The Gap Between Program Planning and Implementation: The Case of R&D Program in Indonesian RPJMN

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FOREWORD by EDITOR-in-CHIEF

We are pleased to present to the readers with the fifth issue of the Journal of Science, Technology and Innovation Policy and Management. In this issue, we continue to publish the results of interdisciplinary scientific researches in various aspects of STI Policy and Management. This issue, prior issues, and other resources are available at www.stipmjournal.org.

We thank the reviewers and editorial boards for taking their precious time to ensure the quality of the articles through the double-blind peer review process. The seven articles in this volume cover a wide range of topics in STI policy and R&D governance and management. In this issue, we introduce a special topic on *Original Concept Formation.* This is a new focus and scope of STI Policy and Management Journal. A concept formation in technology policy (TP) and management of technology (MOT), including proven soft technology concept based on rigorous data, cumulatively published references, and long experiences in the academic sphere. The original concept formation should deal with soft technology problems, policy context for problem-solving, concept formation, and its effective implementation.

M. Nawaz Sharif presents an original concept formation entitled *Technology for Development: Ten True Stories Revealing the Complexity of Replicating South Korean Success.* The essay comprises ten true stories presented to highlight personally observed problems encountered by Asian developing country leadership who tried to replicate South Korean success in fostering technology innovation induced sustainable economic growth strategy without paying robust attention to the crucial role of creating an "innovation climate/culture" as a necessary foundation for myriad development efforts.

The subsequent articles revealed research findings on the various issue of STI policy and R&D governance and management. First article is presented by Erwiza Erman entitled *Changing Stages of System Innovation at the Ombilin's Coal Mines of Sawahlunto: From Ghost Town to World Heritage.* This paper examines system innovation, a transition from one socio-technical system to another by transforming the historical and cultural area into a world heritage city. The objective of this study is to reconstruct the changing stages of system innovation in achieving the World Heritage status at the Ombilin coal mines site of Sawahlunto.

The second article is composed by Rachmini Saparita and Savitri Dyah, entitled *Mechanism of Implementing Technology in the Community of Eastern Indonesia (Case Study in Belu Regency, Nusa Tenggara Timur Province).* This paper focuses on the mechanism of technology implementation to increase society's welfare. The study also evaluated technology implementation activities in the period 2003 to 2019, using meta-synthesis. The analysis found that there are five types of technology transfer mechanisms carried out by researchers at LIPI.

The third article is composed by Budi Triyono, Ria Hardiyati, and Aditya Wisnu Pradana, entitled *Lack of Contribution of the Indonesian R&D Program to Economic Sector: Learning from the RPJMN Implementation*. Through a review of the National Medium-Term Development Plan (RPJMN) documents on the S&T Sector period of 2015–2019, this article attempts to analyze various obstacles related to the minimal contribution of Indonesian R&D Programs in supporting Indonesia's economic sector and national competitiveness.

Wati Hermawati presents an article entitled *Key Success Factors in Managing and Implementing Public Funded R&D Projects in Indonesia*. In this paper, she mentioned that the role of public-funded R&D institutions in supporting innovation and economic performance of MSMEs (micro, small and medium enterprises) is still very small. Therefore, the success factors in managing and implementing R&D projects at R&D institutions should be identified, particularly in providing solution for MSMEs' problems. Through the two case studies, this article provides key success factors and lessons learned to improve R&D project activities at PRCs.

The fifth article is presented by Trina Fizzanty, Kusnandar, Sigit Setiawan, Radot Manalu, and Dini Oktaviyanti, entitled *The International Research Collaboration, Learning and Promoting Innovation Capability in Indonesia Medical Sectors*. This article presents the case of eight international collaborative research projects in medical research in Indonesia. The research found that International research collaboration has opened the opportunity for Indonesian researchers to learn and upgrade their capability and contribute to the scientific arena. However, none of international research projects reached the commercialization stage yet, but some of which were at the beginning of clinical trial stage.

