

Conference Paper

Technology Diffusion Challenges for Micro, Small and Medium Enterprises (MSMEs) in Developing Countries: Case Study of the Appropriate Technology for MSMEs Program (Iptekda) in West Java-Indonesia (The paper is part of a Dissertation with the title of Technology Diffusion Implementation Policy Analysis : Case Study Technology for Region Program (Iptekda LIPI) 2000-2011 in West and East Java written by Dhian Kusumawardhani, 2016)

Amy, Y.S. Rahayu, Irfan R. Maksum, and Dhian Kusumawardhani

Faculty of Administrative Science, Universitas Indonesia

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Abstract

Micro, Small and Medium Enterprises (MSMEs) have been known for their contribution to increase employment rate in developing economies such as Indonesia. With regard to this, the Indonesian Government launched many programs to empower MSMEs. One of these programs, called Appropriate Technology for MSMEs Program-called Iptekda LIPI, has been implemented since 1998; however, owing to the low productivity and limited competitiveness of MSMEs this program has not been successful. The aim of the study is to examine the barriers of MSMEs' competitiveness from the perspective of the technology diffusion policy in Indonesia. The research will address two questions: (1) what are the challenges faced by MSMEs in applying technology for their business, and (2) what are the strategies for improving technology diffusion that will result in MSMEs' success? To answer such questions, this paper will apply the case study of six MSMEs in West Java. The research will apply a qualitative approach using in-depth interviews with six owners of MSMEs in a research context. The findings of the research indicate that the challenges of the program are closely intertwined with the interest and responsiveness of the change agent and the owners of MSMEs. The study recommends a bottom-up approach to technology diffusion for MSMEs and provides a model of MSMEs' empowerment through the diffusion of technology mechanism.

Keywords: Appropriate Technology, Technology Diffusion Policy, MSMEs, Iptekda, Developing Country

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1. Introduction

The collapse of Lehman Brothers in 2008 has resulted on a lowest rate 3.3 per cent of global economic growth compared to the economic downturn in 2000. In addition, productivity and unemployment rate in most regions has grown more slowly in the last decade, compared to the previous decade (The World Economic Forum 2015, p.16). Regarding this situation, many governments around the world, including Indonesia, have attempted to launch policies which focus on domestic competitiveness as well as job creation and innovation. The MSMEs' empowerment, therefore, becomes the most strategic target of such policies due to their potential ability to survive during crisis since their business does not relate to materials from abroad, nor do they involve high rates of employment.

Despite their potential contribution to the national economy, the sector is still haunted by the classical problems of low skills of its human resources, capital constraints and lack of technology usage in their production processes. These problems have affected their poor export performance which is only 4.8 per cent. Chia (2013) adds that MSMEs in ASEAN have encountered many challenges in joining the trade liberalisations, such as the ASEAN Economic Community (AEC). This is because they have limited access to finance and technology, weak entrepreneurial and management skills, and difficulties in coping with AEC market standards, as well as experiencing severe competition from State Owned Enterprises and Multi-National Companies ([2], p.3).

Moreover, according to the research from the Economic Research Institute for ASEAN and East Asia (ERIA) and the Organisation for Economic Research Cooperation and Development (OECD), the Indonesia SME Policy Index in ASEAN has a point value of 4.1, which is lower than Singapore's (5.4) and Malaysia's (4.7) (ASEAN SME Policy Index 2014 as cited in the Jakarta Post February 6, 2015). The gap of policy is caused by various contributing factors, such as: lack of innovation policy for SMEs, lack of technology provision in universities, few linkages between SMEs' needs and Research and Development labs and incubators supply, and a lack of financial incentives for technology development, research and development of activities (ASEAN SME Policy Index 2014, p.11).

In regard to the problems mentioned, this paper will highlight the issue of technology diffusion policy challenges for MSMEs in Indonesia. A case study of the Iptekda LIPI in some cities and districts of West Java will be utilised. The research was undertaken

for several reasons. First, most policies of MSME's empowerment focus on the capital barriers of MSMEs. Technology adoption and diffusion have not been sufficiently addressed. Although technology cannot stand alone, it is very important for MSMEs to compete and grow if they are to be the winner in the global competition. Furthermore, the term technology in this research is adopted from The Dhaka Chamber of Commerce and Industry (DCCI) which prefer use an appropriate technology for MSMEs. Appropriate technology is not merely about simple technology but it adjust with MSMEs characteristics and a country development goals. In addition, it is aimed to introduce a new method of process production in order to improve technological level of usage ([14], pp. 4-5).

