THEORIZING THE SOCIAL ACCEPTANCE OF APPROPRIATE TECHNOLOGY

TEORISASI PENERIMAAN SOSIAL TENTANG TEKNOLOGI TEPAT GUNA

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I N F O A R T I K E L

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S A R I K A R A N G A N

Teknologi tepat guna telah aktif dilibatkan dalam wacana pembangunan teknologi ramah lingkungan yang dapat dipergunakan oleh rumah tangga di negara-negara berkembang. Namun demikian, banyak ahli masih mengabaikan dimensi sosial yang dapat mempengaruhi dampak keberlanjutan atas proses yang terjadi sebelum dan sesudah konstruksi teknologi tersebut. Dengan menekankan pada teori teknologi tepat guna dan teori konstruksi sosial teknologi, paper ini mencoba memberikan suatu ide mengenai dimensi-dimensi sosial teknologi yang melekat pada seting sosial masyarakat dimana teknologi tersebut dibangun.

Keywords:

Appropriate technology
Developing countries
Household

A B S T R A C T

Appropriate technology is actively involved in the discourse of the developing of environmental friendly technology that can be used by local household in the developing countries. Still, many experts neglect the social dimension that may affect the sustainability in the pre and after construction processes. By acknowledging the theory of appropriate technology and social construction of technology, this paper is in attempt to shed the light of social dimensions that are often embodied in the social setting in which technology is constructed.

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1. INTRODUCTION

Local communities living in poor rural areas of Indonesia face difficulties in fulfilling family's basic needs. Cooking activity for local family lacks of accessing affordable cooking technology that is easily operated and lasts long (Alam, 2012). Cooking activity is routine imbued with socio-cultural entailment, which can function as bonding the emotionality among the family members (Wilhite 2005, Winther, 2008, Standal 2010). In developing countries like Indonesia, local households that live in poverty line requires a cooking tech-nology that fits their limited financial capacity, which the materials can be sourced from local resources such as wood, cow dung, remnants, and bamboo. In addressing this issue, appropriate technology such as biogas-powered cookstove is engineered to assist the constrained local community. However, the process of how appropriate technology can affect the community and the way it transform the lives of community are barely investigated. The developmental-state narrative under the notion of modernization discovered by mostly capitalists undermines the locality and pre-existing traditional knowledge (Standahl, 2010).

The objective of this article is to conceptually scrutinize the understanding of the

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societal dimensionalities, which may contribute to successful the adoption of novel technology. A continuous use of biogas technology in the households relies on different determinants that take shape in the local 'world-view'. As this study is in attempt to scrutinize heterogeneous factors that facilitate successes of local technology construction, optimizing the technology adoption in the family and the process of incorporating biogas into routine, different theoretical perspectives are employed to deal with it. First, the theory of adoption of appropriate technology will help analyze how particular extents like construction materials, socio-cultural setting, collaborative effort between users and designers could enable the adoption of technology, while Social Construction of Technology (SCOT) will bring the light the influence of interpretative flexibility and technological frame in shaping the use of technology.

2. THE ACCEPTANCE OF TECHNOLOGY: THEORETICAL APPROACH

2.1. Appropriate Technology

This section deals with the fundamental concept of appropriate technology. First, a conceptualization of appropriate technology adoption is presented as the basis of this theoretical study according to some prominent scholars. Ryan and Vivekananda (1993:20) define appropriate technology as technology that can be operated on locally obtainable materials and under specific rural contexts, and it will gain importance since it equips households with multiple benefits so that contributes to the lives of local community. The main principle of appropriate technology is later characterized with the use of local materials for its construction and is particularly benefitted in specific rural setting where its routine usage is sourced from the local experiences and in connection with the existing cultures that has long been preserved my the community as principle of social interaction.

Organic substance is embedded in the sustainability of the global ecological system (Capra 2003), as appropriate technology uses the local resources, which of its purpose is to reduce the loads of waste thrown onto the environment. Further, the involvement of nature as inseparable entity in human being is also inclusive of discussion in AT (Ryan and Vivekananda (1993). Departing from this view, AT is actually interconnected to the holistic worldview on nature itself, and shall foster integration of "beliefs, social forms, and harmony with nature as well as the organization of physical materials under the laws of science (Ryan and Vivekananda 1993:52).

