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## Key Success Factors in Managing and Implementing Public Funded R&D Projects in Indonesia

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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](http://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 Saporita 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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## Key Success Factors in Managing and Implementing Public Funded R&D Projects in Indonesia

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### ABSTRACT

Public Research Centers (PRCs) in Indonesia are mostly operated by government funding. However, their role in supporting innovation and economic performance of MSMEs (micro, small and medium enterprises) is still very small. The objective of this research was to determine the success factors in managing and implementing R&D projects at a PRC in Indonesia, particularly in solving problems of MSMEs. Two case studies of R&D Projects from PRC 'X' were selected, namely the organic fertilizer project and appropriate technology project. Both projects are quite different in terms of the research process. By using mixed methods, all R&D process elements were investigated. The results of this study show that in general both case studies had indicated success factors that make R&D projects successful and effectively managed, grouped into three common categories: project management process, project resources, and project environments. The two case studies show that each project had different success factors and the lessons learned of these projects can be very useful to improve R&D project activities at PRCs.

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### I. INTRODUCTION

The need for innovation in the global competition era, and the request of policymakers to commercialize the results of Public Research Centers (PRCs) have received increased attention in the management of research and development (R&D) activities in developed and developing countries (Barragan-Ocana & Zubieta-Gareia, 2013; Hermawati et al., 2018). It may be argued

also that the global challenges facing the world today require PRCs to be more innovative and more in contact with industry and society. Like many other developing countries, R&D activities in Indonesia are mostly funded and performed by the government through Public Research Centers (PRCs), including universities and science and technology parks (Intarakumnerd & Goto, 2016; Suzuki, Tsukada, & Goto, 2014; Cheah & Yu, 2016). Their existence is very crucial especially for innovation due to their role in generating knowledge, technology creation and diffusion (OECD, 2011). The global competition also

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encourages companies to seek a more innovative way to survive and many companies in developing countries rely on or work in cooperation with PRCs for generating their new products or services (Gulbrandsen, 2011; Ankrah & Al-Tabbaa, 2015). Furthermore, Bekker and Freitas (2008) stated that according to some estimates, up to 10% of new products or processes are based on the contribution of academic research.

Trott (2008) stated that R&D activities have traditionally been regarded by academic or public R&D institutions and industries as the management of scientific research and new products development. Other concept of R&D was offered by Roussel, Saad and Ericson (1991) who defined it as “*to develop new knowledge and apply scientific or engineering knowledge to connect the knowledge in one field to that in others*”. Therefore, the role of R&D activities becomes very important in providing enterprises including micro, small and medium enterprises, and industry with competitive advantage.

As compared to private sectors, R&D activities at PRCs operated in a less competitive environment, which has conditioned lower tension and less stressful environment resulting in less innovative outputs and outcomes. It seems that the managerial approach for PRCs is left behind in terms of driven targets or desirable results as compared to private sectors, where PRCs mostly emphasize discovering new knowledge than new or innovative products and services (Hermawati et al., 2018). Meanwhile, their existence is increasingly expected to be relevant to public issues including improvement of existing industries and SMEs (OECD, 2011). A similar situation was also mentioned by Luc, Verspagen and Ziesemer (2020) that research activities at PRCs, especially publicly funded, often have a wider impact and orientation towards problem-solving of their stakeholders, such as business, community, academia and public policy, as well as building researchers’ capacity. Stern et al. (2012) also stated that the best results of public funding institute often make policy makers wish to replicate, generalise and scale-up. As time and money-consuming activities, R&D activities are under high risk and uncertainty. Therefore, more and more complex they are introduced and the

managerial approach is extremely important, while R&D by its nature requires special managerial attitude (Mikulskiene, 2014). In recent years, the number of research articles has increased, however, there is not systematic overview of success factors that emerge from a detailed analysis of individual studies, which is still relevant to Indonesian context.

In this paper, we investigate the key success factors in managing and implementing R&D projects of public-funded research centers, particularly for micro, small and medium enterprises (MSMEs) and industry solving problems. This is an individual lesson learned by a PRC in Indonesia, as well as providing practical recommendations in managing R&D project for the success its implementation practices and researches particularly at public funded R&D institutions.