Second, MSMEs is one important sector in Indonesia's economy that has been known for its endurance in facing the economic crisis since 1998. However, many micro enterprises in Indonesia still encounter the classical problem of poor capacity of human resources and lack of technological usage in their production processes. The experience of Iptekda LIPI that has been implemented since 1998, may become a lesson to be learned by any policy makers involved in developing similar programs with the aim of improved interventions.

Regarding the issue of the role of technology for empowering the MSMEs, this paper will address two research questions. First, 'what are the challenges faced by MSMEs in applying technology for their business?' and, 'what are strategies to improve technology diffusion for MSMEs to be successful?' To answer these research questions, the paper will highlight some theoretical frameworks on technology diffusion, technology diffusion policy for MSMEs empowerment in Indonesia, and Iptekda program. The research will apply a qualitative approach using in-depth interviews with six owners of MSMEs in a research context.

2. Literature Review

2.1. Technology diffusion

The concept of Innovation diffusion is closely associated with technological diffusion. Rogers (2003) stated that nearly all diffusion research involves diffusion of technological innovation. Therefore, the words innovation and technology have similar underlying concepts ([10] in [10] p. 14). In this research, technology diffusion refers to the innovation diffusion concept used by Rogers, in which innovation diffusion is a process

using particular channels such as communication media over time among the members in a particular social structure ([4], p.9).

From the definition, we go for further review on the previous research among technology diffusion for MSMEs. Most of the technology diffusion research for MSMEs was related to information and communications technology (ICTs). For example, Vega, et.all (2008) had a research on a public program implementation and its influence on e-business system production and SMEs technological adoption. According to the researchers, there is a correlative relationship between programs and SMEs adoption to e-business application ([16], p. 116). However, the research results indicate that application of technology and innovation in the countries with relatively poor infrastructure is difficult. This is in line with the research conducted by Clark (1994) which showed that technology diffusion has to consider the interest of the adopters since they have different access to technology. For example, despite the fact that it is financially beneficial, green revolution technology is not disseminated in some developing countries, since these developing countries do not have the necessary financial capacity (Clark, 1994, in [9], p.453).

Due to the limited funding, MSMEs in Indonesia mostly consist of micro businesses, while the technology diffusion process requires a special strategy. Such researchers as Caputo, Cucchiela, et al. (2002) suggest that technology diffusion to MSMEs through universities, research-and-development institutes, public sectors, private sectors, or large corporations is therefore necessary. The mechanism of dissemination of technology may be in the form of financial support to operate such technology (training, a financial subsidy to purchase the technology) or free distribution of the new technology. The result of this research is in line with the research finding by Xuefeng Liu, et al. (2013) on the role of intermediary institutions in improving innovation capacity among MSMEs. According to these researchers, small-sized MSMEs and their weak growth have resulted in MSMEs having no ability of self-innovation, with the result of the majority of MSMEs being unable to develop into the competitive and big business. Intermediary organisations may integrate innovation resources in MSMEs and improve the innovation capacity of MSMEs ([18], p. 50).

From several kinds of literature and research on technology and diffusion for MSMEs, it can be concluded that the process of technology diffusion among MSMEs with traditional process production cannot only focus mainly on adopters but also the government interventions in the form of technology diffusion policy. This is because the speed of diffusion depends on not only of firm capacity and capability to learn but also

it depends on the market ([12], p. 97). In the next subsection, the paper will address the issue in the technology diffusion policy in Indonesia context and Iptekda is part of the policy.

2.2. Technology diffusion policy for empowerment of MSMEs in Indonesia: A Case of Iptekda

Considering the potential and obstacles in MSMEs, the government of Indonesia has formulated several policies to empower the MSMEs. They relate to the provisions of technical assistance in the form of training and the supply of effective technology for the MSMEs. Technology is expected to increase productivity of the MSMEs since traditional tools and managerial skills may inhibit competitiveness and productivity (Tambunan, 2007, p.75).

The earlier statement is in line with the opinion of the *Dhaka Chamber of Commerce and Industry* (DCCI) who believes that the success of the MSMEs in a competitive globalisation era depends very much on their capacity to master and integrate technology in MSMEs' business strategy ([14], p.5). Therefore, the DCCI has recommended the use of an appropriate technology for the development of the MSMEs. In this regard, the use of an appropriate technology in the MSMEs does not necessarily mean that the MSMEs need to avoid the use of advanced technology. The use of the appropriate technology aims to achieve optimal outcomes that are in line with the need to support production capacity and quality. Therefore, the final products are acceptable and competitive in a global market.

