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The Development of Mulberry Industry for Sustainable Livelihoods

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Abstract: Mulberry is a perennial and broadleaf woody plant. Mulberry trees have long been cultivated for silkworm rearing. In recent years, the roles of mulberry trees in the prevention and control of desertification, water and soil conservation, saline-land management and returning the grain plots to forestry have been identified. Meanwhile, multi–usage of mulberry as forage for livestock, for fruit and tea preparation has been gradually explored. Therefore, an innovation occurred in the mulberry industry. This article introduces the ecological and economic values of mulberry trees, the applications of mulberry and the development of mulberry industry in Kg. Tudan, Tuaran, Sabah, Malaysia for the community's sustainable livelihoods. This article examines case study of a Knowledge Transfer Programme (KTP) project that employed a sustainable livelihoods approach in which there were measurable effects of poverty reduction. Results are based on a desk study and interviews undertaken at Kg. Tudan in Tuaran, Sabah, Malaysia. The results show that the KTP project in Tudan demonstrated evidence of increases in all five forms of assets: 1) Human asset development; 2) Social assets; 3) Financial assets; 4) Physical assets; and 5) Natural assets.

Key words: Mulberry · Kg · Tudan · Knowledge Transfer Program · Sustainable livelihoods

INTRODUCTION

The Knowledge Transfer Program (KTP) project known as "Environmental Conservation and Community Capacity Building at Kampong Tudan, Tuaran, Sabah: Best Ecotourism Practice by Utilizing the Mulberry Trees in Kampong Tudan" is a 2 years' knowledge transfer program aimed at developing the capacity required to realize the important of their mulberry trees around them as new sustainable livelihood products. The main aim of this program is to develop strategies to improve the livelihoods of the community of Kampong (Kg.) Tudan through community-based conservation efforts that will integrate mulberry agricultural improvement, mulberry resources management and mulberry-environmental management, in collaboration with relevant stakeholders (academicians from different expertise). To achieve this main aim, therefore several objectives were developed; to organize, create and distribute the knowledge about the community-based conservation though the integration of agricultural improvement though mulberry planting; to ensure the availability of the knowledge of mulberry cultivating to be shared to future users through mentorship by the local community who have participated in the programme; and to give back to the local community through social entrepreneurship and raise local community members to become independent entrepreneurs.

Mulberry Trees: Mulberry, a perennial and broadleaf woody plant, is a special economic plant species originally under the order of Urticales in plant taxonomy. In October of 2009, *Botanical Journal of the Linnean Society* modified its classification to the order of Rosales, family of Moraceae, genus of *Morus* L. and species of *Morus alba* L. China is the main origin of *Morus alba* L. in the world. In 1930, Dr. Koidzumi of Japan classified *Morus* L. genus into 30 species, among which 15 are originally grown in China [1].Mulberry leaf, fruit, stem and bark can be

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utilized and easily integrated with other advantageous industries.

Mulberry Leaves: Leaves are major harvested product from mulberry tree cultivation and have long been used as forage for silkworm larvae. At present, China has 11.88 million mu mulberry field which produces about 0.655 million tons of cocoons through silkworm. Farmers receive an income of 7 billion yuan from cocoon production, accounting for 70% of total cocoon output in the world. However, domestic cocoon consumption is less than 40% of the total output. Therefore, it is still a traditional advantageous industry with good prospects for development [1]. However, for the purpose of the project, the team will not venture in the silkworm industry. As the development of animal husbandry and the reduction of grassland resources, using mulberry leaves as forage for livestock and poultry has caused attention of farmers in various countries. In 2000, Food and Agricultural Organization (FAO) of United Nations held an Internet conference on "Mulberry for Animal Production". In 2001, an international conference on "Utilizing Mulberry Leaf Resources to Develop Livestock Production" was held in Hangzhou, China. Major topics of the conference included chemical composition and nutritional value of mulberry trees, feeding system, animal feeding effect, cultivation pattern, harvesting, treatment and preservation of mulberry trees as forage. The utilization of mulberry leaf as livestock and poultry forage has broad perspective, especially in ecologically vulnerable areas. It is believed that combine mulberry cultivation and livestock husbandry can lead to coordinated development of both ecological and economic benefits.

