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Abstract PDF

A review on dynamics and policies of knowledge transfer between university and industry

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Abstract: This article discusses a literature review regarding the dynamics and policies adopted by the government to manage knowledge transfer. This paper also discusses knowledge transfer activities in Japan, which is focused on the model of knowledge transfer and policies implemented in Japan and the importance of regulative pressure to optimise the transfer of knowledge. Literature on knowledge transfer between university and industry, specifically in Indonesia, is still limited and lead to the gap on related studies. This literature review was conducted to fill the gap that focused on dynamics and policies of knowledge transfer between university and industry. Through the discussion, it is expected to give insights and lesson learned for organisations in Indonesia to manage knowledge transfer activities between universities and industries.

Keywords: knowledge transfer activities; dynamics; government policies.

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This paper is a revised and expanded version of a paper entitled 'Dynamics and policies of knowledge transfer between university and industry' presented at the 2nd Mulawarman International Conference on Economics and Business (MICEB), Samarinda, 5–6 November 2019.

1 Introduction

Attention on university's important role in economic development has increased in recent years. It is driven by the transition of university's roles that originally focused on education and teaching, research and development, and community service, has evolved into an engine of economic growth (Goransson and Grundenius, 2011). To realise the new role, university needs to cooperate with other organisations, especially industry. Cooperation undertaken might relate to the transfer of knowledge through university and industry alliances. Transfer of knowledge conducted between university and industry is an interesting issue to explore considering that each party has important role toward economic growth. This encourages university to be more actively collaborate with industry. So far, university and industry are still considered to work separately and causing a gap between both parties. University is considered poorly understood industry's interests for not understanding the problems in the industry (LaRocque, 2015; Allen, 2016).

Transfer of knowledge between university and industry represents collaborative relationship between both parties that focus on core competencies and external knowledge access capabilities. It indicates a wide interaction at different levels and involves different activities for not only knowledge but also technology exchange between university and industry. In this collaborative structure, internal and external knowledge are assumed as strategic resources to support the success of collaboration. This collaboration involves two organisations with different backgrounds, in terms of vision, mission, characteristic, and culture (Kodcharat and Chaikeaw, 2012). Both organisations also have different focus. The university focuses on the production of knowledge, teaching, and learning for the public interest, while the industry focuses on profitability and competitiveness.

Alliance between university and industry is expected to positively effect on the increasing of innovation capabilities and organisational performance through enhancing innovative products that will be useful not only for their own industry, but also for the society. Through alliance, organisation might improve their ability to achieve strategic objectives and to access specific knowledge (Bercovitz and Feldman, 2007). Resources and knowledge synergies that shape market competition could be created through alliance (Harryson et al., 2008).

This article discusses the dynamics and policies adopted by governments to manage knowledge transfer activities based on 49 conceptual and empirical papers published in journal, proceedings and dissertations between 1986–2019. The references used based on issue discussed which include knowledge transfer activities, university and industry alliance, policies related to knowledge transfer, and patent implementation. This literature review is motivated by the lack of literature on related issues in Indonesia which lead to the gap on the studies (Sjafrizal and Pratami, 2019). The organisation of the paper is as follow: Firstly, the discussion will focus on the conceptual review of knowledge transfer. Secondly, the discussion will focus on patents as indicator of knowledge transfer activities level and various policies formulated by the government to regulate knowledge transfer activities. This paper also discusses knowledge transfer activities in Japan. Finally, this paper focuses on discussion regarding the important regulative pressure to optimise knowledge transfer activities.

2 Conceptual review of knowledge transfer

The selection of appropriate information from multiple sources and transforming the information into knowledge becomes an important challenge to the organisation. Blumenberg et al. (2009) define knowledge as the justification of justified beliefs at the core of knowledge-based theory. The theory is built on resource-based approach (Alavi and Leidner, 2001). Knowledge is the major organisational resource that needed in production process (Grant, 1996) and could be obtained through knowledge transfer activities. This argument is linked to Cohen and Levinthal's (1990) argument that emphasises the importance of knowledge transfer to respond the changes appropriately and to create innovation and competitive success. The dimension of knowledge consists of explicit and tacit dimensions. Explicit dimensions are articulated into words and numbers, while tacit dimensions lie on one's thinking. This tacit dimension is not only difficult to articulate and demonstrate, but also requires observation and experience to transfer the knowledge.