Several policies on the use of technology for the MSMEs have been issued since the New Order regime to the Reformation Era. Figure 1 describes the hierarchy of technology diffusion policy for the MSMEs' development in the framework of Bromley's policy concept (1989, p. 33)

Figure 1 shows that the Indonesian government has launched many policies on technology diffusion for the MSMEs from the highest level policy, such as the People Consultative Assembly (MPR) Decree. Based on the MPR Decree Number IV / 1978, technology diffusion in terms of technology transfer and its adoption in the society is aimed for labour-intensive business, and empowerment. In addition, the Indonesian government has also issued several laws concerning empowerment and development of the MSMEs based on science and technology. At the institutional level of policies, the President Regulation Number 7 Year 2005 on National Medium-Term Development

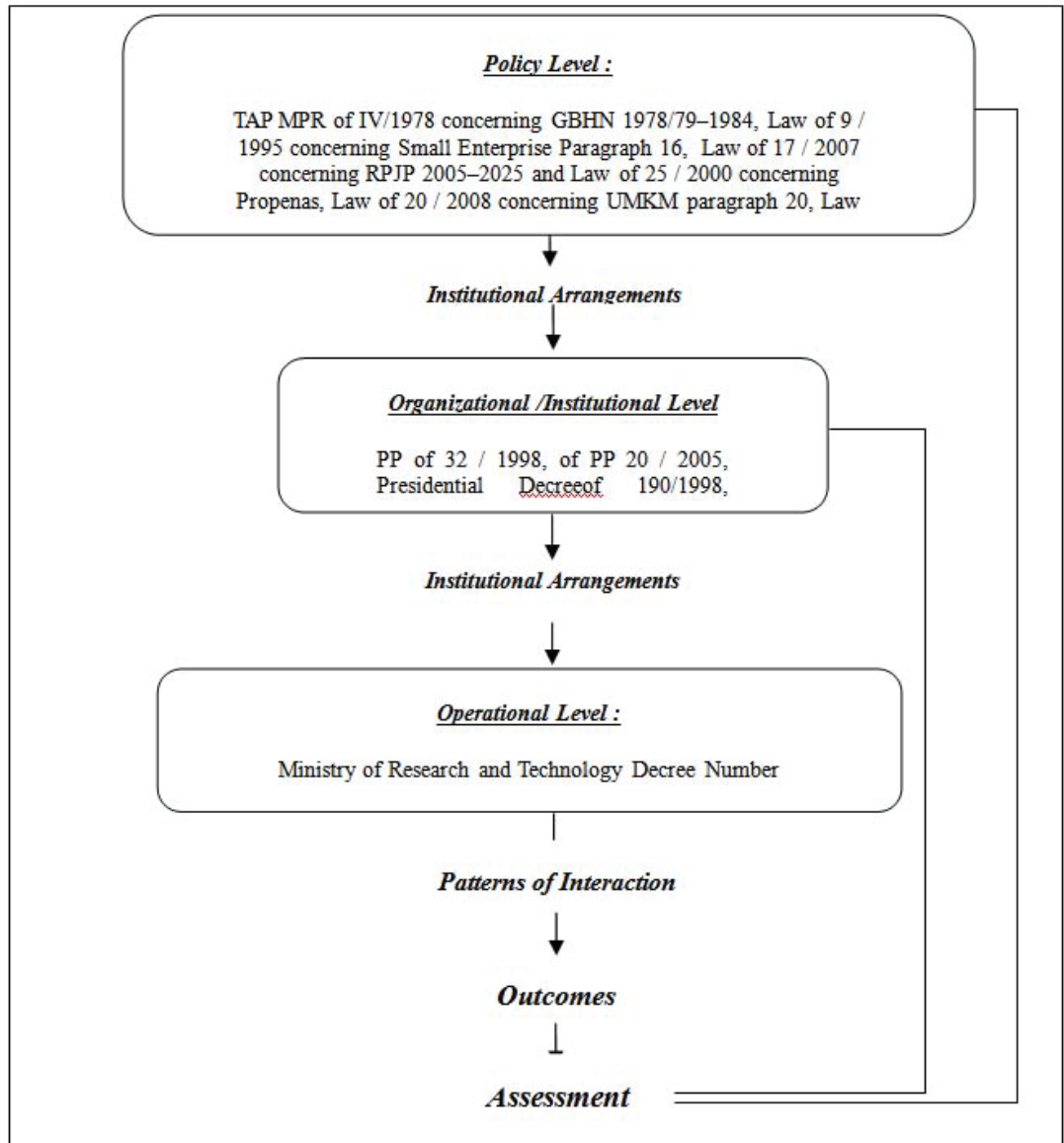


Figure 1: Hierarchy of Technology diffusion policy for MSMEs in the framework of Bromley’s Policy Concept ([1], p. 33).

Plan of 2005–2009, Chapter 21 mentions that the improvement in business technology aims to accelerate the process of adoption, innovation, and technology diffusion among industries, universities and communities.