Even though the facilitating aspect of appropriate technology is broad, there is social system, kinship, needs of the users, cultural context, dissemination of information, availability of locally obtainable materials, and knowledge of the local community apply that are developed to scrutinize the context of case study in this biogas technology research. Warriner and Moul (1992) assert that kinship can make influence on the provision of resources through exchanges to accelerate the adoptions. Other scholars point out that cultures, and financial constitution of knowledge are detrimental to allow the technology adopted by the potential users in the rural areas (Nsiah-Gyaabah 1997, Grieve 2004, Lawal 2010, Driesen and Popp 2010). The needs for using technology are another fundamental extent that is integral in making technology acceptable in the household. Responding to this, Clifford (2010) espouses how culture and the needs are integral in such processes as he argues, if that the needs of individuals for certain appropriate technology are manifested through the tools they use intensively, the culture will remain sustainable. These societal aspects might influence potential users to come up with firm decision and attitude to adopt the biogas. In order to avoid unclear conception of adoption, succinct definition that is invented by scholars shall be utilized. As for the adoption, scholars define adoption as a specific initial action that they are

sufficiently ready to take up the technology (Rogers 2003, Floyd 2003, Subedi et al 2009). In more specific, Rogers (2003) delineates adoption as act taken by an individual on the use of particular technology into their daily practices.

After returning from fieldwork, this theoretical perspective on appropriate technology gains prominence in this study as the findings suit some aspects that are discussed under the concept within this theory. It was also discovered that continuity of operating biogas in the household setting is also confirmed by a sufficient management of cow dung, conducive setting of the village characterized by agricultures and cultural norms of Javanese where mutual assistance as embodied values, and the experiences of users are dissimilar one another. When it comes to culture, there is an interplay between biogas technology and local culture as it is inherent in the sustainability of daily operation and use of biogas (Hubrecht 1979 cited in Ryan and Vivekananda 1993:21).

2.2 Importance of Local Materials Availability and Labor.

Appropriate technology is dependent on local materials. For example, biogas as of appropriate technology characterizes the typical appropriate technology in the rural setting where local materials used for construction and daily feeding into the plants are potentially abundant. It is aligned with study informed by Quadir (1995) on the compatibility of biogas appliances for rural community that the characteristics of rural areas in most developing countries in Asia and Africa with abundant livestock can allow biogas technology growing rapidly than in that in the city.

The supply of local materials utilized for biogas construction and quality of cow dung really matters in ensuring the sustainability of the technology. Furthermore, studies that point out the intersection between adoption and local material supply are elaborated by Akinbami (2001) and Parawira (2009). Under specific investigations and observations in some global practices of biogas, these two scholars there is also finding, espousing that since biogas is locally practicable and no need for requiring sophisticated supports of extra equipments to maintain, it raises more adoption rate among the local people. The importance of stocks of constructing materials used to establish the biogas technology is also ever researched and from the findings in the field it is revealed that all parts of biogas technology that are inclusive of construction materials produced and purchasable in the nearby town and local supply chains may downgrade its production cost and hence savings can potentially be made for financing other necessities (Purohit and Kandpal 2005, Henriques and Schnorr 2010, Walekha 2009).

If the supply of materials considered sufficient, the further process of construction by employing skilful and well-trained labors are notably important for both constructing stages of the plant and daily maintenance practice (Pal 2003). Concerning to it, valuation of labor by also thinking of feasibility of household's financial capability to purchase it (Purohit and Kandpal 2005). In responding to the concern of employing labor, Walekha et al (2009) contend, by getting family members of household involved allowing household to retain the sustainability of biogas, and such efforts would boost and shape more emotional tie among the family members. Apart of it, the access to materials would be imperative consideration to succeed the adoption of appropriate technology, as it relates to the usability of local resources. In conjunction with this, Floyd et al (2003) assert, raw materials which are locally available is rather influential and empowering than those gained from outside. The extraction of local sources for the operation of appropriation technology is believed and conceived to be progressing the lives of household users as well as community at large. Hence, reinvigorating skills and experiences that are on locality basis is highly necessary.

The access to local materials as resource for constructing the infrastructure of technology, as in biogas, is associated to economic situation of

the adopters. For those living in the developing country like Indonesia whereas it comprise 60 percent of rural population who lives in agricultural domain, biogas has higher likelihood to be adopted by the middle-income farmers because they have more access to the economic sources, and possession of landholding (Ni and Nyns 1996, Devadas 2001). So, taking economic condition of the local livelihood into consideration is important.

