that the Business entity will ensure the fulfilment of the agreed service standards for the certainty of investment returns;
b. Revenue management. Revenue management from marine research services will be more appropriate if a Business entity manages it with a PPP Scheme. Corporations must be able to manage income from business properly if there are limitations in operating income;
c. Service standards. Through the PPP scheme, the management of research vessels will improve service standards on timeliness and quality of infrastructure services, which are very crucial factors for business entities in ensuring the satisfaction of research vessel service users. This will increase operating income;
d. Risk management. Business entities have a stronger planning function when partnering with the government in calculating design risk, work delay risk, and funding risk. Through the PPP scheme, it is hoped that the government will obtain the most competent and selective Business Entities in managing these risks;
e. Research vessel management capability. The Business entity will ensure cost efficiency in the management of research vessels in the marine sector because it has taken into account its obligations to provide infrastructure services in accordance with the Minimum Service Standards agreed upon and supervised by the government to ensure the continuity of their investment returns during the cooperation period;
f. Transfer of knowledge. This collaboration is expected to result in knowledge transfer in the management of research vessels and their supporting facilities to be more efficient and effective in increasing the expertise of BRIN, which can provide benefits to stakeholders who use research vessel services for making decisions regarding the implementation of marine research programs in Indonesia.

Based on the aforementioned scope and responsibilities, the PPP project structure is as follows:

a. The implementing agency will enter into a PPP Agreement with BUP, and BUP in accordance with its responsibilities, will design, build, and maintain a fleet of ships and research facilities during the cooperation period. At the end of the cooperation year, the BUP will hand over all assets to the Implementing Agency;

b. BUP will enter into loan agreements with financing institutions, both national and or international, to finance the management of the Baruna Jaya VIII Retrofit and Baruna Jaya IX research vessels, as well as the procurement of Litoral Vessels (0-200 m and 200-1000 m); The loan amount will be made in stages according to the need for the provision, operation and maintenance of the research vessels.
c. BUP receives payments from users in the form of research vessel service transaction rates (based on sailing days), data acquisition services, and research data processing, whose schedules and rates are determined by the fleet department, according to the agreement contained in the PPP Agreement;
d. The Implementing agency will pay BUP in stages to ensure the return on investment. Through the user tariff mechanism, BUP will enter into a guarantee agreement with PT. PII (Indonesia Infrastructure Guarantee Agency Ltd.). Then, the implementing agency will also make a regress agreement with PT. PII.