Regarding the earlier policies, we may conclude that the Indonesian government has put so much concern on the strategic role of the appropriate technology for the MSMEs and the roles to disseminate the knowledge and technology are in the hand of Universities and Research Institutes as part of their commitment in improving capacity building of the MSMEs. Iptekda is one of the programs that has been implemented

since 1998 and has involved many public Universities and Research Institutes such as the Indonesian Institute of Sciences (LIPI).

The aim of universities involvement is due to the locations of the MSMEs which are mostly located in villages. Therefore, the diffusion of technology may reach many MSMEs as the target groups and speed of technology mastering for the MSMEs can be accelerated. Based on the data from the Ipkteda LIPI from 2005-2013, Iptekda has successfully given technology and management assistance for 1,525 MSMEs in 33 Provinces of Indonesia. The locations of the Iptekda are presented in Figure 2.

DISTRIBUTION OF THE LOCATION OF IPTEKDA LIPI ACTIVITIES

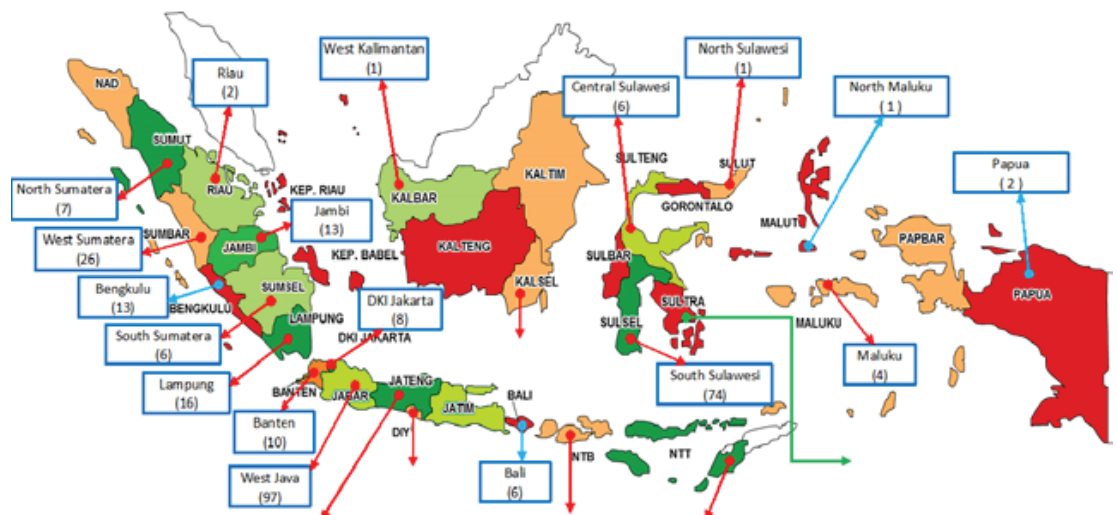


Figure 2: Source : Buletin Iptekda LIPI 2016.

From Figure 2, it can be seen that most of the diffusion of technology by the Universities and LIPI are conducted in West Java. This is because the Province is the closest location from LIPI research centers as well as West Java Universities. Moreover, the MSMEs business in the area of districts and sub districts in the province are various. There are fisheries, agriculture, food processing, craft and dairy products of the MSMEs ([8], p. 2). Despite the highest number of the diffusion of technology of the Iptekda in West Java, Syamsulbahri and Brojonegoro (2006) argue that the number of the Iptekda LIPI activities has a significant influence on the sustainability of the MSMEs productivity.

In West Java, the successful rate of the MSMEs in applying an appropriate technology from the Iptekda is only 36.6% compared to East Java that has similar high activities of the Iptekda LIPI which gains 80.5 % of successful rate ([13], p.64). The contributing factor of the low level of the Iptekda LIPI in the regions is due to some

factors. According to Kusumawardhani (2016) the failure of the technology diffusion policy implementation in the region of West Java is due to the absence of the MSMEs selection which has resulted in the rent-seeker activities from the target groups to the program. As a consequence, the reason for the MSMEs to join the Iptekda LIPI is only to get capital assistance and have no intention to integrate technology assistance in their business activities ([7], p.136).

Moreover, the failure of the Iptekda LIPI implementation is resulted by the new mechanism that aims at establishing independent MSMEs by treating their assistance as soft loan. In other words, when the MSMEs have received the package of the appropriate technology such as machinery and capital assistance, the MSMEs should sign a credit instalment contract for the package and pay the credit to Intermediary Organization called *KIAT* (*KIAT* is one of intermediary Groups established by Universities or LIPI as the executing agency of Iptekda. The membership of *KIAT* is usually owned by the researchers as the change agent of the technology diffusion activity). This technology credit instalment (Generally, the tenor of credit installment is between two and three years, considering that in these periods, MSMEs will be able to improve their capacity and quality of production after adopting the technology disseminated by the implementers of Iptekda LIPI) is paid after the goods produced by the supplied equipment are sold and generate profits. The profits earned by the MSMEs are managed by the *KIAT* and are used to increase the production and marketing capacity of the MSMEs, so that their businesses remain sustainable.

