ASSESSMENT OF THE WET RICE SCHEME IN KAMPUNG STUNGGANG

How feasible is the wet-rice scheme?

One of the farmers in Tanjung Purun irrigation scheme.

SLUSE JOINT COURSE ILUNRM

Esther Sørensen (KU), Martin B. Jensen (RUC),
Sermed Al-Kufaishi (KVL), Karen M. De Mey (KVL)

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Abstract

This report is an outcome of the ILUNRM field course done from 15th to 27th of January 2003 in Kampung Stunggang Melayu in Lundu district of Sarawak, Malaysia. The study, that was interdisciplinary in approach examined the various reasons for the partly abandonment of the wet-rice scheme in Stunggang. For this purpose a variety of methods were applied to extract information on socio-economic, biological, physical and technical issues.

Our findings indicate that there are numerous internal and external factors for the abandonment of the rice scheme and that these interact. The internal factors mainly relate to the design, management and maintenance of the irrigation scheme. Of the external factors is the government's shift towards commercial farming important, which cuts the subsidies to the poor farmers. Another major factor is that especially the young people have shifted aspirations towards non-farm pursuits. In the village we found small-scale industry and income diversification.

An interesting finding from our study was that there were plans of taking over the scheme and a possible turn to commercial farming. If the plan was realised, many of our respondents expressed that they would consider participating.

Acknowledgements

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It also allowed us to test our theoretical assumptions and considerations on real life problems. All these experiences would not have come about if it wasn't for the support and guidance from a variety of people. First of all we are very grateful to our teachers Ole Mertz, Kristine Juul and Tina Svan Hansen and the Malaysian professors who have always been helpful with supervision throughout the field course.

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Lastly but not least we like to thank our Malay counterparts for a successful field trip socially as well as academically.

Copenhagen, March 21st 2003

Karen M. De Mey Martin B. Jensen Esther S.K. Sørensen Sarmed Al-Qufaishi

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1 Introduction

This report is an outcome of the ILUNRM field course done from 15th to 27th of January 2003 in Kampung Stunggang Melayu in Lundu district of Sarawak, Malaysia. The purpose of the study was to examine the various reasons for the partly abandonment of the wet-rice scheme in Tanjung Purun, Kampung Stunggang.
The approach of the study was interdisciplinary thus allowing us to examine more dimensions on the same problem at the same time.

Keeping this in mind we will in the following discuss different aspects related to rice farming to put the study within a context. Afterwards we will discuss the different methods used to obtain our data and present our results. In the end we will discuss and conclude on our results.

1.1 Changing livelihoods and de- agrarianisation in Southeast Asia

According to Rigg (2001) the belief of the rural as distinct and different from the urban is more and more difficult to sustain. He notes that the traditional two world view, rural-urban, has often been counterproductive as it stereotypes rural society and place it in opposition to urban society Rigg (2001:2). Riggs main argument is that the rural urban dichotomy even if made sense once, no longer has relevance. This is because of the infiltration of new activities, diffusion of modernity and education and the enhanced mobility of people due to better transport into the countryside. This general trend sweeping throughout Southeast Asia, is called de-agrarianisation by Rigg; meaning that less people are engaged in farming pursuits. According to Rigg (2001:6) the de-agrarianisation can be characterised by five facets that are interrelated. The first two concerns the income that is re-orientated towards non-farming activities. The forces behind are the increased opportunity and the changing balance of return in favour of non-farm activities for people living in rural areas. The third facet, the social re-identification is closely interrelated to the economic re-orientation where people, especially the young, shift from agricultural to non-farm activities. This shift changes the relations between people and generations and can increase the tensions in for example a village. The fourth facet, spatial relocation concerns the improved infrastructure but is also interrelated to the other aspects. The increased mobility, needless to say, increases the potential distance people can travel to find work or to resettle. It also increases the incentives for industry to relocate as estate prices rise in urban areas. The spatial interpenetration, the fifth facet, is blurring the boundary of rural-urban as spatial economic integration is promoted.

1.2 Rice policies in Malaysia (1900-1990´s)

The rice policies during the period 1900-1980's can be divided into four phases according to Asian Development Bank (1988).

1.2.1 Phase one –low security levels (1900-1930)

The Federal Malay States (FMS)[1] were under the British colonial rule and during this time there was a general reluctance to increase rice production. The British colonial rule preferred to import the rice. The reasons were that: (1) other British colonies had a surplus of rice, (2) more profitable to invest in tin and rubber, (3) most of the suitable areas in Malaysia for rice production were placed outside the British colonial rule.