Knowledge transfer is the process of acquiring knowledge from transmitter as knowledge receiver, it is a dynamic process that involved the process of acquisition, communication, application, acceptance, and assimilation (Abbasnejad et al., 2011). It can be defined as in the context of knowledge transfer between university and industry, and this process of transfer might occur in two directions. It could be done through various mechanisms through laboratories that funded by industry, such as licenses, recruitment, spin-off companies, patents and publications, joint research, consultations, research contracts, and other facilities (Abbasnejad et al., 2011). The transfer focuses on coordinated collaborative activities include exchange, co-development, company-specific capital, and technologies or activities (Anatan, 2018). Successful development of alliances with alliance partners is used as a benchmark for good or bad knowledge transfer performance since the cooperation created in strategic alliances that provides solid legitimacy.

Santoro and Chakrabarti (1999) suggest that knowledge emphasises on several aspects include technological development, risk management of alliances, cooperative network, human capital development, and access of experts and facilities. Some aspects of the knowledge transfer activities within university and industry alliances are summarised in Table 1.

Technology development includes research and development and commercialisation activities. Industry has some concentration related to technology development capability. The important requirements in technology development include: the source of many research ideas, the cost of effective development and commercialisation, and the ability to meet time cycle development. The industry also develops new applications and product, technology processes, and competencies in non-core technology through outsource (Santoro and Chakrabarti, 1999).

Risk management includes competitive research, flexible technical agendas, and increasing success. Specific industry concentration ensures aligning technology trajectory and market requirement, defining specifications and appropriate technical constraints, and reducing obsolescence risk through technology development. In this case, industry's ability to open opportunities is highly dependent on the choice of industry skills and appropriate placement. Both choices can drastically reduce the uncertainty in determining the specific technology that will be developed by the industry. Industries should also

maintain their choices regarding technical approaches and minimise the costs to manage appropriate development risks (Santoro and Chakrabarti, 1999).

Table 1 Focus of knowledge transfer within university and industry alliance

Industry needs	*Special aspect of needs*	*Important industry concentrations*
Technology development	• Research • Development • Commercialisation	• Access toward various research ideas • Cost effective technology development • Decrease in development time cycle • Improving and developing technology process • Developing competencies in non-technology expertise
Risk management	• Risiko pre-competitive research • Flexible technical agenda • Increased success	• Aligning technology trajectory and market needs • Defining technical barriers • Reduce the risk of obsolescence • Managing the choice of approaches • Minimise the damage cost
Cooperative network	• Formalised structure • Defining mission • Organisation critical period	• Symmetrical information exchange • Reasonable commitment time • The value of relationship between organisation • Impact on corporate image
Human resource development	• Training of new employees • Continuing professional education • Curriculum development	• Recruitment of employee with the right skills • Creating training opportunities for potential workforce • Conformity between university curriculum and market needs • Improving skills on ongoing basis
Access to experts and facilities	• Build and strengthening skill and knowledge • The use of university facilities	• Completing existing resources • Cost effectiveness • Capacity to absorbs knowledge and skill • Tacit and explicit knowledge transfer

Source: Santoro and Chakrabarti (1999)

The creation of forum for cooperative networks represents a formalised structure, definition of mission, and critical period of the organisation. Many important industry concentrations such as the exchange of symmetrical information, commitment on reasonable time, relationships value between organisations, impacts on corporate image. Human capital development includes new labour training, new university graduates, professional education, and inputs for curriculum development. Important industrial concentrations include recruiting skilled employees, creating training for workers, compatibility between university curriculum and market needs, and continuous skills improvement (Santoro and Chakrabarti, 1999).

Industry ability to access to experts and facilities influence the industry capability to develop and to strengthen knowledge required for technology development as well as access to facilities from the external organisation. Important industry concentrations include complementary efforts to resources, skills and knowledge absorptive capacity, cost effectiveness and transfer of both tacit and explicit knowledge (Santoro and Chakrabarti, 1999). The university's role as the source of knowledge and research, while industry as knowledge and technology user is developed from many research findings (Fontana et al., 2006). The growing phenomenon shows that since 1980s, many countries have implemented policies to promote knowledge transfer activities (Madique and Patch, 1988 as cited in Pelser, 2014; Guimon, 2013). Policies are made to encourage intensive university and industry roles to realise the success of national economic development.

Interorganisational knowledge transfer is considered important due to some reasons, include (Wang and Lu, 2007): firstly, in-house R&D that usually owned by the industry is considered not enough to develop the ability of knowledge absorption, especially in terms of accessing new knowledge and technology and updating the understanding and mastery of research results from universities. Therefore, cooperation with universities is required as an industry strategy to access and to absorb new knowledge. Secondly, cooperation particularly in terms of research and development innovation is needed to support the way in which knowledge is produced in industrial sector. Thirdly, production of new knowledge supports the university to patent and engage in commercialisation activities without changing the essence and type of research conducted by the university.

