

Technology Innovation Management in Indonesia Construction

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Key words: technology management, innovation-based project, incubation, partnering, science and technology industrialization

SUMMARY

Indonesia has problem with its world competitiveness especially in technology innovation, including in construction; this study explores the technology and innovation management alternatives including forms of innovation-based projects, incubation, and partnering approach; it also in-depth studies the existing roles of government, private, and university in making the industrialization of construction technology innovation possible. Finally a recommendation for industrialization of construction technology innovation in Indonesia up to 2022 and beyond is made by looking the readiness of each parties in running each roles.

RINGKASAN

Indonesia mempunyai masalah dengan tingkat kesiapan persaingan dunia, terutama dalam inovasi teknologi, termasuk dalam konstruksi. Kajian ini mengeksplor berbagai alternatif manajemen teknologi dan inovasi termasuk bentuk dari penerapan proyek yang berbasis inovasi, inkubasi, dan kemitraan; juga peran eksisting dari pemerintah, swasta, dan perguruan tinggi dalam hal industrialisasi inovasi teknologi konstruksi dikaji mendalam. Akhirnya suatu skema industrialisasi inovasi teknologi konstruksi sampai dengan tahun 2022 dan seterusnya di rekomendasikan dengan melihat peran dan kesiapan setiap pihak terkait di Indonesia.

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1. INTRODUCTION

Indonesia has problem with its world competitiveness especially in technology innovation; based on The Global Competitiveness report on "Indicators of Technology-Based Competitiveness" by National Science Foundation-USA (NSF, 2005), Indonesia ranked far under Asean countries, China, India, and Korea. This should also describe the condition of construction technology innovation.

On the other hand, many resources are spent for decades by Ministry of Public Work to conduct researches and develop technology innovation through its research units in sectors of settlements, road and bridge, and water resources, and yet no progress on technology innovation implementation in the industry. An Act (UUJK 18/1999) concerning Construction Services has been effective since 1999 and followed with government regulations, with a mandate to an independent agency namely Agency for Construction Services Development (Lembaga Pengembangan Jasa Konstruksi- LPJK) to conduct technology innovation development, but no progress made since then. A special unit (Agency for Construction and its Human Resources Improvement- BPKSDM) for construction technology innovation development is also founded in Ministry of Public Work since 2000s to facilitate industrialization process between the ministry's research units and industry as a respond to the act, but still no progress is made.

This paper presents results of a study by Mochtar et. al. (2007) that explores the technology and innovation management alternatives including forms of innovation-based projects, incubation, and partnering approaches; it also in-depth studies the existing roles of government, private, and university in making the industrialization of construction technology innovation possible. Finally a recommendation for industrialization of construction technology innovation in Indonesia up to 2020s and beyond is made by looking the readiness of each parties in running each roles.

2. INDUSTRIALIZATION OF CONSTRUCTION TECHNOLOGY INNOVATION

American Heritage Dictionary (2000) defines technology as the application of science for the purposes of the commercial industry. Thus the technology is not on the substance in the vacuum created, but it is created due to the values created by the community, in this case the industrial community. Science and technology (S&T) development and industrialization in this case not only emerged from research laboratories, but are determined by the political process. Thus, innovation or development of S&T institution by the government is not something that value-free, but requires a political decision in accordance with the targets set by the government in enhancing the welfare of the people.

In Figure 1 it is illustrated schematically a structure of system of S&T industrialization. It shows two interacted systems, one represents developing countries while the other represents