1.2.2 Phase two –medium security levels (1930-1946)

The period was characterized by a change towards a more goal-directed rice policy.
The British administration wanted to prevent paddy farmers from leaving paddy farming by: 1) implementing an act, that stated that only paddy can be grown on designated land (still in operation), 2) restrictions on transfers of land title, 3) discourage the paddy farmers to leave paddy farming and even exclude the children of paddy farmers from English education to keep them in rice farming. These measures caused further widening of the income gap between the ethnic groups. The paddy farmers were kept in poverty.

1.2.3 Phase three –high security levels (1947-1970's)

Between 1946-1950 a "Guaranteed Minimum Price" was introduced and that contributed to a steady increase in paddy production. It was only after the independence in 1957 that the goals of complete self-sufficiency were announced for the first time. The rice policy extended to also include –among other things 1) equitable income distribution, 2) reasonable consumer prices, 3) appropriate level of food security.
The Green Revolution of the 1960's, hence the technological breakthroughs, accelerated the speed towards self-sufficiency. By 1970 Malaysia had managed to achieve 80% self-sufficiency. The same year the New Economic Policy (NEP) was introduced (Asian Development Bank, 1988), where the existing rice policies were reviewed to pay a greater attention to paddy farmers. The goal was to improve the incomes among them.

1.2.4 Phase four –search for "optimal" production (1980's)

In the 1980's the self-sufficiency target was lowered due to the slower export growth and the too expensive expenditures and subsidies in the paddy sector (Asian Development Bank, 1988). Even though the economic situation for many rice farmers was improved, many still remained among the poor in Malaysia. According to (Horii, 1991) this was because of the uneconomic farm size and the stagnant yields per unit area. The government tried to improve the subsidy system and the farming practices. But many problems still persist and the tendency was an increase in the acreage of idle land due to:
1) sometimes technical defects in the irrigation and drainage construction, 2) increase in young labourers who migrate to the city for jobs (more profitable),
3) diseases, insects, flooding.

[1] FMS: In 1896 the states: Perak, Pahang, Negri Sembilan and Selangor were formed into Federal Malay States(FMS). The states comprise a bit more than half of the Peninsula of Malaysia. The rest of the peninsula joined in 1914. Sarawak and Sabah joined in 1946. The peninsula gained independence in 1957 and Sarawak and Sabah in 1963, where all the states were brought together in the Federation of Malaysia (King,1992, http://user.itl.net/~glen/asianintro.html).

In general before 1992 the rice industry was an integral part of rural poverty relief. Different measures were implemented to improve the living standards of farmers for moral, social and economic reasons of the government. That meant considerable governmental investments to modernize the industry, to raise the productivity and efficiency and by that increase the income of the farmers. Investments were directed to physical infrastructure (road, irrigation and drainage system) and production cost subsidies (fertilizers, seedling etc.) (Malaysian Institute of Economic Research, 2002). The rice sector was highly regulated and an important issue on the national agenda. The aim was to reach at least 65% self-sufficiency (Malaysian Institute of Economic Research, 2002).

After 1992 major steps towards deregulation and commercialisation were taken. The government wanted to look beyond the self-sufficiency target and treat the rice sector as any other sector that contributes to the economic development and growth. Rice production should therefore be based on large-scale plantations and implementation of high-tech technology. The industry should be fully developed and exploited by the private sector and let the price mechanism function with no government intervention since any governmental intervention would distort the market for rice.
(Malaysian Institute of Economic Research, 2002).

1.3 Tropical wet rice cropping systems

According to Greenland (1998), rice is different from other major food crops since it grows better in standing water than in dryland conditions. The crop is most widely grown in areas where water is readily available and the supply of water to the fields can be easily controlled. Rice ecosystems are the most diverse crop ecosystems in the world and can be divided into wet (paddy) rice, where the crop is flooded for a certain part of its life, and upland or rain-fed rice (Vergara, 1992 in Pearson, 1992). Irrigated rice may be found at any point in a toposequence if water delivery is available, but it is mostly found in lowland areas (Greenland, 1998).

Since temperature throughout the year is generally favourable for rice growth in the tropical wet rice system, water availability is the main limiting factor that determines cropping pattern and the number of rice crops that can be planted (Vergara, 1992 in Pearson, 1992).
In the tropics, rice is generally the main crop in the monsoon season when water is plentiful, while cash crops, besides rice, may be planted during the dry season. Dry periods are often one of the main problems when cultivating rice, especially in the areas with two crops per year. It seems that there is a positive relationship between duration of available water and cropping frequency, but it must be emphasised that this only holds if water from rainfall and run-on is not excessive and surface drainage is good (Norman *et al.*, 1995).