3 Knowledge transfer between university and industry: issues and policies

Universities role in supporting the development of industry sector through the provision of human resources, new ideas, and modelling is still low. This is due to the low contribution of universities, which lead to applied research activities that are useful for solving problems in industrial sector, in addition to teaching and community service activities. Therefore understanding, policy, and management of cooperation through the synergy development between university and industry is needed and should be supported by the readiness of human resources and the willingness of industry to use university services. To advance knowledge, researchers from universities need to be involved, as university researchers understand the basic scientific methodology and research developed for industrial use (Klevorick, 1995 in D'Este and Patel, 2007).

In Indonesia, knowledge transfer activities are still considered quite low (Moeliodihardjo et al., 2013; Sjafrizal and Pratami, 2019). One of its indicators is the low utilisation of patents in the industrial sector (Kardoyo et al., 2010; Nugroho et al., 2016). The increasing awareness of university and industry researchers related to knowledge transfer is faced several obstacles such as: knowledge and technology characteristics, technical skills, mission differences, cultural differences, and the lack of a systematic understanding of intellectual property management. This condition resulted in low cooperation between university and industry in Indonesia, therefore the innovation capability embodied in the patent application is still very low. The high or low level of innovation capability and effectiveness of R&D activities could be assessed based on the high or low number of patents produced. The higher the number of patents generated indicate the higher the innovation capability and the effectiveness of R&D activities. Conversely, the lower number of patents produced indicates the lower capability of

innovation and the effectiveness of R&D activities (Kardoyo et al., 2010; Nugroho et al., 2016).

Table 2 shows the comparisons of international patent registration and domestic patents of Indonesia and some of ASEAN countries and Japan. Based on the data obtained from World Intellectual Property Organization (WIPO) and the relevant state patent offices, patent registration of Indonesia, both international and domestic patents, is still much lower than Singapore, Malaysia, and Thailand. In comparison with Japan, ASEAN countries are still far behind. This indicates that patent has not become a major part in the research activities of lecturers and students in Indonesia (Irawan, 2014).

Table 2 Comparison of patent registration of ASEAN countries and Japan

No.	*Countries*	*International patent*			*Domestic patent*		
		2009	*2010*	*2011*	*2009*	*2010*	*2011*
1	Indonesia	7	16	13	684	795	777
2	Malaysia	224	350	263	1.263	1.275	1.136
3	Philippines	21	14	21	668	759	822
4	Singapore	593	641	661	750	895	1.056
5	Thailand	20	72	67	2.441	2.452	2.161
6	Vietnam	5	9	18	524	521	493
7	Japan	29.802	32.150	3.875	303.114	296.970	293.885

Source: Irawan (2014)

In 2014, the Ministry of Industry of the Republic of Indonesia in the discussion on patent applications and Intellectual Property Rights (IPR) shows that based on data released by the USPTO, there has been an imbalance of patent applications from Indonesia compared to some other ASEAN countries such as Singapore (603 applications), Malaysia (202 applications), Thailand (46 applications), Philippines (37 applications), Indonesia (6 applications), Vietnam (2 applications), while Myanmar and Brunei Darussalam there was no patent applications. The low patent applications indicate the ineffectiveness of patent management mechanisms generated by university elements, R&D institutions, and shows the low utilisation of patents by the industrial sector in Indonesia. To enhance the innovation and effectiveness capabilities of R&D activities in Indonesia, university and industry alliances in facilitating knowledge transfer activities needs to be improved (Kardoyo et al., 2010). According to Sjafrizal and Pratami (2019), Indonesia ranks 97 of 141 countries in the Global Innovation Index, it indicates that innovation the innovation input sub-index in Indonesia is higher than the output sub-index.

Guimon (2013) argues that knowledge transfer policies are developed in four ways, including: first, human resource investment through education means the provision of well-educated and trained workers. Second, investment policy in education that integrates university and industry through integration of research and cooperation in all fields. Third, the research competency development policy is conducted by evaluating the number of articles published. Fourth, institutional cooperation between university and industry aims to improve academic competence in education and research.

Knowledge transfer activities in Indonesia are still considered quite low (Moeliodihardjo et al., 2013). Moeliodihardjo et al. (2013) argues that universities and industries are still considered to operate independently and there is a distance separating

both parties, unlike other countries such as Singapore. Differences in institutional environmental conditions and the limitations of leading companies that have caused the government is less able to act proactively in realising the improvement of university and industry cooperation. Azansyah (2013) points out the importance of institutional conditions as a means of reducing uncertainty. Decreasing uncertainty will have impact on lower transaction costs so that market transactions could be improved. Compared to ASEAN countries, Indonesia's institutional rating is still far below Singapore. Singapore is ranked first, while Indonesia is ranked fifth (Azansyah, 2013). It shows a significant difference in the development of institutional circumstance in Singapore and in Indonesia, although both countries are relatively similar in geographic.

