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Forest Conservation Behavior in Indonesia

The Roles of Micro Hydro Power and Rural Electrification

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In this book, we elaborated the psycho-social aspects of micro hydro power application in rural areas of Indonesia. Hopefully, the report will give us a better understanding of people behaviors in rural areas and provide some recommendations to reduce deforestation caused by small farmers and villagers. The study was a part of the projects initiated by Energy Working Group (EWG) under the Bilateral Energy Cooperation Indonesia Netherlands (BECIN). BECIN was a collaboration project between the Netherlands Embassy in Indonesia and the Government of Indonesia to support a more sustainable energy production and consumption in Indonesia (see http://www.senternovem.nl/becin/index.asp).

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We hope you enjoy the book.

Authors

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CHAPTER 1

INTRODUCTION

Indonesia is a developing country in Southeast Asia that still has many issues to solve such as poverty, energy problems and forest losses. In energy issues, one particular problem that needs serious attention is rural electrification. According to Soesastro (2004), electrification ratio in Indonesia was about 56 % in 2004. He also explained that 90% of the remaining which had no access to electricity were poor. By the end of 2008, Ministry of Energy and Mineral Resources announced that electrification ratio in Indonesia reached 65% and will have targeted 93% electrification ratio by 2025 (65% electrification ratio means that about 80 million people of Indonesia have no access to electricity). New power plants are built to cover the increasing demands. Although not dominant, decentralized electricity based on renewable energy has also received special attention especially for rural electrification (see www.esdm.go.id).

Micro hydro power (MHP) may be the most popular and successful renewable energy for rural electrification in Indonesia. It is maybe due to the fact that MHP is a small scale decentralized energy supply technology which is considered as the most reliable one for rural application (Khennas & Barnett, 2000). Supported by foreign countries, e.g. Netherlands and Germany, the programs such as *Mini Hydro Power Project* (MHPP) and *Contributing to Poverty Alleviation through Regional Energy Planning in Indonesia* (CAREPI) have been implemented in order to accelerate rural electrification program in Indonesia (see for examples http://www.gtz.de/, http://www.carepi.info/, and the official website of the Ministry of Energy & Mineral Resources of Indonesia http://www.esdm.go.id/).

Another serious problem that needs a great deal of attention is the fact that Indonesia is one of the countries that suffers the greatest tropical forest loss (FWI/GFW, 2002). This

non-governmental organization (NGO) explained that until 1950 Indonesia was a forested country. However, 50 % of the existing forests have been lost in the following 50 years. FWI/GFW (2002) was also worrying deforestation caused by rural people and villagers.

This pessimistic review is fortunately followed by some more optimistic news about small farmers and villagers' pro-environmental behavior after the villages they live in are electrified by micro hydro power (MHP). For example, villagers at Tanete Village, Enrekang Regency, which is located in the province of South Sulawesi, were reported to sign an agreement regarding forest conservation in August 2007[1]. They agreed not to cut trees from the surrounding forests without any approval from the local authority. If it is performed they agree to replant the forest ten times of the amount of trees they have cut. The village has been electrified by MHP since 2005. A similar result was also reported by *Kompas Daily*, a leading national newspaper in Indonesia. On August 26, 2008, it reported that villagers at Ngaol Village, Merangin District, located in the province of Jambi (one of provinces in Sumatera) showed more environmentally relevant behavior after MHP electrified the village. They organized a community based regulation concerning forest conservation. The regulation created is similar to the agreement agreed by the Tanete villagers. In these cases, there are three pro-environmental behaviors that have been promoted by the villagers such as creating a community based forest conservation agreement, having an intention not to deforest, and having an intention to replant the forest when the deforestation occurs.

These pro-environmental intentions and behavior shifts, as a consequence of MHP electrification, have generated a curiosity that needs a further investigation. A study in several conservation areas in Nepal by Mehta & Heinen (2001) suggested a possibility that attitudes toward forests conservation would increase if the forests advantaged the people (see also Badola, 1998). In their study about the determinants of forest conservation behavior among farmers in Haiti, Dolisca *et al.* (2009) found that farmers benefited by the forests showed more participation in the forest conservation program. It may be safe to say that the villagers at MHP-electrified villages fully understood the link that the electricity they savored was generated by the water provided by the forests[2]. The benefits might shape their attitudes and behaviors more favorably toward forest conservation.

[1] The agreement is filed at the Energy & Mineral Resources Agency of Enrekang
[2] Based on popular belief, forests are well known to absorb water during the rainy season and continuously supply water to the rivers during the dry season

This study wants to answer the questions of '*how MHP may shape villagers' forest conservation behaviors*' and '*which variables predict the villagers' intention to behave more favorably toward forest conservation*'. There are two studies conducted in this research. Study 1 is to answer the questions. Meanwhile, study 2 is conducted to confirm study 2.

The report of the study begins with introduction (chapter 1) followed by brief explanations of Indonesian energy facts, the micro hydro power principle, the state of Indonesian forests, and the link of MHP and the forests (chapter 2). Chapter 3 elaborates the theoretical background of the studies which includes the theory of planned behavior, descriptive norms, past behavior, and external variables. The results of the study are described and discussed in chapter 4 and chapter 5. Chapter 6 provides a general conclusion of the study.

CHAPTER 2

MICRO HYDRO POWER, FORESTS, AND THEIR RELATIONSHIP

Indonesia has a huge amount of renewable energy potential ready to be harvested. According to the data provided by the Ministry of Energy and Mineral Resources, these potential renewable energy sources include 450 MW mini/micro hydro power, 50 GW biomass energy, 4.80 kWh/m^2/day of solar energy, 3 to 6 m/sec wind energy, and 3 GW nuclear power. Renewable energy contribution in national primary energy mix was 6.2 % in 2005 and it was set to be 17 % in 2025 (Blueprint of National Energy Management, 2006). To achieve the target in 2025, the Government of Indonesia has planned to invest US$ 2678 millions in MHP especially for rural electrification.

2.1. Principle of Micro Hydro Power System

Hydro power is generated by converting the potential and kinetic energy of water by means of a water wheel or a turbine into mechanical power (NRCan, 2004). Generators convert mechanical power into electrical power. In accordance with Indonesian Ministry of Energy and Mineral Resources, hydro power is classified based on its capacity, i.e. micro hydro power generates electricity up to 200 kW, mini hydro power generates electricity between 200 kW and 10 MW, and large scale hydro power generates electricity from 10 MW upward (Directorate General of Electricity and Energy Utilization, 2003).

MHP, usually used by individual or group users in a decentralized system or off grid system, can be derived into several components: an intake or weir to divert the water flow from the main stream, a canal or pipeline to convey the water flow from the intake to the forebay, a forebay tank to filter debris, a penstock pipe to carry the water into the turbine in the powerhouse, a power house where the turbine and the generator are located generating electricity, and a tailrace (see NRCan, 2004).

2.2. Indonesian Forests: the Threats

According to FWI/GFW (2002), Indonesian forests with their unique biological richness are one of the most magnificent forests in the world together with Brazilian forests and Congo forests. However, high rate of deforestation has caused a great loss in the forest cover from 162 millions ha in 1950 to 86 million ha in the next 50 years (FWI/GFW 2002). Until 1997, more than half of Bali/Nusa Tenggara, Java, Sulawesi, and Sumatera forests had been lost. The NGO reported that the trend is likely to continue due to the extreme forest fire, the economical crisis, and the breakdown of political authority and law enforcement.

More than 50% of the forests in Indonesia are assigned for wood production on a selective felling basis, however, due to a poor supervision (as the result of corrupt systems) many forests are overexploited (see FWI/GFW 2002). Another pressure to Indonesian forests, according to the NGO, comes from oil palm plantation programs that have cleared about 7 million ha of forest for conversion. Other source of deforestation comes from illegal logging. Illegal loggers damaged almost 10 million hectares of Indonesian forest (Asia Pulse, June, 22, 2000; FWI/GFW, 2002). Small farmers, villagers, and shifting cultivators are also believed to play an important role in deforestation. It is predicted that about 4 million hectares of Indonesian forests have been lost due to a shifting cultivation (see Sunderlin, 1997; FWI/GFW, 2002). The main message is that if we do not control the people even small farmers and villagers may contribute to large damages to the forests.

Recently, the Indonesian Ministry of Forestry informed that the rate of deforestation reduced to 1.08 millions ha/year during 2000-2005. During this period, the deforestation rate has reduced significantly in the islands of Kalimantan, Sumatera, Maluku, and Papua but it has doubled in Sulawesi. Overall, the deforestation rate was 1.8 millions ha/year during 1985-1997 and 2.8 millions ha/year during 1997-2000. However, the current rate of 1.08 million hectares per year is still a big threat to the existing Indonesian forests.

2.3. Forest, Water, and Micro Hydro Power

While it is believed that forest increases the water supply, the fact offers that it does not always the case (FAO, 2003; FAO 2008). According to the reports, the clearing of a non-cloud forest, whose trees internally consume a lot of water, is proven to increase the water quantity flowing from the catchment area. On the other hand, the cloud forests, which occur especially in tropical and upland areas that are covered by frequent fog, capture

both horizontal and vertical precipitations so that they increase the amount of captured water (FAO, 2008).

In general, well maintained forests will strongly regulate the amount of water yielded downstream, provide good quality of water, reduce variation in water supply between the high and low flows during a year, maintain high soil stability and low levels of soil mass movement, reduce gully erosion and surface erosion; and transfer low levels of sediment downstream (FAO, 2003). Well maintained and healthy forests are essential because more than one billion people in the world depend on them (Cincotta & Engelman, 2000).

The link between micro hydro power, water, and forest is based on the fact that MHP generates electricity by converting potential and kinetic energy of falling water. Additionally, it is perhaps based on the popular belief that the continuity of water supply depends strongly on forest existence: more vegetation means more water to capture and more water to supply. Presumably, these general fact and popular belief seem to cause rural people at the villages electrified by MHP to show more favorable behaviors toward forest conservation. Other than Tanete and Ngaol villages mentioned earlier, the pro-environmental behaviors caused by MHP were also demonstrated by the local communities in Kerala, India and El Limon Community, Dominican Republic (see UNDP, 2003a & UNDP, 2003b). They were reported to begin reforestation and reduce deforestation.

To conclude, it is known that Indonesia is one of the countries that suffer the highest forests loss in the world and deforestation induced by farmers and villagers is substantial. Government of Indonesia has planned to invest US$ 2678 millions in MHP especially for rural electrification until 2025. This rural electrification program, other than its main objective to improve the livelihood of rural people, perhaps will improve villagers' concerns toward forest conservation. This expectation is based on some results reporting villagers from the villages electrified by MHP have shown more concerns toward forest conservation. The link between MHP and villagers' concern toward forest conservation might be based on the fact that the electricity savored by the villagers is generated by MHP, which is driven by water. The water afterwards is supplied continuously by well maintained forests.

CHAPTER 3

THEORETICAL BACKGROUND

After the brief explanations of Indonesian energy facts, state of the forests, and the relationship between MHP and the forests the theoretical background of this study is elaborated in the present chapter. This chapter explains the theory of planned behavior (TPB) which is applied as the basis of the research model of the study.

To answer the questions of '*how MHP electrification in rural Indonesia may shape villagers' forest conservation behaviors*' and '*which variables predict villagers intention to behave more favorably toward forest conservation*', we should review some preceding studies that discuss behavior and its determinants. Fishbein & Ajzen (1975) suggest that people attitudes are influenced by their beliefs and these attitudes influence their behavior. In the case of the MHP villagers who show more positive behaviors toward forest conservation, their change in behaviors is perhaps influenced by their changes in attitudes and beliefs. Experiencing the benefits they get from the forest through MHP may have changed their attitudes toward forest conservation behaviors. If beliefs and attitudes of the villagers provided with MHP are compared to those without it, we may expect that the former will hold more positive beliefs and attitudes toward forests conservation behavior. These positive beliefs and attitudes might shape MHP villagers' behaviors more positively than the non-MHP ones.

3.1. The Theory of Planned Behavior

There are some theories explaining the variables that can predict environmental behaviors. One of them is a model called value-belief-norm theory (VBN) proposed by Stern *et al.* (1999). In this theory, pro-environmental personal norms are the best predictor of environmental behaviors. Three serial beliefs which are ascription of responsibility,

awareness of consequence, and new ecological paradigm determine pro-environmental personal norms. These beliefs in turn are influenced by altruistic, egoistic, and traditional values. Another theory, considered as the most popular one, is the Theory of Planned Behavior (TPB) which is widely applied in explaining the relationship between beliefs, attitudes, and behaviors relating various subjects and activities (Ajzen & Madden, 1986; Ajzen, 1991; Ajzen, 2005). TPB is preceded by the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). TRA proposed that intention is the best variable that predicts behavior. Intention is determined by two predictors: attitudes toward the behavior and subjective norms. These variables depend on their related beliefs (i.e. behavioral beliefs and normative beliefs) and the assessments of these beliefs (i.e. outcome evaluation and motivation to comply). According to Ajzen & Madden (1986), attitude refers to the degree to which a person has a favorable or unfavorable evaluation of the behavior in question, and subjective norm refers to the perceived social pressure to perform or not to perform the behavior. Behavioral beliefs (as the salient information relevant to behavior) and their outcome evaluation determine attitudes toward the behavior, while normative beliefs (the likelihood that the important other(s) would approve or disapprove the execution of the behavior) and motivation to comply with the referent(s) contribute to subjective norms (Ajzen & Madden, 1986; Ajzen, 2005).