2.3 Knowledge, Information, and Socialization Influencing the Decision

The possession of knowledge in enabling appropriate technology is inevitable. In support of his argument, Subedi et al (2009) maintain that knowledge can shape decision-making action so that the specific technology can be suitable with the needs of the users and perceived it as useful innovation. In this regard, knowledge may take form of users' understanding attributed to the technical issues of biogas, engineering process, procedures of maintenance, and other concerns associated to the routine operations for its sustenance. Based on studies carried out by scholars, the effect of knowledge interplays with other trajectories such financial capabilities, digesting information, and even meaning making process of artifacts in the context of adoption of biogas technology (Trip 2001, Subedi et al. 2009, Bensah and Brew-Hammond 2010).

Considering the future sustainability of the use of technology, users shall have capability of identifying potential sources, which can be mobilized for the operating of appropriate technology. For instance, before biogas is adopted, a potential user living in the agricultural setting must be able to take knowledge into consideration. This knowledge consists of set of the particular physical condition of the land and local resource for the improvement of the use of technology, so it would make biogas "acceptable in by the market" (Trip 2001:483), while the information from any source be online or people around that is pertinent to the cost, yields, and technical challenges of the technology in near future can concomitantly contribute to their decision on for taking up the technology (Upadhyay 2003). Farmers living in the agricultural setting are frequently concerned about the issue of the emergence of chemical fertilizer product that could deteriorate their soil. In relations to this, study of Bishop et al (2010) on the risk perception in the context biogas technology unveils, most of the farmers will prefers to leave for biogas as alternative energy because there are no potential dangers compared to other kerosene or LPG based stove.

In the course of adoption, handful information on the technicality of the technology will respectively determine and affect the decision-making process. It shall be transferred according to the setting of where potential users live. The more complete information and the more interest of potential user to it. The deliverable of information is inherent in the use of local language or context in which the technology will be placed and therefore digestible language as means of communication may enable to invite more users. In relations to this extent, Kamal (2011) puts up that digestible information presented through the examples from local setting are rather effective and will foster successful adoption. From this viewpoint, this scholar want to emphasize that participatory communication is a key to making potential users understand the language they use.

In such context, the information on biogas technology is explored through socialization in the local context to raise the local awareness of the financial situation, basic technical maintenance, construction matter, and potential problems that could curtail its sustainability. The impact of socialization for introducing the community members to biogas was intensively studied by Pal (2003). The primary finding of his study is that users can minimize their doubts and confusions about the perceived risk of biogas and get affirmations on what future benefits they can gain from socialization stages that are preceeded with trial activities to give a try of technological use. While Ilyas's study (2006)

focuses rather on the importance of emphasizing the socialization of biogas technology on the benefits for agriculture in order to attract more potential users. According to this research the potential users were attracted and finally registering themselves as biogas users as this technology can help improve the fertility of the land by benefitting the slurry for organic fertilizer. From this study, communication wise the chance of adopting biogas will be higher if the users get exposed to multitude advantages of biogas.

In conjunction with socialization and information, an appropriate technology ought to be tried out by the potential users to check whether it suits their needs and expectations. The reason behind this is that the way potential users try the technology before it is adopted will make them easier to perceive how technology shall be functioned (Rogers 2003). Further more, trials of biogas operation itself can potentially be a hands -on experience in tackling the technical issues in daily practices of the appliances such as the stove, checking the manometers, etc. In the biogas practices in Lusaka, Zambia according to Lewanika (1996) demonstration biogas plants enabled success of engaging more adopters because the event was stimulating and keeping the user's discontentment of new technology away.

2.4 Needs and Motivation

Users might have distinctive preferences on which model of technology, and it is believed as one of the fundamental values for adoption (Floyd et al 2003). From his view, preference is grounded on the suitability towards the users needs. In this regards, Kamal (2011) stresses that appropriate technology is adoptable as long as it is on par with *felt* needs of potential users. Once people conceive felt needs, they would deeply consider what such technology is really meant for live, rather want it for short. If the chosen renewable energy can be implemented in accordance to user's need, they will feel it as an urgency to implement the technology (Kamal 2011).

