Innovation of Government Research and Development Institution Based on Knowledge Management and Information Technology (Case Study on the Government Policy-Making Research and Development Institution)

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I. Introduction

Innovation is to introduce new concepts, goods, services, and methods. Innovation is defined as related to creativity, which comes from the word to innovate which means making changes or in-introducing something new. Innovation occurs in many fields, such as technology, knowledge, economy, social, education, and many more. It may also be categorized into major innovations and small innovations and they are abundant. Innovation does not have to be expensive. Any person can innovate, whenever and wherever. Even our forefathers were innovators or else we would still be living in dark caves.

Law Number 23 of 2014 in the Chapter on Regional Innovation manifested in Government Regulation Number 38 of 2017 on Regional Innovation defined innovation. Article 1 stated that Regional Innovation is reform in all fields in implementing governance in a region. In article 3, Regional Innovation is carried out under the principles of improving efficiency, effectiveness, and service quality, being public interest oriented (not personal interest) and free of conflict of interest, being open, and maintaining value of fit and accountability of results.

Abstract

This study investigates and analyzes knowledge-management-based innovation in developing knowledge sharing and absorbing and the role of Information-Technology-based innovation in supporting knowledge management. It is now a demand that institutions prioritize on creating innovation. Organizations that are able to compete can learn and be creative, which is only possible if the knowledge sharing within the institution is carried out properly. This is also the case for R&D institutions that must make innovations based on knowledge management and information technology. This is a single case study qualitative analysis. Based on criteria, four informants were selected as sources. They were interviewed guided by a list of open-ended questions. The results of this case study provide information on the aspects that are needed to support innovation in government R&D institutions. They also fill the gap in research on knowledge management. Innovation based on knowledge management processes in developing activities to share and absorb knowledge in government R&D institutions has been running and has produced several innovations. It has been utilized to share and absorb knowledge and it is a requirement for a functional official researcher, but there is still limited availability of computers.

Keywords

Innovation; knowledge management; information technology

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In Law 11 of 2019 concerning the National Science and Technology System in article 1 paragraph (13), innovation is produced from thought, investigation, improvement, assessment, and/or application, which contains elements of novelty and has been applied and provides economic and or social benefits. Article 7 Paragraph (2) states that Science and Technology Application are carried out to encourage innovation as an effort to increase the development productivity, independence, and national competitiveness.

At the brink of the free market economy where competition and globalization are the main characteristics, there is a high demand for the availability of Human Resources (HR) with high competitiveness. The basis for competitive advantage has changed from a conventional approach to a contemporary approach, namely knowledge-based intellectual capital, such as creativity, innovation, organizational learning, and strategic capabilities. According to Affandi (2009, p. 1), this paradigm shift has given birth to knowledge management which is seen as more powerful as an important resource which is a prerequisite for creating competitive advantage for individuals, units, departments, and organizations.

Effective knowledge management requires a multidimensional perspective, namely a combination of people, technology, and processes. Technological advances greatly affect many aspects of the management, structure, and activities of organizational tasks. Rockart (1988, as cited in Elita, 2005) stated that Information Technology (IT) is a strategic weapon and utilizing IT is very important. The development and influence of IT on organizations has encouraged organizations to be able to apply technology so that they can better improve their performance, endurance, and organiza-tional response. The use of IT demands an adequate planning that ensures strategic objectives and demands organizational changes that allow system integration.

IT has changed all human life aspects, from communication methods to governance. Communication and governance can now be real-time, digitally, efficiently, and across borders with the exist-ence of IT such as the internet. According to Njoka et al (2020) the critical need for institutions and enterprises in the digital era to embrace and institutionalize use of Information communication technology in the execution of their functions cannot be overemphasized. Information communication technology (ICT) is increasingly playing an instrumental role in infusing efficiency and effectiveness in service delivery in public and private enterprises.