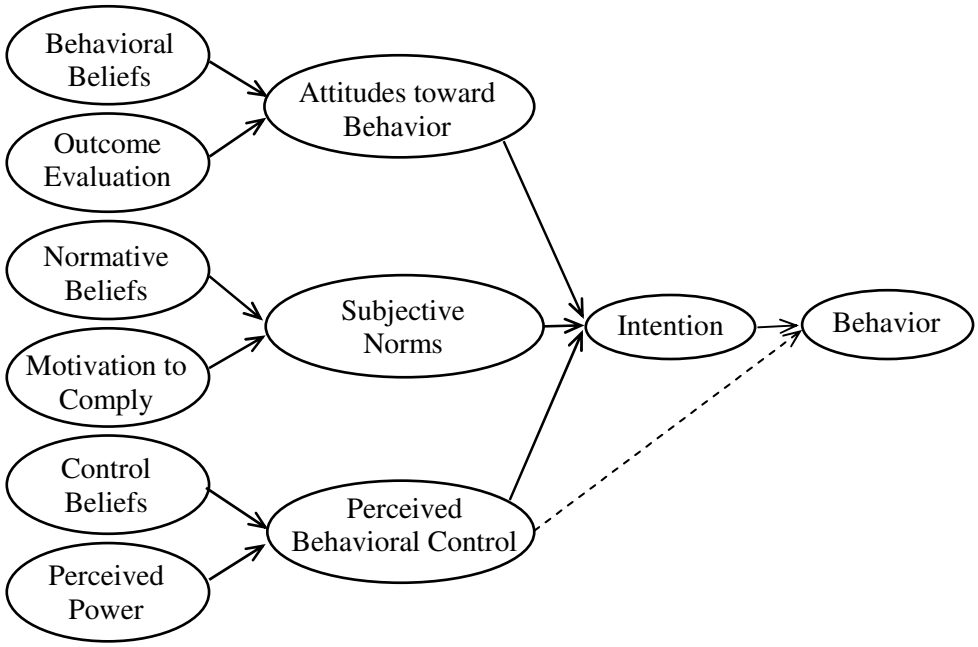


Figure 3-1 The schematic of the Theory of Planned Behavior

Adding the concept of perceived behavioral control (PBC) in predicting behavioral intention transforms TRA into TPB. TPB is better than TRA in explaining behavior especially in conditions when control over the behavioral goal is incomplete (Ajzen & Madden, 1986).

Perceived behavioral control (PBC), together with intention, often directly contributes to predict behavior. It depends on how strong the behavior can be performed at will and how accurate the perception of control over the behavior is (Manstead, 1996). Perceived behavioral control is the perception of the difficulties to execute the behavior and is assumed to represent past experience (Ajzen, 1991; Ajzen 2005). The determinants of perceived behavioral control are control beliefs (beliefs about resources and opportunities) and perceived power to facilitate and inhibit the performance of the behavior (Ajzen, 1991). Figure 3-1 shows the schematic of the Theory of Planned Behavior.

The Theory of Planned Behavior will be applied to assess the role of mini hydro power in shaping behavior toward forests conservation as is widely supported by other scholars (e.g. Manstead, 1996; Armitage & Conner, 2001; Kaiser & Gutscher, 2003; Kaiser *et al.*, 2005). As an example, Kaiser *et al.* (2005) contrasted TPB and VBN and found that TPB's intention was better in predicting people's conservation behavior than VBN's personal norms. They reported that the relations within the TPB concepts were explained appropriately by the model, whereas those within the VBN concepts were not.

3.2. External Variables, Descriptive Norms, and Past Behavior

The main question that needs to be answered by the present study is *how MHP may shape villagers' forest conservation behaviors*. According to Ajzen & Fishbein (1980) and Ajzen (2005), beliefs people hold may be influenced by a large number of external variables or background factors. MHP can be regarded as an external variable that may influence villagers' behavior indirectly by shaping behavioral beliefs, normative beliefs, and control beliefs and the assessment of these beliefs. Formation or adjustment of these beliefs may influence attitudes, subjective norms, and perceived behavioral control as the determinants of intention to behave more favorably toward forests conservation. As Ajzen (2005) noted:

> "*Clearly, people growing up in different social environments can acquire different information about a variety of issues, information that provides the basis for their beliefs about the consequences of a behavior, about normative expectations of important others, and about the obstacles that may prevent them from performing the behavior*." (p. 134)

Other external variables suggested by Ajzen (2005) that might shape people beliefs are demographic variables (e.g. age, gender, education, income, population distribution, and

occupation), personality, mood, emotion, general attitudes and values, intelligent, group membership, past experience, exposure to information, social support, coping skill, and so on. Demographic variables are particularly important to consider in the present study to know whether they would alter the effect of MHP if it exists.

Some studies (e.g. Sheeran & Orbell, 1999; Sheeran & Taylor, 1999; Rivis & Sheeran, 2003) suggested a concept named *descriptive norms* to add to the TPB model to understand more roles of social influences in predicting intention toward a behavior. Descriptive norms, which are defined as the perception of others behavior in question (i.e. what other people do), are different from subjective norms that subjective norms concern with perceived social pressure whether or not to engage in the behavior (i.e. what other people want a person to do) (Sheeran & Orbell, 1999). In their meta-analysis report assessing 21 studies, Rivis & Sheeran (2003) found medium to strong correlations between descriptive norms and intention. Descriptive norms are added to the model of the study to know whether the variable will explain significant variance in intention.

Some other studies have found that past behavior had a significant effect on behavioral intention (e.g. Quellette & Wood, 1998; Conner & Armitage, 1998; Sheeran & Taylor, 1999). They conducted three different meta-analyses assessing TRA and TPB models and concluded that past behavior explained unique variance in intention and behavior. Conner & Armitage (1998) then suggested that future study might include past behavior as an independent variable in predicting intention and behavior together with attitudes, subjective norms, and PBC. However, Ajzen (1991) and Ajzen (2002) proposed that the effect of prior on later behavior should be fully mediated by perceived behavioral control and intention. Otherwise, it might indicate that the behavioral, normative, and control beliefs were inaccurate and unrealistic, attitudes and intention were weak or unsteady, and planning demanded for the success of the intended behavior was poor (Ajzen, 2002). Past behavior will be added to the model of the study to see if it will give some residual effect on intention.

How external variables, descriptive norms, and past behavior are added to the TPB model is explained in the following chapter. Chapter 4 also elaborates study 1 hypotheses, objectives, design, results, discussion, and conclusion.

CHAPTER 4

STUDY 1[3]

Based on the background elaborated in chapter 2 and chapter 3, hypotheses and research objectives can be drawn. Research methodology is also described in this chapter and it is divided in two sub-chapters: research model and research design. Next, some general facts about Enrekang are discussed followed by result analyses and discussion. The conclusion of study 1 is provided at the end of this chapter.

4.1. Hypotheses

Hypothesis 1:

Compared to villagers at the villages without MHP, those at the villages with MHP will show more positive beliefs, attitudes, norms, perceived control, and intention toward forest conservation behavior.

Hypothesis 2:

Intention toward forest conservation behavior is determined by attitudes toward the behavior, subjective norms, and perceived behavioral control, as suggested by TPB, and also by descriptive norms and past behavior.

4.2. Research Objectives

The primary objective of this study is to prove that MHP will shape villagers' beliefs and the assessment of this beliefs, attitudes, norms, perceived control, and intention more favorably toward forest conservation behavior. The second objective is to identify which

[3] The results of the study have been published as two different papers: Santika, Midden, Lemmens (2009) and Santika, Midden, Lemmens (2010)

variables predict intention and whether descriptive norms and past behavior will explain unique variance in intention toward forest conservation behavior.

4.3. Research Model

The schematic of the extended TPB model to evaluate forest cutting behavior is shown in Figure 4-1. MHP is considered as an external variable that is predicted to indirectly influence intention toward forest cutting through beliefs and belief assessments. Demographic variables are also measured and treated as the other external variables. The demographic variables added in this study are age, marital status, education, population, occupation, and net income. Past behavior and descriptive norms are also added as potential predictors of intention (see the theoretical background chapter).

In this study, forest conservation behavior is considered as a behavioral category that consists of a set of activities rather than a single action (see Ajzen & Fishbein, 1980). The most salient activities demonstrated by rural villagers at the MHP villages as reported previously are the decrease in forest cutting, forest plantation participation, and arranging and supporting community based agreement that promote forest conservation. However, only forest cutting behavior is assessed in this study due to the time and budget restrictions.

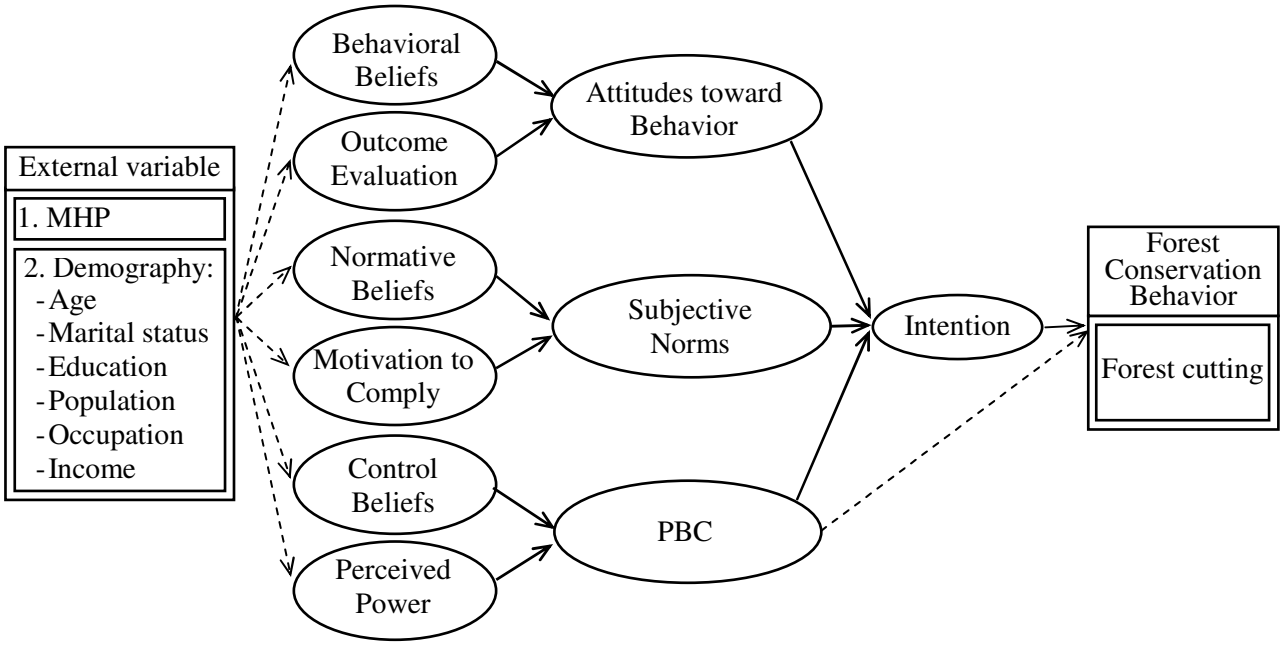


Figure 4-1 The schematic of the extended TPB model

4.4. Research Design

A self-reported questionnaire with fixed responses was employed to measure variables in the proposed TPB model. The survey method was the self-administered survey as it was cheaper than the interview method. Compared to the interview method, self-administered method has some disadvantages such as the responses are usually slower with a lower rate of response and can not reach illiterate respondents (see Blumberg *et al.*, 2008). The questionnaires were distributed at two villages electrified by MHP and at two other villages with no MHP in rural area of South Sulawesi. Applying systematic sampling, participants were randomly selected from the lists of households provided by the official leaders of the villages.

Tanete and Palakka were chosen as the MHP electrified villages together with Lebani and Pasang, the two nearby 'non-MHP' villages. The villages are situated in Maiwa, Enrekang Regency. Lebani had not been electrified when the study was conducted, whereas Pasang has been grid electrified since 1999. 60 questionnaires were distributed at each village, requiring 240 questionnaires in total. The criteria of the respondents were male[4], 18 years old or above, and resided in the villages mentioned above. The questionnaires were provided in *Bahasa Indonesia*, the official language of the country. Before the main questionnaire was created, a pilot study was arranged to assess the villagers' behavioral beliefs, normative beliefs, and control beliefs.

4.4.1. Pilot Study

In the pilot study, a large amount of beliefs about forest cutting were evaluated. 37 behavioral beliefs about advantages and disadvantages of forest cutting were assessed, followed by 24 normative beliefs assessing which of the participants' important others approved or disapproved forest cutting, and 15 control beliefs asking what opportunities and resources facilitated or inhibited forest cutting behavior. When deciding which beliefs to put into the pilot study, there was no particular method applied but authors' subjective opinion.

Respondents were asked to choose every single belief that they think was true. Beforehand, respondents were asked to write down their own opinions about forest cutting in order to gain more beliefs that had not been provided in the pilot study. Eight behavioral beliefs that were most frequently selected by participants were chosen to develop

[4] Due to the characteristic of the behavior in question, female respondents are excluded.

behavioral beliefs of the main questionnaire. It was based on the idea that people may acquire many beliefs about an object but there are limitations on the amount of beliefs they may recall, about five to nine at a given time (see Miller, 1956; Ajzen, 2005). Similar treatment was also applied in formulating normative beliefs and control beliefs.