Mulberry for Fruit: Mulberry fruit has several different colours including purple, purple red, bright red and milky white. The fruit is generally 2–5 cm long and 1.2–1.6 cm thick. Its pulp is white or purple and tasty and refreshing, sweet and free of toxin. It is a special fruit with unique flavour in fresh fruit market. Mulberry fruit is listed as the third generation fruit. It is rich in nutrition and complete with all nutritional indexes significantly higher over other common fruits. Its vitamin and niacin contents are several times to those of apple, which is a natural and nutritious product for health.

According to the records in Chinese Pharmacopeia and ancient pharmacy books, mulberry fruit tastes sweet, sour and succulent. It is good to the internal organs and the joints of human body. It has various healthcare and medicinal effects such as nourishing liver and benefiting kidney, consolidating yin and nourishing blood, alleviating rheumatism and treating dizziness and promoting saliva generation and releasing thirst. Modern medical studies indicate that mulberry fruit is used to increase the percentage of macrophage and the phagocytic coefficient, promote transformation of lymphocytes and improve T-cell mediated immune function. Mulberry fruit can obviously help the growth of hematopoietic cells, facilitate the recovery of injured and reduce red blood cells and haemoglobin proteins to normal level within a short period and promote the recovery of haematopoiesis. The resveratrol existing in mulberry fruit can stimulate the expression of some human genes to inhibit the growth of cancerous cells, to prevent cell mutations caused by carcinogen and to release hydrolyses from lysosome to dissemble cancerous cells [2].

Mulberry for Tea and Medicine: Mulberry buds and leaves are used to prepare good taste mulberry tea. Crude protein in mulberry tea contains 17 kinds of amino acid, among which 15 are essential ones to human body. Mulberry tea also contains carbohydrate, fat, vitamin, chlorophyll and rutin, all of which can be easily absorbed by human body and are favourable to human health. Mulberry tea has the effects of calming liver, improving eyesight and evacuating wind-heat, being a healthcare drink suitable to all ages [3].

Multiple parts including its root, root bark, leaf, twig and fruit of mulberry tree have much significance in traditional Chinese medicine. In recent years, many clinic application studies have discovered that the chemical components of mulberry tree have various pharmacological functions such as reducing blood sugar level, reducing blood lipid level, lowering blood pressure, anti-bacteria, anti-virus, antitumor, delaying aging, anti-filariasis, spasmolysis and antiulcer [4,5,6, 7,8, 9], which it has important clinic application value.

Due to the many ecological and economic benefits of mulberry trees, therefore the plant was chosen for the KTP project in Kg. Tudan, Tuaran, Sabah. The plant also made a perfect crop as a sustainable product to promote sustainable livelihoods among the Tudan community as the kampong was chosen for the UNESCO's Man and Biosphere (MAB) programme that develops the basis within the natural and social sciences for the rational and sustainable use and conservation of the resources of the biosphere and for the improvement of the overall relationship between people and their environment.

The Sustainable Livelihoods Approach to Poverty: The various interpretations and elaborations of the sustainable livelihoods (SL) concept have, in one way or another inspired a number of development agencies to apply what is now becoming known as an SL approach to poverty reduction. This has emerged in response to negative experiences with conventional approaches to poverty reduction, but also as a result of recent findings regarding the nature and understanding of poverty [10]. Three factors shed light on why the SL approach has been applied to poverty reduction. The first is the realization that while economic growth may be essential for poverty reduction, there is no automatic relationship between the two since it all depends on the capabilities of the poor to take advantage of expanding economic opportunities. Thus, it is important to find out what precisely it is that prevents or constrains the poor from improving their lot in a given situation, so that support activities could be designed accordingly. Secondly, there is the realization that poverty — as conceived by the poor themselves — is not just a question of low income, but also includes other dimensions such as bad health, illiteracy, lack of social services, etc., as well as a state of vulnerability and feelings of powerlessness in general. Moreover, it is now realized that there are important links between different dimensions of poverty such that improvements in one have positive effects on another. Raising people's educational level may have positive effects on their health standards, which in turn may improve their production capacity. Reducing poor people's vulnerability in terms of exposure to risk may increase their propensity to engage in previously untested but more productive economic activities and so on [11].