Barney (1996) stated that an organization must prioritize to innovate. An organization must learn and be creative so that it can compete. This can be achieved if the organization carries out knowledge sharing activities properly. In government Research and Development (R&D) institu-tions, as organizations, interactions occur among the functional official researchers, R&D staff, structural officials, functional official researchers, users, and other stakeholders. These interactions improve performance that is beneficial so that the institution can be competitive.

In this study, the research problem is limited to the following matters:
• Innovation based on knowledge management in government R&D institutions is defined as a breakthrough in the procedures for managing research and development organizations/institutions starting from identifying the knowledge of structural officials and staff as well as the functional official researchers to storing and sharing knowledge within the research team and fellow researchers so that innovation is resulted from sharing knowledge through communication (conversations/discussions).
• Information Technology (IT) innovation referred to in this study is a breakthrough in the implementation of technology which greatly influences many aspects in ensuring the structure and activities of the organizational tasks of R&D institutions, in applying tech-
nology to improve performance, resilience, and responsiveness of the R&D organizations/institutions in providing added value or competitive advantage as well as increasing the interest of research and development organizations/institutions in knowledge management.

II. Review of Literature

2.1 Knowledge Management

Knowledge management is to comprehensively organize of the processes of creating and developing knowledge, storing knowledge, sharing knowledge, implementing knowledge in an effort to exploit the organizations tacit and explicit knowledge assets to gain a competitive advantage (Kucza, 2001; Nonaka & Takeuchi, 1995; Zhou & Fink, 2003). Knowledge management is a process to find, select, organize, filter, and present information systematically in a way that increases knowledge mastery in a particular field of study. Overall, knowledge management in an organization is one of the techniques to manage knowledge to generate value and increase advantage in competitions. Sitanggang et al (2020) stated that earnings management practices that are often carried out by management can reduce the quality of a company's financial statements, besides this action can harm investors because they will get inappropriate information about the company's financial position.

2.2 Absorptive Capacity

Cohen and Levinthal (1990) introduced the initial concept of absorptive capacity or the ability to absorb knowledge using the term “learning”. The concept consists of three dimensions, namely the ability of the organization in identifying, assimilating, and exploiting knowledge that can produce innovation. Furthermore, Cohen and Levinthal (1990) stated that the learning level and the knowledge of the members of an organization determine the organization’s ability to expand their base of knowledge and to increase their capability to gain more knowledge. The model of absorbing knowledge from Cohen and Levinthal (1990) is presented in Figure 1.

Zahra and George (2002) re-conceptualized Cohen and Levinthal’s (1990) absorptive capacity by introducing an additional component, namely the transformation of knowledge as an organizational capability in developing activities which combines present knowledge with new knowledge and integrated knowledge. Cohen and Levinthal’s concept which has three dimensions was re-conceptualized into four dimensions, namely acquisition, assimilation, transformation, and exploitation.
2.3 Information Technology (IT)

Information Communication Technology (ICT) is a combination of technologies in information, telecommunication, and multimedia. It has encouraged the progress of a nation’s economy. Adv-ances in ICT have generated prospects and challenges in the development of the economy. Wescott (2005) stated that ICT is used by an e-Governments to be more efficient, to facilitate service provision, and to give information access for the people, and to have higher accountability to the community.

2.4 Research Framework

Figure 2 presents the research framework of this case study.

III. Research Methods

In this study, a single case study was conducted, which was a critical test for information technology-based knowledge management theory. Focus Group Discussion (FGD) was conducted to interview a group that emphasized on how the group interact and behave, when the members were given a certain topic to discuss.

3.1 Research Design

Research design is a tool that guides researchers in conducting research. In this research design, there are guidelines or directions in collecting, analyzing, and interpreting or translating the data collected and then making conclusions. The research design began with a focus on problems that arise in the process of sharing and absorbing knowledge. Then, the results of the identification were compiled and related to the problems of IT-based knowledge management in a Government R&D institution, especially through observation, documentation and interviews.
3.2 Research Propositions

This study suggests the following propositions.

1. The process of knowledge-management-based innovation in developing activities of knowledge sharing and absorbing in government R&D institutions.

2. The role of IT innovation to support the process of knowledge management in developing activities of knowledge sharing and absorption.