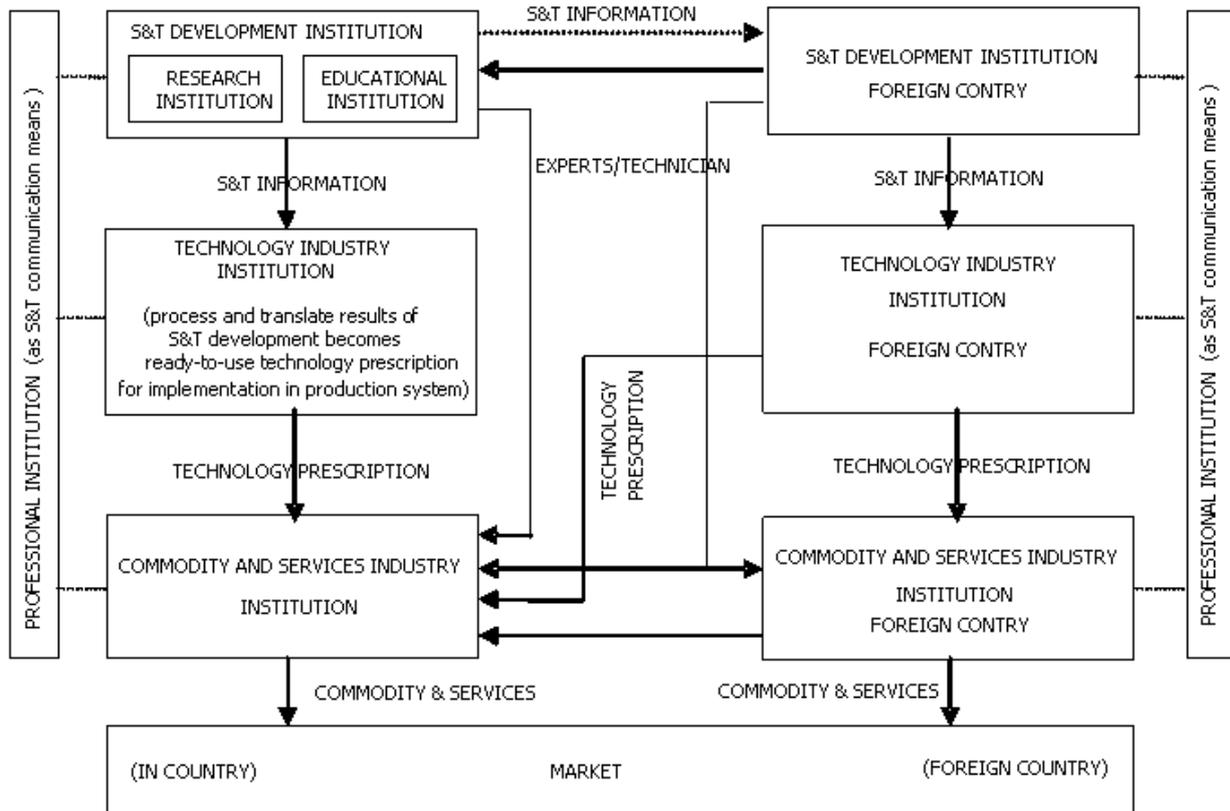


Figure 1. S&T Industrialization System (in Mochtar et.al., 2007)

developed countries. The developing countries receive and the developed countries supply technologies. The developed countries have dominant and decisive role. The developing countries have only one choice, that is to manage their S&T industrialization development so that in the long run they minimize and if possible erase the dependent condition.

Like others, if technology is to be well developed and implemented, the technology and innovation management is a pre-requisite to be applied comprehensively in a country and even a region, so that technology innovation is created, and its risky implementation should be supported by related parties for successful results and to minimize the risks.

In the case of the pattern, there are three alternative approaches: "the application of innovation-based projects," "technology-based business incubation," and "partnership".

One of the ways that successful management of technology applied in the industry is "the application of innovation-based projects" such as a model developed by Office of Engineering and Construction Management, U.S. Department of Energy (Figure 2). It begins from the project early stage (pre-planning) with full commitment developed and all risks anticipation to

implement a new technology or innovation up to the process of design and construction. In this way, industrialization of S&T (new/innovation) process is more secure. Once it is successful, other projects will soon apply the innovation, and even the technology will become a bone of many parties to apply as well.