Finally, it is now recognized that the poor themselves often know their situation and needs best and must therefore be involved in the design of policies and projects intended to better their lot. Given a say in design, they are usually more committed to implementation. Thus, participation by the poor improves project performance.

Several international development agencies are now applying such a 'livelihoods approach' in their practical development work. As we shall see in the following section, however, it is difficult to talk of one unified approach since each agency has adopted a somewhat different version, ranging from seeing it primarily as an analytical framework (or tool) for programme planning and assessment, to a particular type of programme in itself. There are, however, three basic features which most approaches have in common. The first is that the approach focuses on the livelihoods of the poor, since poverty reduction is at its core. The second is that it rejects the usual sectoral entry point (e.g. agriculture, water, or health) and instead begins with an analysis of people's current livelihood systems to identify an appropriate intervention. The final feature is its emphasis on involving people in the identification and implementation of activities where appropriate.

In many respects, the SL approach is reminiscent of the old Integrated Rural Development (IRD) approach, which was also broad and multi-sectoral. The crucial difference is that the SL approach does not necessarily aim to address all aspects of the livelihoods of the poor. The intention is rather to employ a holistic perspective in the analysis of livelihoods to identify those issues or subject areas where an intervention could be strategically important for effective poverty reduction, either at the local level or at the policy level. Some of its proponents havetherefore likened it to an 'acupuncture' approach to development ('putting the needles in the right place') [12].

Sl Approach Through Knowledge Transfer Program in Kg. Tudan, Tuaran: Kg. Tudan (GPS 5°51'45" N, 116°19'53" E) is located on the western slopes of the Crocker Range in the northern section of the Crocker Range Park. It lies at an elevation of approx. 1,130m asl. Administratively, Kg. Tudan is located within Tuaran District, along the border with Penampang District (Figure 1).

Kg. Tudan is easily accessible by a sealed road, completed in 2012, which heads directly into the village for approximately 3.8km off the Federal Road 500 (from Donggongon to Tambunan). The sealed road turns to gravel before Kg. Poring. A number of other unsealed roads connect Kg. Tudan with other villages in the area such as Kg. Baraba and Kg. Bambangan. All houses in the main village area and along the roads were supplied with electricity from the main grid in late 2013. Water is however supplied using gravity feed which is tapped and piped into houses from the main tributary of Sg. Libodon.

The landscape within the boundaries of Kg. Tudan consists of farmland, old growth forests and the village area (Table 1, Figure 2). The old growth forests are areas that have been left under long fallow and are located along the upper slopes of the village boundaries. Farmland consists of plots that are presently under active use and will in the future be returned to fallow. The village area represents the central region of the Kg. Tudan where a cluster of houses can be found. However, there are a number of houses which are located further away on the slopes of the village as well as newer houses that have been built along the main road.