North (1990) argues that institutions are required to provide appropriate incentives to every economic actor. The institutions referred to in this case may be patent and copyright law. North (1990) defines institutions as human-devised constraints that constitute human interaction, comprising formal rules, informal constraints, and enforcement of both characteristics. In other words, institutions are defined as limits on structure, politics, economy, and social interaction (North, 1991). Informal barriers include codes, sanctions, traditions, and taboos, whereas formal rules can be property, constitution, and laws. These rules and restrictions provide benefits to human behaviour to follow the rules and orientations to collective rules that can reduce the uncertainty. Implementation is done by the first party (self-imposed code of ethics), by a second party (retaliation), and or by a third party (coercive social sanction).

In Indonesian institutional context, formal rules are more used to manage knowledge transfers within university and industry alliances (Asmara et al., 2016). Indarti and Wahid (2013) argue that in the developing countries like Indonesia, the implementation of university and industry collaboration is still less than in developed countries. The differences in institutional environment and the limitations of leading companies that have caused the government is less able to act proactively in realising the improvement of university and industry cooperation.

An example of the government policy is the enactment national systems for research and development and science and technology application deriving from The Law No. 18 of 2002. Another example is the enactment of Law No. 3 of 2014 on research and development activities in the industrial sector. However, the enactment of formal rules such as the Act does not necessarily guarantee the success in the implementation stage as stated in the results of empirical studies conducted in Indonesia (Moeliodihardjo et al., 2012).

Study findings conducted by Moeliodihardjo et al. (2012) could be summarised that universities, industries, and governments are still in their respective worlds and quite far away from each other. The findings also show that there is a productive collaboration between successful universities and industries where knowledge is developed and shared. However, these findings are a special case and not a common case in national innovation systems in Indonesia. Moeliodihardjo et al. (2012) suggests that the findings do not show any party ready to take leadership role in the development of Indonesian innovation systems. It is quite different from neighbouring countries like Singapore which shows the high government role in encouraging the economy through national innovation system in the country.

To improve university and industry cooperation, especially knowledge transfer activities, the government sets out several policies related to industry and university sectors. Determination of Law No. 18/2002 on the National System for Research,

Development and Application of Science and Technology, known as Sisnas P3 Iptek in Bahasa, seeks to strengthen research, development, and application of science and technology through research partnerships between universities and industries. To support the implementation of Sisnas P3 Iptek and provide incentives for the industrial sector, the government stipulates Government Regulation (PP) No. 35 of 2007. The regulation regulates the allocation of industrial revenues for the development of engineering capabilities, innovation, and technological diffusion. Regulations are made to overcome the constraints of non-tax state revenue arrangements (PNBP) to encourage cooperation between universities, research and development institutions, industries and government.

Government Regulation No. 35 of 2007 also supports Government Regulation No. 23 of 2005 specified in the framework of financial management and public service agencies. The regulations are developed to provide flexibility in financial management and the adoption of sound business practices that encourage research and development involving universities, research and development institutions, government and industry. The number and quality of researchers as well as the amount of research and development budgets established for R&D activities and outputs can serve as a benchmark for successful government policies in R&D. However, the effectiveness of R&D policies is still difficult to measure due to unavailability of data and lack of integration between national R&D actors.

In the university sector, government policy regulated in the Higher Education Act No. 12 of 2012 also has an important role to transfer knowledge within university and industry alliances in Indonesia. Article 64 confirms the autonomy of universities in the management of academic and non-academic activities. Autonomy admitted in order to produce higher education with good quality and reduce the frequent commercialisation. With the existence of autonomy, it is hoped that the transfer of knowledge could be improved. In addition, university autonomy can have positive impacts on improving the quality of research by encouraging research with patent orientation applied to the industry sector (Kardoyo et al., 2010).

Government support to improve knowledge transfer and bring university and industry links closer is also demonstrated through the provision of research grants, i.e., industrial and university cooperation grants awarded for social sciences and exact sciences (Herdikiagung, 2013). Through the grant, it is expected that the university understands the problems of the industry by producing the output of science and technology products. These products include blueprint, prototype, patent, segregation, policy and modelling methods as new technologies for solving industry problems. Examples of university and industry cooperation grant implementation could be done through joint research between university and industry (Perkmann and Walsh, 2008). Indarti and Wahid (2013) conducted an empirical study to test university and industrial collaboration in Indonesia based on industry perspective. In the study, the university and industry collaboration forms focused on the concept of engaged scholarship.