Finally, Budi Harsanto presents an article entitled *Eco-innovation Research in Indonesia: A Systematic Review and Future Directions*. The article analyzes the recent development of eco-innovation research in Indonesia and provides some potential avenues for future research. The analysis was carried out using Systematic Literature Review (SLR) techniques to synthesize knowledge development of a scientific field in a structured, transparent, and reliable manner.

The editor of STIPM Journal are dedicated to working with scholars in existing and emerging STI issues and produce high-quality papers to expand knowledge in the field of STI Policy and R&D Governance and Management. We believe that all the papers published in this issue will greatly influence on the STI Policy and Management for Sustainable Development.

The STIPM Journal is indexed by Google Scholar, ISJD, IPI, DOAJ, BASE, SINTA, and OCLC World Cat. This makes the journal dissemination wider.

The editor-in-chief acknowledge and are very grateful to the authors, the editorial board, the section editors, the designer, the staff of the LIPI Press Publishing Office, and everyone who has contributed to the publication of the STIPM journal. We are also very grateful to our future readers. By inviting the readers to publish your research results articles in this journal, we believe in the meaningfulness and future collaboration as well as to provide a higher scientific platform for the authors and the readers, with a comprehensive overview of the most recent STI Policy and Management research and development at the national, regional, and international level.

Happy New Year 2021 to all of you!

Jakarta, 15 December 2020

Editor-In-Chief

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STI POLICY AND MANAGEMENT

The Gap between Program Planning and Implementation: The Case of R&D Program in Indonesian RPJMN

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ARTICLE INFO	ABSTRACT
	This article analyzed various obstacles related to the minimal contribution of Indonesian Research and Development (R&D) Program in supporting the economic sector and national competitiveness. This was done through a review of implementation content and context of the National Medium-Term Development Plan (RPJMN) in the Science and Technology (S&T) Sector for period of 2015–2019. The analysis was carried out using the Grindle policy implementation model. The study shows that there are four main factors that hinder the implementation of the R&D program, 1) lack of integration of R&D execution between LPNK and technical ministries, 2) R&D program planning which tends to be technology supply-push, 3) absence of an appropriate evaluation mechanism to measure the achievement research in support of the economic sector and 4) limited research budget resources.

I. INTRODUCTION

Advances in S&T have proven to be an important driver of a country's economic performance (Blanco, Gu, & Prieger, 2016). The ability to create, distribute and exploit knowledge has become a major source of competitive advantage and improved quality of life (Haakonsson & Ujjual, 2015; Mani & Kamath, 2014). The rapid adoption of scientific advances in new products and processes, high rates of innovation, transition to more knowledge-intensive industries and increasing skills requirements have made

developed countries achieve prosperity for their people (Ethiraj & Puranam, 2004; Singh, 2016). This change implies that science, technology and innovation are the keys to improve the economic performance and social welfare.

Indonesia also has made various efforts to develop and apply S&T and innovation to support development in various fields. Intensive S&T development efforts in Indonesia began in the 1970s at the beginning of the Habibie leadership, especially after the formation of the Agency for the Assessment and Application of Technology (BPPT) and the construction of the S&T Research Center (PUSPIPTEK) as a S&T development area in Serpong, Tangerang City. The focus of S&T

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development since then has been on the mastery of key technology in a number of industrial sectors, with the main performance indicators of the extent to which R&D and technology institutions can contribute to the industrial development (Oktaviyanti et al., 2013).

Currently, various efforts have been made by the Indonesian government to enhance the role of S&T in increasing the competitiveness of the national economy. Systematic efforts have been made in which every five years the Government of Indonesia plans the national development programs, including S&T sector, in the RPJMN document. This RPJMN is an integral part of the 20-year programs of the National Long-Term Development Plan (RPJPN). The government's concrete steps in encouraging R&D to support the competitiveness of the production sector have been manifested in the implementation of the RPJMN document on S&T Sector. Until now, Indonesia has implemented three periods of RPJMN for the RPJPN period 2005–2025.

The RPJMN document on S&T Sector becomes a reference for research institutions in Indonesia in carrying out research activities for the next five years. This document contains the direction of national development policies and strategies in the S&T sector. In the context of increasing S&T support to increase the competitiveness of the production sector, S&T development is primarily directed at conducting research with the output of new technology or products that are diffused into the production sector. So, conducting R&D in the RPJMN document is prioritized for research activities that can reach the diffusion stage.

