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SOCIO-ECONOMIC FACTORS INFLUENCING THE EXISTENCE OF BAMBOO WEAVING ENTERPRISES AND FARMERS IN BANGLI

(Faktor-faktor Sosial Ekonomi yang Memengaruhi Keberadaan Usaha Anyaman dan Petani Bambu di Bangli)

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ABSTRACT

Masyarakat di Kabupaten Bangli, Provinsi Bali melakukan budidaya bambu dan memanfaatkan bambu untuk kerajinan anyaman dalam skala industri rumah tangga. Walaupun bambu sudah dimanfaatkan secara komersial namun masyarakat mampu mengelola sumber daya bambu secara lestari dan menghindari eksploitasi berlebih. Tulisan ini mengkaji apakah faktor-faktor sosial ekonomi dari usaha anyaman dan petani bambu dapat dijadikan penentu dalam pengelolaan hutan bambu yang lestari. Data penelitian dikumpulkan melalui observasi dan wawancara kemudian menggunakan analisis deskriptif sosial ekonomi. Hasil kajian menunjukkan bahwa faktor-faktor yang berpengaruh adalah tradisi menganyam bambu dan peran wanita Bali dalam kegiatan ekonomi, peran kelembagaan dalam peningkatan kapasitas masyarakat, kearifan lokal yang sejalan dengan program peningkatan industri bambu, dan adanya manfaat ekonomi untuk masyarakat. Faktor-faktor ini mendorong petani untuk memelihara rumpun bambu dan melakukan pengelolaan panen tebang pilih dengan membuat komposisi batang dalam rumpun dan panen tebang pilih berdasarkan umur batang untuk memperoleh produksi bambu yang lestari.

Keywords: Peran perempuan; peningkatan kapasitas; kearifan lokal; manfaat ekonomi; pengelolaan bambu lestari.

ABSTRAK

Balinese communities in Bangli District, Bali Province, cultivate and utilize bamboo to produce woven bamboo handicraft at small scale industries. Although bamboo has been utilized commercially, Balinese can manage sustainable bamboo resources and avoid overexploitation. This paper examines socio-economic factors influencing the existence of bamboo weaving enterprises and farmers and assesses the determinants in the sustainable bamboo forest management. Data are collected through observations and interviews and descriptively analyzed the socio-economic aspect. The study reveals that the determinants are weaving tradition and gender of Balinese women in economic activity, roles of institutional community capacity building, local wisdoms that are in line with the program of sustainable bamboo forest practices, and economic benefits for the community. These factors encourage bamboo farmers to maintain bamboo clumps and to implement selective harvesting management through deciding the composition of age poles in the clumps and to execute selective cutting based on the age bamboo of the poles in order to maintain the sustainability of bamboo.

Kata kunci: Gender; capacity building; local wisdoms; economic benefit; sustainable bamboo management.

I. INTRODUCTION

Bamboo in Indonesia, especially in Bali, has existed long time ago and very easily found in community land and forest (Arinasa & Sujarwo, 2015). Bamboo is a giant grass which has wide range of land suitability to grow even though in marginal land (Lobovikov, Schoene, & Yping, 2012; Zhou, Fu, Xie, Yang, & Li, 2005). Development of bamboo does not only function to cover land forest area but also has economic potentials to develop small, medium (home industries) and for large investment enterprises. Bamboo utilisation could potentially generate and increase new incomes for the community which will eventually support the improvement of public welfare (Chen, 2003; Herliana, 2014).

Almost all parts of bamboo can be utilized and traded for various purposes ranging from traditional bamboo crafts to industrial bamboo products such as materials of panel for building constructions, pulp and paper, textile, biomass energy, charcoal, carbon stocks, food, and pharmaceutical industries (Darabat *et al.*, 2014; Esteva-Sendra, Morena-Cuesta, Portales-Mananos, & Magal-Royo, 2012; Fatriasari & Hermiati, 2008; Felisberto, Beraldo, & Clerici, 2017; Liu, Song, Anderson, Chang, & Hua, 2012; Lobovikov *et al.*, 2012; Mahdavi, Clouston, & Arwade, 2012; Nakajima, Kojiro, Sugimoto, Miki, & Kanayama, 2011; Nurdiah, 2016; Sharma, Gatoo, Bock, & Ramage, 2015; Teli & Sheikh, 2013; Van der Lugt, Van den Dobbelen, & Janssen, 2006; Wang, Maliang, Wang, & Ma, 2015; Widiarti, 2013; Yang, Li, Ye, Zhu, & Liao, 2016). Furthermore, bamboo also has ecological functions as soil erosion control, water conservation, land rehabilitation and carbon sequestration (Iqbal, Putri, & Bahruni, 2014; Lobovikov *et al.*, 2012; Zhou *et al.*, 2005).