Table 1 shows the relevant data and how the data are related to the study propositions.

<table>
<thead>
<tr>
<th>No.</th>
<th>Proposition</th>
<th>Relevant Data</th>
<th>Information</th>
</tr>
</thead>
</table>
| 1.  | The knowledge-management-based innovation process in R&D institutions is able to increase the innovative ability | 1. Data on the condition of research functional official researchers (composition, competence/skills, and formal education)  
2. The condition of human resources in adopting changes.  
3. Data on management of knowledge and technology transfer.  
4. The ability to absorb knowledge  
5. The innovation power of functional researchers  
6. Strategic environment (provision of facilities and infrastructure, a workplace, and work relations). | To create competitive advantage for individuals and government R&D institutions. Through increased innovation based on mastery of knowledge in a specific field of study/competitive advantage. |
| 2.  | IT Infrastructure in innovation has a major role in supporting the knowledge management process. | 1. The available facilities and infrastructure support innovation  
2. IT applications in support of innovations that have been and will be planned.  
3. Preparation of the human resources in utilizing IT.  
4. Funding support for the development of IT applications. | The use of IT innovations can simplify and accelerate the process of knowledge sharing and absorbing. |

A case study can use six sources of evidence, namely interviews, documents, archives, observations (direct and participant), and physical devices.

3.3 Analysis Technique

A case study refers to an explanatory study; thus, the analysis technique also leads to an explanatory study, in which plenty of analysis, explanation, and data presentation are carried out. Different perspectives regarding the use of IT-based knowledge management are discernable from the structural officials, staff, and functional researchers. Then best solution to the problem in discussion can be found. Finally, an evidence chain is presented by having analyzed the relationship between the collected data.
IV. Results and Discussion

The global economy in 2017 was predicted to improve at 3.5%. The improvement was primarily encouraged by the developing countries. The growth was estimated at 4.6%, larger than in 2016 (4.3%). Developed countries expected recovery in the economy as a result of pro-economic growth policies issued by the United States and Brexit in Europe. This global economy improvement was hoped to encourage an increase in the world trade volume, so that it would improve better than the global growth (about 4% in 2017) (International Monetary Fund, 2017).

The fund or budget for R&D is shown in R&D spending percentage to the Gross Domestic Product (GDP). The Gross Expenditures on R&D of the United States and the largest Asian countries are presented in Figure 3.

Source: Gross Expenditure on Research & Development (GERD) 2016

Figure 3. Gross Expenditure on Research & Development

From the figure, Indonesia ranks lowest in the research budget at 0.25. Vietnam is second place with 0.20; Thailand is in third place with 0.63; fourth is Malaysia with 1.30; China is fifth place with 2.07; Singapore is sixth with 2.20; the United States is seventh with 2.79; Japan is eighth with 3.28; and South Korea is ninth with 4.23.

Table 2. R&D SWOT Strategy Matrix

<table>
<thead>
<tr>
<th>Strength (S)</th>
<th>Weakness (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Existence of R&amp;D institutions in each ministry and non-ministry.</td>
<td>• The quantity and quality of functional research officers are low</td>
</tr>
<tr>
<td>• The existence of clear main duties and functions</td>
<td>• The institutional structure does not reflect the structure of the R&amp;D institution</td>
</tr>
<tr>
<td>• There is a policy formulation mechanism that must be based on research</td>
<td>• Institutions are predominantly structural</td>
</tr>
<tr>
<td>• Regular mechanism and frequency of discussions.</td>
<td>• Low funding support</td>
</tr>
<tr>
<td></td>
<td>• Low level of welfare compared to responsibilities</td>
</tr>
</tbody>
</table>