Although, the implementation of R&D and its funding has been carefully set and directed in the S&T RPJMN document, unfortunately until now the role of S&T in promoting economic competitiveness is still being questioned. More common argument in S&T policy discourse is that the sector has not contributed much to the nation's economic progress. This argument is strengthened by data which shows that the contribution of S&T mastery to economic development is still very limited. This is indicated by the minimal contribution of total factor productivity (TFP)

to gross domestic product (GDP) compared with other variables, namely the contribution of capital and labor, and the fact that Indonesia is still lagging behind ASEAN countries by looking at the average growth of TFP in year 2010–2017 (Asian Productivity Organization, 2019) (Table 1).

Table 1.
Average Growth of GDP, Capital, Labor and TFP during 2010–2017

Varia-ble	Growth (%)				
	Indonesia	Malaysia	Thailand	**Vietnam**	**Singapore**
GDP	5.3	5.1	3.2	6.0	4.1
Capital	4.3	3.3	1.9	3.4	2.4
Labour	2.4	1.3	0.7	0.8	1.4
TFP	-1.5	0.5	0.6	1.8	0.3

Source: Asian Productivity Organization (2019)

Similar data from the Asian Productivity Organization (2019) also shows that the average value of Indonesia's TFP growth has tended to fluctuate. In the period 1970–1990, the average TFP growth in Indonesia was 0.3%, then it decreased to -1.1% in the period 1990–2010 and to -1.5% in the period 2010–2017 (Fig. 1).
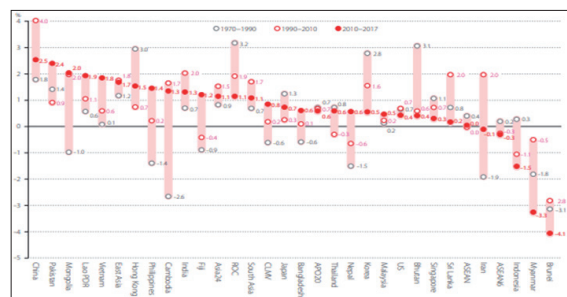
Source: Asian Productivity Organization (2019)
Figure 1. TFP Growth in Various Countries

Considering the above data, this article aims to answer the question of why the S&T program in Indonesia has not been able to contribute significantly to the economic sector. The answers to these questions were explored based on the results of an analysis of the implementation of RPJMN document on S&T during the period 2015–2019. The implementation of RPJMN document was the case in this study for at least two reasons. First, financing for science and

technology development in Indonesia still relies on the government budget. Second, the RPJMN is a national S&T policy document that becomes a reference for conducting R&D along with its funding mechanisms and arrangements.

There are very few studies on the implementation of S&T policies in Indonesia. Most of the previous studies focused on S&T policies relied on planned specific programs, Evaluation of the Implementation of the Solo Technopark Development Program (Rahayu & Nurharjadmo, 2017) and Indonesian Marine Science and Technopark: Implementation of Van Meter and Van Horn Policies in Indonesia (Kurniawan, Alexandri, & Nurasa, 2018). There is no study that focuses on the implementation of the S&T RPJMN for period 2015–2019.

Wahab (2008) stated that the ineffectiveness of a policy can be traced from several causes, bad policy (the content of the policy is bad), bad implementation, which is often referred to as implementation failure, or even maybe the policy had bad luck. The authors see this through how the content of the policy and the implementation environment of the S&T RPJMN for period 2015–2019 can support the objectives of conducting national research itself, which is based on increasing the competitiveness of the production sector, as well as the economy and national development using a framework model of implementation policies developed by Grindle (2017).

II. ANALYTICAL FRAMEWORK

Policy implementation is one of the stages of a policy process. In principle, every public policy is always followed up by policy implementation Wahab (2008). Implementation is considered a major process and a very important stage that determines the policy process. Edwards III (1984) stated that without effective implementation, policymakers' decisions will not be successful. Whereas, Signé (2017) argues that policy implementation has a complicated process. Multiple contextual factors can fail ideal implementation practice. Therefore, policy implementation is a critical issue because in policy implementation, problems that are not found in the concept often arise practice.