Two R&D projects at PRC ‘X’ were selected as a case of study in this paper. The selection of the two projects was based on the results of two previous research conducted and funded by PRC ‘X’ (Siahaan et al. 2017; Setiawan et al. 2018). Two research have been considered best practice since they had transferred the outputs to the productive sectors, the impact Analysis of PRC X’s Competitive Program (2010–2014) conducted in 2017 and the Evaluation of Technology Implementation at LIPI for Improving Regional Development, conducted in 2018. The projects also have a wider impact in the community and have maintained its sustainability for more than ten years (Siahaan et al., 2017; Setiawan et al., 2018).

We reviewed activities in practicing R&D management process that contributing to the success of projects which are funded by the government. The core question is what factors influence the success of R&D projects for MSMEs at a PRC? This approach allows a more thorough analysis of factors that promote the success of such projects. It is important to identify those that should be encouraged to increase any project’s likelihood to be transferred and become successful.

The unit analysis of the study is the public funded R&D project, where the key success fac-

tors were developed based on experts experiences in assessing success of R&D projects at PRCs. The substantive contribution of this scientific study was to provide an understanding of research and technology management at PRC as well as provide guidance to research institutions or principal investigators of R&D projects to effectively manage and transfer the project results and attain desired outcomes.

## II. ANALYTICAL FRAMEWORK

### 1. Critical success factor associated with successful R&D projects of a PRC

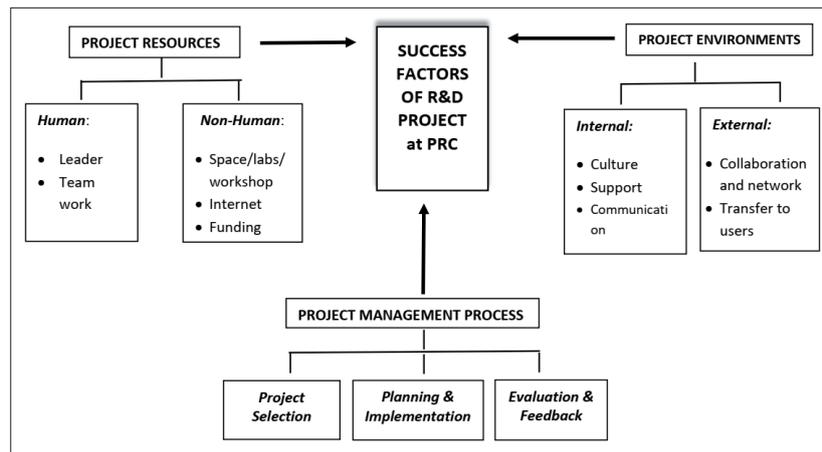
Many studies have discussed factors that either promote or hinder the success of research projects at PRCs. Some of them discussed the success of R&D projects, the success of new development products, and even the causes of project failures, as described by Balachandra and Friar (1997), Sun and Chung (2005), Nagesh and Thomas (2015), Lim and Mohamed (1999) and Barragan-Ocana and Zubieta-Garcia (2013). The success of the project means that certain expectations from users or buyers, owners, planners, engineers, contractors, or operators were met or achieved, although the expectations may be different for each of them. However, in the management practices, the success of R&D projects greatly depends on how the project has been managed and controlled. Alias et al. (2014) mentioned that the main problem with project management practices have always been mentioned as planning, project implementation, cost and time overruns and quality non-achievement. Therefore, knowing the critical factors of project success or failure is useful for the stakeholders or decision makers, especially the government or donors who provide funding for the projects. The indicators of factors that make the project success or failures are often considered as one of the vital ways to improve the effectiveness of the next projects implementation or practices.

Literature shows that the project success or failure depends on the project management process. For example, Luc, Verspagen and Ziesemer (2020) and Nagesh and Thomas (2015) pointed out that the R&D management process approach emphasizes the systematic study of management

by identifying management functions in an organization and then examining each in detail, in terms of the functions of planning, organizing, implementing and controlling. Project manager is not only responsible for time, cost and quality management, but also integration, scope, human resource, communication, risk and procurement management. So, that person is the most responsible person for project success. There are several measurements of project management success that can be evaluated through criteria based on time, cost, quality, scope, resource and activity (Kerzner, 2011) by using models of measuring success like project management performance assessment (Luc et al., 2020) and maturity models of management within organization like the project excellence model (Westerveld, 2003). However, it is not easy since project management creates both tangible and intangible benefits (Mir & Pinnington, 2014).