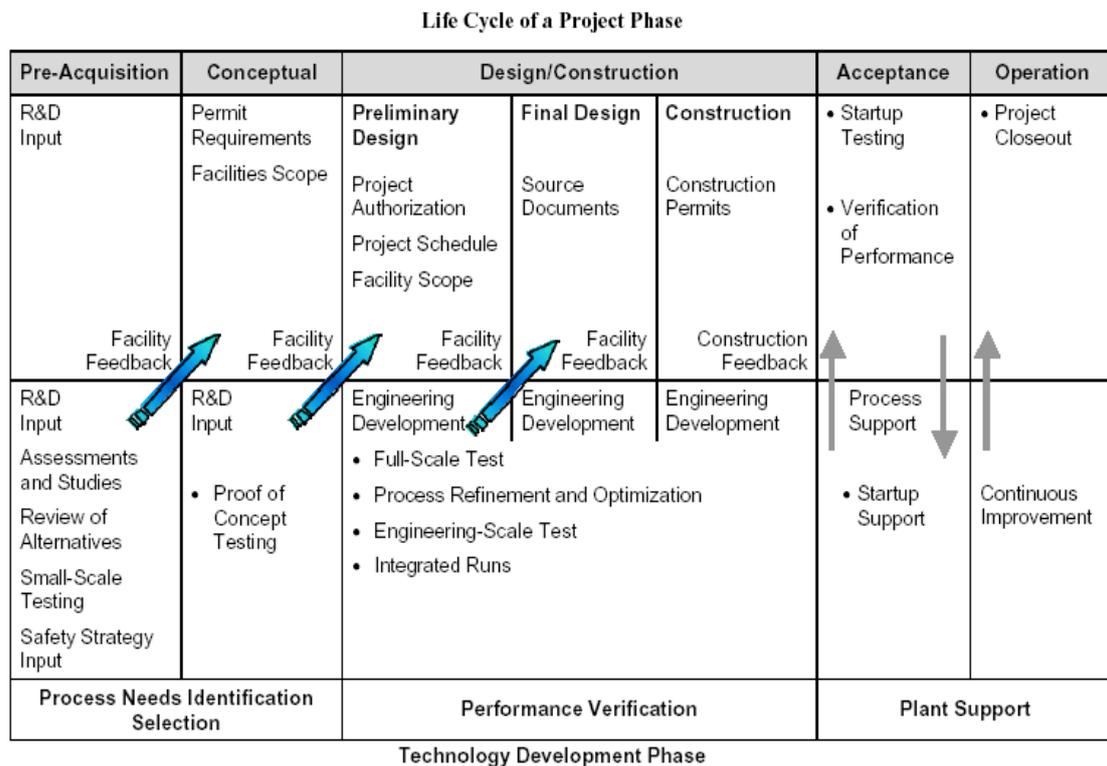


Figure 2. Innovation-based Project (in Mochtar et.al., 2007)

The second alternative is "technology-based business incubation". It encourages the construction business to increase the competitiveness by implementing technology innovation; it also supports on factors determines the success of other businesses, such as capital, skills/capabilities of human resources, legal aspects, and even access to the market.

The last alternative is "partnership". It is collaboration and synergy of all stakeholders in creating and implementing a technology innovation, so that the process of industrialization is a "win-win solution", because all parties benefit from this activity, so that the S&T industrialization in construction can take place with effective and efficient.;

From the results of the survey in the study (Mochtar et.al., 2007) in some R&D Centers in various government institutions, universities, and companies in Indonesia, it is revealed that the most often effort in the industrialization of construction technology innovation is to provide guidance of innovation transfer to the target users, especially in terms of management, human resources, and equipment improvement. The most common problem found in the effort is problem of funding and formal function of institutions that have not been emphasized on industrialization of construction technology innovation efforts. Hence the

solution proposed that is most frequently cited is improvement of institution function beside the improvement of resources and research equipment.

Most countries (Canada, U.S., Ireland, UK) operate a research and industrialization of research results in one program, and in one organization, with the keyword "collaborative", between research institutions (universities, etc.), the government and industry. The most critical first step is "the needs of research" and "research priorities" agreed upon by all parties for developing the program of short, medium, and long term programs to answer the needs and the priorities. Funds needed are supported and tailored based on the interests of each to the topic of research; the most concerned will automatically support most of the funds.

What is also important to consider is the culture of a country where industrialization program will be executed, such as the paternalistic culture in Japan, the role of leaders of the company (formal and informal) in the decision making to use new technology and innovation is very critical; its handling is necessary to make Industrialization of construction technology innovation successful.

3. INDUSTRIALIZATION OF CONSTRUCTION TECHNOLOGY INNOVATION IN INDONESIA

The implementation of industrialization of construction technology innovation in Indonesia still has not been brisk. LPJK which is a collaborative organization focuses only on the program of construction expert certification policies and practices, and not on programs of industrialization of research results. Universities (faculty/academic researchers) are still more focusing on basic research, not on applied research; researchers work individually, and they do not collaborate with industry with the orientation only on their academic position promotion. Industries, through company associations, do not prioritize research and application of its results yet. Individually, some of them have been successful to find and implement new technology/methods/process in the field through their R&D Centers, because the research problem is usually the problems faced in the field or in the projects that are currently running or completed. Government Agency of Technology Development and Implementation (BPPT) through Business Technology Center (BTC) and the Education Ministry has put a variety of collaborative research program, but the results in the field of construction has not been significant. Ministry of Public Work R&D Centers (road and bridges, settlements, water resources) have produced a lot of new technology, but has not been so successful in its industrialization efforts because of the funds due to the limited authority in their formal functions. Individually, there are few success, but in an integrated and more broadly, it seems efforts on S&T innovation industrialization in Indonesia has not yet appeared results.