Likewise, DeGroff and Cargo (2009) stated that policy implementation describes a complex change process in which government decisions are transformed into programs, procedures, regulations, or practices aimed at social improvement. In this sense, implementation has long been recognized as the most important stage in the policy process to transform policy ideas or expectations into real actions aimed at solving social problems. Reflecting a process that involves change over time, implementation is characterized by the actions of different levels of institutions, organizations, and other actors and influenced by the entire context. In this regard, Parsons (1996) stated that implementation studies are studies of change, namely how changes occur and how these changes may be induced.

In general, policy implementation can be considered as a process of implementing government decisions (Berman, 1978). In defining policy implementation, it is important to make a conceptual distinction between the policy implementation process and the policy outcome, even though this is interactive in practice O'Toole Jr. (2000). The implementation process involves acting on behalf of policy, whereas policy outcomes are the final effect of policy. Ottoson and Green (1987) suggested that implementation should be expressed as a social action, that is, policy ideas are transformed into concrete actions and behavior. These social actions are usually aimed at social improvement and most often manifest as programs, procedures, regulations, or practices.

From the definitions and understanding above, in simple terms, policy implementation can be understood as a process to transform policy formulation into policy action in order to achieve the desired end result. CDC USA (2012) stated that policy implementation involves translating policy goals and objectives into operations to achieve policy objectives. To achieve this, the policy implementation process requires good policy in terms of content, agency creation or assignment of responsibilities to agencies for implementing policies, translation of policy objectives into operational rules and development of guidelines and coordination of resources and actors/institutions to achieve the intended policy objectives.

There have been many numbers of research to analyze policy implementation. The analysis was carried out using the perspective of a particular policy implementation model, in order to obtain an explanation of the policy implementation process under study. The analysis of the implementation of the RPJMN policy on science and technology in this paper uses the implementation analysis model developed by Marilee S. Grindle.

Grindle (2017) introduced a policy implementation model as a political and administrative process. The model described the decision-making process carried out by various actors, where the final output is determined by both the policy material and the interactions of the actors in the context of administrative politics. The political process can be seen through a decision-making process involving various policy actors, while the administrative process is seen through a general process of administrative action that can be investigated at a specific program level. This means that when a selected policy has been determined, an implementing organization is needed because within the organization there is inherent authority and various resources that support policy implementation. Meanwhile, the policy environment depends on its positive or negative nature (Fig. 2).
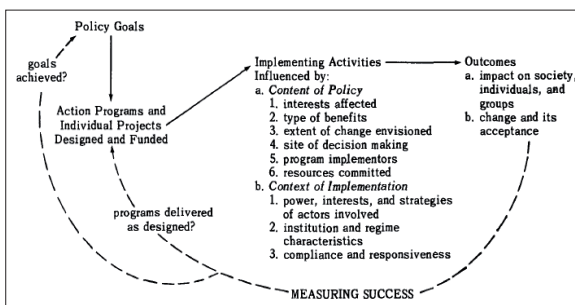
Source: Grindle (2017)

Figure 2. Policy Implementation Model

Further, Grindle (2017) explained that there are two things that can be seen in the implementation of public policy. First, how the various programs planned in their implementation are able to support the achievement of the final results, namely whether or not the goals to be achieved are achieved, where the measurement of the success of implementing the policy can be seen from

1) whether the implementation of the policy is in accordance with what is determined (design) by referring to the policy action, and

2) achievement of the policy objectives. This dimension is measured by looking at two factors, namely the impact or effect on society individually and in groups and the rate of change and acceptance of the target group.

Second, it is seen from the policy implementability itself. Related to this, there are two large groups of variables that influence the success of a public policy implementation, namely the content of the policy and the environment of its implementation.

In this study, we use the Grindle (2017) policy implementation framework model by examining the analysis of the policy content and the context of the implementation environment to analyze the implementation of the S&T RPJMN. This model is considered better than others, because it covers various aspects of policy implementation as a whole (Nugroho, 2008).