The perceived project success or failure is not only a function of time and cost, but also other factors related to the process: outcome, impact and satisfaction of the stakeholders and customers (Hermawati et al., 2018). However, Khang (2008) defined project success as an effective use of a project's final output and sustained achievement of project purpose in the long-term goal, while Nagesh and Thomas (2015) also mentioned that good project management can contribute to project success and be able to prevent project failure

Furthermore, Nagesh and Thomas (2015) specifically mentioned eight common categories of factors contributing to the success of public funded research projects, namely the type of the project, leader's competence, team, environment, funding and other resources, management support, collaboration and degree of difficulty. Having discussed all these factors, this research identified success factors related to R&D projects practices at PRCs in Indonesia. The general factors are classified into project management process, project resources, as well as internal and external environment. Each factor is used to assess the success of public-funded R&D projects management and implementation at PRCs in Indonesia, as shown in Figure 1.



Source: Constructed by Author

**Figure 1.** Success Factors of Public Funded R&D Projects in Indonesia

## 2. Public Research Centers

Public Research Centers (PRCs) are considered as an important science, technology and innovation (STI) institutions for government in enhancing the national economic development (OECD 2011, 2017; Suzuki et al., 2014; Intrarakumnerd & Goto, 2016). As public institutions, PRC's activities are operated mostly through government funding, for example, some of PRCs in Indonesia exist under BRIN (Badan Riset dan Inovasi Nasional/Research Agency and National Innovation). R&D activities performed by these PRCs are also intended to support or solve industrial or firm problems and improvement of existing industries, as well as to provide inputs for STI related policy formulation (Maass, 2003; Hermawati et al., 2018; Hermawati, 2019). Therefore, PRCs need to play very active roles in their relationship with industries or users in order to maximize the utilization of their research results as well as realizing the economic, social, environmental and cultural benefits for the community development.

Hermawati et al. (2018) mentioned that PRCs can perform activities on bridging the demand (user needs) and the supply side (resources) in innovation processes, such as articulation of specific needs and bridging links with outside or users. Roles of PRCs can be very broad, not only producing knowledge and technology innovation, but also in linking various actors such as users, producers, and other stakeholders to boost innovation, where the intervention has an

'effect' to the users (government, businesses and community). They also mentioned that in order to gain trust from the government or other donor institutions, the public funded R&D institutions should strive to provide excellent results and fulfill their stakeholders' needs (industry, community and government), to manage the program effectively, as well as to improve the quality of people's life.

## 3. Public-Funded R&D Projects

R&D projects usually consist of basic research, applied research, and product development. In Indonesia, a wide range of areas in R&D projects may cover food, energy, water, health care, environment and new product or technology development and others. Most of these projects are funded and carried out by government agencies. Nagesh and Thomas (2015) identified that their target is usually in the long-term, needs high intellectual inputs, potentially intangible benefits tangible, and risk is high, therefore it is not always successful. Public R&D projects have a definite outcome within a time frame, schedule and certain cost. Public R&D projects in Indonesia are mostly designed to answer long terms needs and they rarely produce current firms or industrial needs, which has specific performance requirements that must be met (Hermawati et al., 2018). Alias et al. (2014) mentioned that almost any innovative project requires the application of art and science of project management and

it will depend on the size complexity or nature of the project. Furthermore, they also stated that the level of technology, tools or machines and its degree of sophistication needs several certain levels of personnel skills.

Nagesh and Thomas (2015) defined R&D as “*activities comprising creative work undertaken on a systematic basis to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications*”. R&D projects are mostly not short term, but rather projects with innovative output or breakthrough outputs within the work of research team. In general, R&D projects are similar to any other projects, they require resources, teamwork and collaboration when external knowledge and facilities are needed and has time limit (Mikulskiene, 2014; Luc et al., 2020). Thus, integrating R&D project and business strategy of an enterprise or industry is vitally important to the success of the research by PRCs. If there is mistrust between PRCs and business unit (MSMEs and industry), R&D projects will likely fail to commercialize. Therefore, if the project is intended to solve business units' problems, each R&D project has to have business plan and networking with MSMEs and industry.

### III. METHODOLOGY

The research used quantitative and qualitative data. However, qualitative approach in the form of descriptive analysis was used more to strengthen the existing quantitative data from previous studies.

The data in this study is categorized into three, namely project management process, project resources and project environments. Three main factors under project management process are (a) selection of the project, (b) planning and implementation and (c) evaluation and feedback. Assessment of project resources has more focus on human resources, namely performance of their research leader and their research team work, whereas non-human resources factors focus on research facilities, such as laboratory, workshop, internet access, building and availability of funding. The third category of data is project environment (internal and external environment).

Internal environment mainly focuses on the work culture, support from leaders or top management and openness in internal communication. Assessment of external environments focuses on the collaboration's performance, networking and transfer of project outputs to users.