Motivation is a personal state that could harness potential users to reinforce their commitment because it can encourage user to have decisive action towards the certain technology. Furthermore, motivation that emerges from the willingness can stimulate the potential users to operate the chosen technology and learn further about the new technicalities. Likewise, in the biogas adoption motivation that is built upon the sufficient local capacities would be effective for users to use appropriate biogas in daily routine (Pal 2003:3). Furthermore, internal motivation leads users to decisive behavior towards continuous functioning of the biogas technical system, while the information on the post construction services can facilitate them in obtaining knowledge and create independent ideas of coping with potential shortcoming (Ni and Nyns 2006, Muhammad et al 2001). Kumari and Grover (2007:357) in their study of the externality of increasing oil price argue that stronger motivation of household can lead to robust decision in shifting to the biogas.

2.5 Cultural Context and Equal Partnership

Cultural context is inherent in practicing the technology. It is instanced by Nsiah-Gyaabah (1997) on her biogas study in India that the users delimit the use of biogas cookstove for the routine because biogas cannot fulfill the heating level to toast 'dal' (traditional bread used to be cooked on coal-fuelled stove). This cultural practice is termed by Ryan and Vivekananda (1993:27) as 'ingenuity, which can be connoted as local culture.

Another extent that is worth to note is regarding to equal partnership among involved stakeholders. As the ultimate pointing here is the local people and its context, the forging partnership must, without bargaining, lies under the principles of respecting and appreciating tradition and custom of the people themselves. In short, transparency among the involve group is at the heart of the partnership. Kamal (2011) maintains that in the pursuant of effective and ideal renewable energy, public-partnership must embrace and practice transparent, equitable, and

environmentally transfer of technology to the local people.

Good partnership and obtaining government support is beneficial to break the financing barriers of adoption. Overcoming financial constraints for funding the whole process of construction might become potential challenge to meet. In this case, government supports are required to enable users to break down such constraints. Nevertheless, commitment of government to the provision of assistance and popularizing the biogas technology by also forging partnership with NGO are enhancing efforts that effectively boost adoption rates (Katuwal and Bohara 2009). It is instanced by the efforts of Nepal Alternative Energy Effective Center (AEPEC) at aiming the successful establishment of 100 biogas plants in Nepal in 1997, endorsed by Ministry of Science and Technology to accelerate the adoption rate of the biogas technology.

2.6 Social System and Kinship

Technology itself is utilized under particular social system of community. The newly chosen artifacts might be opposed to or in parallel with previous energy sources, which much reliant to the social activities in the community. In this extent, social system functions as embedding effect that can shape the practice of technological artifacts (Altman and Wohwill 1977:279). The social system, on the other hands, can foster a meaning making process towards the technology. The involvement of social system is to make the appropriate technology as 'matter' to be reflected in the worldview of the local people so that they can have consciousness (Capra 2003). The consciousness here will lead to more sustainable functionality of the technology as this concept is part of rationality of users to shape the practice of technology in their life.

Solidarity among the users and non-users and kinship remain considerably strong in affecting the adoption of the biogas technology. The significant roles of kinship as part of social system really matter in the co-shaping of technology as discussed by some scholars (Altman and Wohlwill 1977, Peletz 1995, Bennett and Despres 2011). When artifacts are enhanced through certain process of creation, kinship becomes instrumental for disseminating the innovation (Bennet and Despres 2011). Furthermore, kinship can be imagined as an accommodative space in which innovation of artifacts are placed, as Peletz (1995) points out that kinship interplays as informational extents to the transferred group because it is the 'habitus' for symbolic assets and trust. Meanwhile, the view of Altman and Wohlwill (1977) on solidarity of kinship stresses more on political and economic relations, which this dimension is imbued in the motive of society and power control among the users and non-users.

2.7 Social Construction of Technology (SCOT)

Social construction of technology (SCOT) emerged as a counter theory against technological determinism. It brought new theoretical enlightenment in understanding how technology is co-shaped in the society. The establishment of SCOT thus appeared as a reaction to the technological determinism. Technological determinism is believed by engineering scholars that, "hardware and software technology are the ultimate cause of social change" (Hughes 1993:8). With the ignorance of social relations of technology, the experts and engineers exclude the societal factors that are inherent in the worldviews of users. Moreover, technological determinism also fails to deal with "other factors inherent in the social-cultural setting" (Hughes 1993:16) in which the technology presents. As opposition to the technological determinism, Social Construction of Technology brought new enlightenment in this trajectory. The proponents of social construction of technology also argue that technology is a socio-technical product shaped by "the conditions of its creation and use" (Wajcman 2004:34). The situated artifacts in the environmental milieu of the users would be co-shaped by the interactivity and in accordance with the existing social setting re-

spectively. In addition to this, interpretations of the artifacts are reliant on the users themselves. Responding to this, scholars specify knowledge and experience of users as two extents that are likely capable of co-shaping the artifacts (Mackenzie and Wajcman 1985, Bijker et al 1989 cited in Omrod 2006:43).

