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An Innovation Value Chain in Project Based Companies: A Study of Indonesian Contractors

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Abstract: Innovation is one of the key success factors of contractors to achieve sustainable business. However, studies about innovation cannot be generalized to all business sectors; therefore, a special study about innovation that focuses on contractors in Indonesia is needed. This study is aimed to explore the process of innovation development in contractors, based on an innovation value chain (IVC) approach. A qualitative analysis of the data collected from in depth interviews with top managers of big contractors in Indonesia has been carried out to identify innovations and their sources. This study found that innovations are generated mainly by project teams because those teams are involved directly in projects' activities. The next phase is to test the idea of innovation in the selected projects in order to assess whether the innovation works well or not. Finally, the selected innovations is suggested to be set as a company standard and will be implemented in subsequent projects.

Keywords: Innovation value chain; contractors; Indonesia.

Introduction

Innovation has been defined in various ways. According to Frenz and Oughton [1] in the Report for the Department of Trade and Industry and the Office of the Deputy Prime Minister of the United Kingdom, innovation can be defined as *'new ideas exploited for commercial purposes'*. In this definition new ideas have been described in many forms, more than just new products. Innovation also covers new processes, new markets, new organizational techniques, as well as new sources of supply. Later on, this definition has been adopted by Wilson [2] in Working Paper 19 of GLA Economics. In this paper, this definition has been expanded by considering how innovation allows productivity improvement that leads to cost reduction and so increased profits. Therefore, innovation is considered as an important key in the business process. According to the manual, innovative activity must be developmental, commercial, and financial activity that is carried out by the company [3].

All of these definitions provided the general meaning of innovation that is applicable to all business sectors. However Hansen and Birkinshaw [4] mentioned that companies cannot immediately adopt the most recent or available innovative model to solve their problems. Instead, the companies need to explore their existing processes to create innovation that is influenced by their particular challenges, and then to identify innovative ways to overcome these particular challenges. In order to address this issue, Hansen and Birkinshaw [4] have proposed the idea of an Innovation Value Chain (IVC) that views the creation of innovation as a sequential process.

Contractors are considered as companies that run their businesses in many unique ways [5-7]. The uniqueness of contractors' businesses is because contractors are project based firms (PBFs) that, as the name suggests, run those businesses based on projects. As PBFs, contractors need to manage both their business, which involves repetitive activities, and projects that involve unique and temporary activities [5]. A project is an end product that is unique in several aspects, such as: a) location, b) appearance and c) function. In order to meet a client's demands, a project may have a design, and require a construction method, that is very different from other projects the contractor has dealt with [8-10]. Another challenge contractors have is dealing with a client who is actively involved in, and paying for, the construction process, with all that such a situation implies [11].

Considering the challenges of a particular company, such as a contractor, and the specific conditions of a country such as Indonesia that will influence the ways to generate innovation, this study explores the process of 'innovation development' in Indonesian contractors. Therefore, the study will be conducted based on the experiences of contractors in Indonesia as they have attempted to develop various innovations.

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The Innovation Value Chain (IVC)

Hansen and Birkinshaw [4] mentioned that all companies have similar problems when they want to come up with new and better ideas for products, services and lines of business. Yet, the challenges to create innovation also differ from company to company; therefore, taking the easy option of adopting common advice for creating innovation can be a futile, or even perilous step. Companies searching for innovation need to consider their existing conditions that are unique unto themselves. In order to overcome this obstacle, a comprehensive framework for creating innovation has been proposed. This framework was named IVC and it can be adopted by any company in general. IVC contains integrative processes designed to transform ideas of innovation into outputs.

IVC consist of three sequential phases, starting from: i) the generation of innovation ideas, followed by ii) converting innovative idea into practice, and finally iii) the innovation that has been developed must be disseminated to relevant parts of the contractor's organization. Furthermore, in order to carry out these three phases, six critical tasks must be implemented. Those six critical tasks are: a) internal sourcing, b) cross-unit sourcing, c) external sourcing, d) idea selection, e) innovation development and f) innovation dissemination. Each critical task, as well as each stage, in the IVC is linked in the chain. The framework of the IVC that consists of three stages and six critical tasks is presented in Figure 1.

The idea of an IVC was also proposed by Roper et al. [12]. The proposed IVC involves an internal feedback loop line and external relationships in order to utilize several types of knowledge from various sources for generating innovation. The innovation in this framework is directed to produce new and innovative products and processes, as well as to create added value to existing products and processes. The proposed IVC consists of three main stages, starting from: i) the company's efforts to collect various types of knowledge from various sources to develop innovation, followed by: ii) transforming the knowledge into innovation and finally: iii) exploiting the innovation.