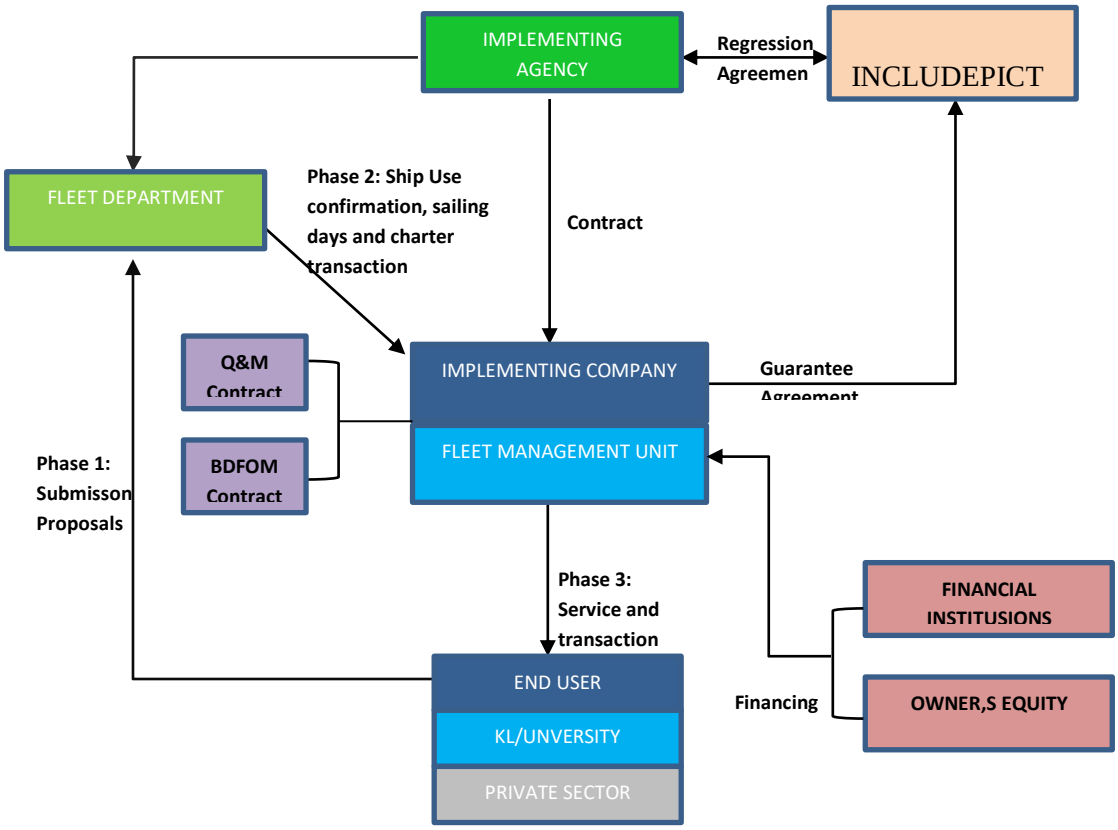


*Figure 5. PPP Structure for the Management and Development of the National Vessel Fleet Research*

Utilization of State Property (BMN) follows Government Regulation Number. 28 of 2020 concerning the Management of State/Regional Property. Research vessel fleet infrastructure in collaboration with the Implementing Business Entity (BUP) includes the management of the BJ VIII and BJ XI, in which the ship is BRIN asset managed by BUP. When utilizing the asset according to BUP, there is no need to provide PNBP to BRIN, because BUP is required to procure a minimum of 3 (three) Litoral vessels (2 vessels measuring 0-200 m and 1 vessel measuring 200-1000 m), starting from year 3. Meanwhile, during the cooperation period, all these assets will be the responsibility of BUP in their operation and maintenance. BRIN will enlist all assets under the responsibility of BUP, as contained in the Cooperation Agreement between the implementing agency and BUP.

At the end of the PPP agreement, BRIN will conduct an appraisal of all assets in the form of a research vessel fleet and its research equipment through an independent consultant. If, based on the appraisal results, all assets managed and maintained by the BUP are still functioning in accordance with the age provisions, all the assets will be handed over to BRIN and will be recorded as state assets.

**Innovation in alternative financing for research infrastructure in Indonesia**

Although numerous types of research by the government through conventional financing schemes such as using APBN and SBSN have been carried out, through these schemes, all aspects that may pose a risk of loss or discontinuity are relatively likely to occur because all forms of management and maintenance are borne to the relevant agency. This is in accordance with a study conducted by Kolinug et al. (2015) on administration assets, asserting that the state government in the local government in Tomohon City, North Sulawesi experienced insignificant effort from the asset sector in terms of collecting reports regarding maintenance activities by SKPD in Tomohon City.

*Table 3: Budget by Source of Funds*
*The year 2017–2021*

| NO | SOURCE OF FUNDS | YEAR | | | | |
|---|---|---|---|---|---|---|
| | | 2017 | 2018 | 2019 | 2020 | 2021 |
| 1 | Pure Rupiah | 976,808,622 | 1,093,891,606 | 1,089,268,213 | 844,942,242 | 955,106,719 |
| 2 | Foreign Loans | 84,894,966 | 94,835,000 | 111,250,000 | 120.050,000 | 109,750,592 |
| 3 | PNBP | 75,242,479 | 77,086,931 | 80,120,425 | 22,390,568 | 57,600,000 |
| 4 | Overseas Grant | 4,950,000 | - | - | - | - |
| 5 | Domestic Direct Grants | 560,000 | - | - | 100,000 | - |
| 6 | Overseas Direct Grants | 2,242,894 | 1,500,205 | 2,113,779 | 7,189,337 | - |
| 7 | SBSN | | 120,000,000 | 240,000,000 | 508,702,101 | 866,989,184 |
| | **TOTAL** | **1,144,698,961** | **1,387,313,742** | **1,522,752,417** | **1,503,374,248** | **1,989,446,495** |