The government of Bangli Regency has set bamboo as the main Non Timber Forest Products (NTFPs) and Bangli Regency as cluster of bamboo development with the Decree

of Bangli Regency Number 522.22/140/2013. Bamboo management in Bangli has strategic roles in creating employment opportunity which covers around 45% workforce absorption and regional income which contributes around 40% of Gross Regional Domestic Income (GDP). There are, in general, about 4,732 business units of handicraft industries in Bangli Regency. It involves about 9,530 labors with the investment value of IDR306 million and production value of about IDR27 billion (Dinas Perindustrian dan Perdagangan Kabupaten Bangli, 2015). The industries of bamboo handicraft are prominent because they are supported by the abundance of raw materials and significant workforce absorption. Bamboo products in Bangli Regency could be utilized for handicrafts, building materials, furniture, food, and traditional ceremonies equipment (Arinasa & Sujarwo, 2015).

Bangli Regency is a region which can describe the integrity of bamboo cluster management from upstream to downstream (Yeny, Yuniati, & Khotimah, 2014). Based on invented data in 2009, Bangli Regency is the largest area in Bali Province for bamboo cultivation. Bangli Regency has four districts, namely Bangli, Susut, Tembuku, and Kintamani. The different topography of each district has formed different types of bamboo management. Kintamani with its highland topography has good potential resource of bamboo forest which covers around 4,081.71 hectare spread in the outside area of state forest area and it is about 150 hectare located inside of the state forest area (Dinas Pertanian Perkebunan dan Perhutanan Kabupaten Bangli, 2014). Kintamani is the biggest producer of bamboo as raw materials in Bangli Regency. Bangli and Susut become the development centers of woven bamboo handicrafts. In these districts, bamboo processing industries developed well due to the populations who perform bamboo weaving as their culture. They have their skills in utilizing bamboo so as to add the value of

bamboo products. Bangli has 26 business units and Susut has 15 business units (Dinas Perindustrian dan Perdagangan Kabupaten Bangli, 2015).

The balance of bamboo supply and demand of in Bangli and Bali are in a deficit condition (See Table 1). It means that the demand of bamboo as raw materials is higher than the supply from nature. Since bamboo becomes an economic commodity and bamboo business developed well in Bangli Regency then there is a high dependency of bamboo as raw materials. There are two possibilities of community respond to bamboo resource. Firstly, the high market demand is feared to encourage the over-exploitation of natural resources as Hardin's Theory who states that the common pool resources will be over exploited since resources-users are individualistic (Hardin, 1968 in Coulibaly-Lingani, Savadogo, Tigabu, & Oden, 2011). Secondly, community performing this business encourages to create mutual relationship with the bamboo resources so as to obtain continuous supply of bamboo as raw materials for their industries. The second possibility may occur if the community has high awareness on sustainability and practices of sustainable bamboo forest management. Referring to sustainable forest management approach defined by Food and Agriculture Organization (FAO) sustainable bamboo forest management can be defined as sustainable utilisation and conservation of bamboo forest values considering friendly-

environment appropriacy, social benefits, and economically viable management for present and future generations (FAO in Hickey, 2008; Wijewardana, 2008).

The second condition is found in Bangli Regency, where people are able to treat bamboo clumps appropriately as well as implementing sustainable forest management practices. We assume that the condition is presumably influenced by socio-economic factors of Balinese society that encourage people to participate in treating bamboo clumps appropriately. As Coulibaly-Lingani *et al.* (2011) findings which state that socio-economic factors strongly influence people participation in forest management. These factors may include participation in the programs of forest management, social community participation in forest conservation, and in improving socio-economic benefits. These factors will determine and classify the degree of community participation (Agarwal, 2001 in Coulibaly-Lingani *et al.*, 2011).

In addition, there is a join-program between International Tropical Timber Organization (ITTO) and the Ministry of Environment and Forestry in this area, namely ITTO PD 600/11 Rev. 1, 2016. This program tries to leverage the social capital that has already existed before. The social capital community are strengthened by value, norms, beliefs, and awareness of the importance of sustainable bamboo forest management. From this institutional approach, sustainable bamboo forest management can be regarded as

Table 1. Supply and demand of bamboo in Bali and Bangli Regency
Tabel 1. Permintaan dan penawaran bamboo di Bali dan Kabupaten Bangli

Supply and Demand (Permintaan dan Penawaran)	Bali Province (Provinsi Bali)	Bangli Regency (Kabupaten Bangli)
Demand (Permintaan)	34,804,682 poles	6,850,609 poles
Supply (Penawaran)		
– Land forest area (Kawasan hutan)	12,681.77 hectare	6,089.80 hectare
– Bamboo production (Produksi bambu)	11,412,900 poles	5,480,487 poles
Deficit (Kekurangan pasokan)	(23,391,782 poles)	(1,370,122 poles)

Source (Sumber): Arinasa & Peneng, 2013; Dinas Pertanian Perkebunan dan Kehutanan Kabupaten Bangli, 2014 in Yeny *et al.*, 2014. With productivity assumption of 899,945 poles/hectare.

governance of bamboo resources. Governance itself means “the whole range of institutions and relationships involved in the process of governing covers both formal and informal institutions”. Formal institutions including laws, policies, and organizational structures, while informal institutions are the power relations and practices that have developed and the rules that apply in practice (Huitema *et al.*, 2009). From this definition, we can derive that formal institutions in this case are the sustainable forest management principles, the ITTO programmes, the bamboo cluster policy in Bangli, and the bamboo farmer groups. While the informal institutions refers to Balinese local wisdoms and culture towards bamboo such as woven bamboo culture by Balinese women, and common community practices in treating bamboo.

