Collaboration Analysis on The 2020-2021 National Research Priority (PRN) Program in Indonesia

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Abstract – The National Research Priority (PRN) is one of the strategies of the Indonesian government in boosting the economy through collaborative research among the government, universities and industry. This program is one of implementations of the 2017 - 2045 National Research Master Plan (RIRN) policy which contains a research roadmap in Indonesia for various strategic research focus areas. Research collaboration at PRN is expected to strengthen limited research capacity in producing quality output so that it can be utilized efficiently for its users. The study is intended to provide an overview of research collaboration at PRN on research achievements, especially those carried out in 2020 - 2021. This study is descriptive research by utilizing secondary data from Dashboard PRN website system and primary data from 2020 - 2021 PRN survey.

Based on the recapitulation of data collected on the Dashboard PRN, it shows that research collaboration at PRN 2020 - 2021 has been developed with the main output being intellectual property right (scientific paper and patents). Meanwhile, based on the survey results, the percentage of research collaborators is as follows: 52% with domestic industry institutions; 18% with domestic R&D institutions; 15% with universities; and the rest are individual research. Furthermore, the grouping of research product targets expected to be achieved in the collaboration includes: 66% Appropriate Technology Products (TTG); product with the advantage of being more economical/efficient as well as products for import substitution or increasing Domestic Component Level (TKDN) both have the same percentage:13%; and products with novelty or frontliner technology: 8%.

Keywords – research collaboration, National Research Priority (PRN), research output

I. INTRODUCTION

Technology innovation is believed to be a driving factor for sustainable economic growth, although it is not the single most important factor[1]. For developed countries, Science-Technology-and-Innovation (IPTEKIN) policies have become one of the main actors in accelerating and supporting national development programs, especially knowledge-based economic development. In a developing country like Indonesia, IPTEKIN policy is still not a priority for stakeholders[2]. Various experts have also stated that the challenges of innovation in developing countries are indeed very complex and require high costs to meet various targets, such as: 1) efforts to catch up with technology which feels difficult to achieve; 2) government policies in supporting innovation are considered weak; 3) weak ability of private entities in supporting investment and commercialization of existing products.

The factual conditions related to Indonesia's innovation development are indeed quite concerning, such as: the achievements in the Global Innovation Index (GII) are in position 85 out of 131 countries in 2020. This position has not changed since 2018. Even judging from the score, the index value Indonesia actually experienced a decline. In 2020, Indonesia's index was 26.49 points compared to 2019's 29.72 points. Meanwhile in Southeast Asia, Indonesia's position is in seventh place, while Singapore is still in the highest rank with 56.61 points[3].

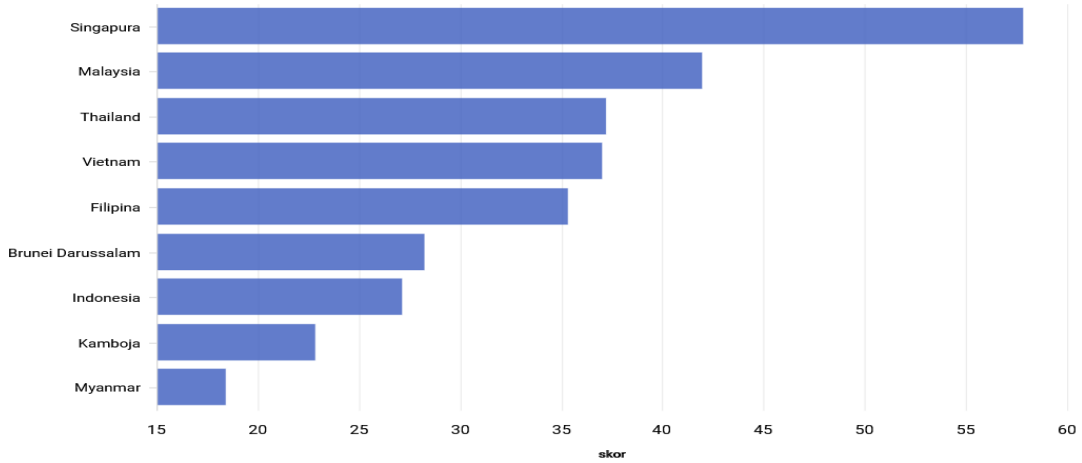

Figure 1 Global Innovation Index in ASEAN Country, 2020
Source: World Intellectual Property Organization