However, in order to operationalize this model optimally, the object of study must be a specific policy object in order to dissect it holistically. The S&T RPJMN document is not a specific object, given the breadth of S&T coverage with many policy directions and programs planned in order to realize national development goals. In this case, we chose R&D implementation programs as a focus of this study, with the consideration that R&D activities in Indonesia have not had a significant impact on the economic sector referring to the data described in the introduction.

III. METHODOLOGY

This study uses a qualitative approach with an explanative method, where the emphasis is more on explaining reality Neuman (2011), which is related to the problem of the minimal contribution of S&T programs in supporting the competitiveness of the production sector. It is seen from the perspective of implementing RPJMN on S&T sector for period 2015–2019. This method was chosen considering the reality that this problem is not something new in Indonesia, and the author has a clear picture of it. The analysis was then

carried out using the policy implementation model developed by Grindle (2017).

Data mining was carried out through in-depth interviews with implementing institutional actors from the R&D unit of the Technical Ministries and Non-Ministry Government Institutions (LPNK) under the coordination of the Ministry of Research, Technology and Higher Education (Kemenristekdikti). The LPNK consists of the Indonesian Institute of Science (LIPI), the Agency for the Assessment and Application of Technology (BPPT), the Eijkman Institute for Molecular Biology (LBM Eijkman), the National Atomic Energy Agency (BATAN), the National Aeronautics and Space Agency (LAPAN), the National Standardization Agency (BSN) and the Nuclear Energy Supervisory Agency (BAPETEN). Data mining was also carried out at the National Development Planning Agency (BAPPENAS) and the KemenristekdiktI as the institutions authorized in the preparation and implementation of the RPJMN.

In addition, data mining is also carried out through reviewing the RPJMN documents along with their derivative implementation documents, which include Government Work Plans (RKP), Strategic Plans (Renstra), Work Plans (Renja), Budget Work Plans (RKA) and the implementing agency's Performance Report (Lakin).

IV. RESULTS AND DISCUSSION

The discussion was carried out based on the analysis results of the RPJMN implementation using the Grindle model. From this analysis, it was identified which factors were the bottlenecks in the implementation of research programs aimed at increasing the competitiveness of the production sector. The results of the analysis showed that the content of the RPJMN policy document in the field of science and technology had directed S&T activities, which included conducting research, engineering and technology services, quality infrastructure services, and nuclear control services to support the competitiveness of goods and services. However, its implementation faced several obstacles.

In the field of conducting research, it is explicitly mandated not to stop at output in the form of inventions, but to be diffused into the production sector in order to have an impact on increasing competitiveness. Even in the document, it is stated explicitly that science and technology development prioritized research activities to reach the diffusion stage of innovation (Fig. 3).
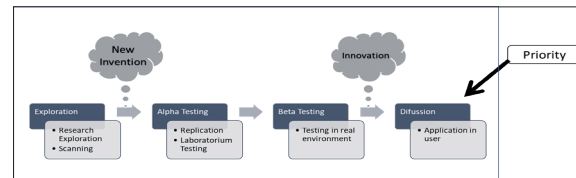
Source: Document of RPJMN Period 2015–2019 (Grindle, 2017)

Figure 3. Research Priorities in the RPJMN

But in its implementation, the execution of research had just reached the level of producing research output in the form of technology (potential for innovation). Meanwhile, to deliver it into an innovative product that has a direct impact on increasing competitiveness was constrained by various obstacles. The results of the analysis using the Grindle model showed that there were various obstacles that occurred due to problems both in the content and context of the implementation of the RPJMN document (Table 2).

The conditions above illustrated the existence of problems in the research program to produce outputs that had an impact on competitiveness. These conditions were grouped into the following four problems.

1. The implementation of R&D was not integrated

The RPJMN is only a reference for conducting research in LPNK under the coordination of the Ministry of Research, Technology and Higher Education. Whereas, research activities in research institutions under the Ministry refer to the RPJMN of each ministry. This resulted in program overlap among institutions and competing with one another instead of collaborating. The poor coordination had also led to the scattering of R&D funds in various research institutions without a clear direction towards the national R&D program objectives.