4353
<table>
<thead>
<tr>
<th>Opportunity (O)</th>
<th>SO</th>
<th>WO</th>
</tr>
</thead>
</table>
| • There has been an appeal from the President of the Republic of Indonesia to regard the existence of functional researchers and their welfare | • The leadership needs to commit in involving R&D institutions in the policy making process  
• Take advantage of the momentum of the Indonesian president's appeal to increase the attractiveness of the functional researchers (both material and non-material)  
• Implement main tasks and functions and improve career development to realize the dual position | • Increase the quantity by recruiting new functional researchers and staff within the R&D institution.  
• Increase the capacity and empowerment of the functional researchers  
• Take advantage of the momentum of the president's support to improve the welfare of the functional researchers  
• Adding the facilities and infrastructure needed by the functional researchers, including the information network and its equipment. |
| • There has been a proposal to increase the allowance for the functional researchers | | |
| • There has been sufficiently clear laws and regulations for the career development of the functional researchers | | |
| • The existence of laws and regulations governing multiple positions for functional researchers | | |

<table>
<thead>
<tr>
<th>Threat (T)</th>
<th>ST</th>
<th>WT</th>
</tr>
</thead>
</table>
| • There is a negative image of the R&D agency as a place of disposal or milestone for structural officials  
• No optimal realization of career development  
• R&D results are underutilized by the users  
• Research and study activities carried out by the technical unit (the users themselves) | • Emulate the negative image of R&D institutions by implementing clear main tasks and functions  
• Market R&D results to user units  
• Provide services for the research required by users at the time needed  
• Increase partnerships with user units in improving the quality of research results | • Change the structure of the R&D institutions into functional-based  
• Set special requirements for structural officials in R&D institutions (eliminating the image of the place of disposal)  
• Increase partnerships with user units in increasing respect for the functional researchers as resource persons and/or experts. |

and workloads of the staff
• Functional researchers have not been considered as an intellectual sources
• Lack of facilities, infrastructure, and information for the functional researchers
• Rewards for motivation are low
Table 3. Weighting of Internal and External Aspects

<table>
<thead>
<tr>
<th>Internal Aspect</th>
<th>Value</th>
<th>Score</th>
<th>Existing Performance (SW)</th>
<th>Weight</th>
<th>Highest Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty of the existence of R&amp;D with clear tasks and functions</td>
<td>Strong</td>
<td>3</td>
<td>+</td>
<td>20 %</td>
<td>+0.6</td>
</tr>
<tr>
<td>Policy formulation mechanism based on the results of R&amp;D.</td>
<td>Medium</td>
<td>2</td>
<td>+</td>
<td>20 %</td>
<td>+0.4</td>
</tr>
<tr>
<td>Quality and quantity are non-optimal</td>
<td>Strong</td>
<td>3</td>
<td>+</td>
<td>20 %</td>
<td>+0.6</td>
</tr>
<tr>
<td>Institutional structure, welfare and rewards are not appropriate</td>
<td>Weak</td>
<td>1</td>
<td>-</td>
<td>20 %</td>
<td>-0.2</td>
</tr>
<tr>
<td>Funding for R&amp;D activities is low</td>
<td>Medium</td>
<td>2</td>
<td>-</td>
<td>10 %</td>
<td>-0.2</td>
</tr>
<tr>
<td>Inadequate facilities and infrastructure</td>
<td>Medium</td>
<td>2</td>
<td>-</td>
<td>10 %</td>
<td>-0.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Knowledge Management SWOT Strategy Matrix

