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PROPOSED METHODOLOGY TO ASSESS EFFICIENCY AND EFFECTIVENESS OF INDUSTRY-UNIVERSITY COLLABORATION FOR SUPPORTING ENTREPRENEURIAL UNIVERSITY

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Abstract. The shifting paradigm of university from research and teaching university to entrepreneurial university has led to the development of infrastructure in university that focus on maintaining the spirit of entrepreneurship. Infrastructures such as technological or science park (Philpot et al., 2007) liaison office, technology transfer office, and business incubator (Etzkowitz, 2004) had been built and developed in several universities in Indonesia. The optimization of those infrastructures had been questioned to get practical implication and contribution in society through well developed and functioned technology in industry. There are needs to be described in the necessary of technology development through entrepreneurial university through the support of industrial collaboration. This study aims to propose several methodologies that appropriate for identifying the needs and interest whether from industry and university to achieve entrepreneurial university criteria. From previous research the methodology is limited to factor analysis to make certain group in several criteria for entrepreneurial university and qualitative methodology for describing the condition of infrastructure readiness for developing entrepreneurial university. In the end this study produces another methodology such as conjoint analysis, analytical hierarchy process, and agent-based modelling to give a brief description of the contribution and policy development in industrial collaboration and infrastructure development which support the goal of entrepreneurial university. The study was conducted by doing some literature review and synthesized it for developing the factor included for developing entrepreneurial university. This study also proposed the challenges of each methodology, how it will be conducted, and provide several questionnaire/research design for each methodology.

Keywords: entrepreneurial university, industrial collaboration, conjoint analysis, analytical hierarchy process, agent-based modelling

INTRODUCTION

The shifting paradigm of university that in the beginning focused on teaches the student and conducting a research had been broaden to produce a new business and technology through the idea of entrepreneurial university. Colleges and universities often claim they create jobs, boost tax, and stimulate the local economy (Siegfried, Sanderson, & McHenry, 2007). The goal of entrepreneurial university is in line with previous claim. The university has been transformed from a teaching institution into one which combines teaching with research, a revolution that is still ongoing, not only in the USA, but in many other countries (Etzkowitz & Leydesdorff, 2000). Through multiple missions of teaching, research, and entrepreneurship activities show significant and positive economy impact of the entrepreneurial universities (Guerrero, Cunningham, & Urbano, 2015). There is a support from entrepreneurial university to produce knowledge capital, the dominant production factor for entrepreneurial economy. The entrepreneurial university is an emergent phenomenon that is a result of the working out of an inner logic of academic development that previously expanded the academic enterprise from a conservator to an originator of knowledge (Etzkowitz, 2004).

The Triple-Helix thesis postulates that the interaction among university-industry-government is the key to improving the conditions for innovation in a knowledge-based society (Etzkowitz, 2004). Thus prove that there are the necessary of industrial collaboration to support entrepreneurial university to create knowledge-based society. Collaboration among them will generate appropriate knowledge and technology needed by society including the industry among community. There will be a great and broader context of community services of the university will be delivered through the collaboration. To be an entrepreneur, a university not only considerably relies on industry and government but also will have a higher degree of interaction with both of them (Etzkowitz, 2004). There will be a necessary study to describe the interaction among them and how each part interest will be conflicted each other. The conflict should be managed to create good interaction between industry-university-government collaboration in terms of technology could be transferred. Etzkowitz (2004) also proposed in terms of development of technology transfer process in university-industry collaboration will need certain infrastructure: technological or science park (Philpot et al., 2011), liaison office, technology transfer office, and business incubator. Consultation and direction from university will contribute in those infrastructures and industry will support it from funding and/or the current technology as the basic to improve new technologies or products.

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The factors to develop an entrepreneurial university had been discussed and identified in many previous researches. Todorovic, McNaughton, & Guild (2010) had developed ENTRE-U scale that measures the entrepreneurial orientation of university departments. Industrial collaboration is included as ENTRE-U dimensions along with the other three dimensions: research mobilization, unconventionality, and perception on university policies. The implementation of ENTRE-U scale is still being discussed and there is no specific methods are required to be used for ENTRE-U scale. Furthermore, motivation of researcher to use industrial collaboration also had been studied by D'Estee & Perkmann (2010). They had been identified several motivations grouped into four parts of motivation: commercialization, learning, access to in-kind resources, and becoming part of the network. Occurrences of specific motivation had been deliberate the possibility conflict of interest in industrial collaboration. Hypothetically, there will be a different motivation inherent with different interest between industry and university in their collaboration. Those differences will decide the effectiveness and efficiency of industrial collaboration.