In formulation of the key success factors, a conceptual framework was developed. Assessment of the success factors used a five Likert scale, very weak, weak, undecided, strong and very strong. By offering anonymity, lead researchers, project leaders, head of PRC, beneficiaries and other stakeholders, such as representatives of local government and donors assessed all factors of a project as mentioned in Figure 1. Results of Likert scale assessment were then analyzed by using descriptive statistics (frequency distribution). A re-assessment of the results at the first step was conducted through focus group discussion (FGDs) to get the final result of factors that bring the success of the project.

A wide range of activities such as discussions and interviews with project leader and all members of the project, donors, head of PRC, beneficiaries, and other stakeholders, were conducted during this study to provide more deep and meaningful results of analysis. Sources of other data, among others, were gathered from project documents, including proposal and research design, summary of project reports, progress reports and literature related to the projects as well as results of visits and re-visits to identify the process of the entire projects works.

Focus group discussions were also held to obtain in-depth information (qualitative and quantitative data) describing the success factor in conducting R&D projects for MSMEs and industry. More specifically, the moderator of the discussion asked the groups to explore how R&D projects process is and how can they meet the demand of MSMEs and industry. The focus group participants were asked to discuss, in detail, their experience in conducting the entire project process as well as stimulating the demand from MSMEs and industry.

Focus group discussions were conducted at the PRC ‘X’ office and attended by the project leader and his team, head of the office and other

stakeholders related to the project. The length of the discussion in the focus group ranged approximately from 1.5 to 2 hours. Different sets of questions and statements were developed and used in the focus group discussions. The assistant moderator took notes during focus group discussion and the evaluation of the notes was taken as soon as possible after group discussion was done. This study was conducted between March to September 2018.

## IV. RESULTS AND DISCUSSION

### 1. Description of the Projects

As mentioned in the introduction, the study selected two R&D projects at PRC 'X' that had been transferred to the productive sectors and have wider impacts economically as well as friendly/

green environment and open employment in the community (Siahaan et al., 2017; Setiawan et al., 2018). These projects had maintained its sustainability for more than ten years, and then it could be regarded as successful PRC's R&D projects. Table 1 provides a brief summary of the two projects under study.

In pursuing complete description of the two projects, an intensive interview was conducted, where each project consisted about 4 and 7 main persons (including the leader) who actively involved in the projects under study, they are project leader, researchers, technicians and research assistants. All of them had extensive experience in their technical expertise with education background ranged from undergraduate to postdoctoral studies. The projects not only supported by head of PRC 'X' but the local governments and other

**Table 1.**  
Successful R&D Projects under Study

Projects Title	Description of the Project
Project A Organic fertilizers (from land microbes) project for sustainable agriculture and environment	The research was started from 2008 until 2010 and managed by two researchers and two technical assistants. The research developed a new formula of liquid and granule organic fertilizers and innovative equipment/technology for blending the organic fertilizer. In 2017, the results of the project were adopted by various farmers' groups in more than five districts in West, Central, and East Jawa Provinces, East Kalimantan and West Sumatra Provinces. The project has trained more than 2,500 farmers from various farmer's groups, cooperatives and MSMEs in making of liquid and granule organic fertilizers. The farmer's group not only used this organic fertilizer for themselves, but also sold it to other farmers. Supports also came from local governments in the implementation areas. This project had increased the farmer's knowledge and skills in making organic fertilizers, increased fertility of the rice fields and agriculture land, increased padi's productivity, and provided a better condition of environment and surrounding as well as improve household's income. The project resulted in one patent and has been licensed by enterprise Y. Until 2018, with the funding from other sources, the project has expanded and has been adopted by other 5 districts, now a total ten districts. Communication between researchers and users were running very well.
Project B Appropriate technologies for MSME in the coastal areas	The project was held from 2010 to 2014 and implemented in Selat Nasik sub-district, Bangka Belitung Island and managed by three researchers and four undergraduates as technical assistants. The project developed various improved appropriate technologies for improving MSME productivities. Types of appropriate technologies produced and introduced to MSMEs among others were machines for making fish crackers, squid crackers, and other added value local products. In implementing the appropriate technologies, this institution cooperates with local governments and local SMEs. The project also held some training for MSMEs related to new technologies and management. The demand for this project were mostly women entrepreneurs (about 150 women). The benefit of this project among others: increasing their productivity, creating large market and increasing their income. The project also assisted MSMEs in packaging including making their own brand and registering to get the certificates from The National Agency for Drug and Food Control (BPOM) and The Ministry of Health. The local government facilitated marketing of the products by building souvenir shops in the center of Belitung city. In 2018, the project was completed but the users still continue using the equipment and some of them even did some innovation to adjust with their production process. The communication between users and the researchers of this project is still ongoing.