4.4.2. Main Questionnaire

The main questionnaire was created after the pilot study results were provided. The questionnaire assessed past behaviors, intention, attitudes, subjective and descriptive norms, and three types of beliefs and the assessment of these beliefs. The past forest cutting behavior was measured with questions such as '*On average, how many trees a villager cut from the forest last year?*' scaled from *none, 1 to 4 trees, 5 to 8 trees, 9 to 12 trees, 13 to 16 trees, 17 to 20 trees,* to *more than 12 trees*. Direct measures of past behavior were also asked in two questions: '*Did you engage in forest cutting or ask/hire others to do it last year?*' and '*Have you ever engaged in forest cutting or asked/hired others to do it?'*. For both questions, there were only *yes* and *no* possible responses provided. Intention, attitude, subjective norms, PBC, and descriptive norms are measured in seven-point bipolar scales. A disguised technique was applied rather than the direct technique usually applied in TPB measures. This technique was applied due to the fact that forest cutting is a sensitive issue that may evoke socially desirable responses (see Ajzen, 2005). Intention to perform forest cutting was asked with questions: '*In your opinion, the neighbor near you will do forest cutting within a year*' and '*In your opinion, the neighbor near you intends to do forest cutting within a year*', scaled from *very unlikely* to *very likely*. Attitudes were asked in a question: '*In your opinion, cutting trees from forest is….*' measured in five evaluative semantic differential scales i.e. *bad – good*, *harmful – beneficial*, *unacceptable – acceptable, unpleasant – pleasant*, *foolish – wise*. Subjective norms were measured in three questions: '*People's most important others think that people should do forest cutting*', '*People's most important others will approve forest cutting*', and '*People's most important others want people to do forest cutting*' scaled from *very unlikely* to *very likely*. PBC was asked in a question: '*For most people around here, forest cutting is a(n)….. thing to do*' measured in three 7-point bipolar scales: *difficult – easy*, *complicated – simple*, and *effortful – effortless*. Finally, descriptive norms were asked in one question: '*How many men that you know from the village have ever engaged in forest cutting or have asked/hired others to do it?*' It was measured in a 7-point frequency scale: from *none* to *all*.

Behavioral beliefs were measured in eight questions such as '*Forest cutting helps people increase their income*' and '*Forest cutting causes natural disasters*'. They were measured in a 7-point biipolar scale ranging from *strongly disagree* to *strongly agree*. Four advantageous behavioral beliefs and four disadvantageous ones were asked. Outcome evaluation was measured in questions such as '*Forest cutting that helps people increase their income is.....*' and '*Forest cutting that causes natural disaster is.....*'. They were measured in a 7-point bipolar scale ranging from *very bad* to *very good*. Questions such as '*Neighbors think that people should not do forest cutting*' and '*Forest police rangers think that people should not do forest cutting*' were asked to measure normative beliefs in 7-point bipolar scale ranging from *strongly disagree* to *strongly agree*. Motivation to comply, as the assessment of normative beliefs, was measured in questions such as '*How much do you think people want to do what their neighbors would like them to do?*' and '*How much do you think people want to do what forest police rangers would like them to do?*'. They were measured in a 7-point unipolar scale ranging from *not at all* to *extremely much*.

Control beliefs and perceived power were measured in the same questions such as '*Availability of modern tools and sawing machines facilitates forest cutting*' and '*Proper education, knowledge and information prevent forest cutting*'. The difference was that control beliefs were measured in a 7-point unipolar scale asking how often a resource or an opportunity was likely to happen, whereas perceived power was measured in a 7-point bipolar scales asking the likely of the resource or the opportunity to happen (see Ajzen 2005). It means that control belief measures were scaled from *never happens* to *always* and perceived power measures were scaled from *very unlikely* to *very likely*[5].

Demographic variables asked in this study were age, marital status, educational levels, family member, occupation, and net income. The complete questionnaire is provided in the appendices. Enrekang Regency where the questionnaires were distributed in is described in the following sub-chapter.

4.5. Enrekang

The questionnaires were distributed to participants from four villages located in Enrekang Regency. The Regency is located between the latitude of 3º 14'36" South and the longitude of 119º40'53" East, about 235 kilometers north of Makassar (previously Ujung Pandang), the capital city of South Sulawesi (Enrekang official site:

[5]In the present study, to avoid confusion among participants, the term *likely-unlikely* was translated into Indonesian '*setuju-tidak setuju*' which also means *agree-disagree*.

http://www.enrekangkab.go.id). The topography of Enrekang is generally a mountainous area, 47 – 3293 meters above the sea level which consists of hills, mountains, valleys, and rivers (South Sulawesi official site http://www.sulsel.go.id). According to the site, the Regency was populated by 182.171 inhabitants in 2005 in which most of them were Muslim and 65% of the populations worked in agricultural sectors.

Enrekang was preferred as the study location as the villagers at Tanete, one of its villages, show more positive behaviors toward forest conservation after the village is electrified by MHP. The Regency also actively supports MHP programs for rural electrification. Eleven new MHP systems were built between 2005 and 2008 with a total capacity of 622 kW (the data are filed at Enrekang Energy and Mineral Resources Agency). Another consideration is due to the fact that the rate of deforestation in Sulawesi increased during 2000 – 2005 when the rate of deforestation trends in other islands decreased (see section 2.2). Forest cover in Enrekang was 85,948 ha in 2004, only 2.7% of the total forests in South Sulawesi (Enrekang Regency Government, 2006). Out of total 85,948 ha of Enrekang forests, 76.099 ha were protection forests and 9.849 ha were production forests.

Tanete, Lebani, Palakka, and Pasang villages are part of Maiwa Sub-regency, south east of Enrekang. Tanete and Lebani are only three kilometers away from each other and surrounded by the Bungin River forests group. Tanete and Lebani were populated by 637 and 927 inhabitants in 2009, respectively (inhabitants at Lebani were based on population at 2 sub-villages). The distance between Palakka and Pasang is also about three kilometers and they are surrounded by Bungin River forest, Pasang River forest, and Batupali forest. There were 675 and 880 inhabitants who lived at Palakka and Pasang, respectively. Population data were based on data provided by the village leaders.

4.6. Results

4.6.1 Pilot Study

The study was done in the middle of April, 2009 at Dusun Batu village, Maiwa, in the Regency of Enrekang. 25 questionnaires were distributed to the first 25 men met at the village. Fully supported by the head of the village and his secretary, all questionnaires were returned. Eight out of 37 behavioral beliefs mostly chosen by participants were then used to obtain behavioral beliefs of the main questionnaire. The same treatments were applied to both normative beliefs and control beliefs. Those chosen beliefs can be seen on the main questionnaire in appendix B.

4.6.2 Main Study

In this study, four villages in Enrekang Regency were assessed to understand the role of MHP in shaping forest conservation behavior. As the first comparison, Tanete, a village provided with MHP for four years, was compared with Lebani[6], a neighboring village that has no electricity. As the second comparison, Palakka village, electrified by MHP for a year, was compared to Pasang village that had been grid electrified for more than 10 years. The demographic variables and the TPB concepts were compared between the villages.

Additional analyses were performed to gain more insight about the correlation among the TPB concepts and how these concepts contributed to intention toward forest cutting. Descriptive norms, past behavior, and demographic criteria, as additional variables, were also assessed to know its contribution in predicting intention toward forest cutting behavior.

240 questionnaires (60 for each village) were distributed from April 23 to May 11, 2009. Fully supported by the participants and the leaders of the villages, 236 questionnaires were returned. However, only 182 respondents answered the 73 questions in the questionnaires completely. To avoid losing too many data, these missing values were treated mostly in a pairwise exclusion method ensuring that the data with missing values were not fully abandoned in the whole analyses. Only in regression analyses were the missing values treated in a listwise exclusion method. In the listwise exclusion methods, if a participant failed to answer even a single question, his whole answers would be excluded from the analysis.

Participants' ages ranged from 18 to 71 years old with a mean of 37.4. Seventy six percent or 179 of them were married. Nine participants (3.8 %) reported never attended or finished elementary school. 121 participants (51 %) graduated from elementary school, 45 participants (19 %) graduated from junior high school, 49 participants (21 %) graduated from senior high school, and 12 participants (5 %) were university graduates. When answering the question of how many family member a participant lived with, there were four out of 236 respondents reported to live alone, 25 participants (11 %) lived with 1 to 2 others, 65 participants (28 %) lived with 3 to 4 others, 83 participants (35 %) lived with 5 to

[6]According to the village official leader, about 40% of the houses were actually installed with unsatisfying 50-watts solar cells that could only empower about 2-3 bulbs during the night. However, if the solar power is somehow used during the day, then there will be no power supply in the night. The village is then considered as a village without electricity.

6 others, 42 participants (18 %) lived with 7 to 8 others, and 17 participants (7 %) lived with more than 8 others. 215 participants (91 %) worked in agricultural sectors, 8 participants (3 %) were unemployed, and the rest (13 participants) worked in other fields. When responding question related to the monthly income, 204 out of 230 participants (89 %) stated that their monthly incomes were IDR 500.000 (EUR 35) or less, 11 participants (5 %) earned between EUR 35 to EUR 70 a month, 15 participants (6 %) earned above EUR 70, and 6 participants did not answer the question.

4.6.2.1 Preliminary Statistical Consideration

Before the concepts were compared, beliefs and their assessments were assessed. Each belief was measured by eight variables. A principle component analysis was conducted to know if there were any underlying components that drove these variables. The analysis was also supposed to avoid perfectly correlated variables measured together. The principle component analysis was followed by a reliability test to check data consistency. Kolmogorov-Smirnov tests of normality were also performed to decide whether to use parametric tests or non-parametric tests in comparing means of concepts between the villages.

Determining Components of Beliefs

To determine any underlying components out of eight variables of behavioral beliefs, a principle component analysis was executed on SPSS. From the correlation matrix produced by SPSS (see Table 4-1), variables 1, 2, 3, and 4 are fairly correlated with each other, but not significantly correlated with 5, 6, 7, and 8, and vice versa. Since variable 7 is strongly correlated with 6 and 8, r = .902 and r = .913, respectively, this variable is then eliminated.

The principle componet analysis was rerun on SPSS without variable 7. It turned out to have only two factors that had Eigenvalues greater than one. They explained 68.2% of the total variance. The value of the factor loading provided on pattern matrix (Table 4-2) shows that variables 5, 6, and 8 loaded highly to factor 1 while variables 1, 2, 3, and 4 related to factor 2 (loading values lower than .4 are suppressed). Therefore, two components underlay villagers' behavioral beliefs. The components were named *beliefs toward forest cutting costs* and *beliefs toward forest cutting benefits*.

Table 4-1 Correlation matrix of Behavioral Beliefs

Behavioral Beliefs Variables	2	3	4	5	6	7	8
Forest cutting helps people increase their income	.340	.370	.307	-.018	.026	.016	-.003
Forest cutting opens new land for farming		.297	.519	.102	.073	.092	.063
Forest cutting provides firewood			.425	-.103	-.079	-.075	-.067
Forest cutting provides wood for housing				.036	.082	.062	.023
Forest cutting damages the forest and nature scenic beauty					.808	.759	.734
Forest cutting causes natural disasters						.902	.878
Forest cutting causes drought and lack of water during dry season							.913
Forest cutting causes landslides							

Table 4-2 Factor loading of behavioral belief variables

	Component	
	1	2
Forest cutting helps people increase their income		.670
Forest cutting opens new land for farming		.745
Forest cutting provides firewood		.713
Forest cutting provides wood for housing		.788
Forest cutting damages the forest and nature scenic beauty	.906	
Forest cutting causes natural disasters	.959	
Forest cutting causes landslides	.931	

The same procedures were applied to the other five beliefs and their assessments. Most of the concepts could be extracted into two underlying components except the normative beliefs that had only one underlying component representing its 8 variables. The total variance explained by those extracted components lies form 54.4 to 68.2 (see Table 4-3). The name of the components is provided in Table 4-4.

Table 4-3 Components extraction of beliefs and their assessment

Concepts	Component(s) extracted	Total variance explained
Behavioral Beliefs	2	68.2
Outcome Evaluation	2	66.7
Normative Beliefs	1	64.8
Motivation to Comply	2	64.7
Control Beliefs	2	54.4
Perceived Power	2	54.9

Reliability Tests of the Scales of Beliefs

After the principle component analysis (or factor analysis) was performed, the reliability tests were conducted to check whether the concepts being measured were consistently

explained by the scales (Field, 2005). Each component of the concepts was tested individually and the results are provided in Table 4-4. The values of Cronbach's alpha range form .702 to .952 (> .7) indicating that the scales were respectably reliable in measuring the concepts.

Table 4-4 Cronbach's alpha of each component of the TPB concepts

Concepts	Component names	Number of item	Cronbach's Alpha
Behavioral Beliefs	Beliefs about costs	3	.952
	Beliefs about benefits	4	.702
Outcome Evaluation	Cost evaluation	4	.905
	Benefits evaluation	4	.706
Normative Beliefs	Beliefs about all referents expectation	8	.925
Motivation to Comply	Motive to comply with close referents	4	.789
	Motive to comply with official staffs	4	.810
Control Beliefs	Beliefs about barriers	5	.713
	Beliefs about resources	3	.727
Perceived Power	Perceived barriers	5	.718
	Perceived resources	3	.721

Tests of Normality and Transformation of Data

The tests of normality were conducted to check if the data were normally distributed. Many statistics base their calculation on the assumption that the data are normally distributed (popularly called a parametric test). K-S tests of normality tables (see appendix A, Table A.1) show results of the tests for each of the concepts. The significant values less than .05 ($p < .05$) mean that the data distribution are significantly different from normality (bold values). Some transformations were conducted to overcome this non-normality as suggested by Fields (2005). After transformation, some of the transformed data became insignificantly different from normality as expected, but some of them were still significantly different from normality. In this case, parametric tests were applied to TPB concepts of which the data are normally distributed, whereas non-parametric tests were applied to all concepts.