To align long-term research needs with science-related development and technology, the government in this case the Ministry of Research, Technology and Higher Education has developed the National Research Master Plan (RIRN) 2015–2045. The RIRN is structured to accommodate all stakeholders and synergise all available strengths to achieve optimal results. The focus areas cover several aspects, such as food self-sufficiency, creation and utilisation of new and renewable energy, development of health technology and medicine, technology development and transportation management, information and communication technology, technology development

defence and security, maritime, disaster management, social humanities, cultural arts, and education. The determination of research focus areas is integrated with two approaches, namely top-down and bottom-up. A top-down approach is conducted through setting priorities according to macro needs and challenges faced in the future. The bottom-up approach is conducted through looking at the potential strengths and resources that refer to the real data.

4 Knowledge transfer within university and industry alliance: lesson learned from Japan

Japan is one of the Asian countries with fast economic development, especially in terms of technology in automotive and electronic industry. Geographically, Japan is an archipelago of 6,852 islands in East Asia bordering the People's Republic of China (PRC), Korea and Russia with islands stretching from north to south namely Hokkaido, Honshu, and Shikoku (Wikipedia). Japan has 128 million inhabitants and the 10th most populous country in the world. Japan's fast economic growth places them as the second largest GDP country after the USA. In economic relations, Japan is involved in several activities of world economic organisations such as the UN, G8, OECD, and APEC.

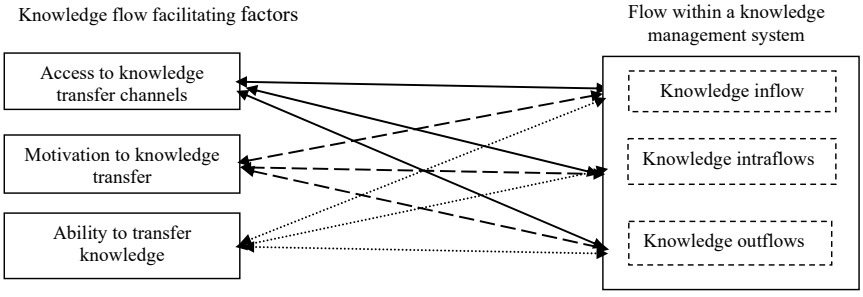
The success of Japan's economy as an advanced industrial country both in Asia and the world cannot be separated from the important role of the development of advanced technology and knowledge. Knowledge is often related to learning, both at the individual and organisational levels, which is important to achieve organisational competitive advantage. Learning process describes a process of targeted problem-solving to fill the actual and potential performance gap. The ideas which generated from the learning process can not all be applied directly to problem solving, but need to be discussed again, and then transformed into knowledge, and implemented through the knowledge transfer process and development.

Dixon (2000) in Strach and Everett (2006) suggests that knowledge transfer is influenced by individual characteristics. The ability to transfer enables organisations to develop knowledge. To understand knowledge transfer activities within organisations in Japan, it is necessary to understand the characteristics of organisations in Japan especially in terms of knowledge management policies that focus on two core areas of social configuration where knowledge could be transferred and internal organisational structures and control mechanisms. Knowledge is embedded in the systems of organisations in Japan as consequence of approaches and other management methods, knowledge activities become part of the management line.

Takeuchi and Nonaka (1986) emphasise the focus of organisations knowledge transfer activities in Japan, especially those engaged in industry, focuses on the success of new product development. In their explanation, they use the six characteristics of the 'jigsaw puzzle'. Knowledge transfer is important aspect in determining organisational performance, as most industries in Japan are external markets oriented, in other words multinational companies compete through technology spillover, exchange of competent staff, and teamwork culture differences (Tallman et al., 2004). Strach and Everett (2006) introduced a knowledge transfer model for companies in Japan as illustrated in Figure 1 which shows two dimensions of knowledge transfer including facilitating factors and knowledge flow. Facilitating factors could be described as contextual conditions that might strengthen or weaken knowledge movement. While knowledge movement is a

spatial measurement and the time of knowledge is transferred by the parent company to a subsidiary, some knowledge is transferred and managed at the subsidiary level, and some are transferred from subsidiary to holding company.

Figure 1 Model of knowledge transfer



Source: Strach and Everett (2006)

Figure 1 describes a knowledge transfer model in which knowledge is developed in context to be transferred to other contexts requiring knowledge transfer mechanisms, organisational settings, and awareness of knowledge for proper transfer. This mechanism becomes the access to the knowledge transfer process. The transfer of knowledge is strongly influenced by the firm's degree of centralisation. The lower the level of centralisation, the higher the decision-making authority by the subsidiaries that has an impact on the lower level of knowledge transfer between parent and subsidiary companies. The larger the subsidiary, measured by the amount of labour, turnover, and financial asset value will have greater control over resources. Based on this perspective, it can be understood that the larger the size of the subsidiary, the higher level of knowledge outlaw from the subsidiary to another subsidiary and to the holding company.