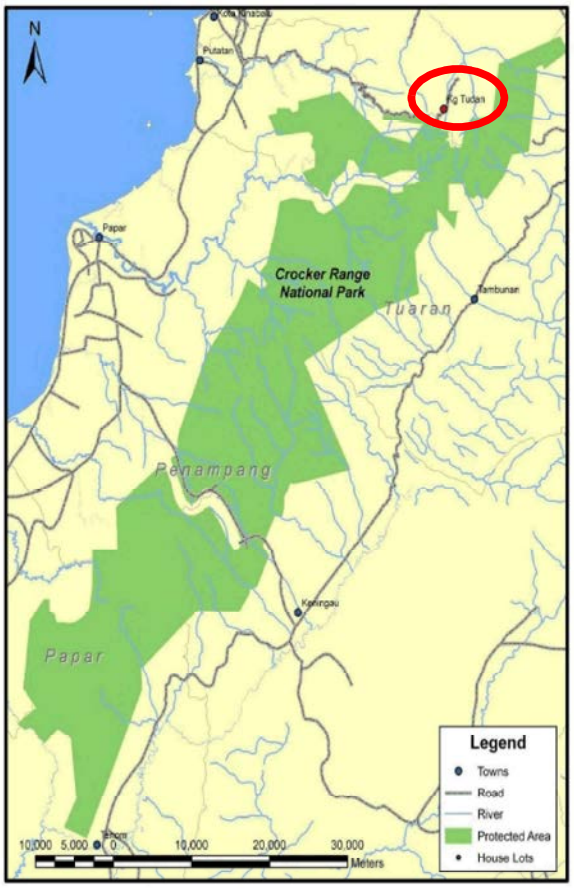

Fig. 1: Location of Kampong Tudan in the Crocker Range

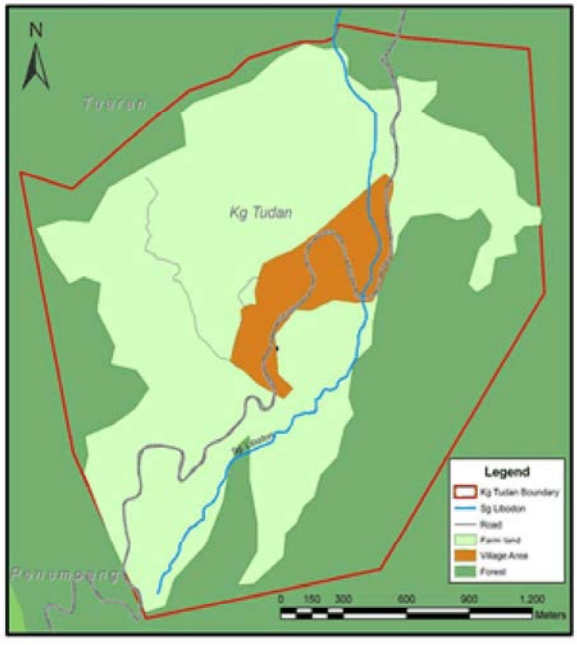

Fig. 2: Land use within Kg. Tudan

Table 1: Land use within Kg. Tudan

No.	Land Use	Area (in hectares)
1.	Active farmland	260.59
2.	Old growth forest	189.90
3.	Village area	30.33
Total	480.82	

Photo 1: The local community of Kg. Tudan and UMS researchers

KgTudan's recorded population is 315 persons with 42 households. However, the number of 'permanent' residents and occupied houses is less as many adults work is larger towns such as Tambunan and Penampang only to come back to the village on weekends, while youngsters have also moved out to seek jobs elsewhere, including in Peninsular Malaysia (Photo 1).

A household survey was conducted and recorded a total population of 217 persons which was much lower than recorded from national census data. The lower population figures show a common trend between Kg. Tudan and villages throughout the State with families relocating to undertake paid employment in nearby towns such as Donggongon, Tambunan and Kota Kinabalu as well as further away in Peninsular Malaysia. However, members of the community who have moved away still maintain strong relationships with the village, particularly on the ownership of land.

Household size was relatively large with an average of six members per household (ranging from two to eleven persons per household). It is quite common for households to comprise of extended families which will usually include several generations i.e. grandparents, parents and children. The distribution of the population in terms of gender was fairly equal with the population represented by 115 females and 102 males. This trend was generally observed throughout the various age groups (Figure 3). However, overall, the community had a relatively young structure with 65% of the population below the age of 30 years old.