Unfortunately, previous study limited to assemble several factors into specific group by using factor analysis (D'Estee & Perkmann, 2010) and structural equation modeling also been used in economy impact of university (Guerrero, Cunningham, & Urbano, 2015). Another research focused on identifying other factors included in entrepreneurial university using qualitative approach. Rothaermel, Agung, & Jiang (2007) through literature studies criticized that most studies on university entrepreneurship tend to be more qualitative in nature, and thus offer less on the "how" and "why" aspects of a theory. There is a limitation to describe the interaction of university and industry to develop entrepreneurial university through industrial collaboration. This study argued that the limitation of methodology used in entrepreneurial university had led to misunderstanding between industry and university to maintain industrial collaboration for developing entrepreneurial university. There is a few brief explanation of the possibility in conflict of interest between industry and university because the limitation of research methodology to describe those interest. The objective of this study is to develop another research methodology that focused on describing interest of participating parts in industrial collaboration especially industry and university for developing entrepreneurial university. This study also hypothesized that the different interest between industry and university will deliver an ineffective and inefficient collaboration scheme.

Based on the main objective of this research, there is several following research questions would be addressed.
RQ 1: What is the suitable methodology used in describing the interest (in terms of efficiency and effectiveness) of participating parts in industrial collaboration?
RQ 2: What is appropriate methodology used in describing the influence of industrial collaboration for supporting the development of entrepreneurial university?
However this study only proposed the research design and possible preposition of the methodology. There will be a necessary further research to implement the methodology proposed.

LITERATURE REVIEW

D'Estee and Perkmann (2010) identified researcher motivation to involve in industrial collaboration and analysed its classification among factor using PCA and factor analysis. This study will provide further research after the classification process and assume the factor in previous study in dividing part: as attributes and level of attributes to be analysed using conjoint analysis as one specific combination of policy that will support EU visions. In other hand, Todorovic et al. (2011) proposed ENTRE-U scale to measure performance of university to becoming entrepreneurial university. Those research use the scale to be analysed using factor analysis and interview as pilot survey. Meanwhile, this research will propose different point of view in the analysis using analytical hierarchy process. Several previous research using different methodology to measure the performance of university in the development of idea in entrepreneurial university (EU) such as structural equation modeling (Guererro, Cunningham, & Urbano, 2015), case study (Phillpot et al., 2011; Jacob, Lundqvist, & Hellsmark, 2003; O'shea et al., 2007). It is actually still limited to analysis of linear relationship in performance component and actual condition mapping by qualitative method.

PROPOSED METHODOLOGY

Conjoint analysis was used to describe the preferences of person in terms of customer of certain attributes in the product. Commonly conjoint analysis used to identify appropriate design of the product based on its specification that represented by certain attributes. In industrial collaboration, there will be several preferences should be identified whether from industry, university, or government as the main parts of it to support entrepreneurial university. The attribute for this methodology can be gathered from literature review. In this study, it will be focus on describing individual motivation from researcher to be involved in industrial collaboration. Previous research conducted by D'Estee & Perkmann (2010) had been identified several consideration or motivation of researcher for working together with industry in several schemes of industrial collaboration. This study will make the context broader, it proposes the preference of industry will also should be identified not only the preference of the researcher who been parts of university.

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Conducting Conjoint Analysis to Describing Preferences in Industrial Collaboration

Adopted from the study conducted by D'Estee and Perkmann (2010) that provide several motivations from researcher to get industrial collaboration, the methodology will be implemented in the same context with the previous study. Table 2 show the implementation and contextualization of motivations regarding industry-university collaboration using conjoint analysis framework. Conjoint analysis will be used rather than factor analysis that had been conducted in the previous research. Conjoint analysis is used to describe the interest from industry and university, to determine the appropriate collaboration scheme that could fulfill the interest from both parts. In conjoint analysis, the importance value of the attribute could be also measured. In this research, the following preposition will be delivered.

Preposition 1: There will be difference or similarity of the preferences from university and industry regarding the objective of industrial collaboration

This study also developed questionnaire design that will be delivered to fulfill the data needed in conjoint analysis. However, this study only provides several possible combinations for level of attributes.

Proposed Methodology: Analytical Hierarchy Process

The Analytic Hierarchy Process (AHP) is a theory of measurement through pairwise comparisons and relies on the judgements of experts to derive priority scales (Satty, 2008). It was used in several kind of research especially to seek the importance or priority of factors and sub factors that considered in a problem. The study about risk mapping and mitigation commonly used this methodology by separating between the information of likelihood and frequency of risk that identified and the impact of identified risk. Thus will help the study to propose the priority in maintaining risk especially for risk mitigation. Which risk should be solved first and what the implication of the risk mitigation action to another risk will also could be identified using this methodology. AHP may become appropriate tools to describing the expert thought. In-house resources of university such as academic staffs and graduate student will be those kind of expert that their thought should be considered in supporting the goals of entrepreneurial university.