The Minister of Research and Technology/Head of the National Research and Innovation Agency (BRIN) (2019) said research and innovation will continue to have a big role in the future. Therefore, collaboration to produce research to ensure its benefits reach the community is urgently needed. This effort needs to be carried out by collaborating all the roles of actors such as the central and regional governments, universities, the private and government R&D institutions, the industrial world, to community organizations. "I want to return to the triple helix concept as the basis for building a research and innovation ecosystem in Indonesia." It is believed that collaboration with the business world is an urgent priority. However, in the research and innovation ecosystem, there needs to be a transformation, from the domination of the role of the state, both in terms of resources and funding, gradually to the domination of the role of the business world. If the triple helix between the government, researchers and the business world cannot be built properly, it is very unlikely to create a strong research and innovation ecosystem.

The government makes serious effort to strengthen research collaboration which is expected to produce research outputs that have economic value by establishing national-scale research sector planning through Presidential Regulation no. 38 of 2018 concerning The 2017-2045 National Research Master Plan (RIRN) which is focused on directing innovation in fields considered to be national needs. One of its efforts is implemented through the PRN 2020-2024 Program. PRN aims to provide a reference for ministries/agencies/local governments and stakeholders in the form of concrete steps that must be carried out collaboratively and continuously in the context of implementing the RIRN 2017-2045. The implementation of the PRN program for 2020 – 2021, or the first two years, is expected to produce intermediate results from the RIRN.

Therefore, this research is intended to provide an overview of research collaboration for PRN in 2020-2021 and its relation to the previously determined research achievements. It is hoped that the description of the collaboration conditions and research results obtained will become a baseline for estimating the usefulness of research as a contribution of science and technology to national development.

II. URGENCY DAN TARGET OUTPUTS OF PRN

The RIRN 2017-2045 states that a top-down and bottom-up approach is used in preparing the PRN Program. The top-down approach is applied by examining state documents that are relevant to the development process which discuss various aspects of research. These state documents include the National Long Term Development Plan (RPJPN) 2005-2025; National Medium Term Development Plan (RPJMN); White Book of Science and Technology; National Research Agenda (ARN); National Industrial Development Master Plan (RIPIN) 2015-2035; and documents of plans and achievements of research and development institutions. While the bottom-up approach is applied by collecting primary data through in-depth interviews; focus group discussions; review by independent experts; and public discussions, as well as data submitted via online channels by universities; non-ministerial government agencies (LPNK), ministerial government agencies (LPK); and industry. The results of these two approaches will then be combined, and the various parties attending the focus group discussion forums will be asked to provide their input, for in-depth purposes and as ideas for improvement[4].

RIRN is expected not only to align planning in the research sector with the RPJMN but also to support the needs of the business world in utilizing research results into commercial products and the needs of the community in utilizing research results for the benefit of the development activities carried out. Therefore, technically RIRN is carried out in the form of a National Research Priority (PRN) which consists of a number of research priorities which are expected to be able to produce innovative products within five years. Referring to the Minister of Research and Technology Regulation No. 39 of 2019 concerning PRN for

2020 – 2024, 9 research focuses are determined, namely: 1) food, 2) energy, 3) health, 4) transportation, 5) technical engineering products, 6) defence and security, 7) maritime, 8) social humanities arts culture and education, 9) multi-disciplinary and cross-sectoral[5].