Source: Summarized from Siahaan et al. (2017) and Setiawan et al. (2018)

funding (donor) agencies also contributed to the projects. Through these projects we identified the critical factors that made PRC's project success.

## 2. Case Study Findings

After describing the two projects, the next step was to identify critical factors that made the project success, bearing in mind those previously identified success factors in the literature (Khang, 2008; Nagesh & Thomas, 2015; Barragan-Ocana & Zubieta-Garcia, 2013; Hermawati et al., 2018). We finally summarized them as the framework for this study as well as specific context for Indonesian PRCs. The variables of success factors of PRC's R&D project in the framework (Figure 1) were the main focus group discussions to determine the project factors success. The focus group results suggested that the following factors are significant for the successful government-funded R&D project management and implementation at PRC in Indonesia, project resources, project management process and project environment (internal and external factors). The detailed description of each factors that make government funded R&D project success at PRC in Indonesia are as follows.

### *Project resources factors*

Project resources consist of human and non-human. Human resources consist of a leader and its research team, whereas non-human resources consist of the availability of funding, space, workshop, laboratory, equipment and internet.

In terms of human resources, R&D personnel or researchers are unique in feature such as good academic training, high aptitude, intelligent, creative and motivated with little training in managing people (Jain, Triandis, & Weick, 2010). They also pointed out that the best work occurs under less control, but provide good challenge and adequate security, has moderate coordination and allows individual autonomy. The teamwork of an R&D projects mostly came from multidisciplinary education or background and expertise according to the project needs. Many experts also mention that good teamwork is able to open discussion on disagreements, member's awareness about their performance evaluation

criteria, mutual respect among members and leader (Dewett, 2007; Griffin & Page, 1996).

In both projects under study, they had good project leaders. R&D project leaders perform important roles within project groups that contribute significantly to performance of the project. According to Grosse (2007), the responsibility of a project leader includes making decision, giving instructions and control, motivating, and initiating new assignments. These actions must be accomplished by the project leader within the scope of a project in a certain time limit and budget, degree of complexity and relative novelty. In this case study, R&D project leader effectively managed the process and coordinated coordinate with others as well as had strong organizational networks. The project leader also integrated and worked with various disciplines of researchers and technicians whenever needed, particularly when the development of new products is needed. The strength of the project leader and his teamwork directly determined the work effectiveness of the project.

The important factors of non-human project resources are funding, equipment, space, laboratory, and internet connection. As stated by Nagesh and Thomas (2015) these factors are able to support the project particularly the availability of funding the project until it is finished as well as the accessibility of state-of-the-art equipment, adequate laboratory. A fast and good internet connection became a main support for project success and innovation. The overview of project resources for both projects is summarized in Table 2.

### *Project management process factors*

Project management process is the whole practice of project implementation including selecting, planning, executing, controlling, evaluating and closing the project and commercialization or transferring the project to the users. R&D projects have to achieve all the project goals within the given constraints. Luc et al. (2020) and Wysocki (2019) mentioned that project management processes can be organized into five groups of one or more processes each.

**Table 2.**  
Project Resources Factors of Project A and B at PRC 'X' in Indonesia

Project Resources Human and Non-Human	Project A	Project B
Leader and team researchers	The leader had a long-term vision in implementing and expanding the project. The leader committed in putting the project in place and economically visible through good cooperation with local government and local enterprises. A good teamwork also existed in this project. (Assessment value is very strong)	Leader may have a good vision of the project, but they fail to expand the project. The cooperation that they built with local government and local enterprises was only for a short-term period. The cooperation between users and workshop that made the sustainability of the project. (Assessment value is strong)
Availability of additional funding	The project was successful in obtaining additional funding from donors and various institutions and expanded the project. (Assessment value is very strong)	The project only operated by the existing funding from PRC 'X'. No other funding sources for expanding the project. (Assessment value is weak)
Laboratory or workshop and space	The research facilities are very good and fully support the project. (Assessment value is very strong)	The research facilities are very good and fully support the project. (Assessment value is very strong)
Internet connection at the office site	The internet connection is strong enough in this area as compared to project B.	The internet connection is not as good as other offices, often down and fluctuate. This was considered as a weakness.