This study aims to analyze socio- economic factors which may become a driving force of sustainable bamboo forest management practices implemented by Bangli community in Bangli Regency. The hypothesis of this study is that socio-economic factors of Balinese community influence people in performing sustainable bamboo forest management.

II. RESEARCH METHODS

A. Location Selection

This study is conducted in Bangli Regency, Bali Province. Purposive sampling is implemented and Bangli is selected in this study due to that Bangli has well developed as the center of bamboo development in Bali. Downstream sectors in woven bamboo developed in line with the increasing market demand; but this industry runs harmoniously with the available bamboo resource as raw materials in upstream. This research would like to investigate to what extent the factors of socio-economic in Bangli society influences the favourable performance of bamboo farmers and woven bamboo enterprises in managing bamboo forest.

B. Data Collection

Data and information were collected in November 2014 which includes primary and secondary data, both qualitative and quantitative. Data collections have been executed through interviews and site observations. The respondents are taken from 10 types of institutions which represent bamboo industry stakeholders in Bangli Regency. They are bamboo farmer representatives of three farmer groups in Kintamani District namely *Wira Usaha*, *Munduk Tunggiran*, and *Hidup Rukun*. The weaving bamboo enterprises in Susut District consists of five bamboo weavers, one craftsman and one whole-seller, and the local customs officials of Bangli District, one extension officer, the team members of ITTO PD 600/11 Rev. 1, 2016, officials in the offices of Dinas Pertanian Perkebunan dan Kehutanan Kabupaten Bangli, Dinas Perindustrian dan Perdagangan Kabupaten Bangli, and Dinas Koperasi dan Usaha Kecil dan Menengah (UKM) Kabupaten Bangli. Respondents are determined by purposive sampling method based on its role and association with bamboo forest and woven bamboo industries. Secondary data are obtained through literature study of the previous research and statistical books.

C. Data Analysis

This research is explanatory research applying socio-economics descriptive analysis. Explanatory research aims to explain relationship between variables from the hypothesis of the research (Arikunto, 2005 in Saskara, Pudjihardjo, Ghazali, & Agus, 2012). Data are analysed descriptively bases on socio-economic factors which determine the performance of bamboo farmers and woven bamboo enterprises in managing bamboo forest. Factors related to socio-economics that would be analyzed are weaving tradition and gender of Balinese women, institutional roles, local wisdoms of Balinese community, and economic benefits.

III. RESULTS AND DISCUSSION

A. Weaving Tradition and Gender of Balinese Women in Bangli

Socially, Balinese women in Bangli Regency have a hereditary tradition in bamboo weaving. Especially in Sulawan Village, Susut District, almost all families in the village have knowledge and skills on bamboo weaving, particularly women no matter they are girls, housewives, or career women. The skills are acquired from generation to generation through a process of direct observation and continuous training from one generation to another generation. The knowledge passed down by mothers to their daughters who utilise their free time to weave bamboo to support additional income for the family. This constant interaction between human and bamboo has created knowledge and skills in weaving bamboo. Therefore, almost women in Susut District can weave bamboo and make this as their livelihood (Figure 1).

Production of woven bamboo is continuously done almost every day by women in their home. The role of women is dominant in utilizing bamboo. This work is done in their free time by women among domestic household works and religious activities. This is consistent with the Theory of Rational Choice (Zafirovski, 1998 in Saskara *et al.*, 2012) which states that the household members would act rationally to maximize utility in the allocation of working hours. Instead of doing nothing in their

spare time, with their woven bamboo skills, the Balinese women maximize their time to produce woven bamboo products and obtain additional income for their family. Other studies in other research areas confirmed that the involvement of housewives in smallholder industries contribute to family income such as bamboo crafts in Tomohon which contribute about 36.05% (Kumaat, 2011), *ketak* crafts in Lombok which contribute about 36.26% (Budiastuti & Wedastra, 2012), and *pandan* crafts in Gianyar which contribute about 69.70% (Desniasih, Vipriyanti, & Pastini, 2015).

The type of woven bamboo product is a box for ceremony called *sokasi*. *Sokasi* is used as a container of offering tools in religious ceremonies. Previously, women in Bangli are used to using *sokasi* for their own needs for worship service purposes. But as the growing market of woven bamboo products in Bali, they also produce *sokasi* for trading purposes. The demand of *sokasi* in Bali is very high, especially for ceremonial purposes and religious activities.