Formulation of targets and indicators set in RIRN for each year in five (5) year period as shown in Table 1

Table 1 Indicators and Targets of RIRN 2020 – 2045

INDICATOR	2015 (Baseline)	2020	2025	2030	2035	2040	2045
Number of science and technology researchers per 1 million population	1.071	1.600	3.200	4.800	6.400	8.000	8.600
GERD/PDB (%)	0,20	0,84	1,68	2,52	3,36	4,20	5,04
The ratio between students of masters, doctoral and undergraduate study programs is compared to the estimated number of candidates for science and technology researcher	5,6	20	40	60	80	90	100
Science and technology human resource productivity (Number of publications in globally index journals, based on SCImago)	2	4	8	10	14	18	22
Multi-factor productivity (MFP) (%)	16,7	20,0	30,0	40,0	50,0	60,0	70,0

Source: RIRN, 2018

Based on the targets and indicators of the RIRN, it can be seen that the policy is directed at increasing the capacity of science and technology human resources in terms of quality (research output as well as increasing levels of education) and quantity (number of researchers). Meanwhile research collaboration in the PRN Program aims to synergize research and development activities so that the allocation of resources (human resources, infrastructure and funding) can be managed effectively and efficiently to support the achievement of the output of research and development activities towards real and capable results. contribute to increasing added value in the economic sector.

III. RESEARCH COLLABORATION

Handoyo and Putera's research (2012) on collaboration in the Ministry of Research and Technology (Kemenristek) incentive program in 2008-2010, in observing 979 sample activities, showed that most of the incentive activities (79.57%) were carried out individually or not in collaboration with other researchers, while the remaining (20.43%) activities were carried out in collaboration by two or more researchers. Therefore the government is trying to improve the mechanism for implementing strategic research, especially those driven by various government research organizations to be able to produce better patterns of collaboration so that it is expected to produce higher quality outputs and outcomes, such as through the PRN program which can be carried out in the form of a consortium that prioritizes elements - elements of the triple helix A-B-G (Academia, Business, Government), namely government research institutions, higher education and industrial research institutions[6].

Octaviani et all (2014)[7] stated that research collaboration or often used the term scientific collaboration has received the attention of the scientific community because it is believed to produce the best products as well as to be utilized and implemented. Sonnewald (2007:645)[8] defines research collaboration as 'human behaviours, between two or more scientists, which facilitates the exchange of meanings and the completion of tasks in relation to the highest goals that are shared together and are in a social context'. Collaboration is a form of cooperation, interaction, compromise of several related elements, both individuals, institutions and or parties involved directly and indirectly who receive the consequences and benefits of these collaborative activities.

Katz and Martin (1997) provide a scope for collaborative research not only regarding achieving goals but also contributing input[9]. Katz and Martin (1997) say that a person or institution is said to be a collaborator if it includes one or more of the following:

1. Collaborate on research projects either full-time or part-time, or people who contribute in whole or only in part.
2. His/her name is included in the research proposal.
3. Responsible for one or more of the research elements (e.g.: for elements of research design, analysis and interpretation of data, or who is responsible for the final results of the research).
4. Responsible for each key level (e.g.: original research idea, hypothesis).
5. Project proponents and/or fundraisers.

The importance of collaboration encourages various initiatives to develop cooperation between individual researchers so that they can jointly carry out research collaborations, such as the existence of an excellent research center that accommodates research groups between various disciplines. Various government policies were also rolled out with the aim of increasing the link between science and technology through collaborative research efforts in certain sectors between universities/R&D institutions and industry. Then, the government also strongly supports efforts to increase international cooperation involving researchers, with the belief that research collaboration will bring benefits in the form of cost savings, accelerating the use of research results, and so on[9].