Source: Author elaboration based on final expert judgments.

- a) Initiating processes: recognizing that a project or phase should begin and commit to do so, including selecting the project.
- b) Planning processes: devising and maintaining a workable scheme to accomplish the business needs that the project was undertaken to address.
- c) Executing processes: coordinating people and other resources to carry out the plan.
- d) Controlling processes: ensuring that project objectives are met by monitoring, evaluating, and measuring progress, qualitative and quantitative measurements and taking corrective action when necessary.
- e) Closing processes: formalizing acceptance of the project or phase and bringing it to an orderly end or transferring to the end users. The overview of the two projects under this study is presented in Table 3.

### **Project environment factors**

Project environment consists of internal and external environment. Internal environment includes organizational (work) culture, decision makers support and internal communication (Nagesh & Thomas, 2015). Romadona et al. (2016) mentioned that S&T organizational

culture of a PRC is multi-dimensional and united between the role of individuals and their social environments. The interaction of individuals themselves, inter-individuals, intra-individuals with individuals with their environment is the process of creating knowledge and building collective understanding in science and technology, where the human resources have the most important role. Whereas Adler and Jelinek (1986) described the organizational culture as a pattern of learning in problem solving by external approach and internal integration to understand the existing problems. Learning itself is categorized into three modes, namely learning mode, implementation mode and social-organizational mode based on the input-practice-output process (Godin & Gingras, 2000). Therefore, organizational culture is defined as the underlying beliefs, assumptions, values and ways of interacting that contribute to the unique social and psychological environment of an organization.

The success of R&D projects also determined by the support from decision makers, such as head of PRC and head of finance division of PRC, as well as good communication (informal and official communication) among team members, and between leader and research team, as well as between research team and all individuals

**Table 3.**  
Project Management Process Factors of Project A and B at PRC ‘X’ in Indonesia

Project Management Process	Project A	Project B
Selection of the project	Process of project selection very clearly fulfill all requirements at all levels and include other stakeholders related to the project. (Assessment results is very strong)	This project also has similar project selection process with project A and consider has similar value in the assessment, very strong.
Planning and implementation	In this stage, the project did not make long term planning, but yearly plans, however, they could expand the project for other years. In the implementation stage they could assist users in getting familiarity with the technology, but they cannot regularly visit or assist face to face. Assessment results of this factor is strong.	This project also made a yearly plan and continue the plan after that. Since they could not seek other funding sources, the plan and implementation stage finished as the project planned. Assessment results of this factor is strong.
Evaluation, feedback and follow-up	The leader and the teamwork evaluate the project regularly to get the feedback and consequently they follow up the evaluation results. These activities need extra cost. Assessment results of this factor is strong.	Due to funding obstacles, the leader and teamwork cannot visit and evaluate the project regularly. They only received report from local government if they need it. Assessment results of this factor is weak.

Source: Author elaboration based on final expert judgments.

(decision makers, other researchers, technicians and admin) within PRC. The effectiveness of verbal and non-verbal communication existed in both projects. The external environmental factors are the willingness to collaborate and develop network with other stakeholders, as well as the good market demand or strong interest from users to use the project results. The overview of project environment factors for both projects is summarized in Table 4.

### 1. Comparative Case Study Analysis

The first case involves making organic fertilizers for agriculture, where farmers, their group, and agro industry benefited from this project. The second case involves in appropriate technology development for MSME. Many MSME in food processing activities, such as those who produce fish crackers, squid crackers, and other added value local products benefited from this project.

Both projects are under PRC ‘X’, but they were managed under different research divisions. The first project was managed under biotechnology research division and the second under appropriate technology research division.

The main funding of these projects came from the government budgets. However, the first project was able to seek more additional funding from several donors, as compared to the second project.

Both projects were examined through the focus group discussion address the factors that mentioned in Figure 1 and then discussed each of the factors. In comparing the two projects, Table 4 shows an overview of the assessment of Project A and B at PRC ‘X’ in Indonesia based on the success factors above. Several potential situations could occur, so the lesson learned will be very useful to improve performance of the project at PRC in Indonesia.