Table 2.

Summary of Policy Content and Implementation Context Conditions

Variable	Condition
Content of Policy	
Interest affected	It is more dominated by the interests of the government as a provider of science and technology; the approach is supply push, but cannot read the users' needs which is production sector.
Type of benefits	The research implementation strategy has led to diffusion / innovation, but results generally stop until invention.
Extent of change envisioned	The evaluation mechanism has not focused on the sustainable use of research results by users.
Site of decision making	Research content is not integrated with the technical sector and tends to be supply push.
Program implementors	The implementation of the RPJMN is only entrusted with the LPNK without the involvement of the technical ministry.
Resources committed	LPNK has limited resources in conducting research and its diffusion.
Context of Implementation	
Power, interest, and strategies of actors involved	The conduct of research at the LPNK has not been integrated with the technical ministries. This condition causes each research institution to tend to only focus on its respective performance targets.
Institution and regime characteristics	There is a high sectoral ego between LPNK science and technology under the coordination of the Ministry of Research, Technology and Higher Education and the technical ministry.
Compliance and responsiveness	When there is a gap between the contents of the RPJMN and a changing government program, LPNK as the implementation of the RPJMN tends to follow the government program.

Source: Grindle (2017), Adopted by Authors

Currently, research had been carried out in segments between the R&D agencies or research units of each ministry and the LPNK. This is a problem because the objective of conducting research was to encourage the competitiveness of the goods and services production sector, but its implementation was not integrated with technical ministries. As a supporting unit, research implementation in the ministry's R&D refers to the RPJMN in the ministry's field and is integrated with the ministry's program, but is not related to the S&T RPJMN document program. The conduct of research at the LPNK and the Ministry ran independently of each other.

The S&T RPJMN has a National Research Master Plan (RIRN), which was later derived into the National Research Priorities (PRN). Meanwhile, research institutes under the ministry also have their own sectoral plan according to the direction of the ministry's development. Even some ministries make their own research programs in the sectoral master plan. For example, the Research and Development Agency of the Ministry of Industry has its own reference in conducting its research, which refers to the National Industrial Development Master Plan (RIPIN). This was a problem because the RPJMN's goal in S&T was to support the competitiveness of the production sector, but it is not integrated with technical ministries.

This condition gives rise to sectoral egos in conducting research, so that when there are intersections in conducting research it is difficult to coordinate. Instead of a synergistic collaboration, it tended to create unfair competition. Meanwhile, LPNK does not have adequate infrastructure and institutional resources to support the downstream research results such as technical ministries. However, LPNK does not have the authority to ensure that the results of its research are disseminated to the production sector by the technical ministry.

This weak coordination illustrated that the implementation of the RPJMN policy is influenced by factors which in the Grindle concept are called the characteristics of institutions and regimes that are more focused on the targets of each institution. In this case, the research results of LPNK which actually intersect or even overlap tended not to be considered an asset by the relevant technical ministries, and had the potential to be seen as taking on the ministry's duties and functions.

The implementation of research should be carried out in an integrated and synergistic manner, so that there is no overlap which wastes the state budget (APBN) and allows

for sharing of resources and knowledge that is beneficial in achieving the goal of increasing the nation's economic competitiveness. Furthermore, research activities that are not integrated and compartmentalized had caused research institutions to tend to focus only on their respective performance targets.

2. Planning approaches tend to be technology supply-push

One of the approaches put forward in the preparation of the S&T RPJMN is a participatory approach. In this case, it is carried out by involving various interest groups, especially science and technology users who are the target of the policy and groups affected by the policy. But, their involvement in the preparation of the RPJMN was still very minimal.