The IVC framework of Hansen and Birkinshaw [4] that has been explained in the previous section was adopted by Ozorhon et al. [13] to propose a framework of innovation diffusion in construction. The main objective of this paper is to propose the process for transforming innovation from knowledge and then to diffuse innovation into several processes employed by contractors. In this study, contractors are considered as project-based firms (PBFs) that have patterns of innovation which, in many ways, are different from others. The majority of innovations in construction are developed at the project level; however, they remain linked to companies' business practices.

The above study has been followed by four case studies in four different projects in the United Kingdom, by Ozorhon et al. [14]. The results of case studies show the collaboration among the members of a project team resulted in both technical and organizational innovations. Several innovative examples in construction projects confirm that innovations do not emerge in conventional metrics. Most innovations occur at the project level and make a significant impact upon three principal aspects of sustainability: a) economical, b) environmental and c) social.

Research Methodology

This study uses a qualitative technique to develop an IVC for contractors. Several steps are needed to analyze qualitative data, starting from categorizing data, and then followed by rearranging data; finally, the result is reported [15]. The development of an IVC framework is carried out in two stages. The first stage is focused on the development of the IVC framework for contractors based on the framework that has been developed by Hansen and Birkinshaw [4]. Further, this new framework is refined; a process informed by the comments and inputs from reviewers in the second stage.

Data Collection

This current Indonesian study uses interviews to collect data because that research model is considered as the most effective method for data collection in qualitative research. Saunders et al. [15] mentioned that an interview gives a chance to the researcher to collect valid and reliable data that is relevant to the research question. However, according to Quinlan [16] interviews also have several potential problems if they are not carried out properly; for example, the interviewer influencing or attempting to lead an interviewee's responses.

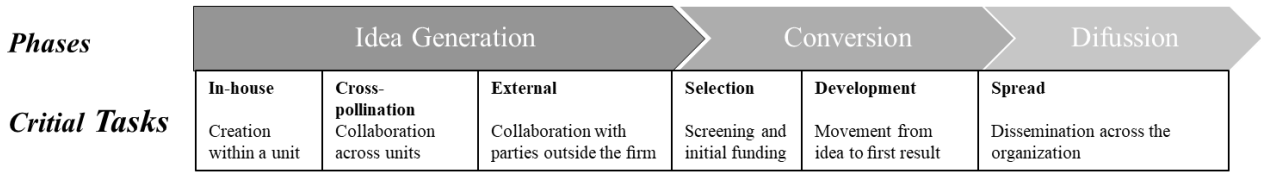

Figure 1. The Innovation Value Chain (IVC)

The respondent sample for data collection in qualitative research is chosen by considering the right people who can provide the correct and necessary information relevant to the issue that is being investigated [17]. Interviews for collecting data in this study were carried out with 19 key people who have experience working in Indonesian contractor companies. They are considered as the right individuals to provide valid information that is necessary for this study because they are involved in generating innovations in contractors. The questions are focused on how the innovation was generated. The interviews have all been fully audio recorded and fully transcribed to facilitate data analysis.

Data Analysis

According to Saunders et al. [15] several steps for qualitative data analysis are started by categorizing data, followed by rearranging categories, and finally reporting results. Categorizing data in this study is carried out by a coding process. Bryman and Bell [18] explain coding as a tool for managing and interpreting qualitative data that helps researchers to figure out the meaning contained in the qualitative data. In qualitative research, coding is defined as a process to break down data into components or parts that have a certain meaning; resulting in a situation where the names of each category can be assigned.

Following the coding process, thematic analysis was implemented to raise the important issues related to an IVC for contractors. According to Braun and Clarke [19], thematic analysis is a method that can be used to identify, analyze and report patterns or themes that are implicit in the data. A theme is directed towards the important issues that were related to the research question. There are two patterns in thematic analysis: semantic and latent. A semantic pattern is implemented when the meanings are explicitly mentioned or written in the data. On the other hand, a latent pattern is appropriate for when the researcher needs to examine ideas beyond what have been mentioned or written in the data. Furthermore, Braun and Clarke [19] also introduce two main ways to identify themes in thematic analysis; the inductive and deductive approaches. Induction involves a bottom-up approach that is data driven; therefore, themes emerge from the data. In the deductive approach, themes emerge from the researchers' theoretical interests.