#### *Project resources factors*

Project resources factors consist of human and non-human resources. In terms of human resources, project leader (who lead the research team) and the research team were the main focus of assessment. Both projects had a research leader and teamwork. However, Project A had a very strong leader. The leader of project A put more attention in creating network for expanding the research compared to project B. Although both projects completed their research works

**Table 4.**  
Project Environment Factors of Project A and B at PRC 'X' in Indonesia

Project Environment Internal and External	Project A	Project B
Work/organizational culture	Although the project was considered not one of their priorities, but the work culture fully supported this project, especially in this division. Their assessment results of this factor is strong	A similar situation took place in Project B. The work culture was considered as one the project supported. The assessment results of this factor were strong
Support from decision makers inside institutions	Decision makers had good support to the entire project time frame. The assessment results of this factor were strong	Decision makers had good support to the entire project time frame. The assessment results of this factor were strong
Communication	Very good communication within the research team and also with director, other teams. The assessment results of this factor were strong	A very good communication within the research team and also with director, other teams. The assessment results of this factor were strong
Collaboration and network development	The leader of the project developed good collaboration with many local governments, enterprises and funding agencies. This made the project wider and had developed many recipients of the technology. Assessment results; very strong	The research team only had collaboration with the existing local government where the project implemented. There is no project replication in other areas. Assessment results of this factor is weak
Market demand and user interest	This factor was measured by the extent and number of technology adopters, which is more than 25 farmers' cooperative or equivalent to more than 2,500 farmers, the distribution of places based on districts/cities (10 districts) and the duration of the project as well as its sustainability. The assessment results of this factor were very strong	In this project, a smaller number of adopters (17 SMEs) and 2 two districts implemented the project. Although the users still use the technology there is no replication project outside the original place of implementation. The assessment results of this factor were strong

Source: Author elaboration based on final expert judgments.

**Table 5.**  
Success Factors of Project A and B at PRC 'X' in Indonesia

	Success Factor	Project A	Project B
<b>Project Resources Human and Non-Human</b>			
1	Lead and team researchers	Very strong	Strong
2	Availability of additional funding	Very strong	Weak
3	Laboratory or workshop and space	Very strong	Very strong
4	Internet connection at the office	Strong	Weak
<b>Project Management Process</b>			
1	Selection of the project	Very strong	Very Strong
2	Planning and implementation	Strong	Strong
3	Evaluation and feedback and follow-up	Strong	Weak
<b>Internal and External Project Environment</b>			
1	Work/organizational culture	Strong	Strong
2	Support from decision makers	Strong	Strong
3	Communication	Strong	Strong
4	Collaboration and network development	Very Strong	Weak
5	Market demand and user interest	Very Strong	Strong

Source: Author elaboration based on final expert judgments.

within allotted timelines and budget, the leader of research project A was able to get additional research funds from other sources for three years project expansion. This makes the total project five years, whereas project B did not continue the project after two-year operation by government funds. However, both research teams worked very hard and kept the team members motivated and giving their very best on the job. It should be noted that all leaders and researchers of both projects had extensive experience within their areas of technical expertise and their education ranged from undergraduate to postdoctoral studies.

In the non-human resources, the results of assessment for both projects, both institutions are very strong in terms of effective laboratory or workshop and research or work space. Understandably, both research divisions have very long experience in their respective research field, for more than thirty years. However, in terms of availability of additional funding, project B was weak, while project A was very strong. The leader of project A was able to source some additional funding from other donors to expand the project as well as recipient of research outcomes until five years and benefited the researchers and institutions by having patent registration for their formula. The internet, as one of the research facilities is very very important, as it can be expand, commercialize, and also boost the communication with other stakeholders. Unfortunately, the internet access in Project B office was not as good as in Project A office.

#### ***Project management process factors***

Both research divisions where the projects were conducted had a clear vision and good reputation of producing excellent and relevant research. Both research teams had very long process in selecting the project. Starting from the idea concept paper, both teams had involved the users, and other supporting stakeholders. Besides internal involvement, they worked closely with potential partners and users in the project selection process. The director of research institution also helped evaluate how the project could add value to the researchers, institution and user/company's business. The project plan of both research projects ran very well. Although they used different

approach in implementing the project, they had developed a system for tracking the timeline of project activities. Similarly, in the implementation stage, they successfully developed the results within the planned timeline.

In terms of evaluation, feedback and follow-up activities, Project A was better as compared to Project B. Project A had an evaluation system of project results (product) conducted by their partners at several project sites. As a result, more feedback was received by the research team. The project leader or research team members regularly visited the project site to follow up the feedback and maintain their network with users and partners, even after they finished the project. Project B considered weak in this area, it did not have joint efforts involving partners and users in evaluation and follow up the project.