The results of research conducted by (Asmara et al., 2019) showed that the process of formulating the RPJMN document had not really involved science and technology users. Although the preparation of the RPJMN had been carried out through a process of identification and the mapping and assessment of the target groups needs. However, the involvement of target groups was minimal and policymakers were often trapped in administrative technocracy. On the other hand, the involvement of R&D institutions in the preparation of RPJMN was very dominant. This mechanism forms a planning model that tended to be technology supply-push and to some extent hindered the research planning process which should be flexible, dynamic, adaptive and sustainable according to user needs. In other words, planning like this causes research programs to be more of the idea of science and technology providers (R&D institutions), not science and technology users.

The technology supply-push approach tended to encourage government research institutions to produce inventions or technology, not thinking about their application for users. In general, research results stopped at the level of invention in the form of publications, prototypes, patents, technology, and others not ready to be applied in the production sector. Meanwhile, the dissemination process was carried out by offering the research results to the production sector or often referred to as the downstream process of research results.

In this case, innovation tended to be seen as a linear technology push which viewed the innovation process as a sequential process, starting with basic research activities followed by design and engineering, manufacturing, marketing and sales. Meanwhile, innovation is a complex process that often required the involvement of all stakeholders from the very beginning the innovation idea is made. In other words, innovation was a co-creation activity between R&D institutions and their users (the production sector).

In addition, most researchers did not understand the needs of the production sector. In several research cases, the authors found different views of the research results. Researchers considered their research to produce innovative outputs, but the production sector saw that the research output was still upstream that cannot be used by companies. This affected the results of research being less useful for increasing the competitiveness of goods and services, because they were less attractive to users.

On the other hand, the technology supply-push approach required enormous costs from the government. This was because the implementation of research was a government initiative compared to industrial demand, which resulted in a high level of dependence on research programs on APBN. This condition was ironic because R&D institutions were often faced with limited budget resources problems.

3. The evaluation mechanism was not optimal

The RPJMN document clearly stated that research activities were aimed at increasing real support for science and technology to increase the competitiveness of the production of goods and services. The targets, target groups and the desired degree of change from conducting the research were also clearly stated in the document.

However, in general, research results stop at the stage of inventions that are not ready to be applied in the production sector. This occurs

because the document message failed to deliver according to indicators for measuring success. R&D institutions, as the research executor, defined the target indicators for the achievement of research activities only for technological products. This technology product often has not been tested for success in the production sector. These technology products may have passed tests, but only on a mini production scale. So that industry players were reluctant to use them.

Furthermore, the evaluation of R&D programs and its projects in Indonesia's public R&D institutions still follow the usual scheme of government goods and services expenditures, which focuses on achieving budget absorption, suitability of the use of the budget between rules and the realized implementation and the achievement of R&D outputs (such as scientific technical reports, journals, proceedings, patents, etc.) according to the rigidly-planned target. This was because the funding was attached to the APBN, whose mechanisms and procedures were tied strictly to the prevailing laws and regulations.

The results of the implementation evaluation showed that the performance report document of each LPNK from year to year showed satisfactory results with a very good level of achievement of program and activity targets. However, these achievements were not accompanied by an impact on increasing competitiveness. The mechanism for measuring the success of the implementation of a program and research activity had not led to the resulting impact and the sustainability of its use by users, but only just how LPNK was able to achieve the research output target.

Evaluation should be directed at achieving R&D programs and projects that were based on quality based on cost-benefit analysis, leading to results that had an impact on science, technology, innovation, and practically on sustainable socio-economic development. If it is related to the Grindle concept, this condition reflected the direction of conducting research within the RPJMN framework had not clearly formulated the types of benefits that showed a positive impact on competitiveness. The types of benefits were not entirely direct. In addition, there were no clear parameters and scales to measure the degree of change expected to be the impact of conducting research.

4. Limited R&D budget resources

The provisions had explicitly stipulated that the planning, budgeting, implementation and supervision processes became one unit that was interrelated and consistent. In this case, the various programs and activities planned were compiled with a budget requirement plan to implement them. An adequate amount of budget was needed so that goals and targets, both outputs and outcomes were achieved properly. However, the total R&D budget provided by the Government was always lower than the proposed budget requirements plan previously.