In the case of industrialization of construction technology innovation policy in Indonesian Ministry of Public Work, it should not only aim to support the development of infrastructure in the environment of the Ministry itself, but it must be developed to the direction of appropriate and efficient technology in accordance with market demand in the construction industry. Development of construction technology innovation should not focus only on technological innovation, but also on aspects of its management and marketing. Management in this case is the right management of research activities and human resources, which are not

hierarchical and bureaucratic, but more in form of matrix of various disciplinary expertise of human resources because the substance of the research is a "Joint-Program" which will involve a variety of disciplines. As a business activity, industrialization of construction technology innovation must consider market demand and networking/partnerships with other research institutions, both in the environment of the Ministries and private. This can avoid the duplication in research. R&D institutions also need to take inventory needs of construction technology innovation in the industry, such as the conduct of intensive interaction with stakeholders, consultants, contractors and manufacturers of building materials and property developers as the end-users. Socialization and marketing of construction technology innovation products should be conducted professionally (interesting and easily understood) and continuing as of the ads commercial products consumer. Ministry of Public Work should not only be known as the Ministry of managing many construction projects, but also as conducting many R&D activities that resulting construction technology innovations that make a reliable in supporting economic development and national human resources.

In terms of institutional strengthening of industrialization of construction technology innovation, it can be two alternative institutional arrangements, either government institution (for example, here is the Ministry of Public Work BPKSDM or BPPT), or a collaborative institutions of all stakeholders in the construction industry (such as in this case is LPJK). These institutions in the regulations and legislation have led to the formal function of industrialization of construction technology innovation, especially the construction services sector.

In the case of the pattern, the two alternative institutional arrangements mentioned above can apply alternative or combination of alternatives of approaches: either "the application of innovation-based projects," "technology-based business incubation," or "partnership".

BPKSDM as one unit in the Ministry of Public Works has a strategic role through the units underneath, which has a basic role of the construction services in Indonesia. Center of Development of Construction Techniques (Pusbikte), as one of the units, has a strategic role in the education, training, development and construction techniques in construction services in Indonesia. But from a study, only the function of education and training has grown rapidly, in cooperation with the universities of education degree and non-degree field of construction services. Its Section, Field Engineering Construction, that should handle the development of technical innovation and technology for the construction industry has not grown both in terms of research and development especially in the industrialization of construction technology innovation efforts. Main obstacle is the budget, quality of human resources, and networks that are still limited. This is certainly the consequence of its present formal Duties, Function and Auth that does not support it.

A Focus Group Discussion (FGD) conducted in this study (Mochtar et. al., 2007) attended by various stakeholders element of S&T industrialization of construction services sector (such as the Indonesian Ministry of Industry, Ministry of Transportation, BPPT, R&D Center of Ministry of Public Work (Settlement, Roads and Bridges), and Pusbikte) confirms the findings above:

- Almost all of the parties confirm that the process of R&D is still more oriented to running programs of each institution only, and not oriented to the results of the applied, so that the industrialization process of R&D result is not running.

- R&D Center of Ministry of Public Work affirm that its result is still very limited, and the industrialization is limited on projects in the Ministry, and it is also still very few. It is expected of increase in the future with the improvement of system and resources of industrialization of construction technology innovation.
- BTK Pusbiktekk also stressed and confirmed that the programs that run mostly in the areas of education, whereas in the case of industrialization of construction technology innovation programs are still limited to cooperation with universities that have a technology innovation that need to be socialized.
- In terms of its researchers themselves, representatives from the Ministry of Transportation researchers expect the profession of researchers find improvements both in terms of status and respect. Consequently, it is proposed to develop an organization of researchers union for better program of improvement of researchers status and respect..
- Activities of Business Technology Center (BTC) of BPPT are confirmed by its representative in the discussion, with the additional information that there will be a national program under the coordination of the Ministry of Finance in the near future, namely the National Center for Innovation, with the aim of stimulating the creation and application of innovative technology industry nationwide, including in the sector of construction services. BTC is one of the components in the program.

Based on the above findings and discussion, the proposed direction of the development of structured action of industrialization of construction technology innovation in the future is as follows (Mochtar et.al., 2007):