Knowledge transfer model require knowledge transfer mechanisms, organisational settings, and awareness of knowledge for proper transfer. This mechanism becomes the access to the knowledge transfer process. Knowledge transfer is strongly influenced by the firm's degree of centralisation. The lower the level of centralisation, the higher the decision-making authority by the subsidiaries that has an impact on the lower level of knowledge transfer between parent and subsidiary companies. The larger the subsidiary, measured by the amount of labour, turnover, and financial asset value will have greater control over resources. Based on this perspective, it could be understood that the larger the size of the subsidiary, the higher level of knowledge outflow from the subsidiary to another subsidiary and to the holding company.

The motivation of knowledge transfer must be owned by every level in the organisation to influence the behaviour, intentions, and interests that can encourage engagement in the process of knowledge transfer. Another important factor that needs to be created is belief that stimulates social change. Trust is an important motivator in supporting transfer of knowledge because trust provides a definite level of significance for transferring data, information, and knowledge (Nonaka, 1990).

The ability to transfer knowledge depends on the use of common language in communication. It is assumed that companies using a single language will be more appropriate in the management of knowledge transfer compared to firms using more than one language since the lack of local language skills for multinational corporations is a

quite serious issue that hinders the transfer of knowledge. Good social relationships also need to be developed to build an information channel that might reduce the time and cost needed for knowledge transfer. Such information channels could be in formal information channels and informal. Formal channels include reports, meetings, outlines, instructions, and other communications channels written and recorded. While the informal channels to facilitate the process of knowledge transfer could be in the form of personal development practices among the working teams of different subsidiaries as a mechanism of socialisation.

In business environment where there is no longer a boundary between organisations, it is rare to find organisations that innovate independently without cooperation with other parties. Therefore, it is imperative for organisations to select strategic technology field that focuses on competitive efforts in global markets by investing in various fields as an option since the use of new technology has shifted the current technology.

Mayasuki Kondo in a presentation at Stanford University on 15 September 2000 with the theme 'The age of corporate-boundaryless business' gave an example that glass fibre has replaced the copper wires. The technology used was quite different. In this competitive environment, 'time to market' becomes an important competition factor, requiring collaboration with other companies to shorten production time and waiting time and reduce production costs through the achievement of production efficiency and effectiveness. There are many perpetrators in Japan national innovation system. A company collaborates with other companies to complement each other. For example, a manufacturing company's machine is working with an electronics manufacturing company to jointly develop a computer numerical control (CNC). In this case, manufacturing company's machine act as vendors machine and as consumers of suppliers. Particularly in developing countries, most R&D activities are the responsibility of the public sector. To ensure that R&D activities are running well and achieving the expected goals, cooperation between public and private sector is required. At the industrial development stage, the public sector is a research and development actor. In Japan itself, at the stage of industrial development, the public sector organised several national projects to compete with developed countries. The strategy used is to involve researchers, both from the public and private sectors, in national projects as partners through initiatives generally derived from the public sector.

At the maturity stage of public and private partnership program, the public sector becomes the initiator to start a program, while the private sector still lacks sufficient knowledge to lead the program but over time, the knowledge in managing and implementing the program increases so that the role of the private sector also increases. For example, in an incubator program, the public sector financially supports the partnership program at an early stage and at a later stage of development public sector involvement may be reduced. Kondo (2004) provides an example of the case of the inter-industry exchange plaza program in Japan. This program is a technology transfer program from public research institutions to the private sector. The program began in 1970 informally and formalised in 1980. The initial program was called technology exchange plaza program, initiated by public research institutions and local government, and the development shift was initiated by the private sector. To date there are 3,000 active groups and about 125,000 companies participate in it and most are operated by the private sector.

At the research and development stage, it classified in three stages including: basic research, applied research, and development research. At the basic research stage, the

main actors in a national innovation system are the academic sector, therefore any partnership between the public and the private sector tends to begin at the basic research stage. At the development stage, the main actors are the industrial sector, therefore the research initiatives are conducted by the industrial sector. At the applied stage, both the public sector and the industrial sector initiated the research undertaken. University and industry alliance is form of public and private sector partnership that become the driving force of Japan economy, therefore number of policies are developed to promote the activities of university and industry alliances.

Japanese Government developed the first Basic Science and Technology Plan in 1996 which was further strengthened by the establishment of the second Science and Technology Policy in 2001. Research collaboration, research contracts, and academic donations are the three main ways in which companies in Japan to collaborate with academics in educational institutions. Collaborative research requires the involvement of university and industry in utilising resources and working together to achieve common goals under the signed contracts. Contract research conducted by university researchers under contract with the company, the cost of research becomes the responsibility of the company.