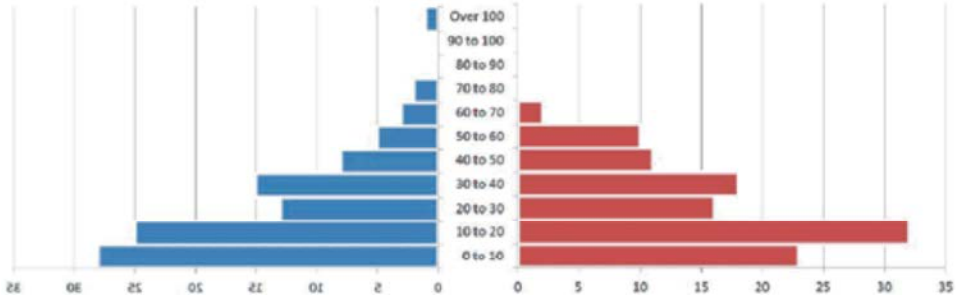

Fig. 3: Age distribution among maleand female residents

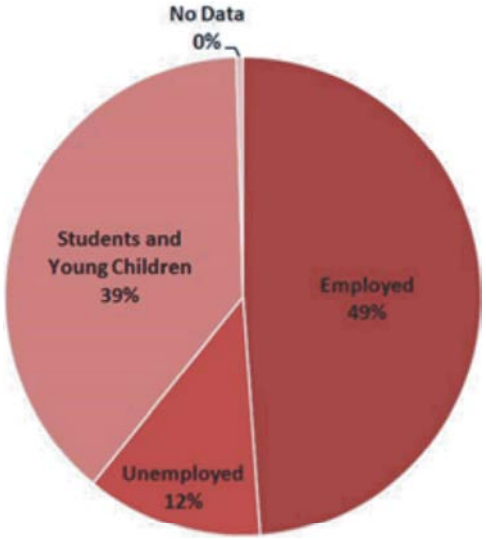

Fig. 5: Distribution of employed and unemployed residents

Table 2: Occupation status among residents

No.	Occupation	No. of Residents
1.	Farmer	51
2.	Teacher	13
3.	Managerial	3
4.	Truck Drivers	3
5.	Gov. Servant	3
6.	Geologist	1
7.	Heavy Machine Operator	1
8.	Contractor	1
9.	Janitor	1
10.	Labourer	1
11.	Gardener	1
12.	Police	1
13.	School Clerk	1
14.	Security Guard	1
15.	Unemployed	30
16.	Students and Children	104
17.	Not available	1
	Total	217

Kg. Tudan's working age segment comprises of more than 62% of the total population while another 39% is made up of students and young children (Figure 5). Thirteen percent of the population was recognized as not having recognized formal employment (which included housewives) although most members of the community are often involved in family-organised activities such as farming. Many of those who are unemployed are young adults who have completed secondary level education but do not have the opportunity to further their studies. These young adults can be expected to seek out employment opportunities outside of Kg. Tudan, or eventually work full-time tending to their family farms.

For the segment of the community who are employed, more than 62% are farmers (Table 2). Teachers, who are mostly employed at the local primary school, make up the most significant number of professionals, followed by those in managerial positions, truck drivers and other government servants.

Agriculture constitutes the main source of livelihoods for the majority of households in Kg. Tudan. As opposed to paid employment, the income from agriculture can vary substantially for each household based on the crops that are harvested each week and by sales that are generated at the markets. It was often difficult for respondents to accurately describe or track the amount of income generated each month as cash from sales was collected on a daily basis, much of which was spent immediately on necessary expenses.

For the 25 households solely involved in agriculture, the data collected showed an average income of just over RM400 per month for each household which was substantially less than what was being spent (Figure 7). Cash income was primarily derived from the sale of crops and supplemented from time to time with the sale of livestock such as domesticated pigs as well as income was derived from forest-based products (i.e. bush meat, jungle durian etc.) (Figure 6).