4.6.2.2 Comparisons between the Village with MHP and the Village with no Electricity

Demographic Comparisons

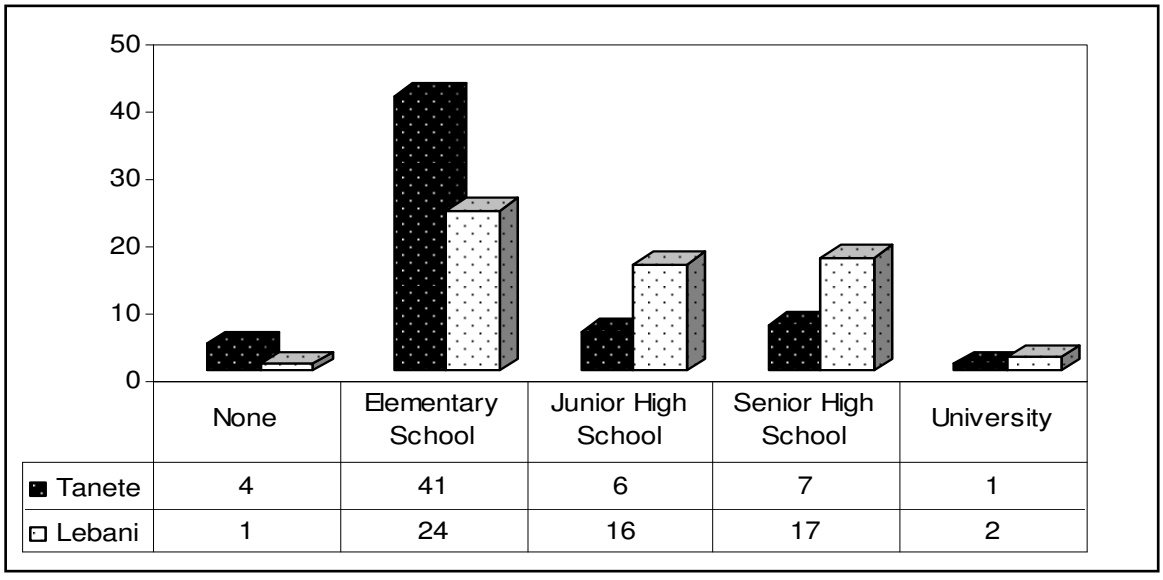
To understand the genuine role of MHP in shaping forest cutting behavior, the villages being compared were expected to be demographically similar; therefore, any effect of external variables other than MHP could be avoided. Demographic comparisons were done to know if there were differences exist between the villages, and if they existed we would like to know whether the differences offered significant contributions in predicting the outcomes. In other words, by controlling the effects of demographic variables we would

like to know whether MHP still had a genuine effect on beliefs, attitudes, norms, perceived power, intention, and behavior toward forest conservation.

As the first demographic comparison, the variable assessed was the ages of participants at Tanete (the village with MHP) and those of participants at Lebani (the village with no electricity). The average age of the participants at Tanete (M = 35.81, SE = 1.28) and Lebani (M = 34.14, SE = 1.14) was not significantly different, $t(114) = .977$, $p > .05$.

A similar result was found in the marital status of participants at the two villages. With 44 married and 15 unmarried participants at Tanete and 49 married and 11 unmarried participants at Lebani, there was no significant difference based on the participant marital status between the villages $\chi(1) = .876$, p (two-sided) = .382 (>.05).

The educational level distribution of participants at Tanete and Lebani is shown in Figure 4-2. With only one illiterate person, 24 elementary school graduates, 16 junior high school graduates, 17 senior high school and 2 university graduates, participants at Lebani seemed to hold higher educational levels than participants at Tanete with four illiterate persons, 41 elementary school graduates, 6 junior high school graduates, 7 senior high school and 1 university graduates. Chi-square test confirmed that there was a significant association between the educational level and the village a participant live at, $\chi(2) = 14.73$, p (two-sided) = .001 (<.05)[7]. Whether the educational levels will influence comparison outcomes will be analyzed later in this section.



	None	Elementary School	Junior High School	Senior High School	University
Tanete	4	41	6	7	1
Lebani	1	24	16	17	2

Figure 4-2 Education level comparison (Tanete and Lebani)

[7] Because of their small frequencies of occurrence, when the chi-square test was conducted, the illiterate participant data were combined with the elementary school data; meanwhile, the university data were combined with the senior high school data.

The comparison between the number of the family members in both villages showed that there was no significant difference between participants at Tanete (M = 3.97, SE = .164) and those at Lebani (M = 3.78 SE = .133), t(117) = .869, p > .05. Means of 3.97 and 3.78 indicated that participants at both villages lived together with about five to six others.

Similar results occurred in the job field and net income variables. These last two variables were less interesting to our discussion since almost all participants at both villages reported as farmers (97 % at Tanete and 93 % at Lebani) and had the net income which was less than Rp.500.000,- (less than US$ 50,-) a month (90 % at Tanete and 88 % at Lebani). It also means that most of the participants lived below the poverty line of US$ 2.15/person/day. This line value represented Indonesia as a middle-income developing country (see Chen & Ravallion, 2007). With five to six family members, the condition might become even worse.

TPB Concepts Comparison

Following the demographic comparison, TPB concepts were compared between the participants at the village with MHP (Tanete) and at the village with no electricity (Lebani). The independent t-tests result of eight TPB concepts that have normally distributed data are provided in Appendix A, Table A.2. The means of motivation to comply, control beliefs, and power factor are significantly different between the two villages (see bold values). In general, participants at Tanete had a more favorable motivation to comply, control beliefs, and power factor toward forest cutting (M_{MtC} = 3.74, SE = .23, M_{CB} = .27, SE = .19, and M_{PF} = .18, SE = .19) than participants at Lebani (M_{MtC} = 2.70, SE = .23, M_{CB} = -.19, SE = .15, and M_{PF} = -.27, SE = .17). The differences were significant, $t_{MtC}(112) = 3.23$, $p < .05$, r = .29, $t_{CB}(109) = 1.87$, $p < .05$, r = .18 and $t_{PF}(111) = 1.79$, $p < .05$, r = .29. Five other concepts that were tested on the independent t-tests were not significantly different between the two villages.

The non-parametric tests that were applied to all TPB concepts showed that six out of 16 variables were significantly different between the two villages (see Appendix A, Table A.3). They were motivation to comply, control beliefs, perceived power, direct subjective norms, descriptive norms, and direct PBC. The rest of the concepts were not significantly different. The Mann-Whitney test results are provided in Table 4-5. Only the concepts that have p < .05 (exact test) are shown. When the medians of the six concepts between the two villages were compared, it could be concluded that participants at Tanete (electrified by MHP) acquired the concepts more favorably toward forest conservation than participants at

Lebani. These results also confirmed the previous results on parametric tests that participants between the two villages were significantly different on their control beliefs and power factor toward forest cutting behavior.

Table 4-5 TPB concepts that were significantly different between Tanete and Lebani tested on Mann-Whitney tests

		N	Median	Mann-Whitney U	Significance (1-tailed)	Effect Size (r)
Motivation to Comply [a]	Tanete	56	3.94	1087.5	.001	.28
	Lebani	58	2.92			
Control Beliefs [a]	Tanete	51	.25	1246	.047	.16
	Lebani	60	-.28			
Power Factor [a]	Tanete	54	.12	1266	.03	.18
	Lebani	59	-.47			
Direct Subjective Norms	Tanete	56	5	1354	.035	.17
	Lebani	60	3			
Descriptive Norms	Tanete	56	6	1185.5	.002	.26
	Lebani	60	5			
Direct PBC	Tanete	57	3	1195.5	.003	.25
	Lebani	59	2			

[a] The data are normally distributed. The difference is also significant when tested with parametric t-tests.

The Effect of Education on the Concepts

In the demographic comparisons previously described, participants at Tanete tended to hold lower education levels compared to those at Lebani. This difference may influence the concepts held by participants at Tanete and Lebani. In other words, significant differences in beliefs, attitude, norms, and behavior that participants at both villages held might be related to the educational background, not related to the MHP variable as previously predicted. Therefore, six concepts that were significantly different between participants at Tanete and Lebani shown in Table 4-5 should be further analyzed to determine the effect of participants' education levels.

Table 4-6 ANOVA results of education as the independent variable

Dependent Variable	Independent Variable	df	Mean Square	F	Sig.
Motivation to Comply	Education	4	1.600	.486	.746
Control Beliefs	Education	4	3.263	1.999	.100
Power Factor	Education	4	1.837	.984	.420
Direct Subjective Norms	Education	4	3.503	.202	.937
Descriptive Norm	Education	4	5.571	2.497	.047
Direct PBC	Education	4	2.175	.174	.951

Table 4-6 shows ANOVA results of the education in predicting the concepts. Only descriptive norms were significantly determined by the education levels. However, when

MHP variable was controlled, the genuine effect of education on descriptive norms were no longer significant $F(4, 110) = 2.228$, $p = .071$. Descriptive norms were indeed significantly predicted by MHP, $F(1, 110) = 7.639$, $p = .007$.

Chi-Square Tests for Categorical Measures of Past Behavior

The last two questions were related to past behaviors of whether they cut trees from the forests last year and whether they had cut trees from the forests. These questions were categorical that they had only two possible answers, i.e. yes or no. Chi-square tests were performed to compare these two categorical variables. Table 4-7 shows the results. Forty three participants of Lebani reported that they had never cut trees within a year, while 17 others reported that they had. Similarly, forty three participants of Tanete (have MHP installed) reported that they did not cut trees last year, while only 14 others reported that they did. There was no significant association between having MHP installed and past behavior of last year cutting trees, $\chi(1) = .214$, $p = .401$ (>.05). A similar result was also found when past behavior of whether they had cut trees from the forest in their lifetimes was assessed. There was no significant relation of having MHP installed and performing past behavior of whether they had cut trees from the forest, $\chi(1) = .071$, $p = .468$ (>.05).

Table 6-7 Self-reporting answers about past behaviors of cutting trees between participants at Tanete and Lebani

		Did you cut trees from the forest last year?		
		No	Yes	Total
MHP	No	43	17	60
	Yes	43	14	57

		Have you ever cut trees from the forest?		
		No	Yes	Total
MHP	No	28	32	60
	Yes	28	29	57

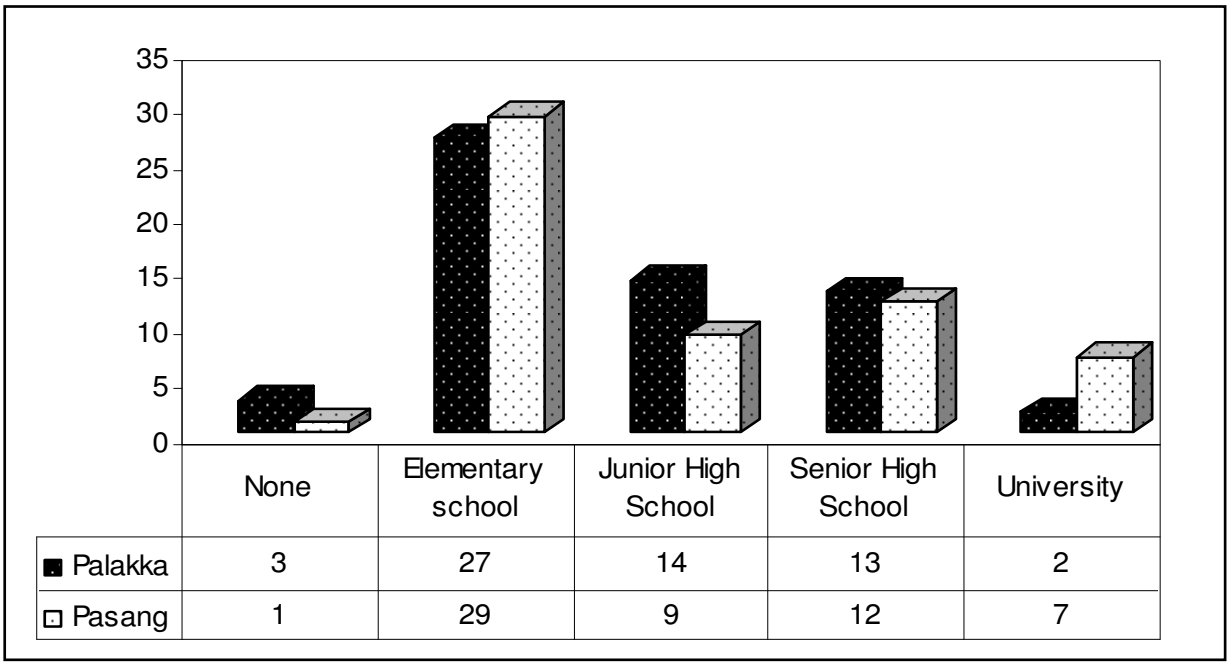
4.6.2.3 Comparison of TPB Concepts between Village with MHP and Village with Grid Electricity

Demographic Comparisons

The second comparison of the concepts was conducted between participants at Palakka (a village with MHP installed for a year) and at Pasang (a village electrified by grid for ten years). Beforehand, it would be interesting to evaluate some demographic differences between the villages.