Source: https://spanint.kemenkeu.go.id/

The illustrated table presents the types of funding sources in the last five years conducted by BRIN, consisting of Pure Rupiah, Overseas Loans, several kinds of grants, and SBSN. SBSN funding sources have dominated research infrastructure spending, both physical laboratory construction and laboratory equipment to support research activities. Therefore, the PPP scheme is deemed novel for BRIN in developing research infrastructure expected to significantly impact the development of science and technology in Indonesia. In addition, this PPP project develops a blended financing pattern, such as vessel research managed at the beginning of the implementation period from the Foreign Loan financing scheme originated from France's state Agence Franaise de Development (AFD).

Apart from being an alternative to financing research infrastructure, this project provides numerous benefits to government and private stakeholders. The following are some of the identification benefits provided by the PPP project for the Management and Development of the National Vessel Fleet Research, including:

**a. Community-Saving**

1) In addition to providing benefits to the government, the existence and implementation of the BRIN PPP project will also positively impact society, including the business world in particular. Some of the identified benefits include:
2) The provision of data and information on marine research will facilitate the community and the business world related to the utilization of coastal and marine resources to optimize their business or new investments in the utilization of marine resources, both living and non-living.
3) The availability of data and information on biological resources such as fish stocks, especially in the WPP Indonesia area, including the deep sea, will increase the productivity of the community's capture fisheries to increase public income.
4) The availability of employment opportunities due to the realization of investment in the maritime sector for the fisheries and marine sector, transportation, mining, energy and environmental services such as tourism.

**b. State Budget/Regional Budget and Regional Expenditures Saving**

The obtained benefits for the government upon the implementation of PPP-KRKN project include direct and indirect benefits, such as:

**i. Immediate Benefits**

The immediate benefit is to sustain the state budget savings for implementing marine research, especially in the provision of research vessel operational funds or operation subsidies that the state has born.

1) Conducting research to explore marine resources, both living and non-living resources, in all Indonesian waters up to the EEZ area, which is included in the deep-sea category. Thus, the potential profile of marine resources can be more optimal and complete, especially for the deep sea, which has high economic value for the needs of food, medicine, and cosmetics.
2) Increasing state revenue through exploration fishery and marine biological and non-biological resources. Currently, the maritime sector contributes 20% to annual GDP; the maritime sector is expected to contribute 25-30% of GDP every year.
3) Accelerating the mapping of EEZ boundaries and the possibility of adding EEZ boundaries based on convention UNCLOS with its multifunctional marine research capabilities and wide coverage.

**ii. Indirect Benefits**

One of the indirect benefits is strengthening Indonesia's commitment to implementing the concept of managing its marine resource potential with the blue economy concept. The concept of the blue economy is Indonesia's commitment to several world forums to introduce a model for managing and utilizing Indonesian marine living and non-living resources with the sustainability principle to help save the earth's ecosystem, which is getting worse due to world economic exploration.

1) Encouraging the availability of reliable facilities and infrastructure in the field of marine research for the development of research and passion for marine research by the Government, Universities, the Business World, and related NGOs.
2). Providing data and information on potential water resources, including the deep sea, will stimulate increased investment interest in fisheries, marine affairs and the development of new and renewable energy.

3) Increasing the interest in investment and investment realization in fisheries, marine affairs, and new and renewable energy will open up job opportunities so that it will absorb the workforce of the Indonesian people and help reduce unemployment.

**PPP revenue potential**

The rewards obtained from PPP projects are deemed important for the private sector. Rewards refer to the results from building or investing in PPP projects. According to Iossa and Martimort (2015), giving rewards/benefits is pivotal to success in the PPP scheme. Likewise, Qizilbash's (2011) opinion that PPP is a collaboration between private and NGOs to develop new ways of producing and distributing services, sharing risk and rewards, where all parties (private and public) benefit from this transaction. In the PPP scheme, the income comes from the investment return provided by Implementing Agency /Government.