Based on data from Kemenristek/BRIN, Indonesia's national R&D budget was only 0.28% of the gross domestic product (GDP) in 2018. Based on World Bank, this is lower than several Southeast Asian countries. In 2017, Singapore's R&D budget reached 1.9% of GDP, Thailand 1.00% and Vietnam 0.5%. And Indonesia's GDP was far below the world average of 2.3%.

This lack of budget certainly had a significant influence on the process of implementing research programs and activities, especially in achieving the planned targets. Some LPNK take adjustment steps by reducing the number of target achievements (volume), both output and outcome, according to the amount of available budget. Meanwhile, several other LPNKs made efforts to streamline the process of implementing existing programs and activities, with a note that the process is carried out without reducing the quality of the activity product and allowed it to be carried out in accordance with the available budget. Budget cuts also had an impact on the performance of LPNK in an effort to encourage the competitiveness of goods and services. Some programs and activities cannot run according to the target scheme of targets that had been planned in advance.

The main problem of the minimum R&D budget was due to the lack of private involvement, so that the R&D budget was very dependent on the government budget through the APBN. Based on the data released by Kemenristek/

BRIN, about 83.7% of the GERD in 2018 or worth Rp34.69 trillion (0.23% of GDP) came from government funds, both from the central and regional government budgets. The total of non-government R&D spending amounted only to 16.3% of the GERD.

By looking at the numbers above, it can be concluded that government funds still dominate and become the primary sources of funding for R&D activities in Indonesia. The lack of willingness of the industries to innovate through R&D activities was a major problem that had not been resolved. Industries in general considered research activities as less attractive because of its nature, which required a substantial investment value with a high degree of uncertainty of its success in the market.

On the other hand, a variety of innovative products that have been proven successful in the market, whether born from research activities or not, were still the first and foremost choice for industries to develop their businesses. This should not be surprising, given the main motive of the industry itself, which hopes to get maximum profit, while minimizing the costs and business risks.

On the government side, the lack of various regulations to support and incentivize both R&D institutions and industries to collaborate, develop and innovate through research activities was still the main obstacle that needed to be followed-up. Increasing the private R&D funding was an inseparable part of strengthening the national science and technology system through regulatory support and incentives.

V. CONCLUSION

The Indonesian government had prioritized various research programs and activities in order to be able to reach the diffusion stage of innovation to support the competitiveness of the national production sector. This policy direction was contained in the research implementation strategy in the 2015–2019 RPJMN document. However, the results of the study showed that the implementation of this policy is still hampered by various issues. This condition had resulted in the minimal contribution of R&D

programs in supporting the competitiveness of the production sector in particular, as well as the national economy and development in Indonesia. These various obstacles can be grouped into four problems as follows.

1) The implementation of R&D was not integrated

   So far, research was carried out in fragments in LPNK and Ministries (R&D Agency), so they were not integrated. This was a problem because the objective of conducting research was to encourage the competitiveness of the goods and services production sector, but the implementation of research in LPNK was not integrated with technical ministries.

2) The planning approaches tended to be technology supply-push

   The formulation of research program planning documents did not intensively involve the production sector (industry) as users of research results, often the policymakers were trapped in administrative technocracy. The formulation of this document was dominated by the ideas of research institutions. Such a mechanism forms a planning model that tended to be technology supply-push, which did not pay attention to the needs of the production sector.

3) The evaluation mechanism was not optimal

   There were no clear parameters and scales to measure the degree of change expected to be the impact of conducting research. Indicators of measuring the success of the implementation of a program and research activity had not led to the resulting impact and the sustainability of its use by users. Rather, it only measured the extent to which LPNK was able to achieve the research output target. The evaluation process had so far followed the usual scheme of government's goods and services expenditure. This hampered the development of R&D activities themselves; the characteristics were rigid, administrative technocratic and tend to be procedural.

4) Limited R&D budget resources

   The budget for research and diffusion activities in Indonesia is still low. The amount had not reached 1% of GDP. In practice, the

research budget provided by the government was always smaller than that proposed in the RPJMN. This was due to the minimal involvement of the private sector in R&D on the one hand, and the high dependence of the R&D budget in the APBN which w faced with the limited ability of the government to allocate budgets for R&D.

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