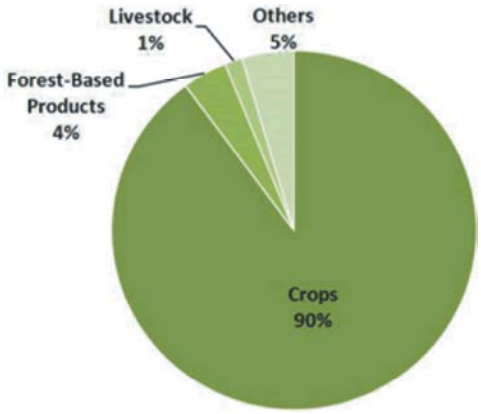

Fig. 6: Sources of income for households involved in agriculture

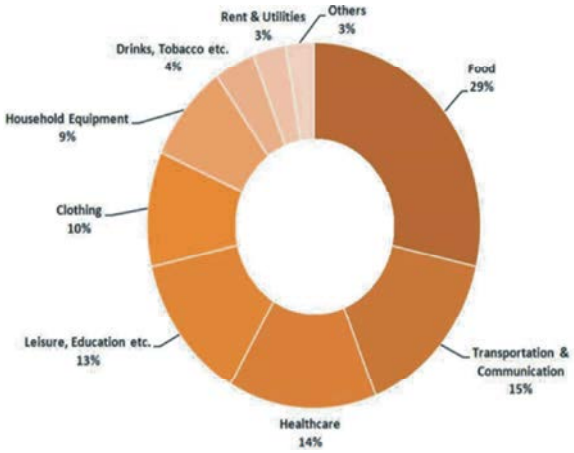

Fig. 7: Sources of Expenditure for Households Involved in Agriculture

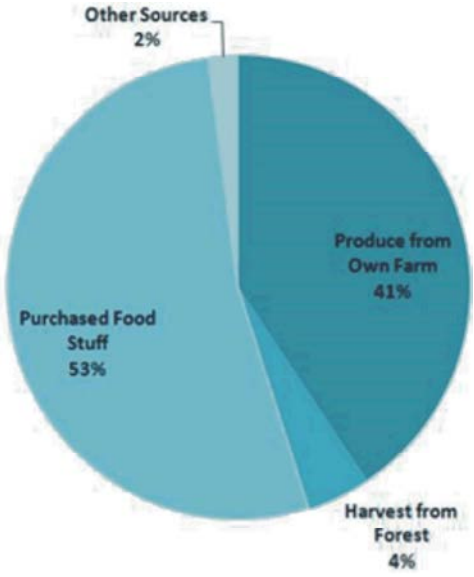

Fig. 8: Sources of household food

Household expenditure can supplement the lack of accurate data on household income to provide a better picture on cash flow within a household. However, some precaution should also be applied as households similarly lack detailed tracking of expenditures. The average expenditure among households where agriculture was the main source of income was estimated at RM 1137 per month.

The main expense was for the purchase of food supplies which accounted for almost 29% of total household expenditure (Figure 7). Purchased food in fact represented 53% of the total food consumed within the household (Figure 8). Although most households produced a variety of food crops, households now more readily purchase a variety of food products from outside with income generated from cash crops and due to the ease to access markets outside. Respondents also acknowledged that food security was not an issue with the abundance of crops that could be grown in Kg. Tudan. Food purchases were followed by expenditure on transportation and communication (15%), healthcare (14%) and education (and leisure) at 13%. With the exception of a few families who have vehicle on hire-purchase, households generally do not hold loans presently that require monthly servicing.

RESULT

The study consisted primarily of a review of the KTP project case study with input from members of the project team and from Tudan's community participants. Based on the content analysis analysed using Leximancer, it is shows that, the Mulberry KTP project in Tudan demonstrated evidence of increases in all five forms of assets: 1) Human asset development; 2) Social assets; 3) Financial assets; 4) Physical assets; and 5) Natural assets (Figure 9).

Figure 9 provides a general overview of how the case study demonstrated improvements in the lives of the rural poor through increased income, opportunity of employment, improved basic needs and services such as households capital, health awareness and information regarding opportunity and possibility of new businesses, access to physical development of assets such as homestay cum office building and potential of expanding infrastructure to include other agriculture component such as livestock and improved awareness on the importance of sustainable livelihood through the usage of community's land.

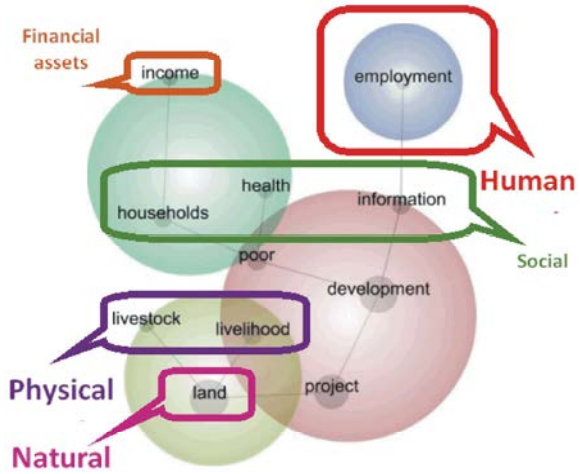

Fig. 9: Concept map derived from Leximancer shows evidences that the KTP's mulberry project had significant positive impacts towards the Tudan's community