#### ***Project environment factors***

Both projects had strong organizational culture characterized by their researchers who have high morale, existence of spirit of innovation, highly receptive to new ideas, freedom of delivering and accepting or choosing innovative things, high risk tolerance and acceptance of failure. Similarly, both projects also had good communication within the project team and people outside of the project team. This gave positive impact to the process of research project. Both projects also had strong support and encouragement by the top management for the whole process of the project including an effective transfer and commercialization of project output to MSME as users.

Empirical evidence shows that Project A had very strong collaboration and network development with other stakeholders such as local/district government, cooperatives, and local agriculture offices and MSMEs. Various activities such as training, technical consultations, as well as general discussions related to the project were held and funded by local government or MSME in the district site. These activities was held almost every year and the researchers regularly visited local government and users of the project to discuss and find new ideas from them. In Project B, those activities were not as strong as in Project A, particularly after finishing the project. There was almost no continuation of collaboration and

network with other stakeholders. In fact, collaboration and networking were key to maintaining the sustainability and supporting expansion of the research project. Whereas factors that affect collaboration among others were knowledge of the project's products, effective sharing equipment or facilities and other resources, and clear agreement or mutual understanding among collaborators.

Although the researchers were mainly role as executors of the research projects, they also learned many aspects from the market place. A lot of project innovation aspects come from the market or users. Project A had a wider and greater demand from the users compared to Project B. the output of Project A has spread in more than ten districts in West, Central and East Java Provinces, East Kalimantan and West Sumatra Provinces with total of farmers utilize this output about 2,500 or around 20 farmer's cooperative groups, whereas user of Project B was only 17 MSMEs in the area of Belitung District. The users' interest towards research projects' output were derived from good coordination and communication among researchers, leader research division, local government and MSME/user as well as. Project A had identified their market or users during the project selection.

## **V. DISCUSSIONS**

Different factors influencing the success of public funded research project are shown in Table 4. A very strong factor was revealed in both projects for the project resources including the availability of modern laboratory and workshop space and selection process of the project. Whereas, both projects had strong factors in the project management process for planning and implementation and in the project environment for work culture, support from decision makers, and communication.

A lead researcher (leader of the research team) is very important person in the research work. The good leader is a person who has a vision of the research and direct the teamwork in all process of research and achieve its goals. Although the leader of Project B was good (strong) in general, there were other serious weaknesses related to the availability of additional support

funding for expanding the project and meeting the users need. The user's perceived values and satisfaction are mostly shown as feedbacks during project's outputs utilization phase, and this can persist for a longer period than implementation. Due to these weaknesses, sustainability of the project and project outputs are difficult to achieve.

Based on the analytical framework (Figure 1), all factors were important and considered as key success factors, however, there were very critical factors among them, namely leader and research team, support from decision makers and stakeholders as well as market demand or user interest. A precise project selection was done by leaders with expertise project enlarged and acceptable to the users and MSME. The success of the R&D project and PRCs was also determined by the support from decision makers, since the seed funding comes from the government through the R&D institution. Having the strength of leader and researchers (research teamwork), support from decision makers, interest of users or market demand, the project becomes even more demanded. Both projects had different value assessment in terms of leadership performance, support from decision makers and market demands. The study showed that Project A is stronger in all factors compared to Project B.

Once the most critical factors were rigorously identified, the project was more feasible and clearer to continue design actions and enhance positive impact for the institutions, researchers, and project's sustainability. Furthermore, availability of research infrastructures including the internet and good work culture were essential to achieve the project success. The PRC and their researchers also should develop and maintain good network and active communication with regional governments, donors and private sectors including MSME, so they can do their regular research based on the users' needs as well as to provide solution to the users' problems (industry, MSME or other stakeholders).

## **VI. CONCLUSION**

Form the case study, it can be concluded that in general, the factors influencing the success of R&D project at a public funded PRC can

be categorized into three; *project management process* (project selection, planning, implementation and evaluation); *project resources* (research leader and research team); and *project environment* (internal and external factors). Although all factors are very important in making success of R&D project at public funded research institutions, the different attainment in making the project wider and sustainable is mostly determined by the project leader and research team, support from decision makers and demand from users.

It is worth mentioning that those factors will help PRC and its decision makers on effectively managing the project to achieved the desired outcomes. The respective government agencies, such as the Ministry of State-Owned Enterprises (BUMN) or the Regional-Owned Enterprises (BUMD) or other partners could support the research networking and funding through information, brokerage, matching services, organizing trade fairs, and business seminar to bridge the researchers from PRC with the users/MSME and industry.

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