In the social shaping of technology, interpretative flexibility is the core concept characterizing this approached (incorporated with users innovation as its outcome), while the technological frame is another concept to propose the explanation of the development of hete-rogeneous socio-technical process, hence denying social reductionism.

2.8 Interpretative Flexibility

Users hold and retain important roles in determining and taking shaping the artifacts. The ability of users in discerning the meaning of the artifacts for their lives lies in the interpretative flexibility. In principle, interpretative flexibility affirms that the change on the technology or the artifacts are unfixed, always interactively evolved, and remodeled in the implementation stage. To clarify this, Wajcman (2004:37) defines interpretative flexibility as "capacity embodied in the group of users or people engaged in a technology and such understanding is varied one another and in further stage user could make alternative meaning and deployment of technology".

Different group can have alternative meaning of the technology and could socially constructed by their social experiences and this is what "heterogeneity" characteristics lie in it. On the other words, heterogeneity implies about differences in meaning-creation process embedded in that technology. In the same vein, heterogeneity based on Volti (2001:75) is articulated as a state of 'meaning-making', which generated by particular actors involved and engaged in the utilization of technology to choose and further utilize the technology in accordance to "the needs, desires, and intentions". In relations to it, experiences hence become the ground basis of distinguishing the conceptualization of artifacts (Flichy 2007:8). Innovation is nonetheless a set of action that might come after the meaning-making process end, and it hence would set out a different shape of the artifacts. This notion is furthermore elaborated by Akrich (2001:207) with her thought on how such extent can actually lead to a new creation of knowledge because technology encapsulates particular ability to "generate and naturalize new forms and orders of causality and indeed, new forms of knowledge about the world".

Innovation performed by users as continuation of interpretative flexibility gains significance because users are actors that inseparable in the regime of socio-technical. Several studies on the SCOT confirms, users are the core and main source of innovation and such act is thought to be way of overcoming the limit of the artifacts (Rochracher 2001; 2003, Ornetzeder and Rochracher, Flichy 2007). As integral part of sustainable use of artifacts users are viewed as important source of innovation which also incorporates the expectation, social practices, and even institution (Ornetzeder and Rochracher 2006:140) and the further investigation on all of these in the field of innovation leads to an urgency because the dynamic practices, patterns of usage, and even co-shaping processes of innovation can be unveiled. From this perspective, artifacts of technology and users themselves are bound to create intertwining. The rationalization of the technology by users is situated in this junction. In addition to this thought, the users' way of innovating cannot externalize the role of designer, as Flichy (2007) argues that negotiation between users and designers always prevail because users conceive distinct framing towards the artifacts. At times engineering studies perceive it as contradictory but it leads to actual opportunity and moment of learning between both. The co-learning space generated by the innovation is explained further by Rochracher (2003) that mutual learning processes of designers and users can happen in larger scale revolving in the regimes of technologies. In more subtle matter

innovation can be sustained by roles, responsibility and perception of the users (Geels 2004:899).

In the context of biogas technology, where the artifact is placed in specific setting of agricultural society, local knowledge and experiences are two entities that remain conceived by the household users. As Escobar (1999:9) maintains, local agricultural knowledge should be viewed, in the context of innovation, as "context-specific improvisational" rather than indigenous knowledge. Departing from this thought, innovation resurfaces on as adaptation of users to the setting or spatial areas in which the artifact is on use. Experimentation on the artifacts as pathway of local modeling emerged out through use and this can become practices (Escobar 1999:9). Speaking on local practices, cultural value is intricate but the innovation can hardly be kept away from it. In this manner, cultural values can, through that local practices, order the objects, configure the experience and behaviors of the users.