This study adopted the latent orientation because the research is carried out based on the existing IVC framework; therefore, the ideas implied in the data need to be examined to find semantic contents that are compatible with the existing IVC framework. The data analysis approach used is a top-down approach, in order to identify the activities that are relevant to each stage of the IVC framework. Finally, a new IVC framework that is specifically suitable to be implemented by contractors is identified.

Several steps are followed to help the researchers become familiar with the data, from the initial to the final step. The themes are then defined according to the IVC framework, in the data analysis. The details of each step are as follows:

1. The analysis starts with reading and re-reading the interview transcript(s) in order to become familiar with the data and to catch the meanings implied in the data.
2. The next step, after the researcher becomes familiar with the data, is generating initial coding. In this stage, the data is organized in a systematic way; the statements are grouped under three stages of the IVC.
3. After the coding process is completed, the themes in accordance with each stage of innovation in the IVC framework are searched for.
4. The initial themes that are found in the previous step need to be reviewed, and then modified as necessary in order to make sure that the themes work in the context of the entire data set.
5. In addition, some important issues that relate to and support the three stages of an IVC are identified during the coding process.
6. Finally, the framework of the IVC that can be specifically implemented by contractors is defined.

In order to improve the quality of the framework and to confirm that the framework is valid and applicable to the real situation, a review process is carried out. In this stage, the IVC framework for contractors that has been developed in the previous stage is reviewed by five top managers of five different contractors in Indonesia.

The review process is started by preparing the guidance containing the IVC framework, as well as several questions to gather information from the reviewers. The three questions in the guidance are:

1. Are the stages in the diagram in accordance with the real process of generating innovation in contractors?
2. Are there any incorrect or missing processes in the diagram?
3. Please give general comments on innovation development based on the experiences of your company.

The guidance was sent to the reviewers through e mail, and then their comments and inputs were sent back by email as well. The comments and inputs from reviewers are utilized to refine the framework and to enrich the explanations that accompany the framework.

The Process of Developing an IVC for Contractors

The IVC framework has been developed based on the qualitative data that were collected through interviews with 19 top managers who own or work for contractors in Indonesia. The backgrounds of the interviewees in this study are presented in Table 1.

Table 1. Interviewees' Backgrounds

Position	Working Experience	Number
Owners of small-medium contractors	15 – 29 years	6
Directors of big contractors	20 – 30 years	5
Project managers	8 – 12 years	8

In this study, coding is the main data analysis process employed in order to develop an IVC for contractors. The coding was carried out by grouping contractors' statements that are relevant to each stage of the IVC. Which are: i) idea generation, ii) idea conversion and iii) idea diffusion. However, during the coding process, some statements are found to be more important than others, and are therefore used in order to enrich the explanations that accompanying the IVC framework. Therefore these statements were coded in the other nodes out of three stages of IVC.

The coding is carried out by grouping the statements of each interviewee that have similar meaning from each stage of the IVC. The coding in each stage of the IVC, and any additional codes found during the coding process, are explained in the following sections.

Idea generation for Contractors' Companies

- Every two years, the company arranges a program named "Innovation Day". At that event, the innovations from various projects are contested.
- Project teams are challenged to produce innovations. For example, the project has a target to gain a net profit 10%, and then they produce innovations that can increase the profit up to 15%, higher than the target. The difference will be shared to the project team as their reward.
- If the project team can complete the project successfully, they will receive incentives, bonuses, and other rewarding options. Incentives are often used to motivate a project team to produce innovations.
- A project team is given autonomy/freedom to produce an innovation or innovations.
- Every project must create innovations; with the number of innovation that must be created depending on the value of the project.
- Innovation occurs naturally in project sites; for example, because of the owner's needs.
- Started from small scale, from project and department, then to Head Office. Every two years, an innovation team is assigned to evaluate any proposed innovations.
- Every project gives input to the engineering team in the Head Office. The project team makes an analysis of the innovations that have been created in the project and then delivers their analysis to the engineering team.
- Actually, the centre of innovation is the engineering department; however, the idea of innovation can come from the project team that is intensively involved with equipment and methods. However, usually a project team does not have the capability to consider the aspects of safety and quality; therefore, the team needs to collaborate with other parties in the Head Office.
- Our company has a division named 'Planning and Engineering' (P&E) to back up the project team's goal of creating innovations in order to build the project effectively and efficiently. By successfully meeting these two criteria the project can be finished on schedule, on budget and satisfy the quality requirements.
- The engineering department in our company is also responsible for research and development.
- The project team has the opportunity to discuss issues and suggestions with the engineering department in order to find the best way to implement the innovation.
- We are looking for experts from outside the company that know better than us; therefore, they can give valuable advice about the proposed innovation.
- We benchmark against Malaysia, Singapore and Australia as the countries (in our geographical region?) that are more advanced in technology than we are in Indonesia.
- When we collaborate with foreign contractors, our project team learns a lot from them; on several occasions technology transfer from them to us has happened.