The demand tends to be continuous along the year and increases along with population growth. The exact number of *sokasi* market demand is not yet exactly known. However, if we apply assumptions that one family must have a set of *sokasi* for a ceremony, and the number of family in Bali is 666,900 families (*Kepala Keluarga/KK*) so the number of demand is about 666,900 units of *sokasi* for a religious event only. This number does not



Source : ITTO document

Figure 1. The process of bamboo weaving of *sokasi* by women in Susut District Bangli Regency

Gambar 1. Proses penganyaman bamboo menjadi *sokasi* oleh para wanita di Kecamatan Susut Kabupaten Bangli

include the market demand of places outside Bali and abroad. Consumers outside Bali commonly use *sokasi* for storage of items such as books, shoes, accessories, and others (Yeny *et al.*, 2014)

To produce semi-finished *sokasi* is commonly about three days. It means that in every three day period, a bamboo weaver would sell semi-finished products to craftsmen as well as to wholesalers in the market chain. The raw material of *Bambu Tali* (*Gigantochloa apus* J.A & J.H. Schultes Kurz) costs about IDR50,000 per bundle of bamboo. Each bundle consists of 5 bamboo poles with the length of 2.5 m. One bundle of bamboo can produce 15 sets of *sokasi* with the price of IDR25,000 per set. They earn about IDR50,000 per day for their weaving wage. Next step is the work of craftsmen that will add the process of paintings, coloring, and coating on the semi-finished products, and drying them under the sun before they are ready for sale in retail market.

The woven bamboo industries nowadays become the livelihood for most people in Susut District, Bangli Regency, particularly for women, both girls, housewives, and career women who have had another job whether in formal or informal sectors. For Balinese women although there are other income sources and actually could substitute the income from bamboo weaving, most of Balinese women do not leave their culture of weaving bamboo because there is cultural custom that bind them. This is consistent with the theory of Nurture in gender perspective from Edward Wilson (Sasongko, 2009 in Saskara *et al.*, 2012) which mentions that gender role is constructed by culture. It means that when Balinese women participate to work for a living this is not merely because of economic factor, but there is cultural influence in work ethics. Working for Balinese people both women and men is a good deed, namely *Dharma* (Bhagawad, 1972 in Saskara *et al.*, 2012).

According to Saskara *et al.* (2012) which states that women who work in formal sector and cannot organize her time well will often experience cultural clash. But not for woven bamboo activities performed by Balinese women in Bangli; this is because the characteristic of this job is to support the culture where the products are used for cultural ceremonies and done in spare time. Therefore, there is no conflict among activities of weaving bamboo to the culture of Balinese. It is also affecting the continuity of the culture of weaving bamboo that has been going on for generations. Although the economic benefits of weaving bamboo have been replaced by working in other sectors, the culture of weaving bamboo keep sustaining because of its connection with the Balinese culture sustainability.

The role of gender and tradition of weaving bamboo among Balinese women in Bangli support the development of woven bamboo activities (positive relationship). Moreover, the large and continuous demand of *sokasi* make continuous production of woven bamboo. The need or demand of bamboo as raw material is required continuously. This condition also drives the continuous supply of bamboo as raw material, and in turn, will also drive bamboo farmers in the upstream level to supply bamboo continuously. The bamboo farmers have to maintain their bamboo clumps and appropriately manage the bamboo harvesting in order to produce the continuous supply of bamboo in sufficient quantity. Both bamboo clumps maintenance and bamboo harvesting management are the practices of sustainable bamboo forest management. Therefore, this analysis confirms that gender and cultural factor in bamboo weaving encourage and indirectly influence the implementation of sustainable bamboo forest management in Bangli Regency.

B. Institutional Role in Implementing Sustainable Bamboo Forest Management

Institutional role is important in building collective actions of community. Particularly for this case, institutional role is demanded to provide guidance and to raise the community awareness of performing practices related to sustainable resource management. The institution that is referred here is “the enduring regularities of human actions in the situations structured by rules, norms and shared strategies” (Crawford and Ostrom, 1995 in Koontz, Gupta, Mudliar, & Ranjan, 2015). The institutions can affect the decision making process in governing as well as promote or hinder individual actions to adapt of the dynamic conditions. The institution must have rules and policies in-use which should be in accordance with the local community norms and the institutions should also have organization power to give reward and punishment. The Institution should be recognized and respected by community; it should apply specific management which is in accordance to the location, participatory rules, economic incentives for owners and users, which then these all will become the instruments for controlling sustainable use and consensus agreement (Nursidah, Nugroho, Darusman, Rusdiana, & Rasyid, 2012).

Both formal and informal institutions should be implemented in the governance of natural resource. For this study, the governance is the management of bamboo forest. As we identified above, that the formal institutions consist of sustainable forest management principles, bamboo cluster policy of Bangli, the ITTO program, and bamboo farmer groups. While the informal institutions are the Balinese local wisdoms and culture of bamboo, the woven bamboo culture done by Balinese women, and the common practices of community in treating bamboo.