Conducting AHP to Identifying the Importance of Factors in Entrepreneurial University

In this research design, this study proposed to use ENTRE-U original scale items which developed by Todorovic et al. (2011). This study classified the items in ENTRE-U that contains: research mobilization, unconventionality, industry collaboration, and university policies as the factors in AHP. Each item will contains of several sub items that will be identified as sub factors in AHP. The distribution of factors and sub factors in AHP can be seen in Table 3. In this research, the following preposition will be delivered.

Preposition 2: There will be a significant difference of importance for each factors included in entrepreneurial university development using ENTRE-U original scale items which developed by Todorovic et al. (2011)

This study also developed questionnaire design that will be delivered to fulfill the data needed in AHP.

Proposed Methodology: Agent-based Modeling

Agent-based modelling (ABM) was commonly used to describe social interaction between involving parts of the problem and the methodology will provide the development of changing environment in certain period of time. In conducting ABM, there is one important thing should be done first. That part is describing the behaviour or attitude of each agent toward the problem. Thus, the research conducted by using agent-based modelling should be considered as the study have been gathered the primary data that provide the information about that. The methodology will use another methodology as its support. The data from conjoint analysis and AHP can be useful to answer the needs in maintain agent-based modelling. In industrial collaboration for supporting entrepreneurial university, there will be specific agents such as industry, university, and government. In conjoint analysis, the preferences as the behavior of university and industry or moreover government could be provided. In AHP, the priority of activities could be described as well to see the development of university to achieve entrepreneurial university classification. That will be common information that needed in agent-based modeling to predict the behavior of parts involved in the development of entrepreneurial university. ABM will need the sequence of activities based on priority in AHP will be happened and the behavior will be conducted during activities based on industry-university preferences developed by conjoint analysis.

Conducting ABM to Simulate the Behavior of Agents in Provide Industrial Collaboration

Based on the data in AHP and conjoint analysis, furthermore simulation can be conducted. By using agent-based modeling, the behavior of each actor can be simulated based on the preference that being gathered by using conjoint analysis. The priority of the activities also can be described by using the data based on AHP results. In the end secondary data such as number of patents, journals, or spin-offs can be used also as the outputs description in the model.

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Preposition 3: There will be implication of behaviors and activities from university, industry, and government to the development of entrepreneurial university.

LIMITATION AND DISCUSSION

This study only proposed three methodologies: conjoint analysis, analytical hierarchy process, and agent-based modelling. The context will be focus on industrial collaboration with university in terms to support the achievement of entrepreneurial university. This study limited to provide only the research design, the data collection not been yet developed. In the further research, by using the proposed research design the research that focused on the influence of industrial collaboration for entrepreneurial university achievement should be necessary. Using qualitative methodology, another factor occurred in industrial collaboration or infrastructure development also will be considered to make a better improvement of research. Furthermore, the component that had been used in the research design should be modified to contextualize the idea of the component to specific statement that can be understood by the unit of analysis that will be used. It applies especially to the research in different countries.

CONCLUSIONS

Through conjoint analysis, analytical hierarchy process, and agent-based modeling there will be several prepositions should be addressed. Through conjoint analysis, the preposition that should be addressed is: there will be difference or similarity of the preferences from university and industry regarding the objective of industrial collaboration by modified the motivation of researcher in industrial collaboration in study developed by D'Estee and Perkmann (2010). Through AHP, the preposition that should be addressed is: there will be a significant difference of importance for each factors included in entrepreneurial university development using ENTRE-U original scale items which developed by Todorovic et al. (2011). In the end, this study proposed to combine between data gathered through AHP and conjoint analysis into modeling and simulation process by using ABM. Data gathered by AHP will fulfill the sequence of possible activities based on the priority of the ENTRE-U scale. Meanwhile, data gathered by conjoint analysis will support the description of behavior from Industry and University (and also Government if it possible) agents based on their own preferences about motivation item. Finally, in ABM this study developed a preposition that stated as: there will be implication of behaviors and activities from university, industry, and government to the development of entrepreneurial university. Further research should be conducted to use the methodology by using the questionnaire design that was developed in this study. It will be necessary to collect the data by using those questionnaires to specific respondents: university, industry, and government.

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