T-tests were applied to analyze the average participant age between both villages. The results show that participants at Pallaka (M = 37.78, SE = 1.27) were significantly younger than participants at Pasang (M = 42.02, SE = 1.44), $t(113) = 2.212$, p(2-tailed) = .03. The age variable should be analyzed further to know whether the difference would have genuine effect on the concepts. In marital status, no significant difference was found between participants at the two villages. 40 participants were married and 19 participants were unmarried at Palakka, meanwhile 46 participants were married and 12 participants were unmarried at Pasang, $\chi(1) = 1.991$, p (two-sided) = .21 (>.05).

Figure 4-3 shows the education distribution of participants at Palakka and Pasang. By examining the figure, it was also quite safe to assume that there was no difference in the educational backgrounds of participants at both villages. Chi-square test supported that there was no significant association between the villages and the education levels, $\chi(2) = 1.55$, p (two-sided) = .474 (>.05).



	None	Elementary school	Junior High School	Senior High School	University
Palakka	3	27	14	13	2
Pasang	1	29	9	12	7

Figure 4-3 Comparison of participants' education (Palakka and Pasang)

There was also no significant difference in the number of the family member at Palakka (M = 3.86, SE = 0.17) and Pasang (M = 3.52, SE = 0.11), $t(115) = 1.107$, p(2-tailed) = .09. Generally, participants lived with three to six members at the villages. When the job field and the net income of participants at both villages were compared, participants' occupations were mostly farmers (86 % at Palakka and 88 % at Pasang) and the net income was less than Rp. 500.000, - (less than US$ 50; 93 % at Palakka, 84 % at Pasang). Therefore, it would be safe to say that participants at those villages were similar in the occupation and income.

TPB Concepts Comparison

In this section, nine TPB concepts that have normally distributed data were compared using the independent t-tests. The results are given in the appendix A, Table A-4. Five out of nine concepts tested were significantly different (bold values). For example, participants at Palakka held less favorable beliefs toward forest conservation (M = -.43, SE = .17) than participants at Pasang (M = .48, SE = .19). This difference was significant, $t(111) = -3.488$, $p < .05$, r = .31. All the significant differences of the concepts are provided in Table 4-8. The mean of the concepts can be compared to see the direction of the effect. The scores were set in a way that higher values indicated more concerns toward forest conservation.

Table 4-8 T-tests results comparing participant TPB concepts between Palakka and Pasang

Concepts	Villages	N	Means	Std. Error Mean	t	df	Sig. (1-tailed)	R
Behavioral Beliefs	Palakka	57	-.4254	.17305	-3.488	111	0.000	0.314
	Pasang	56	.4806	.19398				
Outcome Evaluation	Palakka	59	-.1720	.18311	-2.058	113	0.021	0.190
	Pasang	56	.4326	.23172				
Log Normative Beliefs	Palakka	58	1.7130	.03836	-2.599	112	0.005	0.239
	Pasang	56	1.8633	.04337				
Sqrt Direct Attitude	Palakka	59	2.6201	.13677	-3.096	113	0.001	0.280
	Pasang	56	3.1876	.12096				
Indirect Subjective Norms	Palakka	56	30.7857	6.30722	-2.366	109	0.010	0.221
	Pasang	55	53.1636	7.06239				

Table 4-9 TPB concepts that were significantly different between participants from Palakka and Pasang (tested on Mann-Whitney tests)

	Village	N	Mean Rank	Median	Mann-Whitney U	Significance (1-tailed)	Effect Size (r)
Behavioral Beliefs[a]	Palakka	57	46.49	-.4355	997	0.000	0.324
	Pasang	56	67.70	.4515			
Outcome Evaluation[a]	Palakka	59	50.97	-.0131	1237.5	0.010	0.216
	Pasang	56	65.40	.4514			
Normative Beliefs[a]	Palakka	58	48.97	.1097	1129.5	0.002	0.263
	Pasang	56	66.33	.7082			
Direct Attitude[a]	Palakka	59	48.19	5	1073	0.001	0.303
	Pasang	56	68.34	9			
Direct Subjective Norms	Palakka	58	45.09	3	904.5	0.000	0.378
	Pasang	55	69.55	6			
Descriptive Norm	Palakka	57	49.39	4	1162.5	0.008	0.227
	Pasang	55	63.86	5			
Direct PBC	Palakka	58	49.51	1	1160.5	0.004	0.248
	Pasang	56	65.78	3.5			
Indirect_Attitude	Palakka	57	48.31	30	1100.5	0.005	0.246
	Pasang	54	64.12	56.5			
Indirect_SN[a]	Palakka	56	48.36	39	1112	0.006	0.240
	Pasang	55	63.78	65			
Intention	Palakka	56	48.05	-.5	1095	0.003	0.262
	Pasang	56	64.95	.5			

[a] The data are normally distributed. The difference was also significant when tested with parametric t-tests.

Similar to the comparison previously described in section 4.6.2.2, non-parametric tests comparing all TPB concepts between participants at Palakka and Pasang were also carried out. The results are given in appendix A, Table A.5. 10 out of 16 variables were significantly different between both villages. The significant results are summarized in Table 4-9. As seen on the table, all concepts' mean rank and median of participants at Palakka were significantly lower than those at Pasang. It means that participants at Palakka reported that they had less favorable beliefs, attitudes, social norms, perceived control, and intention toward forest conservation behavior. Participants at both villages were not significantly different in some aspects of beliefs (i.e. motivation to comply, control beliefs, and perceived power), indirect PBC, and past behavior.

The Age Effect

To test whether the age variable had genuine effect on the concepts, correlations between participants' age and ten concepts in Table 4-9 were evaluated. The results show that only directly measured subjective norms were significantly correlated with participants' age, r = .19, p = .046. However, when the effect of MHP was controlled in a hierarchical regression analysis, the effect of participants' age on subjective norm disappeared (see Table 4-10).

Table 4-10 The age effect on direct measures of subjective norms disappeared when MHP variable was controlled.

		B	Std. Error B	Beta
Step 1				
	Constant	.459	1.525	
	Age	.074	.037	.190*
Step 2				
	Constant	.272	1.440	
	Age	.044	.036	.113 ^{ns}
	MHP	2.848	.747	.347***

Note R^2 = .04 for Step 1, $p < .05$; ΔR^2 = .07 for Step 2, $p < .001$.
^{ns} not significant; * $p < .05$; *** $p < .001$.

Chi-Square Tests for Categorical Measures of Past Behavior

Two other measures of past behavior were categorically scaled with only yes or no responses. The questionnaire asked whether the participants cut trees from the forests last year and whether the participants had cut trees from the forests. Participants' responses are summarized in Table 4-11. 47 out of 56 total respondents at Pasang reported that they did not cut trees from the forests last year, while nine respondents admitted cutting trees from the forests. On the other hand, 40 out of 58 respondents at Palakka answered *no* to the question and the other 18 respondents answered *yes*. There was a significant association between MHP and participants' past behavior of last year

cutting trees $\chi(1) = 3.529$, $p = .048$ (1-sided). Based on the odds ratio, participants at the village electrified by MHP (Palakka) were 2.35 times more likely to have cut trees from the forests last year than participants at the village that was grid electrified (Pasang).

When assessing past behavior of whether participants had cut trees from the forests, similar results were found. There was a significant association between the past behavior of whether participants ever had cut trees from the forests and participants' villages, $\chi(1) = 4.592$, $p = .025$ (1-sided). Participants at Palakka were 2.25 times more likely to have cut trees from the forests than those at Pasang.

Table 4-11 Self-reporting answers about past behaviors of cutting trees between participants at Palakka and Pasang

			Did you cut trees from the forest last year?		
			No	Yes	Total
MHP	No	Count	47	9	56
	Yes	Count	40	18	58

			Have you ever cut trees from the forest?		
			No	Yes	Total
MHP	No	Count	33	24	57
	Yes	Count	22	36	58

4.6.2.4 Considering Electricity as a Variable

In Tanete-Lebani and Palakka-Pasang comparisons described in the previous sections, we saw that MHP variable inconsistently influenced the concepts. Tanete-Lebani comparison in general shows that the villagers at the village electrified by MHP show more favorable beliefs, norms, and perceived control toward forest conservation behavior (measured in forest cutting domain). Palakka-Pasang comparison, however, showed that people at the village electrified by MHP held less favorable beliefs, attitudes, norms, perceived power, and intention toward forest conservation behavior. To get more insight about this inconsistency, Figure 4-4 shows the TPB concepts from those 4 villages.

Figure 4-4 shows that in general the villages electrified by MHP for four years and electrified by grid for ten years were better in shaping inhabitant concerns toward forest conservation than the villages that had no electricity and was electrified by MHP for 1 year. The figure depicts that grid electricity variable might also have positive association with

villagers' concerns toward forest conservation. Perhaps, it was not the MHP variable that positively correlated with concerns toward forest conservation but the electricity.

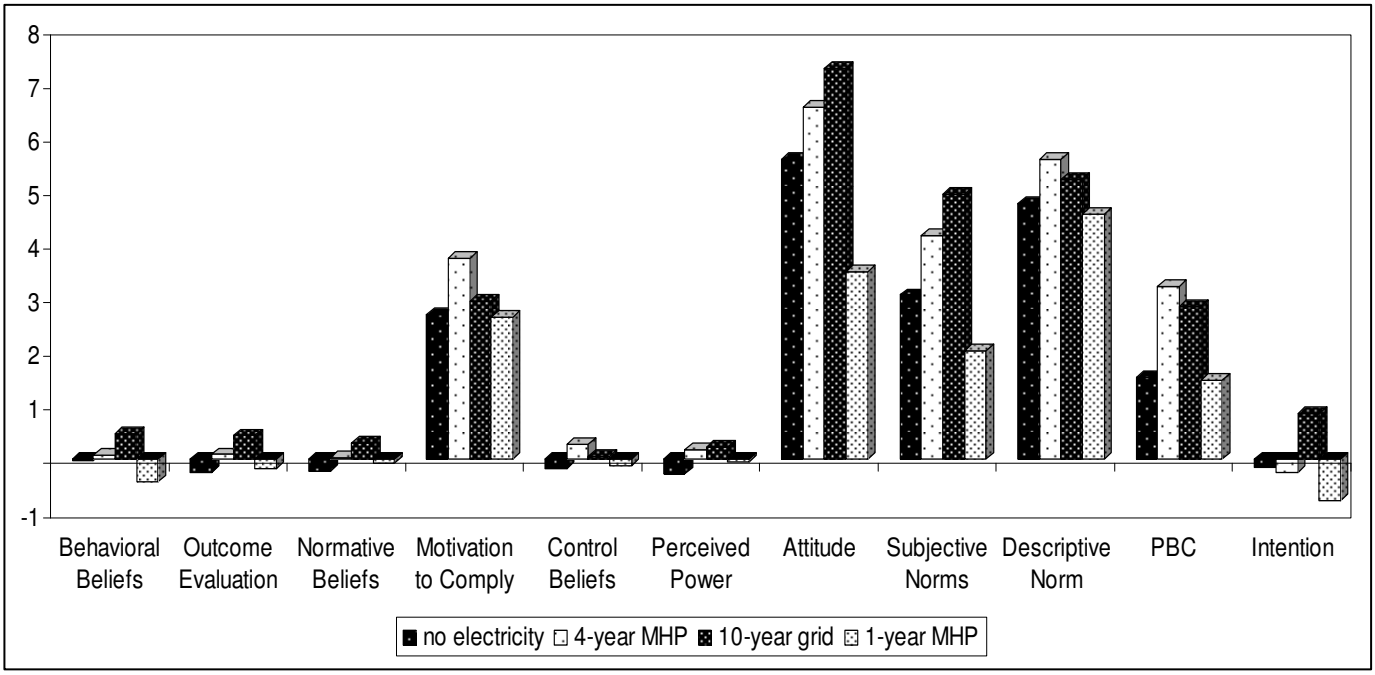


Figure 4-4 Participants' TPB concepts comparison among villages (higher value indicates higher concerns toward forest conservation)

To test this idea, those two villages electrified by MHP were combined and contrasted with two villages not electrified by MHP. The results are provided in Table 4-12. The table shows that only four out of thirteen TPB variables and descriptive norms being compared were significantly different between participants at 'MHP villages' and at 'no MHP villages'. Participants at 'MHP villages' significantly showed more favorable motivation to comply than participants at the villages with no MHP, but they show less favorable intention, directly measured attitudes, and behavioral beliefs toward forest conservation.

The villages were then grouped as villages with electricity and villages without electricity. It was conducted to find out the role of electricity, regardless of its sources, in shaping forest conservation concerns[8]. In spite of the fact that Palakka was provided with MHP for a year, it turned out that this village should be considered as a village without electricity due to the insignificant improvement in concerns toward forest conservation. It was confirmed by comparing the concepts between the participants at Palakka and Lebani. Only directly measured attitudes were significantly different between the villages. Pallaka participants (M_{Att} = 3.49, SE = 0.88) significantly held less favorable attitudes toward forest

[8] Forest conservation concerns in the present study reflect beliefs, attitudes, norms, perceived control, intention, and behavior toward forest conservation.

conservation than Lebani participants (M_{Att} = 5.59, SE = 0.75), $t_{Att}(115)$ = -1.810, p (2-tailed) < .05. It is assumed that one year savoring electrification was not long enough to change beliefs, attitudes, norms, PBC, and intention toward forest conservation behavior.