From the analysis of the technology diffusion activity through the program of the Iptekda LIPI, it can be concluded that although technology gives benefits for productivity increases and the competitiveness of the MSMEs, in reality, there have been several challenges and obstacles revealed after in-depth interviews with 6 owners of the MSMEs in West Java who had joined the Iptekda LIPI in the period between 2000 to 2013. The details of data collection and analysis method are presented in the following section.

3. Research Method

3.1. Data collection process

As previously described, the data for this research were collected by an in-depth interview. The technique was justified by the following reasons. First, the researcher

wished to describe and analyse the technology diffusion in the Iptekda LIPI in several regencies/cities in West Java from the perspectives of entrepreneurs of the MSMEs that become the target groups. Therefore, the interview was the most suitable technique for the entrepreneurs of the MSMEs considering the fact that the educational level of most MSME entrepreneurs had not reached junior high school.

Communication obstacles due to the MSMEs entrepreneurs' lack of education resulted in their preference for oral communication rather than written interviews or questionnaires. (An informant in Bogor Regency refused to fill or answer the questionnaires or even oral questions although he knew that it was only for the collection of profiles for MSMEs that were already cultivated by Iptekda LIPI. He was afraid that the data collected would be used as the data for local elections that are commonly broadcast on television) Second, qualitative data collection enabled the researcher to explore new information that might have been neglected by previous evaluations or studies concerning the Iptekda LIPI, particularly those studies or evaluations using a survey method. Six entrepreneurs of the MSMEs were involved in the in-depth interview. They worked in such fields as agriculture, farming, dairy products, and food processing products. Most of the MSMEs were located in Bandung, Bogor, Cibinong, Ciamis, and Tasikmalaya. Therefore, they were used as the loci of the research as well.

However, since the technology diffusion requires elements of agents of change, time and social system, in this research the researcher also conducted an in-depth interview with the researchers from LIPI and higher education institutions as the agents of change. As a result, more comprehensive and deep information could be obtained. The decision of research location was also based on the quantity of the technology diffusion activities in the region and the experience of the program implementers. Bogor Agricultural Institute and Bandung Technological Institute represent the change agent from Universities, while LIPI' Biotechnology Research Centre, Biology Research Centre, and Appropriate Technology Research Centre are part of change agent representatives from the Government Research Center. In addition, these institutes have had extensive experiences of the Iptekda LIPI implementation from 2000 to 2013. The large number of the Iptekda LIPI and their long experience in the technology diffusion for the MSMEs may provide comprehensive information about the challenges encountered by the MSMEs in West Java for applying technology in their production process.

3.2. Instrument of data collection

This research has also applied semi-structured interviews in gathering the data in order to investigate the challenge of the MSMEs in applying the technology in their process production and the strategy to improve technology diffusion process that may lead to MSMEs success. The questions are mostly adopted from Rogers' diffusion of Innovation elements such as change agents, technology characteristics and roles of opinion leaders. The questions of the interview are related to the degree and intensification of communication between the change agent and target group and a strategy of communication applied in motivating the MSMEs to apply the appropriate technology in their business process.

3.3. Data analysis

The data collected from the in-depth interview with informants were presented and then transcribed by transferring the recordings to a written form through a verbatim method (word by word). This information was categorised as primary data. Secondary data were obtained from policy documents, manuals, and previous research results by marking and classifying them to meet the interest of the research. The collected field data were then classified and coded for each category. Later, each code was associated to the theme in the theory. Finally, the results were triangulated using the data and theory to ensure validity and reliability.

4. Field Findings and Discussion

Results of the research in several regencies/cities in West Java show that the challenges faced by the MSMEs in the application of technology in their enterprises are inseparable from the role of the agents of change represented by the researchers of LIPI and Universities. The agents of change have a capability and expertise in providing knowledge about the mastery of technology for the production process. In the next sub section, some examples of research findings on communication problems are highlighted.

4.1. The role of the change agent in Iptekda LIPI

As stated previously, the role of the change agents becomes an important element for technology diffusion process. However, their lack of communication strategy to the grassroots level has resulted in failure of the program. For example, when the researcher gave technology of cattle-productivity by using probiotics, the farmers as the target group did not intensify their communication with the researcher during the program implementation. In fact, the farmers tended to communicate with the boss of the researchers since they only knew the boss personally than the researchers. Furthermore, they also underestimated that the researcher lacked knowledge about livestock industry.