<table>
<thead>
<tr>
<th>Strength (S)</th>
<th>Weakness (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The existence of functional researcher officials of various levels in every government R&amp;D institution</td>
<td>• Lack of <em>utama</em> and <em>ahli</em> researchers as well as research professors in government R&amp;D agencies</td>
</tr>
<tr>
<td>• Researchers are used to utilizing IT advances</td>
<td>• Low formal education and lack of skills to absorb knowledge</td>
</tr>
<tr>
<td>• The existence of communication forums and meetings facilities for functional researchers, resource persons, and users</td>
<td>• Lack of hardware to share and absorb knowledge.</td>
</tr>
<tr>
<td>• Easily accessible sources of knowledge</td>
<td>• Inadequate library support.</td>
</tr>
<tr>
<td>Opportunity (O)</td>
<td>SO</td>
</tr>
<tr>
<td>• The recruitment of civil servant candidates for functional research positions</td>
<td>• Take advantage of the civil servants recruitment to grow a community for sharing and absorbing knowledge.</td>
</tr>
<tr>
<td>• The benefits of sharing and absorbing knowledge in carrying out research activities are felt</td>
<td>• Maintain the habit of sharing and absorbing knowledge through various facilities, both direct and indirect</td>
</tr>
<tr>
<td>• Internet facilities are available in every work room and meeting room, although the hardware is not yet provided adequately</td>
<td>• Increase thinking power through formal and informal education</td>
</tr>
<tr>
<td>• There are opportunities to attend formal and non-formal education</td>
<td>WO</td>
</tr>
<tr>
<td></td>
<td>• Improve the quality of functional research officials through formal education, especially doctorate degree</td>
</tr>
<tr>
<td></td>
<td>• Provide facilities and conveniences to increase and maintain the credit score of functional researchers.</td>
</tr>
<tr>
<td></td>
<td>• Utilize various sources of knowledge for the knowledge sharing and absorbing process.</td>
</tr>
<tr>
<td></td>
<td>• Maintain a culture of reading, listening, writing, and speaking.</td>
</tr>
</tbody>
</table>
### Threat (T)
- There is a chance for transfer outside the R&D agency.
- Unfavorable image of R & D institutions.
- The absence of a proper reward system.

### TS
- Eliminating functional officer transfers, especially for functional officials of levels *pertama* and *muda*.
- Eliminate the negative image of R&D institutions by holding quality meeting forums with good resource persons.
- Implementing a reward system not just a certificate.

### TW
- Provide facilities for formal education.
- There is a prohibition on the transfer of functional first and young researchers.
- Appreciation to the functional researchers for being a resource or expert.

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#### Table 5. Weighting of Internal and External Aspects

<table>
<thead>
<tr>
<th>Internal Aspect</th>
<th>Value</th>
<th>Score</th>
<th>Existing Performance (SW)</th>
<th>Weight</th>
<th>Highest Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>The existence of functional researchers from various levels</td>
<td>Strong</td>
<td>3</td>
<td>+</td>
<td>20 %</td>
<td>+0.60</td>
</tr>
<tr>
<td>It is customary for the functional researchers to take advantage of the progress of information technology</td>
<td>Medium</td>
<td>2</td>
<td>+</td>
<td>15 %</td>
<td>+0.30</td>
</tr>
<tr>
<td>The availability of facilities for internal and external meeting forums and other sources</td>
<td>Strong</td>
<td>3</td>
<td>+</td>
<td>20 %</td>
<td>+0.60</td>
</tr>
<tr>
<td>Formal education and the ability to share and absorb knowledge are inadequate</td>
<td>Medium</td>
<td>2</td>
<td>-</td>
<td>20 %</td>
<td>-0.40</td>
</tr>
<tr>
<td>Kurangnya professor rset atau penet utama Lack of research professor or utama researcher</td>
<td>Strong</td>
<td>3</td>
<td>-</td>
<td>15 %</td>
<td>-0.30</td>
</tr>
<tr>
<td>Library facilities and infrastructure</td>
<td>Medium</td>
<td>2</td>
<td>-</td>
<td>10 %</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

**Total 0.60**

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### 4.1 Open-Ended Interview
In this case study, interviews were conducted with several key informants. The descriptions of the key informants who participated in this study are based on four categories of functional researchers who are in the Ministry of Manpower and Transmigration and outside the Ministry as well as its structural officials (as users).

### 4.2 Analyzing Case Study Data
In case study research, there are four data analysis technique that are often used, namely pattern modeling, explanation building, time series analysis, and logic model programs. The four techniques can be used in a single or multiple case study strategies.
4.3 Data Analysis Technique

The data analysis consists of descriptions of data test, categorization, tabulation, or evidence recombination to refer to the initial proposition of the research:
1. Based on theoretical propositions.
2. Develop a description of the case.