Table 4-12 TPB concepts comparison between two villages with MHP and two villages without MHP

	MHP	N	Mean	Std. Error Mean	t	df	Sig. (1-tailed)
Intention	with MHP	112	-0.518	0.291	-2.015	226	0.023
	no MHP	116	0.319	0.296			
Direct Attitude	with MHP	116	5.000	0.584	-1.795	228	0.037
	no MHP	114	6.421	0.534			
Direct Subjective Norms	with MHP	114	3.070	0.404	-1.628	227	0.053
	no MHP	115	3.948	0.358			
Direct PBC	with MHP	115	2.330	0.290	0.388	228	0.349
	no MHP	115	2.157	0.342			
Descriptive Norm	with MHP	113	5.071	0.140	0.421	226	0.337
	no MHP	115	4.983	0.155			
Indirect Attitude	with MHP	111	28.045	2.999	-0.979	222	0.164
	no MHP	113	32.735	3.724			
Indirect SN	with MHP	110	35.836	4.660	-0.539	221	0.295
	no MHP	113	39.584	5.149			
Indirect PBC	with MHP	104	33.750	3.208	-0.441	218	0.330
	no MHP	116	35.603	2.751			
Behavioral beliefs	with MHP	113	-0.180	0.130	-2.124	226	0.017
	no MHP	115	0.218	0.135			
Outcome Evaluation	with MHP	113	-0.051	0.132	-0.621	227	0.268
	no MHP	116	0.078	0.159			
Normative Beliefs	with MHP	113	-0.028	0.086	-0.434	227	0.332
	no MHP	116	0.030	0.101			
Motivation to Comply	with MHP	112	3.193	0.148	1.690	223	0.046
	no MHP	113	2.819	0.165			
Control Beliefs	with MHP	109	0.064	0.128	0.765	224	0.223
	no MHP	117	-0.069	0.119			
Power Factor	with MHP	112	0.056	0.133	0.466	227	0.321
	no MHP	117	-0.027	0.120			

Table 4-13 shows that the electricity variable had positive association with concerns toward forest conservation. All the TPB concepts were significantly different showing that

the villagers at electrified villages held more positive beliefs, attitudes, norms, perceived control, and intention toward forest conservation behavior.

Table 4-13 TPB concepts comparison between 2 villages with electricity and two villages without electricity

		N	Mean	Std. Error Mean	t	df	Sig. (1-tailed)
Intention	Electricity	112	0.295	0.314	1.828	226	0.034
	No Electricity	116	-0.466	0.274			
Direct Attitude	Electricity	113	6.920	0.517	3.058	228	0.001
	No Electricity	117	4.530	0.584			
Direct Subjective Norms	Electricity	111	4.541	0.374	3.797	227	0.000
	No Electricity	118	2.542	0.370			
Direct PBC	Electricity	113	3.027	0.346	3.522	228	0.000
	No Electricity	117	1.487	0.271			
Descriptive Norm	Electricity	111	5.405	0.144	3.625	226	0.000
	No Electricity	117	4.667	0.144			
Indirect Attitude	Electricity	108	36.157	3.385	2.338	222	0.010
	No Electricity	116	25.060	3.323			
Indirect SN	Electricity	109	47.174	4.938	2.696	221	0.004
	No Electricity	114	28.711	4.750			
Indirect PBC	Electricity	105	38.533	3.145	1.744	218	0.041
	No Electricity	115	31.252	2.768			
Behavioral Beliefs	Electricity	112	0.275	0.137	2.686	226	0.004
	No Electricity	116	-0.225	0.127			
Outcome Evaluation	Electricity	110	0.261	0.151	2.304	227	0.011
	No Electricity	119	-0.213	0.140			
Normative Beliefs	Electricity	111	0.169	0.091	2.471	227	0.007
	No Electricity	118	-0.156	0.094			
Motivation to Comply	Electricity	111	3.349	0.168	3.108	223	0.001
	No Electricity	114	2.671	0.140			
Control Beliefs	Electricity	108	0.156	0.133	1.773	224	0.039
	No Electricity	118	-0.152	0.114			
Perceived Power	Electricity	112	0.204	0.128	2.099	227	0.018
	No Electricity	117	-0.168	0.123			

4.6.2.5 Relationship among TPB Concepts and other Variables

In the previous section, a comparison of TPB concepts among participants from four different villages was assessed. The comparison, however, did not evaluate the relationships among variables and did not explain which variables predicted intention toward forest cutting. The present sub-sub-chapter analyzes the correlation within the TPB

concepts and among the TPB concepts and other variables such as descriptive norms, past behavior, and demographic variables (e.g. age, education, income). Hierarchical regression analyses were applied to determine variables that predicted intention toward forest cutting.

Correlation among Concepts

Correlation analyses were conducted to know what relationship existed among the TPB concepts. In TPB, three sets of beliefs and their assessments are the determinants of attitude, subjective norms, and PBC. These beliefs and their assessments should, at some point, correlate with attitude, subjective norms, and PBC. Correlation analyses also assessed how strong the relationship between direct and indirect measures of attitude, subjective norms, and PBC were, and how these concepts correlated to behavioral intention.

The Spearman correlation coefficients among the concepts are given in the appendix (Table A.6). The Spearman correlation was used instead of Pearson correlation due to the non-normality of certain variables. The matrix shows that direct measures of attitudes, subjective norms, and PBC were positively correlated with intention, r_{sA} = .157, *p* (1-tailed) <.01; r_{sSN} = .276, *p* (1-tailed) <.01; r_{sPBC} = .127, *p* (1-tailed) <.05. Indirect measures of attitudes, subjective norms, and PBC showed weaker correlations: only PBC was significantly correlated with intention, r_{sA} = .072, ns; r_{sSN} = .103, ns; r_{sPBC} = .167, p (1-tailed) <.01. Direct measures of attitudes, subjective norms, and PBC were positively correlated with one another and the strength of the correlations ranged from medium to large. For example, direct measures of attitudes were positively correlated with direct measures of subjective norms and direct measures of PBC, r_s = .573, *p* (1-tailed) <.01; r_s = .469, *p* (1-tailed) <.01, respectively.

Similar results were also found when the correlations were assessed between directly measured attitudes, subjective norms, and PBC and indirectly measured ones. In general, directly measured subjective norms had the strongest correlations with the indirectly measured attitudes, subjective norms, and PBC, r_s = .441, p (1-tailed) <.01; r_s = .494, p (1-tailed) <.01; r_s = .496, p (1-tailed) <.01, respectively.

Directly measured attitudes had positive medium-effect correlations with their two predictors (i.e. behavioral beliefs and outcome evaluation), r_s = .311, *p* (1-tailed) <.01; r_s = .386, *p* (1-tailed) <.01, respectively. Directly measured subjective norms had stronger

correlations with their two determinants (i.e. normative beliefs and motivation to comply), r_s = .476, *p* (1-tailed) <.01; r_s = .338, *p* (1-tailed) <.01, respectively. On the other hand, directly measured PBC had the smallest correlations with its antecedents (i.e. control beliefs and power factor), r_s = .168, *p* (1-tailed) <.01; r_s = .211, *p* (1-tailed) <.01, respectively.

The other concept that was added to the theory of planned behavior is the descriptive norms. It was added to know whether this social influence will better explain the intention toward the behavior. Table A.6 shows a weak positive correlation between descriptive norms and intention, r_s = .162, *p* (1-tailed) < .01. The correlation coefficients were summarized in Figure 4-5.

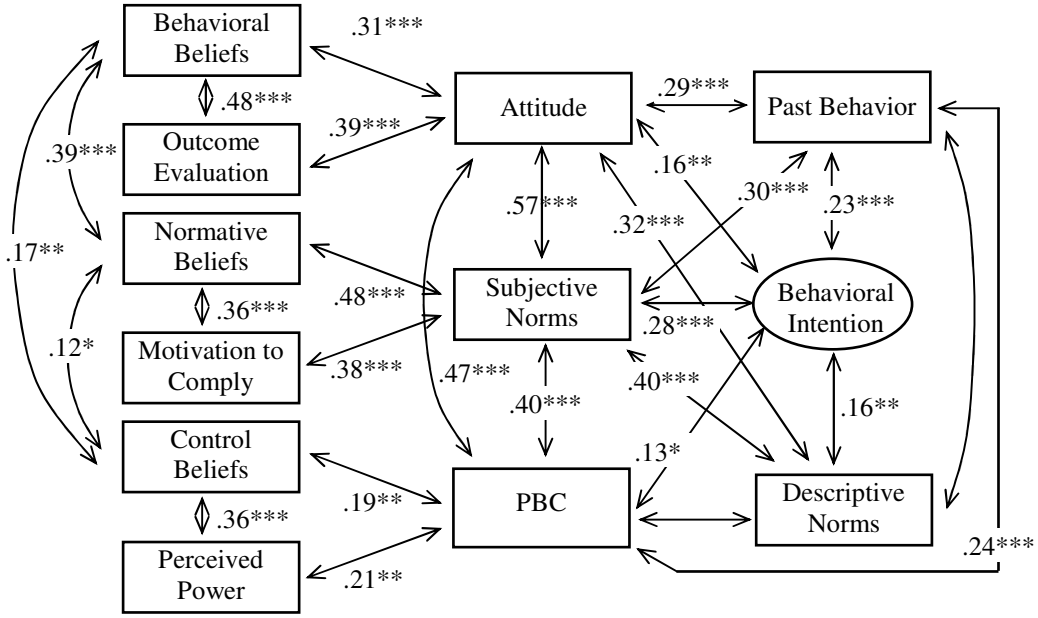


Figure 4-5 Correlations among concepts. * *p* < .05, ** *p* < .01, * *p* < .001.**

Predicting Intention toward Forest Cutting

To understand how TPB concepts and the other variables explained behavioral intention, a hierarchical regression in combination with a forced entry method was conducted to assess the participants in the four villages. In this regression method, the independent variables were entered step by step and the sequence of entering the variables was based on past works. In this case, directly measured attitude, subjective norms, and PCB were firstly entered. They were followed by descriptive norms, past behaviors, MHP variable, and the demographic variables in the second step. Dummy coding was created for categorical variables that have more than two categories. Before the variables were entered, their correlations with intention were checked. Any variables non-significantly correlated with intention were excluded from regression analyses to maintain a higher

statistical power. Those variables were age (r = .03), marital status (r = .04), family member (r = -.01), ps > .05.

Intention was transformed into square root intention[9] to obtain errors (the differences between model and observed data) that were normally distributed. Listwise exclusion method was applied to exclude the missing cases from the analysis. This method deployed 219 completed questionnaires (out of 236) to analyze. A summary of the hierarchical regression is presented in Table 4-14.

Table 4-14 The regression summary with square root intention as the dependent variable[10]

	B	*Std. Error B*	*Beta*	*Pearson correlation*	*Partial correlation*
Step 1					
Constant	1.240***	0.061			
Direct Attitude	0.000^{ns}	0.009	-.004	.180**	-.003
Direct Subjective Norms	0.043**	0.012	.274	.300***	.230
Direct PBC	0.015^{ns}	0.014	.078	.177**	.072
Step 2					
Constant	1.426***	0.180			
Direct Attitude	-0.005^{ns}	0.009	-.047	.180**	-.040
Direct Subjective Norms	0.035**	0.013	.220	.300***	.184
Direct PBC	0.015^{ns}	0.014	.077	.177**	.073
Descriptive Norm	0.002^{ns}	0.030	.005	.123*	.004
Have you ever cut trees? (1=yes)	-0.209*	0.092	-.160	-.242***	-.156
has MHP installed? (1=yes)	0.113^{ns}	0.085	.087	.140*	.092
Junior HS vs Elmntry. School	0.030^{ns}	0.110	.018	.016^{ns}	.019
Senior HS vs Elmntry. School	0.048^{ns}	0.109	.030	.059^{ns}	.030
University vs Elmntry. School	0.458*	0.201	.154	.206**	.156
Illiterate vs Elmntry. School	-0.331^{ns}	0.259	-.083	-.079^{ns}	-.088

Note Higher values indicate more concerns toward forest conservation
R^2 = .095 for Step 1, p < .001; ΔR^2 = .067 for Step 2, p < .05.
^{ns} not significant; * p < .05 ; ** p < .01; *** p < .001.

Table 4-14 shows that the first step regression model explained only 10% variation in behavioral intention and only subjective norms explained significant variance in intention. Regression coefficients (B values) of attitudes and PBC were not significantly different from zero. These insignificant contributions of attitudes and PBC in predicting intention might stem from the large effect correlation between attitudes and subjective norms (r = .550, p < .001) and a medium effect correlation between PBC and subjective norms (r =

[9] Formulated as sqrt_intention = 4 – [7 – intention]$^{1/2}$

[10] A stepwise (backward) regression analysis was also conducted and gave a similar result in which subjective norms, past behavior, and university education explained significant variance in intention.

.370, $p < .001$). Meanwhile, attitudes and PBC effects on intention were small ($r = .180$, $p < .01$ and $r = .177$, $p < .01$, respectively). As a consequence, it is very probable that attitudes, subjective norms, and PBC shared the same variance in intention and the unique variance in intention explained by attitude and PBC became insignificant.

In step 2 of the regression analysis (Table 4-14), variables i.e. descriptive norms, past behavior, the present of MHP, and dummy coding of education levels were entered. The extended model now explained 16 % variance in behavioral intention (increased by 6.7 %). The 16 % variance in intention was explained by subjective norms, past behavior of forest cutting, and education. If participants scored low on subjective norms toward forest cutting (meaning that they supported forest conservation) they also tended to score low on intention to perform forest cutting. If participants had performed forest cutting in the past they had stronger intention to perform forest cutting. University graduates had lower intentions to perform forest cutting compared to the elementary school graduates. When beta values of each variable were considered, the relative importance of these variables in predicting intention was comparable. Subjective norms were ranked first followed by past behavior and education levels.