Return on investment to the private sector is thus crucial in PPP projects. After infrastructure or project development is implemented, all management and maintenance will be handed over to the private sector through the formed BUP. Therefore, the potential income that will maintain the return on investment must be identified earlier in accordance with the business as a good target market for the sustainability of the ongoing project. The potential revenue for this project comes from various sectors, which are described as follows:

**a. Government Ministry**

Ministries/public institutions in Indonesia that directly or indirectly have main tasks and functions in determining policies and utilization of maritime resource potential in Indonesia are the Ministry of Economics and Maritime, BAPPENAS, KKP, Kemenristek DIKTI, Kemenhub, MEMR ESDM, Ministry of Defense, KemenPAR and KLHK. Each Ministry has its main duties and responsibilities that directly or indirectly utilize the results of Marine Research. In 2020 the State Budget for these 9 Ministries was ± IDR 95.07 Trillion, and from this budget, there is an indication of potential activities related to marine research of Rp. 319Billion. Marine research activities in each Ministry are various according to their duties and functions. In the Ministry of Maritime Affairs and Fisheries (KKP), for example, most of the marine research is conducted related to fish stock surveys, marine service surveys, and ecosystem surveys in the context of marine spatial planning and to develop marine conservation areas.

**b. Non-ministerial Institutions**

Non-ministerial institutions in autonomous bodies/agencies or those under the Ministry are directly or indirectly related to maritime research and development in Indonesia. The non-ministerial institutions include BRIN, BMKG, BIG, and DISHIDROS AL. This institution has one of the main tasks of developing science and research in the maritime field or providing maritime data and information to support development activities in related fields or sectors. As an illustration, BRIN, a government research institution that takes a position and role in advancing science and technology in Indonesia to support the marine sector annually, receives a budget of approximately IDR 1 trillion. Approximately 60% of this budget is allocated for routine expenses, and the remaining 40% is implemented for research and scientific development activities.

**c. National and International Universities/Research Institutions**

Several universities or research institutes affiliated with universities in Indonesia are acknowledged for their marine research, such as the Bogor Agricultural Institute with its Faculty of Fisheries and Marine Sciences, the Bandung Institute of Technology, ITS, UNSRI, and UNHAS in Eastern Indonesia. In each of these universities, there are Units or Study Centers outside the Faculty in charge of Marine and Fishery Sciences conducting research in coastal and marine areas. These universities and research institutes generally have adequate marine research or survey equipment, but very few have research ships.

**d. BUMN/National Private**

State-owned or national private companies engaged in the maritime sector require adequate data and information from maritime research results in Indonesia. SOEs or Private Companies directly related to maritime research include the companies engaged in oil, mineral, and gas mining, especially those whose mining operations are along the coast and the sea. Several SOEs are engaged in oil, mineral, and gas mining, such as PERTAMINA, PGN, and ALUM. State-owned enterprises or other national private companies that require data and information support for marine research in carrying out their business operations are companies engaged in telecommunications, energy, and transportation. The installation of submarine pipelines or cables from BUMN urgently needs marine data and information so that the installed submarine pipelines or cables do not endanger shipping safety and disrupt or damage coastal and marine ecosystems. For example, the Singapore-Java-Pacific Echo Cable Route event requires marine research.

**PPP Project Risk Analysis**

The alternative for infrastructure funding that is pursued through the PPP scheme aims to share risks and responsibilities between the government and the private sector. The existence of the PPP scheme helps the government because the government is responsible for providing the infrastructure required for people's lives while the state budget has experienced limitations. On the other hand, the private sector can benefit from the PPP scheme because the projects carried out will generate revenue to replace the development costs provided by the private sector so that the private sector gains the confidence to get involved in collaborative projects with the government while the government provides infrastructure guarantees through PT PII . This guarantee aims to cover the risks that arise as a result of several conditions in the implementation of the PPP that cause these risks to be exposed.