To support the country's commitment to advance technological developments, Japan has a policy to support the cooperation program of education institution as a producer of science and industry that applies the findings conducted by researchers in academia. The efforts to accelerate economic development focused on implementing changes in the education sector. Policies in the early industrialisation sector in Japan (Nakamura and Grace, 1985 as cited in Kondo, 2004) with the aim of improving the level of education of Japanese society to pursue the backwardness of Japan in science and technology. Education inculcated in the community includes formal education, moral education, and community education. Formal education is obtained in schools, moral education is obtained at home, while public education is obtained in daily life. Compulsory education programs are programmed in primary and secondary education for 6–15 years of age in public schools run by the prefectural or municipal governments and sometimes by the central government.

To support the role of universities in creating competent and real beneficial human resources in the industry, government policy not only focus on improving the education system but also encourages the enhancement of cooperation in education and the industry in Japan. The main objectives of university and industry collaboration include: innovation to develop Japan's economy to be more competitive in the world, transferring outcomes generated by the university to the community, developing new interdisciplinary research areas, and developing human resources for the community and economy. This goal could be achieved by implementing university and industry collaboration systems and that time more than 200 universities have university and industry collaboration office, 67 universities are supported by the Japanese Government (Monbukagakusho: MEXT) Program for activities in their university and industry collaborations.

The targets of the program include joint research, patent application, contracted research, and licensing/patent. The latest data indicates the total funding received from the private sector has increased in total for five years from ¥15.123 M (in 2005) to ¥57.988 M (in 2010). In enhancing the role of university and industry cooperation, the government has a significant role particularly in achieving the main target of creating an innovation ecosystem. This innovative ecosystem is intended as a sustainable system in which the private sectors, universities, research institutions, and universities, as well as

national or local governments collaborate and compete each other to generate innovation. The MEXT advisory committee on university and industry collaborations delivered measurement reporting to establish the innovation ecosystem in Japan on 7 September 2010. The main sub targets to be achieved include creating a knowledge circulation system through university and industry collaboration, and government, strengthening the capacity of universities to collaborate with the private sector, and developing resources for university and industry alliance.

To create a system of knowledge circulation through university, industry, and government collaboration, it is needed to develop a platform to create knowledge by promoting open innovation. University and industry sectors collaborating from the early stages of the research. The second way is to provide cooperation support from the start of the start-up Japan Science and Technology Agency (JST) and Innovation Network Corporation of Japan (INCJ) provide collaborative support for start-up in the early stages of R&D. Efforts to strengthen the capacity of universities to collaborate with the private sectors could be done through the development of: networks, joint research practices, and patent-based promotions. Joint research practices are conducted by involving more universities and industries in improving joint research methods through research objectives and more flexible contracts. Promotions using JST patents are expected to support bundling of the university patents used.

In 1990, Japan Government introduced a university and industry collaboration system based on the basis applied in the USA. Government policies begin from the establishment of The Act on the promotion of universities to private industries technology transfer (The TLO Act) in 1998. The Japanese Government implemented many policies to promote these activities. This promotion is important to convert public R&D investment into industrial innovations. Through the joint research, university might obtain deeper understanding of R&D and might develop research agenda for innovation. University activities in industrial activities can potentially increase university R&D activities that positively impact innovation, and university research activities should not be limited only to areas that lead to directly applications within the industry.

The Act on Special Measures for Industrial Revitalization (The Japanese Bay-Dole Act) established in 1999 enabled the university to obtain copyright on discoveries resulting from research funding. At that time, it was still very rare for universities to register patents, in general patents registered on behalf of individuals and not organisations. To overcome this problem, in 2004 a new mechanism was introduced to create inter-university competence. Inter-university funding is paid on a lump sum basis as an institution for operating costs. Since funding for joint research collaborated with the private sector, it increased the motivation of the universities to engage in cooperation with industry through university and industry alliances.

5 The importance regulative pressure to optimise knowledge transfer

Anatan (2008) discusses the reason why knowledge transfer activities are important for both university and industry. Such an understanding could be explained by means of a long-term relationship aimed at fostering, maintaining and renewing both parties involved in the alliance. In university and industry alliances, the university has an important role in providing accessible for graduate students at various levels of education from diplomas, graduates, professional education, masters, to doctorates to the industrial

sector. While the industry role is providing technical opportunities for students to get training and explanation related to industry through company visit. In addition, industry might also acted as a provider of research funds for universities.

Anatan (2014) discussed mutual benefit of knowledge transfer for both parties. According to Harryson et al. (2008) as cited in Anatan (2014), collaboration creates synergy between resource and knowledge that might reshape market competition. The benefit of knowledge transfer could be explained from both perspective. From industry's perspective, industry decided to collaborate with university in order to enhance its R&D due to the low of in-house R&D within the company. The decision also influences by another consideration such as increasingly short product life cycles, the reduction in R&D funds, and the change in industry research priorities (Anatan, 2014). While from university's perspective, the decision to involve within university and industry alliance is influences by some considerations, such as the effort to gain financial resources and to increase knowledge regarding technology development.