Amabile et al. (2001) states that there are three dimensions that can be used to describe research collaboration, namely: 1) the profession of the participants, 2) affiliations between institutions, and 3) the organizational level of the collaboration[10]. Sonnenwald (2007) then added two more dimensions, namely: 4) scientific discipline and 5)

geography[11]. Seeing this dimension, a research collaboration must involve several academic researchers, although non-researchers can also collaborate. A research collaboration can occur between individuals from the same institution or between individuals from different institutions, even different countries. Collaboration can also connect different disciplines (Handoyo and Putera, 2012)[12]. Collaboration is also one of the crucial solutions for solving fundamental research and innovation problems in Indonesia (Head of BRIN, 2022).

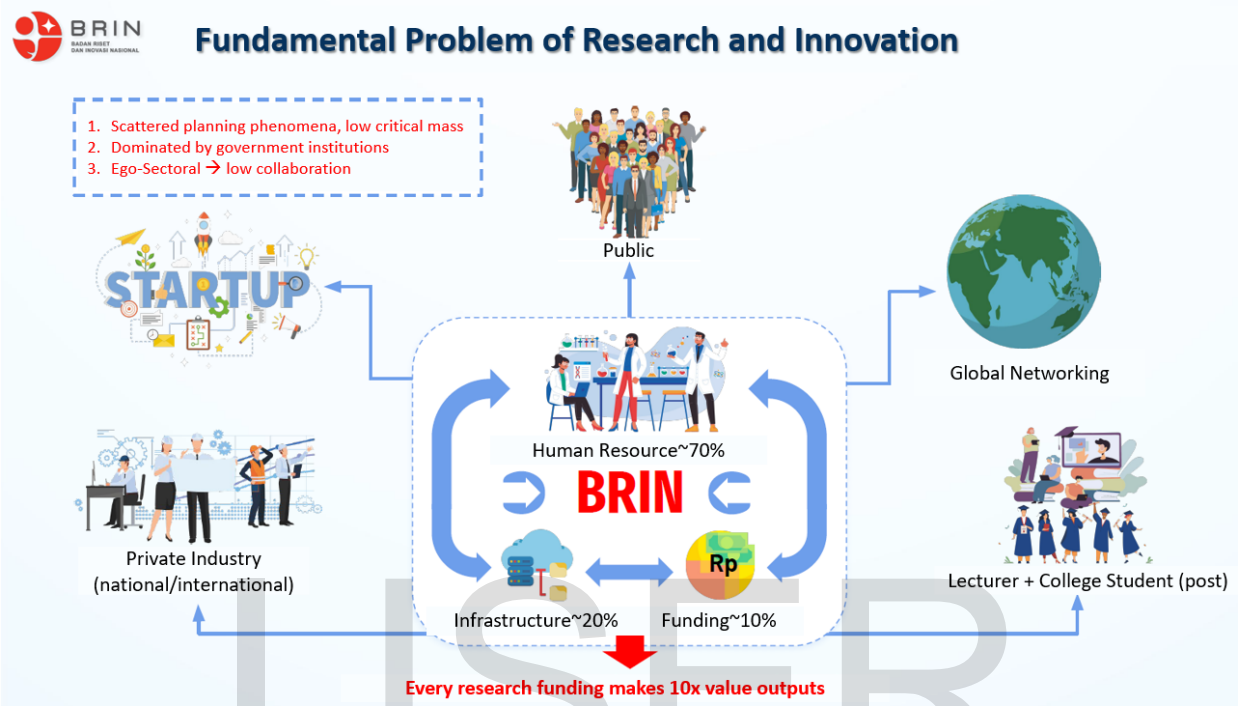

Figure 2 Fundamental Problem of Research and Innovation in Indonesia
Source: Head of BRIN Monday Morning Rite Presentation, 2022

As Figure 2 shows, ego-sectoral aspects can be a source of preventing collaboration. In strengthening research and innovation ecosystems that are increasingly conducive, collaboration between parties in accordance with their respective roles is absolutely necessary. This collaborative effort is expected to be a bridge in minimizing limitations on the quality of research human resources, research infrastructure and research funding.