The existing condition is that most people in Kintamani District, Bangli Regency work

in the sectors of agriculture and forestry. The farming tradition makes them familiar with bamboo. They manage the area of around 120 hectare of bamboo forest in Kintamani District. They plant various types of bamboo, namely *tiing tali* (*Gigantochloa apus*), *tiing petung* (*Dendrocalamus asper*), and *tiing tabah* (*Gigantochloa nigrociliata*). They also combine bamboo with coffee and citrus plants (Astawal, Komaladewi, & Atmika, 2016). Previously, bamboo clumps were not managed well. People treated it as wild plants that grew naturally. This condition changed when bamboo poles could be traded in market and have economic value. Since that time, the society has begun to manage bamboo clumps as agricultural crops. The common practices of bamboo farmers are that they do clearing the clumps from twigs and broken poles, harvesting old bamboo for construction purposes, and cutting the medium-young for weaving purposes. They cut down bamboo only on certain days according to the local wisdoms of wariga. Discussion about local wisdoms will be discussed in more detail in the next sub-chapter. They do not use bamboo as food purposes and do not fertilize the clumps (Yeny, Yuniati, & Khotimah, 2016).

Most bamboo farmers join in farmer groups. There are three farmer groups in Kintamani District which manage bamboo as their commodity. They are *Wira Usaha*, *Munduk Tunggiran*, and *Hidup Rukun* group. The members of the farmer groups are about 60 farmers. Farmers in Kintamani District are actively involved in their group activities. They were functioning the group as a place for learning activity, building cooperation, and performing production. This is accordance with (Ramadoan, Muljono, & Pulungan, 2013) who state that these group functions have significant effects on the level of farmer participation. In addition, the high degree of farmer group participation in Kintamani District, make the groups can provide information on the benefits of the forest,

access to market, increase annual income, improve knowledge and technical assistance on bamboo clumps management. This is also in accordance with the result study of Dolisca, Carter, McDaniel, Shannon, & Jolly (2006).

The high participation of bamboo farmers are also influenced by external program intervention. For instance, farmer group of *Hidup Rukun* has high participation in implementing sustainable bamboo forest management. They attended Bamboo Ranger Training Program and Assistance, which is jointly managed by the Ministry of Environment and Forestry and the International Tropical Timber Organization (ITTO). The program is targetted to enhance bamboo farmers' capability in managing sustainable bamboo clumps. They are introduced to the Standards of Operational Procedure (SOP) in bamboo forest management. They are also facilitated to participate in a training of how to maintain bamboo clumps properly, to manage the composition of age poles in the clump with numbering scheme, to practice selective cutting harvesting based on age of poles in order to maintain sustainable bamboo supply, and to improve marketing access (ITTO PD 600/11 Rev.1, 2016).

The program is conducted to leverage the local wisdoms and the common practices of bamboo farmers in Kintamani District, Bangli

so as to be the best practice of bamboo forest management. Generally the concept of the program is in line with the Balinese local wisdoms and the common practices which have been developed before. They are trained to be Bamboo Rangers with the expectation of preserving bamboo clumps in proper and organized ways. The study of Witantriasti (2010) argues that the farming experience and farmer groups have close correlation to the intensity of community forest management. Therefore, when they are introduced to bamboo forest management principles and practices, the willingness of farmers to accept and to participate in their bamboo group are high.

Since farmers can manage bamboo harvesting properly based on the group training lesson, the bamboo clumps are healthy and can contiously produce bamboo poles from sustainable bamboo resources. Then they recognized that they can earn contious income from the bamboo clumps if the clumps are healthy. This accords with (Coulibaly-Lingani *et al.*, 2011) who say that the economic benefits will influence the participation in forest management. The more benefit obtained from the forest management activities would bring higher degree of farmer participation (Maskey, Gebremedhin, & Dalton, 2006 in Coulibaly-Lingani *et al.*,



(a)



(b)

Source (*Sumber*): ITTO Project PD 600/11 Rev.1, 2016 Document (*Dokumen ITTO Project PD 600/11 Rev.1, 2016*)

Figure 2. (a) Farmer group in a training class on bamboo forest management;

(b) Some members of farmer group are practicing in selective harvesting management

Gambar 2. (a) Kelompok tani mengikuti kelas pelatihan tentang pengelolaan hutan bambu

(b) Beberapa anggota kelompok tani sedang mempraktekkan pengelolaan panen dengan metode seleksi

2011). The incentives for the members will influence the shape of their participation outcomes that is also at the same time affected by the context of the social network system (norms, values, and social capital, members socio-economic) and demographic attributes (gender, age, level of education and income), and the internal as well as the external institutional context (technical assistance and the pattern of authority) (Coulibaly-Lingani *et al.*, 2011).

According to the existing policy and regulation, the government policy has established Bangli Regency as cluster of bamboo development with the Decree of Bangli Regency Number 522.22/140/2013. Under this policy, Regent of Bangli is obligating the related institutions to actively be involved in the development of bamboo, particularly through organizing the bamboo business system from upstream to downstream and the empowerment of farmer groups. The farmers also add bamboo collections in the existing bamboo forest and expanding the bamboo plantation on marginal lands or erosion-prone.