Descriptive norms were hypothesized to give significant contribution in explaining variance in intention (e.g. Sheeran & Orbell, 1999; Sheeran & Taylor, 1999; Rivis & Sheeran, 2003) but proved otherwise in the present study. Descriptive norms in these analyses did not significantly predict intention. A similar result was found related to MHP variable. Having MHP to electrify the villages did not bring significant residual contribution in explaining variation in intention. There were no significant contributions of educational backgrounds in predicting intention, yet it only applied to illiterate participants, elementary school, junior high school, and senior high school graduates. The significant result was shown by the university graduates.

Some possible interactions between MHP variable and other variables such as attitudes, norms, PBC, past behavior, and education were also analyzed. However, these interactions are highly correlated with their original variables so that they created multicollinearities among predictors. For examples, interactions of MHP*attitudes, MHP*subjective norms, and MHP*PBC correlate highly with attitudes, subjective norms, and PBC, $r_1 = .909$, $r_2 = .918$ $r_3 = .922$, respectively, significant at ps $< .05$. When the collinearity tests were performed on SPSS, it was found that the variance inflation factors (VIF) of those variables were greater than 10 that indicated a serious problem of multicollinearity (see Field, 2005). Hence, interaction variables were dropped from the

regression analyses. Figure 4-6 shows correlations between intention predictors in TPB and a summary of variables that predicted behavioral intention.

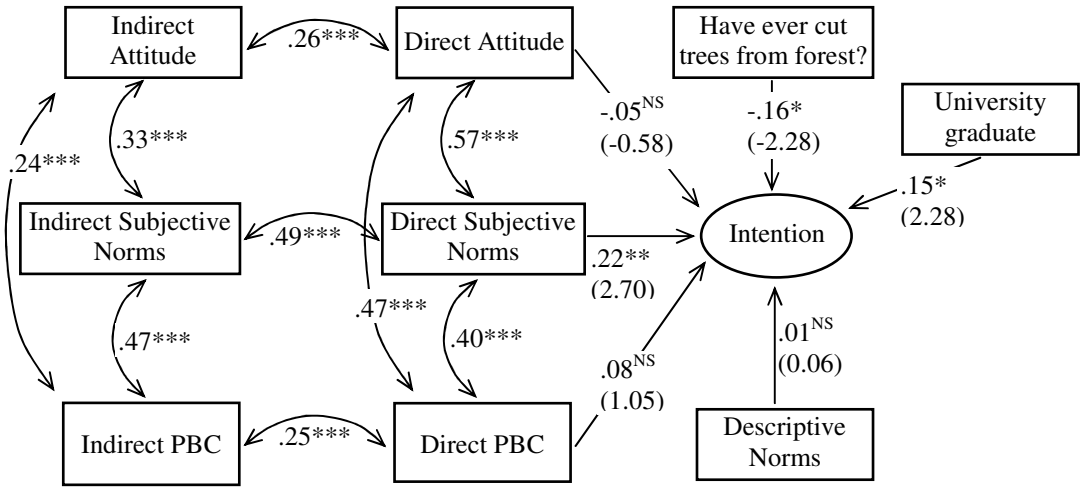


Figure 4-6 Predicting intention from TPB and other variables. Correlations between direct and indirect measured intention predictors are also shown. Straight arrows indicate standardized regression coefficients (beta) with t-test values in parentheses. Two-headed arrows indicate spearman correlation coefficients. ^{NS} not significant, * $p < .05$, ** $p < .01$, *** $p < .001$

The Role of Beliefs in shaping Intention toward Forest Cutting

The regression analysis shows that intention toward forest cutting was predicted by subjective norms, past behavior, and education. Since the subjective norms was developed by beliefs which were composed of one or two components (see section 4.6.2.1), a regression analysis was also conducted in order to find out the components that predicted subjective norms. All components of behavioral beliefs, normative beliefs, control beliefs, and the assessment of these beliefs were included into the analysis. Table 4-15 provides the summary of the regression analysis.

Table 4-15 shows that variance in subjective norms was accounted for by the evaluation of forest cutting benefits, perceived barriers, beliefs about all referents expectation, perceived resources, and evaluation of forest cutting costs (listed from the component that had the highest effect on subjective norms to the one that had the lowest effect). Those components explained 46% variance in subjective norms. Interestingly, the first two components that had the highest effect on subjective norms were the component of outcome evaluation and the component of perceived power. Normative beliefs had a weaker effect on subjective norms. There was no significant effect of motivation to comply on subjective norms. As a summary, the components of subjective norms are also provided in Figure 4-7.

Table 4-15 The stepwise-backward regression summary with square root subjective norms as the dependent variable

		B	Std. Error	Beta	T	Sig.
Step 1	(Constant)	2.584	.042		61.244	.000
	Beliefs about costs	-.023	.045	-.029	-.511	.610
	Beliefs about benefits	-.006	.066	-.008	-.097	.923
	Cost evaluation	.111	.045	.142	2.480	.014
	Benefits evaluation	.277	.064	.349	4.313	.000
	Beliefs about all referents expectation	.149	.051	.186	2.937	.004
	Motive to comply with close referents	-.008	.046	-.010	-.168	.867
	Motive to comply with official staffs	-.077	.052	-.095	-1.480	.140
	Beliefs about barriers	-.011	.047	-.013	-.223	.824
	Beliefs about resources	-.001	.050	-.001	-.023	.982
	Perceived barriers	.192	.053	.232	3.626	.000
	Perceived resources	.134	.049	.168	2.718	.007
Step 7	(Constant)	2.584	.042		61.843	.000
	Cost evaluation	.129	.042	.165	3.054	.003
	Benefit evaluation	.271	.046	.341	5.902	.000
	Beliefs about all referents expectation	.159	.048	.199	3.341	.001
	Perceived barriers	.199	.048	.242	4.134	.000
	Perceived resources	.146	.044	.182	3.338	.001

N = 203; R^2 = .464 for Step 1, $p < .001$; ΔR^2 = -.007 for Step 7, $p > .05$. Sqrt_SN = $5-(10-SN)^{1/2}$

4.7. Discussion

In study 1, participants among the four villages were compared. Participants at Tanete (electrified by MHP) were compared with participants at Lebani (no electricity) and participants at Palakka (electrified by MHP) were compared with participants at Pasang (grid electrified). The analyses were followed by regression analyses assessing participants within the villages.

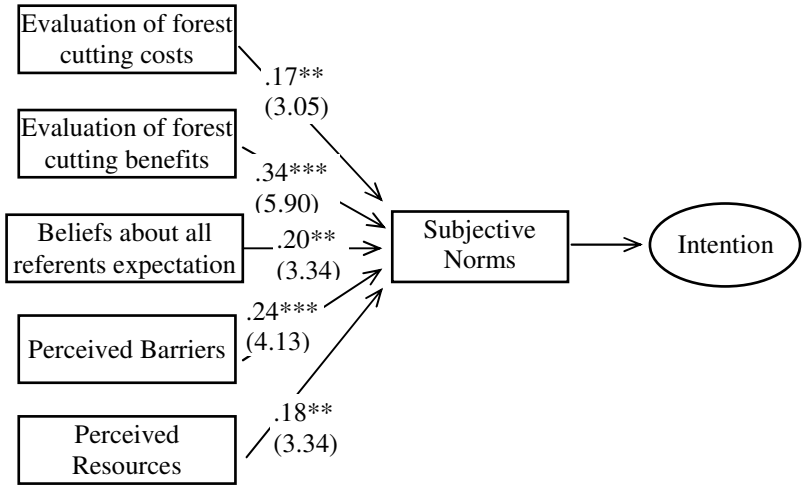


Figure 4-7 The components of subjective norms. The arrows indicate standardized regression coefficients (beta) with t-test values in parentheses. ** *p* < .01, * *p* < .001.**

Electricity as a Variable

In Tanete-Lebani comparisons (section 4.6.2.2), participants at both villages were demographically similar except that the education levels of participants at Lebani were higher than those at Tanete. However, this variable did not share any genuine effect in explaining any of the concepts. When TPB concepts were compared, it is found that MHP variable significantly increased participants' motivation to comply, control beliefs, power factors, directly measured subjective norm, descriptive norm, and directly measured PBC toward forest conservation. MHP variable, however, did not give significant effect in directly measured attitude, and indirectly measured attitude, subjective norm, and PBC. More importantly, there is no significant association between having MHP to electrify the village and intention to perform forest cutting. The very small variance in intention (R^2 = .095) accounted for by our TPB model might be the reason why differences in motivation to comply, control beliefs, power factors, directly measured subjective norm, descriptive norm, and directly measured PBC did not lead to differences in intention.

On August 29, 2007 (two years after MHP electrification) 73 households at Tanete signed an agreement indicating that people from the village would not cut woods from the forest for any commercial purposes. A cutting permit from the local authority is needed if the villagers need woods from the forest. If the wood cutting is performed they agree to replant ten times the amount of trees they cut. This pro-environmental behavior performed by the villagers can perhaps be explained by their more pro-environmental motivation to comply, subjective norm, and descriptive norms and by their higher pro-environmental control beliefs, power factor, and perceived behavioral control described above. Therefore, the social norms of what other people would like them to do and what other people actually do together with self efficacy might be the main determinants that explained why they signed the community agreement. However, further analysis shows that the intention to perform forest cutting and the past forest cutting behavior of participants at Tanete were not significantly different than those at Lebani, the neighboring village that has no electricity. Thus, the pro-environmental action of signing the forest conservation agreement is not followed by a more favorable intention toward forest conservation behaviors (measured in forest cutting).

In section 4.6.2.3, participant at Palakka (electrified by MHP for a year) were compared with participants at Pasang (grid electrified for ten years). The demographic comparisons performed in previous section showed that Palakka participants were significantly younger than Pasang participants. However, the difference did not give any residual effect on

beliefs, attitudes, norms, perceived control, intention, and behavior toward forest cutting. 12 of 18 variables were significantly different (i.e. behavioral beliefs, outcome evaluation, normative beliefs, direct attitudes, direct subjective norms, descriptive norm, direct PBC, indirect attitudes, indirect subjective norm, intention, and 2 categorical past behaviors). Interestingly, the direction of the differences opposed the direction hypothesized. Participants at Palakka (electrified by MHP) were significantly hold less favorable beliefs, norms, perceived control, attitude, intention, and past behavior toward forest conservation than participants at Pasang (grid electrified). For example, the intention to perform forest cutting of participants at Palakka was significantly higher than that of participants at Pasang. It means that in general participants at Palakka hold less concern toward forest conservation behavior than those at Pasang.

In Tanete-Lebani comparisons, participants at Tanete (electrified by MHP) showed more favorable beliefs, norms, and perceived control toward forest conservation behavior than those at Lebani (no electricity). MHP variable had a positive association with forest conservation. In Palakka-Pasang comparisons, participants at Pasang (grid electrified for 10 years) showed more favorable beliefs, norms, perceived control, attitude, past behaviors, and intention toward forest conservation than participants at Palakka (electrified by MHP since April 2008). In the latter case, MHP variable had a negative association with forest conservation. These inconsistent results indicated that perhaps MHP was not the variable that determined forest conservation behavior. This indication was confirmed by the result in section 4.6.2.4. It showed that MHP was not the variable that increased concerns toward forest conservation. The result in section 4.6.2.4 also indicated that electricity increased villagers' concern toward forest conservation. The Palakka-Pasang comparisons and no-electricity vs. electricity comparisons pointed out that participants at the villages that had been provided with the electricity for a longer period held a better beliefs, attitudes, norms, perceived control, and intention toward forest conservation behavior than those at the village with no electricity or at the village electrified for a shorter period. In contrary, a planned contrast comparing Pasang (10-year grid electrified) and Tanete (4-year MHP electrified) showed that most of the compared concepts gave no significant differences. Significant differences were observed only in intention and motivation to comply. Participants at Pasang (M = 0.84, SE = 0.42) significantly held better intentions than participants at Tanete (M = -0.25, SE = 0.46), t (224) = 1.85, p (1-tailed) = .03. However, in their motivation to comply, participants at Pasang (M = 2.95, SE = 0.24)

were significantly worse than participants at Tanete (M = 3.74, SE = 0.23), t (221) = 2.58, p (1-tailed) = .05.

There is no clear explanation on how electricity may increase one's concerns toward forest conservation. The electricity perhaps increases villagers' chance of exposures to more information related to forest conservation. The information may come from the electronic media such as televisions and radios. In the study about intention to conserve water in the California-Nevada Truckee River Watershed, Trumbo & O'Keefe (2001) called this phenomenon an *information gradient*. Information gradient suggests that information exposures are more concentrated in urban areas and the exposures are gradually de-concentrated when they move into remoter areas. Villages that have electricity are usually geographically closer to urban areas. Information gradient may also emerge at the villages that have electricity in which information exposures are more often than at the villages without electricity. Information in turn may shape villagers' beliefs, attitude, norms, intention, and behavior (see also Gardner & Stern, 2002). Ajzen (2005) suggested that besides personal and social factors, informational factors (experience, knowledge, media exposure) may also act as the external variables influencing beliefs, attitudes, norms, PBC, intention, and behavior (see also Bamberg *et al.* 2003). Electricity may provide different experiences, knowledge, and media exposures that shape people's beliefs, attitude, norms, perceived control, intention, and behavior more favorably toward forest conservation. This suggestion is also in accordance with the results provided in Table 4.13. The table shows that rural electrification increases participants' beliefs, attitudes, norms, perceived control, and intention toward forest conservation behavior.