This is important considering that until now the ratio of science and technology human resources is very low, namely 1:934 population, Indonesia's patent registers only amount to 2,272 or 24% of the 9,362 global patents, and international publications are still ranked 52nd out of 230 countries. One of the reasons for the above figures is because Indonesia only has 301,885 science and technology human resources consisting of lecturers, researchers and engineers. 1,280 of whom have taken doctoral degrees. For this reason, BRIN is targeting an increase in science and technology human resources with doctoral degrees reaching 20 percent in 2024. To overcome this, the National Talent Management (MTN) Program in the field of research and innovation carried out by BRIN to accelerate the quality and competence of science and technology human resources to become superior human resources towards Golden Indonesia 2045 (Acting Deputy for Science and Technology Human Resource, BRIN, on the 30 Minutes talk show with Scientists, on BTV, 18 October 2022)

Currently, most the national expenditure budget in Indonesia is coming from the Central Government, namely IDR. 24.92 trillion (80.97%), while from the manufacturing industry around IDR. 2.81 trillion (9.15%), and private R&D of IDR. 2.81 trillion. The government budget used for the appropriation research and development is around IDR 25.82 trillion or just 0.21% (Government Budget Appropriation for R&D/GBAORD per GDP). (Source: presentation of Head of BRIN, at Orientation for Heads of Research Organizations of BRIN; March 9, 2022)

IV. RESEARCH METHODS

This study is part of the PRN Program 2020-2021 Evaluation, with an emphasize on research collaboration analysis. This study began with discussions with the program implementation team, data collection through online surveys, and continued with the collection and analysis of qualitative (textual) data from various reports and websites.

This research uses descriptive analysis referring used by Patton (2015)[14], which emphasizes the importance of

qualitative interpretation in constructing meaning by involving interpretation from interviews, observations and qualitative investigation data documents to find patterns and themes that are substantively meaningful.

Primary data was collected through an online survey which was responded to by the coordinator of PRN activities, with the population in this study being 363 PRN activities which have been done. The survey was responded to by a minimum sample size of 10% of the total population, or as many as 37 samples (Gay and Diehl, 1992)[15]. Sampling was chosen purposively by paying attention to the nine focus areas in PRN. The survey questions assess the respondent's reaction as measured by a Likert scale from 1 to 5. The survey data processing technique uses statistical methods of distribution and coding. Secondary data was obtained from various studies related to PRN as well as data on the PRN Dashboard System (https://dashboardprn.brin.go.id/) designed by BRIN and KSI in 2021.

V. ANALYSIS

In overcoming the limited research resources in Indonesia, research collaboration between A-B-G (academic, industry and government) is needed. The form of research collaboration can be in the form of: support for strengthening the quality of human resources through collaborative research so that an increase in the quality of human resources is obtained both in terms of education level and experience in carrying out certain research focuses that are more applicable; research funding (cost sharing); utilization of research facilities and infrastructures; as well as various other incentive and disincentive mechanisms

An overview of the interrelationships between the various focus areas and targets as well as research collaborations carried out at PRN 2020-2021 can be observed from the intermediate data on the PRN dashboard website in Figure 3 below:

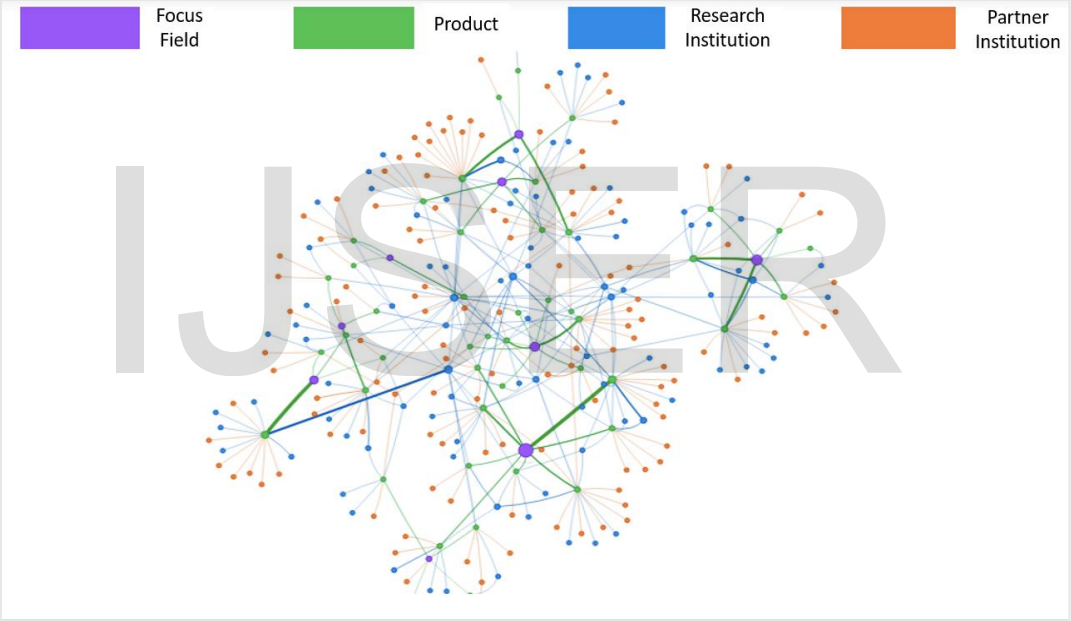

Figure 3 Connectivity Product Research with Researcher and Partner
Source: Website Dashboard PRN

Based on this illustration, in the implementation of PRN 2020-2021 it has been seen that there is a connectivity network that connects the linkages of each focus area with research targets (products) in each research activities. While in the implementation process it can be observed that the initiator carried out the activity by involving partners. At each node of the research focus area there are several product targets initiated by research initiator. Furthermore, it can also be observed that these researches tend to be carried out with partners (not with just one research institution) although it can also be seen that the distribution of the number of collaborative partners varies in each research.

An investigation of the description of collaboration in PRN 2020-2021 was also carried out by conducting a survey to obtain information about the tendency of the selected collaborative partners to support the implementation of this research.

From the survey results as illustrated in Figure 4, information was obtained that 13.16% of respondents did not have partners, and 86.84% of respondents had collaboration partners with the following variations: with domestic R&D institutions (18.42%), with domestic universities (15.79%) and with domestic industry (52.63%). Based on the survey results, it can be seen that the highest percentage of partnership is done with industry institutions. This indicates that there are some research products that have the opportunity to be commercialized with the support of industrial partners. Although this survey has not confirmed the status of the research product, whether it is still being

carried out on a laboratory scale or is it already at the final research stage and is ready for scale up (limited production) towards the mass production stage by fulfilling various complete product standards.