Besides the government policy, there is also a custom law that supports the sustainable bamboo forest management in Bangli. This is called *Awig-Awig Adat*. This rule binds the whole community to obey; otherwise there are customary punishments for those who violate the rules. This is included as informal institution and the rules are followed in practice by the community members. *Awig-Awig Adat* contains the rules of forest possession and the regulation that prohibit excessive bamboo cutting and determine certain days to do not cutting the living things (Yuliani, Suka, & Pujaastawa, 2017). Thus, there are limitations in exploiting bamboo stocks in the nature. Bamboo farmers only cut bamboo on some certain days that are allowed and never cut off the whole poles in the clumps. This is in accordance with the sustainable bamboo forest management principles i.e. to do selective cutting and leaving the young bamboo to

grow so as to ensure the sustainable supply of bamboo in the future.

In this discussion regarding institutional role, we can see that the integration of informal institutions and formal institution of the community in treating bamboo as a manifestation or initial social capital of the community would become an adaptive institution in managing sustainable bamboo forest. Both formal and informal institutions are harmonious and not being counter-productive to each other. The formal institutions function to leverage the informal institutions. The adaptive institution itself is “the institution that acts as an actor which are able to adjust to encourage individuals to act cooperatively to maintain and to improve a desirable state” (Koontz *et al.*, 2015). The desirable state in this case refers to the sustainable bamboo forest management as the governance of bamboo resource in nature. So we can confirm that the institutional role could positively accelerate the participation in implementing sustainable bamboo forest management. We can acknowledge that the institutional role as one of determinants in implementing sustainable bamboo forest management.

C. Mutual Relationship between Local Wisdoms with Sustainable Bamboo Forest Management Principles

Bamboo has a privilege place in Balinese society in Bangli Regency. Balinese life since they are in the womb until in the grave cannot be separated from bamboo. Balinese people which predominantly are Hindus retain their culture strongly (Sukerta, Kriyantono, & Kanto, 2015). We can see this from their daily life which is always related to religious ceremonies (Puspadewi & Ngurah, 2014). Bamboo is one of three plants which are always used in Balinese rituals and ceremonies beside banana (*Musa paradisiaca*) and coconut (*Cocos nucifera*). Bamboo symbolizes welfare and safety. Bamboo-based tools such as *penjor*, *sunari*, *sanggancucuk*, *asagan*, *bale*

pawedan, bonjor, jelepung, gesing and lante are used for ceremonial purposes (Eisman, 1992 in Yeny, Yuniati, & Khotimah, 2015).

In daily life, besides bamboo is utilized to meet human needs, there are some traditional norms and customs based on local wisdoms that support the sustainable management of bamboo forest. As we have discussed before that these local wisdoms are informal institution, we will see some local wisdoms which is in accordance with the sustainable bamboo forest principles. Some of them are *Tri Hita Karana* (the three sources of welfare), *Manik Ring Cacupu* (like a baby in the womb), *Atma Cradha* (belief of atman or soul in every living creature), *Tumpek Bubuh* (attitudes of giving before taking), *Wariga* (Balinese traditional calendar) and belief that bamboo shoot is like a baby who is nursing to the mature poles. That is why it is prohibited to cut the whole poles in a clump (Yeny *et al.*, 2015).

These local wisdoms function as the social capital which are beneficial to support the external intervention program because these would ease the ways of introducing the concept of sustainable bamboo forest principles. Furthermore, these two have interchanged and that are harmonious to each other. For instance, to introduce the concept of sustainability, this is in accordance to one principle of *Tri Hita Karana* (three sources of welfare) namely *Palemahan* (the harmony relationship between human and the environment) (Yeny *et al.*, 2016). *Palemahan* guides people to keep the harmony relationship with the environment and then it will bring welfare for the community. Another concept is *Manik Ring Cacupu* (like a baby in the womb) which also explains about sustainability. This principle assumes that environment is as the womb and human as the baby. So, we have to maintain the environment well to provide good condition for the human, and in turn, the human can grow and live well.

Principles of selective cutting harvest are in accordance with the principles of *Wariga*

(Balinese Traditional Calendar) and the belief that bamboo shoots as babies are nursing to the mature poles. *Wariga* is knowledge concerning on the characteristic of day. The day could become a good day or bad day based on calculation of traditional cycle calendar. These cycles calculation is believed that it will influence to the result of the work of the day. One of the days in *Wariga* is prohibited to do cutting of living things. Therefore, there is a limitation in time to exploit bamboo forest product. Exploitation without limitation could bring bamboo forest to destroyed conditions, unsustainable, and the worst is that it would lead to the distinction of bamboo forest.

They believe that bamboo shoots are nursing to the mature poles. Therefore it is prohibited to cut the whole poles in a clump. There must be some mature poles left in the clump to protect the young bamboo otherwise the clumps would be dying. This principle is parallel to the concept of age composition management of bamboo poles in a clump and selective cutting method in harvesting which are introduced in Bamboo Ranger Program. Bamboo Ranger Program introduces numbering method to make age composition of bamboo poles in a clump. There are three or four generations in a clump with numbers of date that indicate the allowed poles to be harvested. The oldest poles are harvested earlier and subsequently to the younger.