Innovation as integrative process reformulated in the design, co-shaped by values, experiences, ideas, norms, and local practices is a dynamic work where there is no clear boundaries between users and technical experts in partaking in the stages of developing the artifacts and all of these are of contributions to allow new innovation launched continuously (Rochrachr 2003). Independency on the operation of the technology is the primary outcome that may bring to light to the user's capability of retaining its continuous operation. For instance in the biogas development, if the upcoming technical problems occur, they are expected to repair the reactor by themselves and find alternative pathways to reverse the persisting problem. Therefore, knowledge transfer as inherent process in the society can foster independency and self-reliance (Driesen 2010). In the case of biogas construction, actor instead of users who play roles in that process is Construction Partner Organization represented by the AWFFDFM as Non-Government Organization (NGO). NGO is contributive with their potentials of gaining trustworthiness and mobilizing public supports to advancing the innovation. In concern of this, Rochracher (2009:2014) emphasizes, NGO's role in "negotiating standards, enrolling, and aligning supply-side, and demand-side actors, communicating with public and building trust for the respective products" is important in making users innovation less conflicting and acceptable for certain groups.

The role of users in innovation and making sense of the innovation within the household and community is understandable through the concept of domestication of technology. As a new technological artifact that emerged in the household through adoption, each household would have distinctive pattern in incorporating it into already established daily practices. Household is hereby viewed as non-isolated and inclusive sphere, meaning that ascribed ideas on artifacts could accrue in the family through the process of domestication. As Silverstone (cited in Lehtonen 2003:381) argues, household is a "dynamic space, engaging themselves in the public world of production and exchange of commodities and meaning". Domestication as inevitable trajectory prevailing in the family can go through different situation according to the social setting. First, a concise elaboration on domestication which lies behind the social-shaping of technology allowing us to discern how this process impregnates interactivity between actors and their technology as Aune (cited in Blechar 2005:62) pinpoints that domestication can also be understood as taking up something alien into routine and the routines will in turn adopt the artifact and this conception has been centrally made domestication to be of the core of social shaping of technology.

In each household the way of incorporating and taming the technology are varied. Nevertheless, there are some typical structure or process involved in domestication, as elaborated by Berg (2006:99) encompassing Appropriation, Objectification, Incorporation, and Conversion. Firstly, appropriation concerns moments of obtaining/attaining the technology, often

characterized by the distinctive act of ownership after the users found the artifacts arrive at home. Secondly, objectification refers to the changing of behavior or action as an expression of tastes, values, and style. Thirdly, 'incorporation' is to explain how technological artifact is integrated in the routines of everyday life, while 'conversion' delineates the situation in which the household members attempt to immerse the technology or connect it with the existing values and even society. Domestication relates to the social shaping because when the technology is changed and the everyday will repeatedly follow (Aune 1996 cited in Christensen 2009:434).

Further, appropriation process of technology may inevitably necessitate users to get a grasp of meaning what the artifact really is. This is what Selwyn (2003:108) attempts to present as "sense". She thus elaborates, when a user gets exposed to the certain technology or artifact they will imbue it with "live experience or life world" of their own in order to make it more immersed in and beneficial to their life. In each artifact meaning construction is regarded as one of the materials that significantly shape those experience. The functions of the artifacts may instigate certain objectives and symbolically encoding and these become significant contribution to the phases of domestication as well (Pantzar 1997, Mackay and Gillespie 1997, Hyness and Rommes 2006, Sørensen 2006). Identity is also critical in this extent as it signifies different label of social status that actor would later have (Sørensen 2006:47). A subsequent production of meaning and social identity inexorably nest in the broader cultural context of setting in which those artifact is placed.

2.9 Technological Frame

The technological frame concerns about the interaction created between particular actors who are part of social groups. This concept applies to analyzing the aftermath situation after the technology is adopted or used by that actor, so that it navigates an understanding on how "existing practice does guide future practices, though not completely determined" (Bijker 2009:27). It explains meaning that the continuous practice as a result of adoption of certain technology is indicated from the subsequent learning processes with other fellow users and the particular collaboration is concerted among them. Since the interaction is not always smooth, some constraints might be tackled but this is the way how technology is exercised to achieve an optimum use. In succinct voice to emphasize this matter, Bijker (2009) confirms "… technology is constructed by a combination of enabling and constraining interaction within relevant groups in specific way" .