- From the analysis of the root of the problem, it is revealed that the development of a “Roadmap” of construction services sector is needed so that the direction of development, including its industrialization of construction technology innovation, can be planned well, including institutions that address them. Preparation of the Roadmap is highly recommended to be implemented as soon as possible in the future.
- Industrialization of construction technology innovation is a process of technology management in order to translate the product of technology innovation (new technology) into a prescription that can be used directly. Consequently, an institution is needed to perform the industrialization of construction technology innovation which places itself as a substantial central point between producers and users of technology of construction services. From the results of the study it is identified that BPKSDM and LPJK institutions that are considered "eligible" (formal function's perspective, the nature of the organization, mandate of Act 18/1999 on Construction Services, etc.) institution to play the role of industrialization of construction technology innovation in construction;
- The industrialization of construction technology innovation currently has not run well, and requires special handling and long-term programs. Development should be gradually adjusted to the conditions and readiness of institutional providers. In this regard, the development phase can be divided into three (3) phases, namely: (i) Phase I (preparatory phase; 2010-2012); (ii) Phase II (stage of consolidation / The; 2012-2017); and (iii) Phase III (stage of development; 2017-2022).
- In accordance with the readiness of the institution that was detected in a certain level of industrialization of construction technology innovation has run, the institutions that

deal with recommendations for Phase I and Phase II is BPKSDM, while Phase III is LPJK.

- In line with the above proposal, the recommended strategic plan, program and activities of the institutions is analyzed and compiled. In principle, human resources (especially the preparation of researchers), research facilities, the collaboration of all stakeholders, and ultimately structured efforts of industrialization of construction technology innovation such as technology management, partnership, and incubation to be very strategic.
- In the near future, it is recommended that BPKSDM to reinforce its policy, formal function, strategic plan expansion, programs and activities related in aspects of industrialization of construction technology innovation, so that in the year of 2010 it is ready to perform the function as a short-term action plan for the year 2012.
- For the period of Phase II, increased capacity of Institution Organizer of industrialization of construction technology innovation on BPKSDM, continued expansion through consolidated system of coordination with stakeholders, and the start of industrialization through the application of the model approach, including project-based approach, partnership, business incubation is to be implemented;
- Finally, for the long term, LPJK whose formal functions in Act No. 18/1999 among others is industrialization of construction technology innovation in construction should be ready in 2017 after taking over, expand, and improve the task from BPKSDM.
- It is expected that these recommendations can be realized in accordance its stages and proposed strategic plan, programs and activities, so that Indonesia can hope to increase competitiveness in the field of construction services through the application of innovation and the best S&T can become a reality.

4. CONCLUSION

From this study, the importance of technology management and innovation is **explored**, **that** it should be conducted comprehensively in the country and even the regional, so that new technology or innovation continues created, while the application in the industry that is highly risky must be specially supported. Some of the technology management approach that was successfully applied in the industry are “Strategy-based project”, “partnership”, and “business incubation”.

While the results of a survey on the main actors in the research revealed that most efforts that frequently used in the industrialization of construction technology innovation in construction service is to provide aid of the transfer of construction technology innovation to target users, especially in terms of innovation management, human resources, and tools (equipment). The most common problems found in the efforts are funds and institutions that have not been of formal functions emphasized industrialization of construction technology innovation efforts itself. Therefore the proposals that most often cited is the development of institutional capacity, including improvements to the resources and research equipment/laboratory itself.

In developed countries, the keyword is the "collaborative", namely the cooperation between research institutions (universities, etc.), the government and industry to agree on "the needs of research and research priorities" for the short, medium, and long terms programs. Research funding sources are tailored to the interests of each parties to the topic of research; the most

concerned will automatically support most of the funds. Furthermore, the culture of a country where the industrialization program will be run especially in the decision process to use new technology and innovation is very critical to make industrialization of construction technology innovation successful. Technology-based business incubator is also a model made in the U.S., especially developed in universities in encouraging efforts on S&T industrialization, including in construction services.

Implementation in Indonesia still has not been brisk. LPJK, universities, companies, government institutions (BPPT, BPKSDM/Pusbikte) do not touch the efforts on industrialization of research results.

To overcome this situation, a recommendation of the direction of the development of structured action of industrialization of innovation in the of field construction services in the future is developed in this study based on current readiness of each institution to play the role of industrialization of innovation in construction technology, including Ministry of Public Work and LPJK. LPJK is to be the final institution for that strategic role in the long term for the year of 2017 and beyond. The final result should be the improvement of Indonesia world competitiveness in technology innovation.

Indeed, this paper is very specific for Indonesia, one of developing countries. Similar developing countries, such as Vietnam, Cambodia, Nigeria, etc. may have similar construction technology innovation problems, and thus may benefit from findings and conclusions of this article to overcome their problems.

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BIOGRAPHICAL NOTES

- Experienced in teaching at universities (home based on Indonesia Institute of Technology- ITI), researching, and consulting (design, supervision and management) in construction areas
- Around 30 publications in various international and national journals and conferences on productivity improvement, pricing strategies, marketing expenditures, production management, and green construction issues.
- Member of National Construction Development Board (LPJKN), Indonesia Construction Experts Association (ATAKI), Indonesia Consultant Experts Societies (INTAKINDO)

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