Therefore, we can see that the local wisdoms are consistent and have interchanging relationship with the principle of sustainable bamboo forest management. The other study of (Yuliani *et al.*, 2017) also reveals that local wisdoms have important role in conservation efforts of the holy bamboo forest (*duwe forest*) in Panglipuran Village, Bali. Balinese people obey in implementing their custom laws based on *Awig-Awig Adat* and local wisdoms in treating their environment, including bamboo forest. There is a reward and punishment system in practice. If someone violated the custom law or local wisdoms they would receive customary or moral punishment from

the community. This is in line with (Henry, 2006 in Saskara *et al.*, 2012) who say that the implementation of reward and punishment system would affect the job performance or the implementation of the rules. The work environment, work culture, family's culture and its culture rules will be interconnected in the communities where they are located (O'Neil *et al.*, 1995; Wiersma, 1990 in Saskara *et al.*, 2012).

In more detail, the study of Saputro (2006) argues that the social capital (in that case trust, social norms, and social relationships) can inhibit overexploitation and 'tragedy of the common', especially for natural resources that are managed communally. This study encounters in a situation when community understanding about norms is high then the violation of norms are low. The program is more effective in its implementation when it is in line with the local wisdoms, customary laws, and norms. Therefore, the role of local wisdoms and norms are important determinants in the implementation of sustainable bamboo forest management program.

D. Economic Benefits as an Appeal to Perform Sustainable Forest Management

Economic factor is an effective stimulation for people to conduct action continuously. Bamboo price from year to year is

increasingly rising; for example in 2013 *tiing petung* (*Dendrocalamus asper*) price was about IDR70,000 per pole but in 2014 it rose to IDR120,000 per pole (Yeny *et al.*, 2014). These conditions encourage farmers to take care of the existing bamboo clumps and to grow more bamboo clumps in other lands.

In this case, we will analyze economic factors through financial analysis and market analysis. The assumptions of this analysis are that the discount rate in bamboo plantations cash flow is 12%. The financial analysis both at bamboo plantation, bamboo weaving production, and finishing production are profitable. The benefit cost ratio of them are more than 1.00 point, they are at 14.19 and 9.81 for bamboo plantation, and at 1.87 for bamboo weaving production, and at 1.34 for bamboo *sokasi* finishing process. While the Internal rate of return from bamboo plantations is 60.98% for bamboo petung and 56.84% for bamboo tali. We can see the calculation in Table 2, Table 3, and Table 4 as they follow. The value of Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) in bamboo plantations are relatively big because we assumed that the lands which is utilised in this case are assumed to be the farmers' property, so there are no investment cost for the land. The biggest investment is for bamboo seedlings.

Table 2. Result of financial analysis of bamboo plantation (petung and tali, with 25 year business period)
Tabel 2. Analisis finansial penanaman bamboo (bambu petung dan bambu tali dengan periode usaha 25 tahun)

Investment Criteria (Kriteria investasi)	Value per hectare (spacing of 4x5 m) (Jumlah per hektar (jarak tanam 4x5 m))	
	Bamboo petung (Bambu petung)	Bamboo tali (Bambu tali)
Net present value (NPV) (Pendapatan bersih)	IDR499,080,453	IDR255,513,862
Benefit cost ratio (BCR) (Rasio keuntungan dan biaya)	14.19	9.81
Internal rate of return (IRR) (Tingkat pengembalian modal)	60.98%	56.84%
Break Even Point (BEP)(Titik impas)	5 th year	4 th year

Source (Sumber): Primary data (Data primer)

Table 3. Revenue cost analysis of bamboo weaving production (semi-finished product)

Tabel 3. Analisis penerimaan biaya pada produksi anyaman bamboo (menjadi produk setengah jadi)

Cost (Biaya)	Revenue (Pendapatan)
Bamboo raw material (<i>Bahan baku</i>) = IDR50,000	1. semi-finished sokasi (<i>sokasi setengah jadi</i>) = IDR375,000
Labour wage for 3 days (<i>Upah tenaga kerja selama 3 hari</i>) = IDR150,000	
Total cost (<i>Biaya total</i>) = IDR200,000	
Total revenue (<i>Pendapatan total</i>) = IDR375,000	
Revenue Cost Ratio (<i>Rasio pendapatan dan biaya</i>) = 1.87	
Net income of weave bamboo processing (<i>Pendapatan bersih dari proses penganyaman bambu</i>) is IDR175,000 for three days or IDR58,400 per day <i>selama tiga hari per hari</i>	

Source (*Sumber*): Primary data (*Data primer*)

Table 4. Revenue cost analysis of bamboo sokasi finishing process (final product)

Tabel 4. Analisis penerimaan biaya pada proses akhir sokasi bamboo (menjadi produk jadi)