“Although Mrs N is the field coordinator, we do not ask her assistance in applying technology of probiotics since her knowledge about cow-breeding is quite limited. In fact, she tends to know about theoretical framework of livestock or cow productivity since her probiotics technology does not have any significant impact on our cow improving weight.” (In-depth interviews with farmers from Cibinong Area, 15 February 2013).

Based on the information stated from the farmers, we may conclude that the problem of *heterophily* occurred and hindered the technology benefit for the farmers. According to Rogers (2003) heterophily when the change agent speaks a different language, it resulted in the distortion of communication as the adopters failed to understand an important message. In the case of Cibinong farmers, the change agents were treated as strangers beyond the community of MSMEs livestock and resulted in the failure of technology to be disseminated and applied in the community of livestock. In regard to communication problem, the case of personal relationship between the researchers superior or boss and the MSMEs owners also occurred in another MSMEs that runs business in cassava chips or organics fertilizers.

We have a difficulty in designing activities with our MSMEs, since from the beginning of Iptekda, our boss has recommendation to give the assistance for them. On the process of assistance, the MSMEs tend to neglect us as the field coordinator, and made us difficult to monitor their progress in applying technology result and impact on their business. All reports go directly to our boss, and our boss does not have any time to give information from the report

that they made to us. (An in-depth interview with a researcher from LIPI Bogor, 3 February 2013).

The problems of intensive communication and technical assistance between the change agents and their adopter also are also influenced by the lack of financial and non-financial reward that the researchers could get from their institutions. At LIPI, the activities of capacity building for grassroots are not part of the institution main functions. As a consequence, the researchers tend to choose to conduct research in laboratories instead of community development activities such as Iptekda LIPI.

From the perspectives of the researchers or change agents from Universities, the researchers are still given reward in terms of career promotion for their community development. However, the researchers still complain about the minimum payment of honorarium that they can earn from the Iptekda LIPI. This information is described based on an interview transcript below:

..the program goal is very idealistic. We should motivate MSMEs owners to pay their loan for the assistance that they received but in reality MSMEs cannot meet the objectives. They only want money in cash and we do not have sufficient amount of budget to monitor their productivity after the program ended in one year. If the MSMEs owners have had intentions to pay, our operational cost can be paid off from the credit payment from the MSMEs." (An in-depth interview with a researcher from Institute Technology of Bandung, 10 February 2013)

From the perspectives of communication aspect, we may conclude that although the change agents have an important role in the technology diffusion as stated by Rogers (2003), their role cannot work because of bureaucratic environment of their workplace such as LIPI and public universities, however, thus resulting in their low responsiveness to adopter' needs. The problem becomes worst by the lack of financial resource availability for the program which makes the MSMEs tend to receive the Iptekda LIPI as part of grants assistance rather than capacity building assistance.

In the next subsection, we address the issue of the diffusion of technology strategy for the MSMEs to be successful. It also analyses the role of opinion leaders in the society as they play an important part of the success of the diffusion of innovation for the MSMEs. In addition, the characteristics of technology in the Iptekda LIPI may bring potential factors to address the issue of sustainability of technology usage and mastery among MSMEs.

5. The Characteristics of Technology

Referring to Rogers' theory, the nature of technology diffusion in Iptekda LIPI is interpreted by the target group from the perspective of *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*. *Relative advantage* is meant by Rogers to be the extent to which an innovation is perceived to be better or more beneficial than previous innovations. The level of benefits can be measured from economy, social prestige, comfort, and satisfaction. In West Java, the majority of the MSMEs perceived no economic benefits. Several informants stated:

.... The problem is that we want some profits, with little profit from this big yoghurt at the price of five hundred rupiah Of course, the profit is too small For local consumers, it is expensive. (In-depth interview with Wife of the Head of RW, Sampora Village, Bogor Regency, 9 February 2013)

However, from the perspectives of satisfaction and social prestige, several informants feel the benefits of the adopted technology. The following is an excerpt of one interview.

Until now we are competing with Banjar, sale gulung should be the special food of Banjar city. Coincidentally, the people who produce fried sale, particularly sale gulung, are all the people from Ciamis. Pak Tarwa, Pak Haji Tarwa, is [are] from Ciamis. That's why when Pak Camat in Banjar instructed me to move the domicile to Banjar, with identity card of Banjar, so that we can belong to suppliers of Banjar special gifts. (In-depth interview with entrepreneurs of sale gulung, Ciamis Regency, 14 March 2013)

In terms of the use of probiotic feed technology, the farming group in West Java found no *relative advantage* because they did not earn additional profit. Such was also the case for entrepreneurs of yoghurt. Although they have been familiar with the technology of yoghurt production, they were not interested in continuing the use of the technology since they found no relative advantage.