Idea Conversion and Diffusion

- Every innovation needs to be tested and usually the trial was done in the next project.
- We tried to use a new type of formwork that was created in one of our projects, in some following projects. Finally, we found this type to be more efficient and effective compared to the conventional formwork system.
- The innovations were tested and then evaluated. After being confirmed the innovation is good and feasible, it will be set as a company standard and implemented in forthcoming projects.
- These books contain the collection of our innovations. The innovations that have been approved are documented and then set as the company's standard that must be implemented in all projects.
- Several simple construction methods have been set as the company's new standards.

- Our company has a patent for sliding formwork for use in tunnel projects. As a result of this innovation the company has opened a new division of formwork that can support future projects involving this novel formwork.

When the coding process for the three stages of the IVC was carried out, it was found that several statements indicated a new and important issue relating to the IVC. This new issue involves the benefits of innovation generation to a contractor. This new issue was caught as a new code in order to complete the framework of the IVC. The statements that can be coded to present the benefits of innovation generation are as follows:

- We create something new that has never been offered by our competitors.
- We need to find something cheaper but with the same quality. It motivates us to create a new system, or systems, that are more efficient.
- In several projects, we offer innovations those are rarely offered by other contractors.
- The most important is efficiency; the innovation can make a company or process more efficient.
- The existing established method of proceeding was changed to make it more efficient, as well as adding value.
- We need to be innovative because a contractor's business is located in a highly competitive environment. Therefore, we must be different compared to our competitors in order to attract clients to us. We must offer lower prices combined with better quality.
- The project managers need to be innovative otherwise costs will spiral out of control.
- The company needs to create innovation in order to meet the targeted cost.

After the coding process was completed, an additional important issue was found that needed to be included in the IVC framework. That issue is the support from the company along the stages of IVC and the benefits that contractors can get from IVC implementation.

Once the IVC framework had been developed it was reviewed by five top managers who work for five different contactors in Indonesia. These five contractors are considered to be the top established contractors in Indonesia who are highly experienced and who have a good record for developing innovation. The profiles of the five IVC reviewers are presented in Table 2.

The reviewers were unanimous in confirming that the IVC framework is applicable for developing innovations for contractors operating in Indonesia. However, several inputs and comments have been suggested by the reviewers in order to improve the quality of the proposed IVC framework. Based on the inputs and comments of the reviewers, the IVC framework has been refined by adding "assessment" after "idea generation". The inputs and comments of the reviewers also enrich the explanations that accompany the framework.

Table 2. Profile of Reviewers

No.	Position	Ownership	Experiences
1	President Director	Private	30 years
2	Senior Vice President	Public-private	26 years
3	Operational Director	Private	26 years
4	Head of Branch Office	Private	30 years
5	Senior Project Manager	Private	20 years

Research Findings

After the coding process was carried out and the findings were reviewed several times, based on the IVC framework, finally the particular IVC framework that was most appropriate for the contractors was developed. Initially, the framework consists of three IVC stages: i) idea generation, ii) idea conversion, and iii) idea diffusion. However after the review process, one stage is added in the diagram. This additional stage is "assessment" that is added after "idea generation". The support from the company is needed along with the process in order to achieve success at each stage. Finally, after the innovation is successfully generated and implemented, several benefits are achieved.

The IVC that is particularly appropriate to be implemented by contractors is presented in Figure 2. This framework is developed based on the experiences of small-medium, as well as big contractors in Indonesia; therefore, it is considered as the framework that can be implemented by all classes and sizes of contractors. However, contractors in different classes may differ in their circumstances and potential; for example, smaller companies may not be able to support a R & D department. In such a situation the R & D function will be carried out by individuals in the company's head office.

The IVC framework shows innovative ideas are mainly developed at project level by the project team. A company's project team is its source of innovation ideas because its members are involved intensively with construction activities which very often have many problems. They also deal directly with clients, who are usually very demanding.