Cost (Biaya)	Revenue (Pendapatan)
Semi-finished sokasi (<i>Sokasi setengah jadi</i>) = IDR25,000	1. Sokasi (<i>Sokasi</i>) = IDR60,000
Labour wage for finishing (<i>Upah tenaga kerja finishing</i>) = IDR12,500	
Finishing equipments (<i>Peralatan finishing</i>) = IDR7,500	
Total cost (<i>Biaya total</i>) = IDR45,000	Total revenue (<i>Pendapatan total</i>) = IDR60,000
Revenue Cost Ratio (<i>Rasio pendapatan dengan biaya</i>) = 1.34	
Net income in craftsmen as well as wholesalers for 1 set sokasi (<i>Pendapatan bersih pengrajin dan penjual grosir untuk 1 set sokasi</i>) IDR15,000	

Source (*Sumber*): Primary data (*Data primer*)

On the other hand, the market analysis shows that the markets demand of woven bamboo handicrafts is continuously demanded for religious ceremonies and souvenirs; and the market trend is increasing. This condition drives continuous demand of bamboo as raw materials from bamboo plantation. Therefore, bamboo plantation is required to provide continuous supply. They must have healthy bamboo clumps to obtain continuous supply of bamboo. This encourages farmers to maintain bamboo clumps and to conduct bamboo harvesting management properly because there are many potential economic benefits from the plant.

Good maintenance on bamboo clumps can

enhance the productivity of bamboo clumps, improve the quality of bamboo poles, and ease the bamboo harvesting. The bamboo clumps maintenance includes cleaning bamboo clumps from old branches, destroying poles from other plants in the clump, fertilising the bamboo clump ring, and managing the compositions of bamboo poles age in a bamboo clumps. The good composition is 3-4 generations in a bamboo clumps. The age composition management could be run together with the selective harvesting management. The selective harvesting management means that we conduct selective cutting based on the age of the poles and make a composition of age poles in a bamboo clump. The proper

bamboo clump maintenance and harvesting management will produce continuous supply of bamboo poles as raw material for woven bamboo industries and increase the economic value of bamboo.

Other studies of Martin & Galle (2009); Maskey, Gebremedhin, & Dalton (2006); Nugroho, Nurrochmat, Hardjanto, & Kadarusman (2016) confirm that the economic factors such as income resource, employment, consumption needs, commercial orientation and feeling of satisfaction on current business influence farmer motivation to preserve the natural resources for future supply. In addition, (Nugroho *et al.*, 2016) say that market access in utilizing the natural resources, profits, transaction cost, and the guarantee in utilizing natural resources are the economic factors that affect the economic behavior of the users. The same condition could be found in Kintamani District, Bangli Regency both the bamboo farmers and the woven bamboo industries make bamboo as commercial commodity for business and they obtain economic benefit from bamboo. They are aware that bamboo is an economic resource that needs to be preserved for the future to guarantee that in the future they can still utilize and take benefit from the plant. Therefore, due to these economic benefits for both the bamboo farmers and woven bamboo industries they all want to implement the sustainable bamboo forest management.

IV. CONCLUSION AND RECOMMENDATION

A. CONCLUSION

From the discussion above, we can confirm that the socio economic factors influence the implementation of sustainable bamboo forest management in Bangli District. The bamboo weaving tradition is the initial and social capital of the society; it develops to become an economic activity and a livelihood for the community. In gender perspective, women take a role as the actor in utilizing bamboo

resources for woven bamboo products. Balinese women have a hereditary bamboo woven expertise over generations. They believe that working is a good deed for their family (*dharma*) and can support the custom; therefore, woven bamboo industry can be long lasting.

The continuous market demand of woven bamboo products drives bamboo as raw material to be available continuously. Since bamboo poles have economic value, it stimulates bamboo farmers to maintain their bamboo clumps and to perform selective harvesting with the purpose of sustainable bamboo supply. With the continuous bamboo supplies, they can earn continuous economic benefits from bamboo. They are aware that the practices of sustainable bamboo forest management are profitable. Knowledge on sustainable bamboo forest management is obtained from farmer group activities through Bamboo Ranger Program executed by ITTO PD 600/11 Rev.1, 2016 (community capacity building program). The program acts as external intervention/formal institution which leverages the local wisdoms in introducing the concept of sustainability and the principles of sustainable bamboo forest management. In addition, custom laws and government policies in Bangli support very greatly and are in line with the implementation of sustainable bamboo forest management.

Based on this research we find that socio-economic factors can be the determinant of the implementation of sustainable bamboo forest management and can inhibit 'the tragedy of the common' and the overexploitation of bamboo forest.

B. RECOMMENDATION

Since socio-economic factors can be the determinants of sustainable bamboo forest management and can inhibit the overexploitation of nature resources, these factors should be the main consideration in implementing sustainable forest management program. We have to ensure that the program

is in accordance with the local resources and not contradictory with the socio-culture of the community, both gender, traditions, institutions, custom laws and local wisdoms. Therefore, that the proposed programs can be internalized and introduced to the community. It would be more effective when the program provides economic benefits for the community and supports the community culture. The capacity building through the empowerment of farmer group is also effective in delivering the message of sustainability concept, principles and practices of sustainable bamboo forest management.

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