3. DISCUSSION

Built on the understanding that appropriate technology becomes a success only if it is constructed with locally obtainable materials, culturally suitable, supports social and kinship systems in the community, and is a collaboration between users and designers. Looking in this sense, it is important to note that the collaboration of these aspects is significant in making biogas technology continuous in the household. Although the biogas is only constructed by 17 households, from the quality perspective, all of the installations are well completed along with high capacity of the CPO (Construction Partner Organization) in providing services, post-construction monitoring and training (Alam 2012). While the local materials like bricks, sand, and coral stones are obtained from the recycled debris of house, other technical equipments (i.e galvanized pipelines) are also easy to purchase at affordable price from the local material construction agencies. The labours are also well trained and employed from the local manpower who really understand the state of local communities (Alam 2012). Furthermore, I also found that equal relationship between users and technology designer (CPO) is obvious from the initial phase of construction (designing the plant, allowing users to make their own choice towards construction materials that they can make available) right till the end of it (e.g providing post construction services).

Technological frame and interpretative flexi-

bility are main concepts characterizing the Social Construction of Technology. In this research each of this is applicable in analyzing how the practice of biogas usage co-shapes one another. First, the interpretative flexibility is useful to examine how users generate innovation—for instance, in the case of cowshed modification and adding quills into the mixture of cowdung and water. In this framework, innovation is inherent with the users capacity to improvise the technological artifacts. Capacity that embodies in the practice of innovation depends on the characteristic of user group. For the user who experiences quills as waste, he would use biogas as media to decompose the quills. Meanwhile for the users who have unchanged structure of cowshed, making the innovation by integrating the mixer with the cowshed is undertaken to maximize convenience and comfort. The ideas of such creations emerge as a translation of knowledge and cognitive schema bearing in their mind. I argue that this extent is on par with the argument of Wajcman (2004) that the capacity owned by the users in the application of technology is an important dimension of interpretative flexibility. However, when the innovation in the making and the outcome of the result has not been proven--like in the case of adding quills, I discovered a co-learning interaction between user and designer occurred. Given such situation, the designer represented by TN who is the CPO attempted to get secondary information from more scientific argument about why quills can accelerate the heating process in the biogas plant but at the same time he did not forbid NG as user to discontinue his effort. In this manner, NG is still aware of the consequences that might arise if he fills the quills too much into the mixture. Such mutual learning process is constructive driving the technology to become part of a productive effort (Rochracher 2003, 2009). It also confirms, such negotiation happens not because of gap of knowledge, but user has distinct interpretation towards the artifacts (Flichy 2007).

The biogas users in Sri Hardono village are relatively close one to another and this proximity gives them chance of exchanging technical skill. Upon completion of biogas construction, users usually receive a brief instruction from the CPO on the know-how in operating biogas and regular monitoring that they can perform by themselves. The first month after biogas construction, users in this village often had little issue which can be handled, for instance the blue flame did not pop up on the biogas stove. In overcoming such setbacks, users whose biogas has been active usually observed the new users and gave some strategies on how to cope with gas outcome. Such particular interaction is created by users who have similar concerns. The application of technological framing is seen from this interaction as an alternative way of making the operation of technology continuous (Bijker 2001).

In this research domestication of technology is incorporated in the SCOT to understand the ways biogas technology is integrated into the routine of the household. Equipped with its concepts of appropriation, objectification, conversion, it is very germane to examine how users and technological artifacts are interacted and socially accepted. Further, the discussion sheds light if the changing values of technology can make impacts to the households through the benefits that they gained from the use of technology. The decline in perception of risk towards the vulnerability of cooking activities after migrated to biogas cook stove is one of the obvious examples. In such process user create a new ‘meaning’ for their life, which is done by making comparison between the old cook stove and the new one (biogas). Once they perceive that the new one can provide more safety, they will make the technological artifact as part of their routine. This situation is maintained by Sewyn (2003) that the user can sense the benefit of the technology through the reflection of live experience and changing values.

4. CONCLUSION

This theoretical work shown a dynamic interaction which is barely observed in the study of appropriate technology in the developing

nation. For years engineering has become the prolonged domain to take into main account whenever appropriate technology is to be generated. This is, however, no longer sufficient to put focus only on technical sides. The paper unveils, before the technology proceeds to the hand of users, many social dimensions shall be considered, as it will lead to the sustainability of the products themselves. In the end, it is expected that more appropriate technologist would co-work with the users and other associated stakeholders as to allow progressive innovation in the use of technology as such.

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