Contrary to the two entrepreneurs, other entrepreneurs of MSMEs in the fields of crafts, *sale gulung*, and decorative fish in Ciseeng felt that they received some *relative advantage*, especially in the form of social prestige due to the presence of local government and the actor of technology diffusion, locally called 'the professor' or with the publicity in the local mass media. Therefore, *relative advantage* was felt differently by different *adopters*.

For the *adopters* having experiences in the business, *relative advantage* may not necessarily be in the form of a productivity increase but also in the increase of sale price. Unfortunately, the field coordinator as the *change agent* did not accommodate the profits earned due to the *heterophily* factor in which both *change agents* and *adopters* felt that they had their exclusive expertise. For example, the *adopter* was experienced in farming, while the *change agent* was an expert in probiotic technology. There was a miscommunication between them, resulting in unachieved relative advantage.

Yoghurt entrepreneurs did not feel the relative advantage since they had no experience in the production of yoghurt. Their failure to understand was similar to the *change agent's* failure to understand the profile of their *adopter*. In spite of being well accepted, the adopter, other than obtaining additional capital, did not feel the relative advantage. In other words, the relative advantage for entrepreneurs of MSMEs with such characteristics as entrepreneurs of yoghurt means a way to obtain additional capital through the government's grants since they have not needed any technology.

Technology diffusion with such characteristic of *adopter* groups requires a need analysis before the *change agents* diffuse the technology. Without such a needs analysis, the process of decision making in technology adoption will depend very much on the *change agent's* preference rather than on the adopters' need. Accordingly, the objective of the *change agent* to encourage the mastery of technology for MSMEs as mandated in the Government Regulation number 20 / 2005 becomes difficult. Furthermore, the technology introduced to increase productivity has to consider the need of the *adopters* for simply additional capital.

With regard to the perception about the compatibility to the prevailing norms or values in the communities or potential *adopters*, in the research area, there was no technology contradictory to the prevailing norms or values in the adopters of technology. Furthermore, compatibility also relates to the situation, condition, and need of the potential *adopters*.

This is funny. My lecturer told me that research is a matter of machines, talking about machines. Therefore, we need the technology that is effective to be applied in our areas. For example, yesterday... there was a tool to clean up salak trees. It needs large voltage. Electric machine. So we feel sorry to use it. It is useless. Not only could we [not] use it...we don't even have that much of electricity..., eee.... for industry in rural areas, actually the best alternative is according to me. Handmade. (In-depth interview with salak artisan Manonjaya, Desa Cineam, Tasikmalaya, 10 March 2013)

The informant emphasised the importance of compatibility between the technology and the infrastructure of the village with a low capacity of electricity supply. Otherwise, the application of technology will not be effective. Therefore, the people refused to use it because they were afraid of the negative consequence of the use of technology and this situation created an additional burden for the *adopters* especially the early *adopters* in West Java.

Complexity or simplicity of the operation of technology is related to the level of ease or difficulty of the technology. Perceived difficulty of the technology operation will result in an absence of adoption among the target groups. On the contrary, simple and easily operated technology will encourage the *adopters* to welcome the diffusion. In Iptekda LIPI, an appropriate technology introduced to the entrepreneurs of MSMEs was not perceived to be difficult.

It is easy for us to introduce this, because he has known the previous technology, he has known. In six months, they will be familiar. They already can use the on-and-off switch. The process is not difficult, simple to understand and implement this work. So, there is no problem. (In-depth interview with researcher of IPB, Bogor City, 4 March 2013)

The trialability of technology will minimise the uncertainty of the technology. In Iptekda LIPI, one of the requirements of technology diffusion activity is that the technology can be operated easily and has been applied in other places. In West Java, since the need for technology was not the priority, compatibility was not important, since the adoption of technology of Iptekda LIPI was based on their intention to obtain additional capital rather than their need for an increase in production capacity. Besides, compatibility was not ensured and therefore, many businesses are no longer operating.

When the adopters feel the benefits of the technology, they will sustain the adoption. In West Java, the concrete benefits of technological innovation were associated to improvement of knowledge and increase in income rather than development of business. This was due to the minimal business experience of the entrepreneurs of MSMEs in this region. For example women community in Sampora village Bogor regency used to know yoghurt as stale milk, but after Iptekda LIPI they know that it is a healthy dairy products.