The idea that has been generated by a project team needs to be followed up and discussed with head office. Usually the department that has responsibility to follow up the innovations from projects is the engineering department. In some contractors' companies,

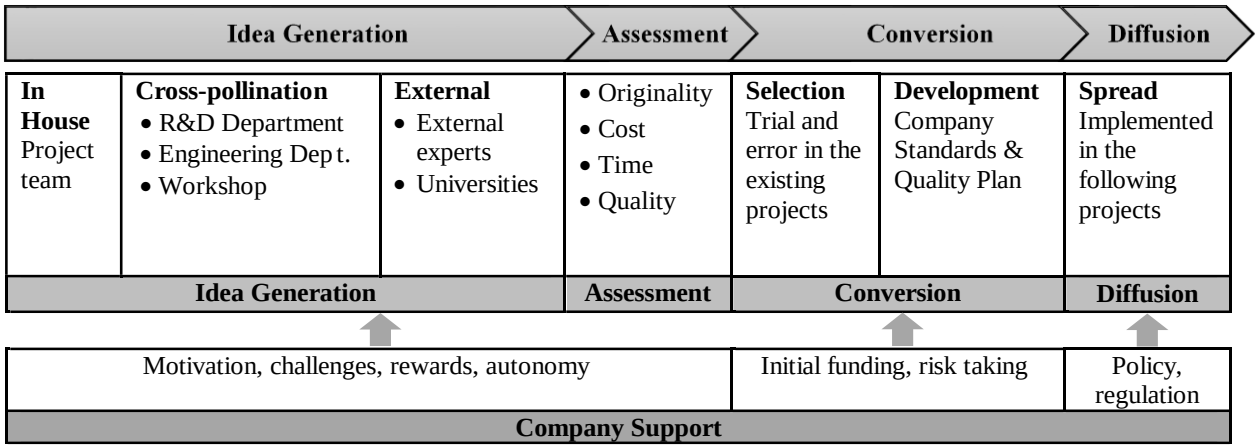

Figure 2. The IVC for Contractors

the function of the engineering department is carried out by the research and development department. Idea generation can be supported by external parties, such as experts, academicians and project partners. However, an innovative idea can also be generated by collaboration between: i) a project team, ii) a head office department or iii) external experts, or between all three entities.

The next stage, after the idea has been generated, is "assessment". In this stage, the idea that has been generated needs to be assessed to ensure and validate its originality and to avoid any duplication with: a) existing products, b) construction methods or c) management systems that are available in Indonesia or other countries. Innovative ideas also need to be assessed to guarantee that any innovation does not incur unnecessary costs, and that it also meets time and quality requirements.

Furthermore, the IVC process enters the next stage, which is "conversion". This stage consists of two activities: "selection" and "development". In "selection", the innovative idea that has been generated and assessed in the previous stages is tried out in other projects in order to confirm that the innovation is feasible to be implemented in relevant projects. This stage is based on trial and error; so allowing the innovation to be revised as needed. After the innovation has been confirmed as "feasible to be implemented in projects in general", the standards and quality plans for that innovation are developed. The final stage of the IVC framework is "diffusion" where the innovation has been set as the new standard to be implemented in subsequent projects that require that innovation.

The diagram shows that support from the company cannot be ignored and is essential throughout the process. The support from the contracting company that is needed at each stage of the IVC's development will be different. At the "idea generation" and "assessment stages", the company needs to motivate and challenge all parties that are involved in the project's activities in order to generate innovations. For example, the head office holds an innovation competition in order to trigger the creation of innovation. Rewards in various forms, such as profit sharing and / or promotion are part of the company's initiative to motivate its staff to create innovations. The contractors must also give autonomy to staff to encourage them to think of various innovative ideas and suggestions.

The implementation of an IVC framework provides a number of benefits for a company. Examples of the benefits of an IVC framework that have been identified in this study include: a) increasing competitive advantage, b) enhancing the company's image and c) increased opportunity to win projects. Innovation also increases the ability of contractors to solve technical problems and reduce a project's costs.

Conclusions

A specific study of innovations relating to contractors' working performances is needed because the ways to generate innovations differ when compared to other industries. Contractors are PBFs that run their businesses based on projects; therefore many of the innovations are derived from and utilized for the project's activities. Under this situation, the innovation generation process discussed in this paper focuses mainly on its technical aspects; other aspects, e.g. contractual, have not been considered.

This study proposes a framework to generate, assess, convert and diffuse innovations, which is suitable for contractors. The framework has been developed based on the concept of an IVC; however, several adjustments and developments were made to suit the IVC framework to mesh with the conditions of the contractor

The IVC for contractors in this study can be considered valid and suitable for contractors because it has been reviewed and confirmed by several top Indonesian managers who are professionally and commercially involved in contractors' activities throughout the country. The IVC is informed by and developed from the experiences of contractors in Indonesia; therefore they are influenced by the particular business circumstances present in that context. However, contractors in other countries can implement this framework after making necessary and / or appropriate modifications.

Declaration of Conflicting Interests

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