**Proposition 1: Knowledge-management-based innovation process in R&D institution can improve innovation ability. Perception of knowledge management process in government R&D institution**

Knowledge-management-based innovation process in government R&D institution began with the knowledge that the institution has which is identified from the conditions of the functional researcher officials, namely their educational level, official level, and experience. Interviews with the key informants showed that the functional researchers in government R&D institutions were relatively unable to compete with foreign researchers. The number of researchers who were at professor level is very low, even though main researchers are available.

The results of the study used for mapping, or the pre-case study, showed that the informants generally agreed that the knowledge management process in R&D institutions can increase innovative ability through a process of various abilities in exploring innovation skills. The knowledge management described in this study is in line with the key informants’ opinion. This indicated conformity with the point of view on knowledge management process in increasing the functional researchers’ innovation.

The attitude of knowledge sharing categorized as very good. Functional researchers conducted many knowledge-sharing activities and shared expertise, ideas, and conceptual information among researchers and became resource persons in and out of the R&D institutions. This condition had an impact on functional levels but did not have an impact on career structural positions (for concurrent positions).

The different conditions of the R&D environment, especially of the frequency of meetings held in the work environment of the technical unit or directorate general, affected this knowledge sharing attitude. With a high frequency, it could produce various innovations resulting from the research activities carried out and many recommendations that have been submitted to technical units; however, not all of the recommendations produced have been used as policy materials.

The informants’ responses showed support to the view that knowledge management can increase innovation. As meeting forums in and out of the R&D institutions were conducted more frequently, they could obtain ideas and manifest them in recommendations from research results. Some of the informant responses indicated a high category, yet the researchers had a tendency to be reluctant in distributing ideas outside the research team which are shown with a low category. On the other hand, the reluctance was lesser at formal meetings, which is in the high category.

**Proposition 2: IT innovation plays a major role to support the knowledge management process**

The IT facilities and infrastructure in R&D available were internet channels, although and some had not installed an intranet channels. With those facilities, the functional research officials were able to obtain online knowledge that they needed, so that even though the computers available were still limited, many functional researchers had their own laptops. The condition was indicated by a high category value for obtaining various sources of data and information online. In another case, the advances in the
technology of data and information storage were generally not used by the functional researchers as it was in the medium category.

The technological advances in communicating between or fellow functional researchers at R&D institutions showed a moderate category. This was indicated by the frequent direct communication conducted by the functional researchers, such as regular meetings of research teams, routine meetings of R&D Communication Forum (Forum Komunikasi Kelitbangan/FKK) and Regional R&D Communication Forum (Forum Komunikasi Penelitian dan Pengembangan Daerah/FKPPD), regular meetings between functional researchers, and other meetings.

The informant responses also showed answers regarding IT infrastructure which have a major role in the knowledge management process. The available IT systems were still limited to the internet and intranet networks. The systems were used to obtain explicit knowledge. However, storage facilities of the research activity materials had not been used effectively. To effectively use this information system, it is necessary to consider a container which could handle the explicit knowledge storage.

The knowledge sharing and absorbing is related to the communication and collaboration using the IT advances. Nearly all government R&D institution had an information system via the internet. However, it had not been maximally utilized as well as the intranet. By utilizing these technological advances, there will be no more obstacles in obtaining new knowledge. Although the computers provided are lacking, functional researchers have had laptops, so laptops were the primary need for functional researchers.

To effectively and efficiently use IT, online-based training learning tools are still necessary, although some functional researchers already have e-mail addresses for communicating. This condition showed that the current progress of IT has been relied on in sharing knowledge, which is indicated by many functional researchers who used IT. From the data collection and information from interviews, FGDs, questionnaires, and discussions, descriptions are presented based on the propositions.