Some countries also identify the risks arising from the ongoing PPP project. For example, the PPP project in Malaysia has struggled with several problems and challenges in aspects of project implementation, performance appraisal and monitoring. Three causes were identified as contributing factors that created the problems and challenges of the selected PPP model worldwide: human, technical, and financial factors. Among them, technical factors produce the highest and most complex issues (Hashim et al., 2017). Another study by Bing et al. (2005) identified the feasible risks in PPP projects in the United Kingdom and classified risks into three levels: macro level, meso level, and micro level. Further research by Palupi and Yuaniarto (2016) has identified the risk in infrastructure projects under the PPP scheme. The study pointed out the ten main risks that must be properly allocated, including: (1) financial and economic risk, (2) design and construction risk, (3) operational and maintenance risk, (4) political risk, (5) force majeure, (6) legal and policy risk, (7) income risk, (8) environmental risk, (9) project/contract failure risk, and (10) land acquisition risk. The risks allocated to the government include political risk, legal risk, and land acquisition risk. The private sector bears design and construction risk, operational and maintenance risk, and revenue risk. The risks that must be shared between the government and the private sector include financial risk, force majeure risk, and risk of project/contract failure. Another discovery was reported by Subramanian et al. (2012), who analyzed the political dimension of cooperation between partners. This study proposes risks and opportunities for a collaborative framework and identifies five general categories of risk perceived by decision-makers: capacity and knowledge, accountability and choice, sovereignty and autonomy, equity and access, stability and support.

*Table 4: Allocation Risk for the Management and Development of the National Vessel Fleet Research*

| NO. | TYPE OF RISK | ALLOCATION RISK | |
|---|---|---|---|
| | | GOVERNMENT | PUBLIC |
| 1 | Design, construction, and test operation risk | | √ |
| 2 | Sponsorship risk | | √ |
| 3 | Financial risk | | √ |
| 4 | Operation risk | | √ |
| 5 | Income risk | √ | √ |
| 6 | Network connectivity risk | √ | |
| 7 | Interface risk | √ | √ |
| 8 | Political & policy risk | √ | |
| 9 | The risk of force majeure | √ | √ |
| 10 | Ownership risk asset | | √ |

Source: Pre Feasibility Study of Consultant (2020)

## Conclusions

The development of research infrastructure, such as research vessels, aims to increase the participation of Indonesian researchers to produce research that can bring competitiveness with other countries. The limited government budget causes the need for research infrastructure to experience a slowdown. Therefore, BRIN initiates infrastructure development with the PPP scheme, the latest innovation. The PPP scheme has much better benefits and sustainability than the existing financing schemes. The innovation developed in this research vessel PPP project becomes the latest research infrastructure financing scheme within BRIN and Indonesia. To date, both BRIN and other research institutions in Indonesia have implemented the general state budget scheme to develop research infrastructure. In addition, the blending of finance in this project is expected to increase the interest and feasibility of the private sector project to participate in investing in this PPP project. Potential income on the project is thus derived from: government institutions, BUMN, the private sector, and universities both nationally and internationally engaged in marine resources. Risk analysis developed in the general business entity will manage the risk of financing, procurement, and maintenance of vessel research, by which the business entity will transfer some of the risks to other participants, such as design consultants and a company that manufactures ships and research equipment. The risk of operating marine research vessels and their supporting facilities becomes the risk of a business entity. The government also manages political and regulatory risks, including amendments to laws and regulations. Under certain conditions, such as force majeure, the government and business entities share the management risk by considering the ability of each party to handle the potential risks.

## Recommendations

Based on the results of the analysis, several recommendations are made. First, the risk sharing between the government and the private sector is important because it will determine the success of PPP projects, not only the BRIN PPP projects but also projects in other government agencies that will implement a PPP financing scheme. Second, the commitment to the implementation process, starting from the planning process and transaction process to managing the infrastructure that has been built, takes a long time requiring mutual commitment from both parties at every stage. Third, the determination of the investment return scheme to the private sector must be studied more deeply to benefit both parties or to explore other investment return schemes because the innovation factor has been challenging in PPP projects. Finally, to determine the potential to gain for the private sector, mapping the financial capacity

of the Implementing Agency is also pivotal when using a return on investment scheme in the form of Availability of Payment.

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