The result implies that the government and decision makers should come up with some more practical ideas to boost rural electrification programs as electrification may provide an additional benefit: increasing pro-environmental concerns.

The Dominance of Subjective Norms in Predicting Forest Cutting Intention

The hierarchical regression analyses (section 4.6.2.5) provide variables that determine intention to perform forest cutting. Of the three predictors of intention, only subjective norms significantly predicted intention toward forest cutting. Attitude and PBC had no significant effect on intention. The dominance of subjective norms in predicting intention toward forest cutting might be related to the disguised technique that was applied. The high correlation between subjective norms and intention perhaps can be attributed to the intention asked to the participants. Instead of directly asking participants' own intention,

the question asked participants' perception of others' intention to perform forest cutting. It means that subjective norms as the perceptions of others' expectation are more likely to strongly correlate with the perception of others' intention. Otherwise, attitudes and PBC usually have higher correlations with intention if the intention asked was participant' own intention (direct intention).

If it is assumed that the participant perception of others intention to perform forest cutting strongly reflected participant' own intention, it should be accepted that social pressures were the dominant variable that shape intention toward forest cutting. This result differs from standard results usually found in weighing predictor effects in intention (in term of standardized regression coefficients). Attitudes were usually the dominant variable in explaining variance in intention; however, in some studies PBC exceeded attitudes and subjective norms in explaining the variation (see Albarracin *et al.*, 2001; Armitage & Conner, 2001; Johnston & White 2003; Ajzen, 2005). On the other hand, subjective norms were usually the weakest component. In a similar study assessing determinants of forest conservation behavior in Haiti, Dolisca *et al.* (2009) also found that subjective norms did not significantly predict intention. However, a study of Trumbo & O'Keefe (2001) assessing intention to conserve water supported the present study. Examining three distinct communities located in the California-Nevada Truckee River Watershed they noticed that subjective norms surpassed attitudes and PBC in predicting behavioral intention to conserve water. In Truckee community, they even found that subjective norms were the only significant predictor of intention.

A study predicting workers' turnover intention among the Japanese and British also pointed out that attitudes failed to predict workers' turnover intention (Abrams *et al.*, 1998). Subjective norms, country of origin, and their interaction significantly predicted the intention. Subjective norms of the Japanese had a stronger effect on intention to leave the job than those of the British. Abrams *et al.* (1998) noticed that subjective norms were related to collectivistic culture in which strong social bonds increased people tendencies to react in accordance with what other people wanted them to do. Similarly, Finlay *et al.* (1999) proposed that collectivistic cultures might mostly consist of normatively controlled people. Therefore, in our study, perhaps participants' strong collectivistic culture background is the best explanation of the dominance of subjective norms in predicting forest cutting intention. It implies that information aimed to emphasize the dominant of subjective norms in shaping forest conservation behaviors may be created so that it prevents people from performing forest cutting (see also Finlay *et al.*, 1999). Direct

counselling, education, or advertisement aimed to increase social pressures and community concerns toward forest conservation may activate the collectivistic self and increase obedience among villagers not to perform forest cutting.

Predictors of Subjective Norms

A deeper analysis of the data showed that 46% variance in subjective norms were explained by the evaluation of forest cutting benefits, perceived barriers, beliefs about all referents expectation, perceived resources, and evaluation of forest cutting costs. How the components influenced people perception of others expectation may be related to the tendency that people want to be cognitively efficient. Due to the vast amount of information surrounding us, we tend to conserve mental effort when evaluating ourselves and others (Kenrick *et al.*, 2007). This tendency may create a *false consensus effect* in which people overestimate the degree to which others agree with them (Kenrick *et al.*, 2007; Ross *et al.*, 1977). For example, the more a farmer evaluates the benefits of forest cutting the more he will think that others will also get the same benefits, therefore approve forest cutting. The more he perceived the barriers to perform forest cutting the lower he perceived that important others would approve forest cutting.

It means that efforts intended to alter the components of beliefs are worth trying in order to increase concerns toward forest conservation. The government LPG conversion program converting cooking fuel to LPG is perhaps a good effort. Creating more jobs for rural people living near the forests may also be another solution. These efforts may alter the evaluation which considers forest cutting as the source of firewood and income. Law enforcement could be another option. People that illegally cut trees down from the forests should be punished or fined. Forest police ranger patrols should be performed regularly and more often. This solution could increase perceived barriers of performing forest cutting. Education and advertisement emphasizing social objection of forest cutting may also be performed as they would alter beliefs about what important others want a villager to do. All of these efforts could positively change subjective norms toward forest conservation. Subjective norms, in turn, may influence intention to act more favorably toward forest conservation. However, it should be kept in mind that subjective norms of the model only explained 10% variance in intention.

Past Behavior and Educational Background as Additional Variables that Predict Behavioral Intention

The second variable that predicts forest cutting intention is past behavior of whether participants have performed forest cutting. The result is similar to that explained by Ouellette & Wood (1998) in their meta-analysis study. In 19 of 22 TRA studies, they found that past behaviors explained unique variance in intention together with attitudes and subjective norms. In 8 of 9 TPB studies they also found unique variance in intention accounted for by past behavior. Connor & Armitage (1998) and Sheeran & Taylor (1999) also supported the result of the present study that past behavior explained unique variance in intention. Previously, Ajzen (1991) suggested that the effects of prior behaviors on later behaviors should be mediated by the perception of control, but some evidences did not support this idea (see Conner & Armitage, 1998 for a review). In the present study, past behavior also did not correlate very strongly with PBC, r = .29. Later, Ajzen (2002) provided evidences that past behavior might serve as a predictor of future behavior when the following conditions were met: violated principle of compatibility, unstable attitudes and intention, inaccurate and unrealistic perceived behavioral control and beliefs, and insufficient planning for implementation of the intention. Otherwise, prior behavior is usually not a good predictor of later behavior. In the present study, unstable attitudes and inaccurate PBC are perhaps two reasons of why past behavior provides residual effect on intention. Unstable attitudes refer to attitudes that are easy to change over time whereas inaccurate PBC refers to an over or under estimated perception of control toward a behavior. Unfortunately, unstable attitudes and inaccurate PBC can not be tested using the available data. In this case, the insignificance of attitudes and PBC in predicting intention, however, might be the indication of unstable attitudes and inaccurate PBC.

Gender and education variables are two demographic variables that usually shape environmentally relevant attitudes and behaviors (Kollmuss & Agyeman, 2002). However, gender influences on forest cutting beliefs, attitudes, norms, perceived control, intention and behavior can not be tested in the present study since only male participants were asked to participate. In the case of education, people possessing higher education tend to acquire more knowledge about environmental issues. Moreover, Dolisca *et al.* (2009) found that forest conservation programs received more supports from literate farmers. This is consistent to the result of the present study in which education levels predicted behavioral intention. University graduates showed less intention to perform forest cutting compared to elementary school graduates. It suggests that decreasing massive

deforestation can be achieved by increasing the level of education. However, most respondents reported to live below the US$ 2 poverty line. It means that higher education levels are hardly affordable. Comprehensive programs aimed to reduce poverty and increase education are necessary and will help reduce deforestation. As Dolisca *et al.* (2009) stated "*.....with improving incomes and livelihood, participation of farmers in forestry programs will likely increase, contributing to conservation objectives*".

Limitation

Another result that is worth mentioning is the fact that the TPB model explains only 10% variance in intention. This is quite low compared to other studies applying the same model (e.g. Sheeran & Taylor, 1999; Sutton, 1998). A meta-analysis study conducted by Sheeran & Taylor (1999) for example found that the average variance in intention accounted for by TRA and TPB were 37% and 42%, respectively. Sutton (1998) similarly found that, on average, TRA and TPB models explained 40% and 50% variance in intention, respectively.

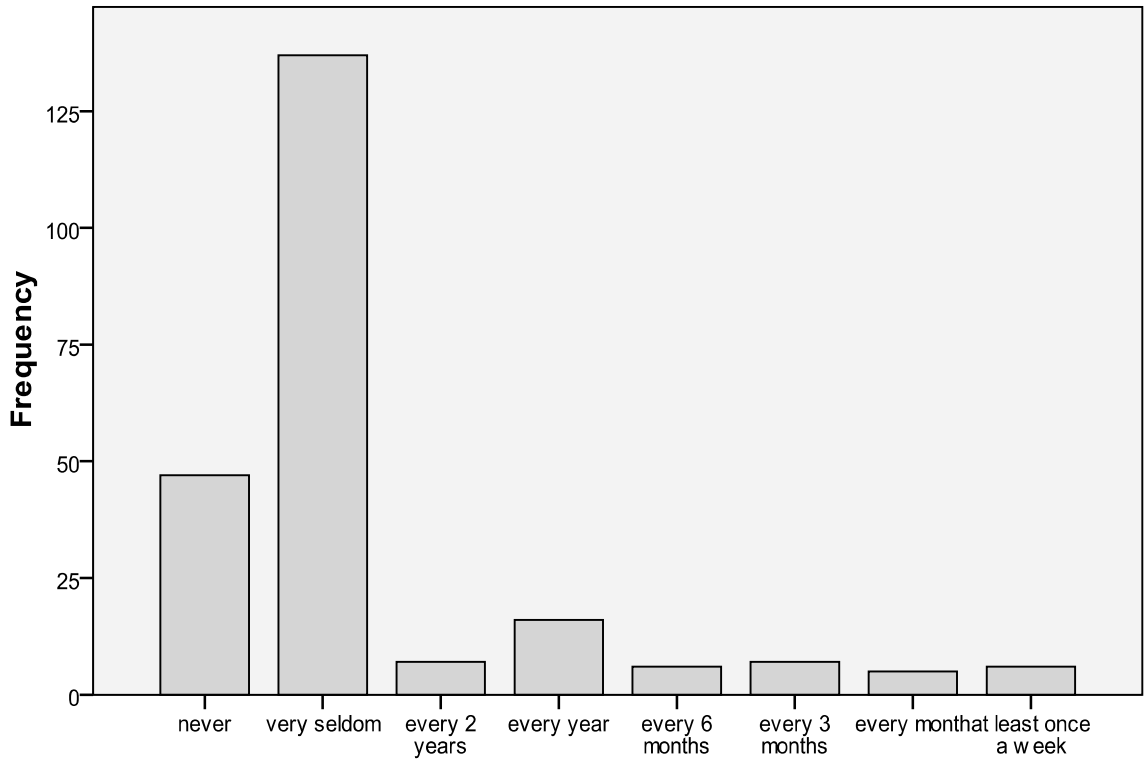


Figure 4-8 Response to past behavior question of How often a villager cut trees from the forest?

The reason of why this study gives pessimistic impression in explaining variance in intention may be related to the disguised technique that was applied. Instead of directly asking participants' intention to perform forest cutting, the questionnaire asked

participants' perception of their neighbors' intention. This technique was applied with consideration that forest cutting is a sensitive issue that may elicit answers which are socially desirable (see Ajzen, 2005). It was expected that participants' answers will be strongly biased by their own intention. In this study, however, participants' perception of others' intention to perform forest cutting perhaps did not appropriately reflect participants' own intention. Therefore, the model only explains a modest variance in intention.

Perhaps, the scale correspondence was also violated. When respondents were asked *How often a villager cut trees from the forest?* most of them answered *very seldom* (137 respondents) or *never* (47 respondents). Only 16 respondents answered *every year* (see Figure 4-8). Since the questionnaire solely asked participants' intention to perform forest cutting during one year period whereas the actual activity is rarely performed in a yearly basis making the scale correspondence possibly violated.

4.8. Conclusions

Contrary to the hypothesis, MHP did not always have positive association with farmers' beliefs, attitudes, norms, perceived power, and intention toward forest conservation behavior. Villagers at the village electrified by MHP for four years showed more positive concerns toward forest conservation than villagers at the village that had no electricity. However, villagers at the village electrified by MHP for a year showed less concerns toward forest conservation than villagers at the village electrified by the grid for ten years. Meanwhile, rural electrification significantly increased villagers' concerns toward forest conservation. The condition could be attributed to the information gradient phenomenon. Since more information exposures were experienced by the villagers having electricity, their beliefs could be altered. The changes could shape attitudes, norms, perceived controls and intentions favorably toward forest conservation behavior.

Of the three predictors of intention suggested by TPB, only subjective norms significantly predicted intention toward forest cutting. It might be related to the indirectly-measured intention in which participants' perception of others' intention was asked to participants. Perception of others' intention is more likely to correlate with perception of others' expectation (subjective norms). Strong social bonds in collectivistic countries like Indonesia may also lead people to become more apt to others' expectation (see Abrams *et al.*, 1998). Villager subjective norms were determined by the following components of beliefs: evaluation of forest cutting benefits, perceived barriers, beliefs about all referents expectation, perceived resources, and evaluation of forest cutting costs. These

Some studies have reported that villagers shaped their behavior more favorably toward forest conservation after their villages were electrified by micro hydro power (MHP). As a result, they reduced deforestation, reduced their intention toward forest cutting, and participated in reforestation programs. This study was to prove the findings and to answer the questions on how MHP may shape forest conservation behavior and what variables determine intention toward forest conservation behavior. The study uses the theory of planned behavior (TPB) as the model. Two studies were conducted: Study 1 compared the villagers living at the villages with MHP and those living at the villages with no MHP and Study 2 confirmed results in study 1 by contrasting participants at three villages: a village with no electricity, a village electrified by MHP for two years, and a village electrified by the grid for nine years. The results of the study are particularly important for professionals, NGOs, government agencies, and anybody who concern about forest conservation and the massive deforestation of the world forests.

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