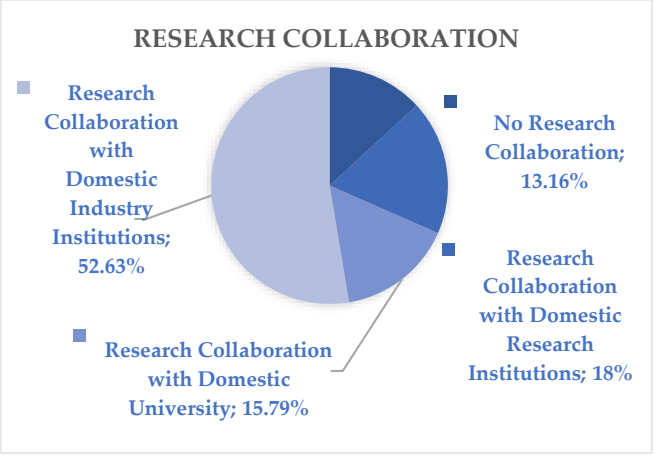

Figure 4 Response about Research Collaboration
Source: Data Processed

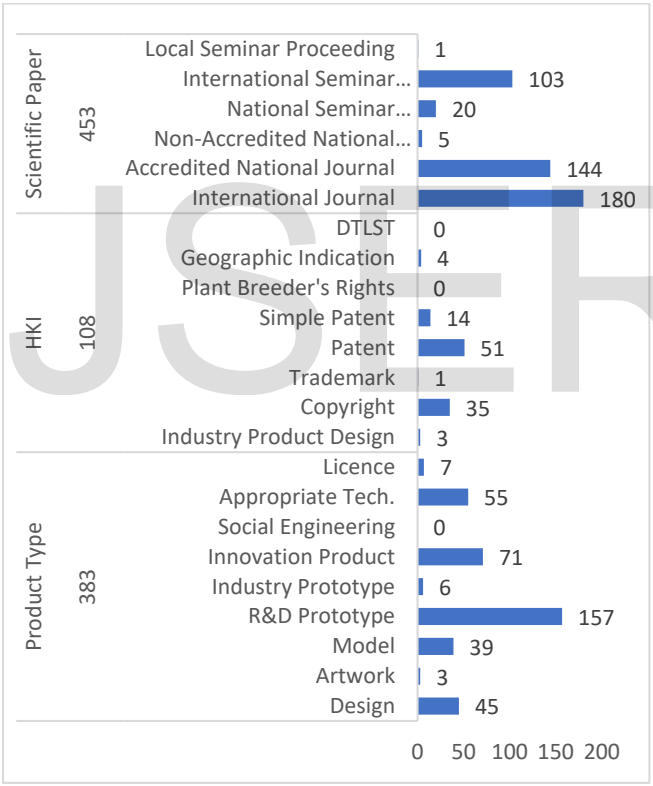

Figure 5 The Output of PRN 2020-2021, in the Group of Product Type, IPR, and Scientific Paper
Source: Website Dashboard PRN

From the identification of research output achievements, based on Figure 5 it is shown that the PRN 2020-2021 generally produces output in the form of research products, Intellectual Property Rights (IPR), and scientific papers. The output in the form of scientific papers had the highest achievement, namely 453 titles, with 180 titles (39.74%) of it were published in international journals. The output in the form of HKI had the lowest achievement, namely 108 HKI, with 51 (47.22%) of it in the form of patents. Meanwhile, when viewed from the group of research product types, PRN 2020-2021 produced 383 research products, with 157 products (or 40.99%) of it were research and innovation prototypes.

Furthermore, deepening information about the linkages of collaboration to budget support, facilities and infrastructure, and increasing human resources (mastery of key technologies) obtained the following information:

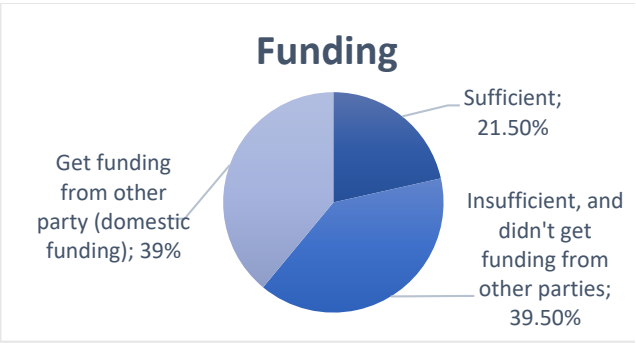

Figure 6 Response about Funding
Source: Data Processed

Data on the assessment of the adequacy of the budget for research implementation, as shown in Figure 6, shows that 21.5% of respondents stated that the research budget was sufficient and 39.5% stated that it was lacking but did not have other sources of funding. Meanwhile, 39% of respondents stated that they received budget support at the local (other unit of their own institution) and national levels (from outside their institution).