The results of the field observation conclude that the challenge faced by MSMEs in West Java in the application of technology for their business is the role of change agents in communicating the technology and the MSME empowerment program

through the instalment scheme of the technology transfer fund. Unwillingness of the change agent to use informal approaches by utilising the opinion leaders has complicated the government's efforts; in this case, the researcher from the R&D institute.

5.1. Strategy of implementation of a technology diffusion policy of MSMEs' empowerment

The findings reveal unaccomplished technology diffusion activities through Iptekda LIPI. There are some problems faced by MSMEs in West Java in adopting and using the technology as part of their production process. To implement the technology diffusion policy for MSMEs' empowerment in this region, the diffusion has to consider the social and cultural systems.

Among the people in the research location, the researchers identified strong familial bonds. Individual values are determined by community view, therefore, the village executives or elite groups such as the religious figures play a significant role in decision making. In the context of technology diffusion, the role of opinion leaders and *change agents* is very crucial in the acceptance and adoption of technology. For example, in lobster cultivation, the field coordinators approached the local government's executive in choosing the MSMEs and during the harvest time, they involved residents having high social and economic status in the community.

Likewise, the researchers of decorative fish cultivation approached one of the fish cultivators who had won a national competition. They recruited other members. The group leader who was the national champion of decorative fish cultivation was designated as the *opinion leader*.

Successful technology diffusion requires all-out efforts. The following interviews illustrates this.

I had direct interview. I interviewed the group leader ... and he had won a national competition. The first national champion. When we got the fund, finally we had 25 members of the group. (In-depth interview with researcher of P2 Limnologi LIPI, Bogor Regency, 25 February 2013)

Next, it should be the community leader if possible. Therefore if this is successful, she will communicate more quickly to the families...that she...is the leader for the community. Thus they have a leader. She is the leader of Karang Taruna in her village or community. We give her higher priority than the common people do. When harvest,

we have many people. They claimed, 'Oh she brings this...that...' the owner, a woman, went out. She is a rich person, a figure. (In-depth interview with field coordinator P2 Limnologi, Bogor Regency, 10 February 2013)

Based on the in-depth interview, it can be concluded that the social cultural system prevailing in a community is part of the strategy for *change agent* to diffuse their technology. However, this strategy is only beneficial in determining the level of acceptance by MSMEs of the technology. However, sustainable technology diffusion would depend on the need of MSMEs and the intensity of assistance as observed in the case where the introduced technology was not used after the *change agents* ended their assistance.

Intensive assistance after the diffusion of technology through Iptekda LIPI will run well if KIAT can properly serve as the manager of the technology transfer fund to MSMEs. This is possible since all fund management aims to further develop and empower MSMEs. The field coordinators can also utilise the collected funds for the diffusion of technology to other MSMEs. Unfortunately, results of in-depth interviews with MSMEs in West Java show that relatively new and passive MSMEs in this region are struggling for survival in these times of economic hardship.

For such MSMEs, strict election criteria are needed during the technology diffusion. Longer periods of instalments of technology transfer funds are required. This strategy is in line with the research of implementation of Iptekda LIPI in a case study in Malang Raya, East Java. The results of the research suggest that successful technology diffusion policy in Malang Raya, East Java depends on responsiveness and obedience in implementing technology diffusion through the active role of the change agents and target groups and in identifying the need for technology for the development of business ([7], p.265).

The success may be in the form of increased productivity, efficiency, and marketing ([6], p.22). Results of this research supported the findings of previous research conducted by Syamsulbahri and Brojonegoro (2006) that the highest percentage of success was found in East Java. In West Java, the failure of technology diffusion was apparent in the absence of mutual interest between the field coordinators, who felt they had too much of a load of diffusion technology of Iptekda LIPI and the MSMEs who perceived technology as a mere attempt to get additional grants from the government.

6. Conclusion and Recommendation

From the findings on the field and literature analysis, it can be concluded that although technology is a strategy to improve competitiveness of MSMEs, the case of West Java shows that the expectation of MSMEs to adopt the technology in production processes and achieve relative advantage and sustainable business could not be fully accommodated by R&D institutes or higher education entities. This is because the technology diffusion process requires significant time and above average responsiveness from the change agents. Unfortunately, these two factors were absent in the technology diffusion process administered by the change agents due to the absence of interest and low financial remuneration for their full responsibility. The alternative solution to overcome the problem is the involvement of the local government, entrepreneur associations, and village governments in the selection of MSMEs so that the target group will adopt and implement the technology to increase productivity, efficiency, and marketing.

In other words, it is necessary to redesign the technology diffusion policy by taking into account the policy environment and by involving actors in addition to the government's R&D institutes and higher education bodies. Therefore, it is necessary to identify the real need of MSMEs particularly in the field of technology to ensure that the products of MSMEs are competitive in the global market.

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