Even though previous studies confirmed that knowledge transfer activities are benefiting both university and industry, this activity is still considered low in Indonesia. The low transfer of knowledge is due to the often 'mismatch' between both parties. To encourage knowledge transfer activities, an active role of government is essential. Indonesian government has both general rules and specific rules regarding industry policy, such as tax and custom, however implementation is still questionable (Asmara et al., 2016). Study conducted by Moeliodihardjo et al. (2012) indicates the lack of government's role in encouraging alliance between university and industry. This is demonstrated by the fact that universities, industries, and governments are still operating independently in their respective worlds. The results of the study also show that neither university, industry, nor the government have yet to show any party who is ready to take leadership role to develop national innovation system (Moeliodihardjo et al., 2012).

Several studies address the influence of government through regulative pressure on the adoption of inter-organisational linkages (Teo et al., 2003), enterprise systems assimilation (Liang et al., 2007), and cross-border alliance decisions (Ang and Michailova, 2008). The results of empirical studies have proved to be a positive influence of regulative pressures on enterprise resource planning (ERP) adoption in inter-organisational interrelations, corporate system assimilation processes, and cross-border alliance decisions.

Regulation is a form of government and industry association intervention that have significant role in knowledge transfer. North (1990) states that regulations may include codified rules and are used in economic interactions, such as laws and policies that limit the behaviour of individuals within and between organisations. Organisations facing stronger regulative pressures will be more innovative than organisations that face weaker regulatory pressures. The higher the capability of organisational innovation, the easier the transfer of knowledge (Porter and van der Linde, 1995). In other words, regulative pressures have a positive effect on knowledge transfer. Low regulative pressure leads to a widening gap between universities and industries and impacts on the low organisational ability to innovate (Moeliodihardjo et al., 2013).

Regulation plays important role in determining the behaviour of organisations to interact with other organisations, whether within the same or different industry environment. Interaction between organisations could be done through inter-organisational collaboration taking into account the aspects of costs and opportunities or benefits. Through comprehensible regulation, uncertainty factors,

opportunistic behaviour among partners could be minimised in order to reduce the transaction costs (North, 1990).

Regulative pressures emphasise the aspects of research and development cooperation, regulations protecting intellectual property rights are an important subject in the literature since research and development activities in alliances between organisations are influenced by the legal system and regulation (Carlin and Soskice, 2006). Governments and industry associations have important role in determining the effect of regulative pressures on the successful transfer of knowledge.

Study conducted by Anatan (2017) found that regulative pressure does not have a positive effect on knowledge transfer between university and industry. This finding does not support the proposition developed by Poglajen (2012). Regulative pressure affects the exchange relationship in terms of investment in knowledge and equipment between the two organisations, in particularly regarding the dimensions of centrality or autonomy, exclusivity, and funding. A high level of dependence on alliance partners will occur in conditions of low autonomy, high levels of exclusivity, and funding contributions from dominant non-markets. In conditions of high dependency, the organisation will be more similar to partner organisations, thus having a positive effect on the knowledge transfer process between alliance partners. In Indonesia, it indicates the low role of the government in supporting knowledge transfer activities between university and industry (Purwaningrum, 2016; Anatan, 2017).

The success to encourage knowledge transfer activities is strongly influenced by the commitment of both cooperate parties. In developing collaboration, both organisations need to establish common visions and mission as a 'glue' between alliance members to prevent the possibility of agenda deviation in cooperation, and the possibility of the emergence of opportunistic traits in order to pursue individual interests. Another factor that should be exist within the cooperation are trust and effective communication. Trust represents the ability to shape expectations about future goals and behaviours, as well as the necessary conditions to create mutual trust that hope will be achieved. Trust in the context of relationships among alliance partners is a reciprocal relationship of risk, trust required to 'neutralise' the risk of opportunistic behaviour of every member involved in the collaboration. While effective communication is also important to resolve conflicts that may occur between alliance partners. In addition, formal and informal communication between alliance partners will affect professional qualifications so that a good network of collaboration could be achieved.

6 Conclusions

This article is expected to contribute to conceptual literature related to knowledge transfer. The transition role of universities in this knowledge-driven economy as engine of economic growth lead to the increase of awareness on research partnership to support government in order to increase organisational competitiveness. To successfully manage knowledge transfer, the role of government and industrial association is needed. Governments have a significant role in business policies and practices, while the industry association is responsible for assimilating within the organisation's work routines to meet government regulations and encouraging other organisations to engage in similar activities. Trust and effective communication between both parties also have significant

role to achieve successful knowledge transfer activities and alliance performance between university and industry.

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