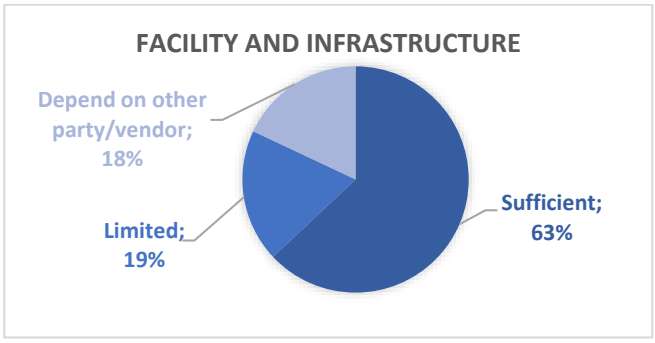

Figure 7 Response about Facility and Infrastructure
Source: Data Processed

Data for assessing the availability of facilities and infrastructure to support research, as shown in Figure 7, shows that 63% of respondents stated that the availability of facilities and infrastructure was adequate, 18% stated that their availability was limited and 18% still depended on vendors or other party both domestically and abroad.

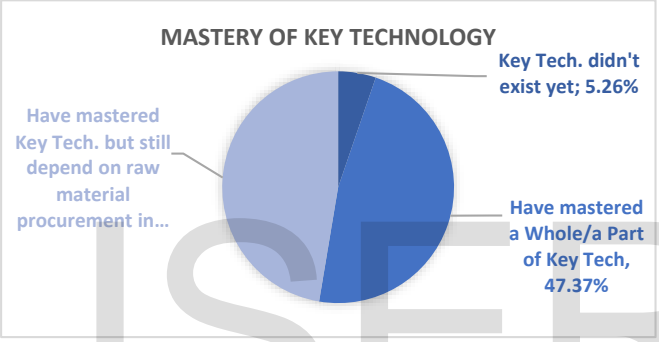

Figure 8 Response about Human Resource Capacity on Mastery of Key Technology
Source: Data Processed

Data for assessing on mastery of key technologies shows the capabilities of HR in mastering the required key technologies. Based on Figure 8, 5% of respondents stated that required key technology had not been mastered by HR, and 47.37% of respondents stated that the HR had mastered either part or all of the required key technology. The remaining 47.37% stated that they had mastered the key technology but were still dependent on procurement (raw materials) at the national/international level.

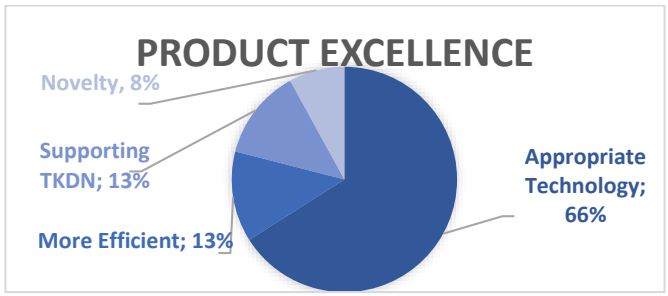

Figure 9 Response about Product Excellence
Source: Data Processed

Survey results related to the product excellence, as in Figure 9, shows that as much as 66% of research achievements are in the form of appropriate technology (TTG). Products with the excellence of being more economical/efficient as well as products for import substitution/increasing the Domestic Component Level (TKDN) both have the same percentage: 13%. Furthermore, products with novelty/frontliner technology: 8%.

VI. CONCLUSION

Based on the results of this study, the following results were obtained:

1. A research collaboration has been formed in the implementation of The PRN Program 2020-2021.
2. The percentage of research collaborators is as follows: 52% with domestic industry institutions; 18% with domestic R&D institutions; 15% with university; and the rest are individual research.
3. The output of research collaboration in the form of Scientific Papers and Intellectual Property Rights (patents, licenses, etc.) have mostly been achieved, while research products (designs, models, prototypes, etc.) still need improvement.
4. Research product targets expected to be achieved in the collaboration includes: 66% Appropriate Technology Products (TTG); product with the excellence of being more economical/efficient as well as products for import substitution/increasing Domestic Component Level (TKDN) both have the same percentage: 13%; and products with excellence of novelty/frontliner technology: 8%

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