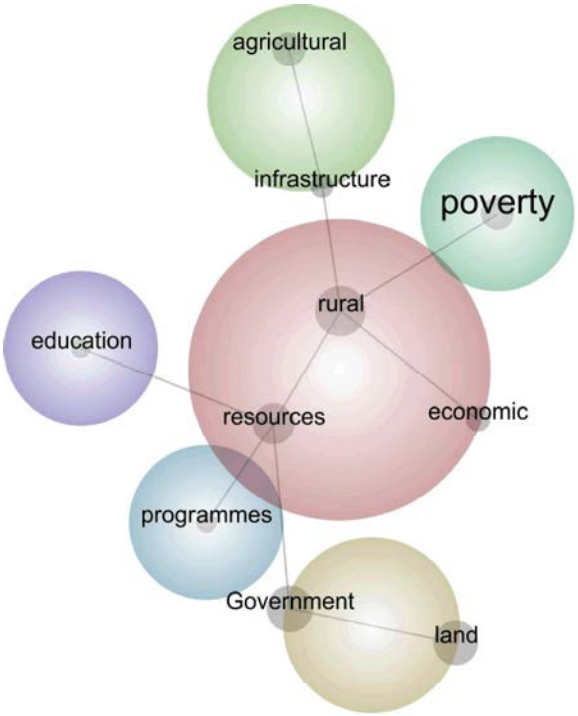

Fig. 10: Challenges in the mulberry KTP project

Like other community-based projects or programs, the mulberry KTP project also faced several challenges. Based on the content analysis in Figure 10, it is shown that there are three main areas of concern among the participants of the mulberry project – rural community themselves, the resources (in this case, the mulberry) and the economic aspect.

Based on the content analysis done, the rural community itself was the main challenges in the mulberry project. Analysis shows that there are two possible problems that will occur; the first one is the distribution of income among the community. Those who participated in the project will definitely gained additional and/or sustainable income compared to those who are not participating; therefore poverty will still be presence among the people of Tudan. Secondly, for those who participating will faced difficulty and problems in maintaining the infrastructure built for the agriculture activity and in this case, the mulberry plantation. As one of the participants said that, *"we are very happy that UMS is here helping us out, but what happened after 2 years? I don't think without UMS's supports and helps, we can manage to handle this project ourselves. Who will assist us? This project, who will maintain it? We don't have enough money to maintain this project."*.

Resources or in this case, is referring to mulberry is also the main concerns of this KTP project. Based on the interviews, it can be identified that there are three aspects of concerns among the mulberry KTP's participants – education, programmes and the Government. Education is very important for the community, they are quite concerns about the knowledge of the mulberry and the mulberry related businesses that they are going to do, which under this circumstances, shows that the community is lack of confident. Due to the lack of confident on heading the project, therefore, the community is quite reluctant to organize programmes related to mulberry planting and businesses. Moreover, they would also want to have the state Government to help them with the managing of their land for the mulberry project. *"We would like to have a local Government to help us with the project, just like what the Sabah Agriculture Department did with the honeybee project here. It would be better to have them involve especially in terms of managing the community's land. Unfortunately, sometimes people will get jealous and or get greedy!"*.

Lastly is the economic challenge. The mulberry KTP's participants are concern about the managing and distribution of "wealth" once the mulberry products are on sale. They are also concerns about possible other businesses opportunity such as homestay, mulberry-based tourism, mulberry-based cafç etc. One participant said that, *"should we start thinking about creating a koperasi? I think we should think about other possibilities of making a homestay or even tourism here"*. Other participant said, *"how to share the profit?"*.

CONCLUSION

Generally, the mulberry KTP embody good principles of sustainable livelihoods approach through the development and specifically incorporate principles associated with

- Building assets (human, social, physical, financial and natural);
- Focusing upon livelihoods (comprising capabilities, assets and activities required as a means of living); and
- Enhancing sustainability.

The desk review suggests that mulberry KTP approaches can contribute to real poverty reduction if applied effectively. Based on the desk review, the KTP demonstrated improvements in the lives and resilience of the rural poor through some combination of increased income, improved basic needs and services, better access to knowledge and enhanced awareness in terms of sustainable livelihood among the rural. Moreover, the analysis also indicates that the SL principles addressing social inclusivity and environmental sustainability also presence and embodied in the knowledge transfer programme. With good developmental tool kit and appropriate sequencing in the programme, the programme can enhance the quality of a wide range of approaches to improve the lives of the rural poor.

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