**Proposition 1: Knowledge-Management-Based Innovation in Developing Knowledge Sharing and Absorbing in R&D Institutions**

<table>
<thead>
<tr>
<th>No</th>
<th>Data</th>
<th>Measurement</th>
<th>Condition</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Data on the condition of functional researchers (composition, competence / skills and formal education)</td>
<td>Competence composition</td>
<td>It was sufficient; however, R&amp;D institutions in the ministry need to recruit new civil servant candidates. Seen from the scientific discipline, the teams were solid but needs improvement, especially for researchers with doctoral education.</td>
<td>R&amp;D institutions have implemented knowledge management with an indication of the researcher's ability to provide the knowledge that they have and the ability to gather knowledge from other researchers, structural officials, or other sources. With various stages of discussion, various ideas from internal and external</td>
</tr>
<tr>
<td>2.</td>
<td>The condition of human resources in adopting any changes that occur</td>
<td>Interest and attitude in sharing activities</td>
<td>High reluctance to share knowledge based on attitudes towards knowledge sharing</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Description of Proposition 1
The availability of various references and researchers' experiences could be obtained from internal and external meeting forums. Transfer of knowledge could be obtained from internal and external team discussions could absorb knowledge and provide mutual input.

R&D institutions have implemented knowledge management with an indication of the researcher's ability to provide the knowledge they have and the ability to gather knowledge from other researchers, structural officials, or other sources. With various stages of discussion, various ideas or ideas from internal and external teams can be obtained in solving a problem through a research recommendation (creating a competitive advantage for individuals and government R&D institutions).

**Proposition 2: Innovation Plays A Major Role in Supporting the Knowledge Management Process**

<table>
<thead>
<tr>
<th>No</th>
<th>Data</th>
<th>Measurement</th>
<th>Condition</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Facilities and infrastructure available and provided</td>
<td>Availability of internet and hardware facilities (computers and laptops) anywhere and anytime</td>
<td>Internet was available both in the work room and in the meeting room, but the hardware (computer or laptop) was not available. Currently, researchers can</td>
<td>The researchers have felt the need of using IT to increase performance and provide added value or competitive advantage. Therefore, online-based training</td>
</tr>
</tbody>
</table>
2. Information technology applications that have been and will be planned

| Establishment of research results and online discussions as well as online journals | The Internet is a necessity but has not yet been used to disseminate research recommendations and studies. |
| Researchers’ mastery of various computer software in conducting research | Almost all researchers were able to use computers but not all softwares, such as SPSS, etc. |
| Procurement of computers and laptops annually | The procurement of hardware devices increases every year. However, outdated hardware had not been retracted, so that they seemed to be adequate. There was also a policy that made an impression that structural officials were given more facilities than researchers. |

Researchers had felt that they needed to use IT to improve performance and provide added value or competitive advantage. Therefore, online-based training learning tools are still needed. Although IT had been used, regular forums for regular meetings were still needed.

V. Conclusion

The following points are the conclusions and suggestions based on the study results.

1. The perception of knowledge-management-based innovation process in R&D institutions to increase innovative ability:
   a. The knowledge-management-based innovation process was found in R&D institutions. The process started with the innovation of policies from government R&D institutions in forming research teams. The composition of the research team supported knowledge sharing and absorbing activities. The process occurred in the preparation of proposals, designs, instruments, data collection, data processing, data analysis, and the dissemination.
   b. The environmental conditions of R&D institutions with the quantity and quality of meeting forums held are inseparable from innovation based on knowledge management. This will increase the research result quality and the bargaining position of
functional researchers. Innovations obtained from the knowledge management process are indicated to be in the high category.

c. The implementation of knowledge-management-based innovation was found in government R&D institutions as an effort to increase the functional researchers, competence in producing recommendations; however, their product were not taken into consideration policy-making. As a result, the user (the technical directorate general or the technical unit) carried out their own research activities which are actually the main task and function of R&D. This condition is also used to avoid harsh constructive criticism and is categorized in the high category.

2. Description of IT Innovations which have a major role in supporting the knowledge management process:

   a. Advances in IT have not been maximally utilized. This was due to the lack of available standard computers, even though the functional researchers had already relied on the current technological advances in sharing knowledge. The use of internet and the infrastructure to gain explicit knowledge is in the high category.

   b. The internet had been available; however, supporting facilities and infrastructure had not been provided.

References