Surface drainage can be described as (ASAE, 1980 in Ritzema, 1994):

1. The removal of excess water from the soil surface in time, without causing soil erosion, to prevent damage to crops and to keep water from ponding on the soil surface.
2. Surface drainage is applied primarily on flat lands where slow infiltration, low permeability or restricting layers in the profile prevent the ready absorption of high intensity rainfall. The drainage system is therefore intended to prevent prolonged saturation accelerating flow to an outlet without causing siltation or soil erosion.
3. To improve the growing condition of crops at field level by ensuring the timely and orderly removal of excess water. The land surface should be smooth and should have a continuous slope to allow the overland flow of water to a collector point. From this collector point, water should flow to the area's natural or constructed main drainage system of field and collector drains.

Surplus water, and the problems of excessive soil reduction associated with waterlogging, are a major limitation in many tropical wet-rice systems and is a common occurrence during the monsoon season and on the flood plains. Submergence patterns are difficult to predict. Given the uncertainties introduced by the problems of unpredictable flooding it is not surprising that many farmers tend to use very limited inputs other than seeds (Greenland, 1998).

Soils of the wet-rice ecosystem may be classified as wetland soils. Wetland soils are highly diverse, but their development and properties are all strongly influenced by temporary or permanent water saturation. Wetland rice soils of the tropics have a medium (fine loam) to fine (fine clay) particle size distribution. This is the case because coarse soils are inefficient in water use due to high percolation rates. Some basic properties of wetland soils are further that they do not become acid after continuous cultivation for reasons associated with their physical chemistry; nutrients tend to be leached into the soils rather than out of it because of their position in the landscape; phosphorus is usually more readily available; nutrients are replenished from time to time by silt deposited from flood waters and erosion is unlikely to occur because the rice paddies are surrounded by bunds and covered by water (Greenland, 1998).

Salinity is mainly a problem in tidal wetlands and any areas where no internal drainage occurs, so that any salts in the irrigation water gradually accumulate in the soil. The best remedy is to ensure that some internal drainage, however slight, occurs. This will require that drains and ditches are well maintained to allow water to drain through and across rice paddies. The rice plant is moderately tolerant of salinity and some varieties have considerable tolerance (Greenland, 1998). Soils with a salinity level of less than 4 dS m^{-1} are suitable for wet rice production in Malaysia according to Protz (1981, quoted in Norman *et al.*, 1995).

The commonest nutrient deficiency in paddy soils is of nitrogen. According to Greenland (1998), calcium and magnesium deficiencies are rare, and potassium is quite often adequate although it will usually become deficient under continuous intensive cropping.

Although the level of phosphorus tends to be higher in wetland soils than in upland soils, responses to phosphorus fertilisers are common.

Problems like pests and diseases arise in the tropics because of high humidity and waterlogging and can cause widespread damage to rice crops (Vergara, 1992 in Pearson, 1992). Also intensive cropping increases the possibility of pest and disease outbreaks (Norman *et al.*, 1995). Kushwaha (1986, quoted in Pearson, 1992) mentions rats as a pest frequently occurring in rice fields. They can damage the rice crop at all stages of growth. Many methods are used to control rats in the rice fields and can be considered as quite effective if conducted on a large scale.

1.4 Objectives

The general objective of the field study is to investigate the reasons for failure of the wet rice scheme in Kampung Stunggang Melayu by assessing the suitability of the area for wet rice cultivation as well as the changing livelihoods and the villagers' future perspectives and expectations.

1.5 Specific Objectives

(1) a. To describe Kampung Stunggang Melayu in terms of e.g. infrastructure, facilities, education level.
b. To describe sources of income and evaluate socio-economic incentives for engagement in wet rice cultivation
c. To examine the governmental or institutional role regarding the wet rice scheme.
d. To define the major changes in land use and livelihood during the last decades and determine the villagers' perception on the future use of the irrigation scheme and rice farming.

(2) a. To describe the prevailing physical environment, land use and agricultural practices and determine the soil characteristics in terms of type and nutrient content.
b. To determine the water quality and the extent of salinity intrusion into the wet rice scheme.
c. To investigate the existing irrigation and drainage system.
d. To identify pest problems

1.6 The study area

Kampung Stunggang Melayu is situated in Sarawak (Malaysia) along the Kayan River about 2.5 km from Lundu city and 10 km from the South China Sea. The river divides the village in two parts and has to be crossed by a ferry. The majority of the villagers from about 300 houses (headman), are Malay and live primarily in individual houses often build on stilts.

The Malays dominate the coastal zone and their main defining characteristic is their Islamic religion (King, 1992). The Malays are traditionally small-scale traders, live from sea and inland fishing, rice agriculture, coastal gathering and more recently also commercial agriculture (King, 1992).

Around 1970 the government implemented a wet rice scheme in Tanjung Purun (see Figure 1). There were two government agencies involved in this scheme: the Department of Agriculture (DOA) and the Department of Irrigation and Drainage (DID). This wet rice scheme covers an area of about 140 hectares (DID) and is located on the east side of the river. The purpose was to establish an irrigation system, which could provide enough water to grow rice two seasons per year and by that increase production.

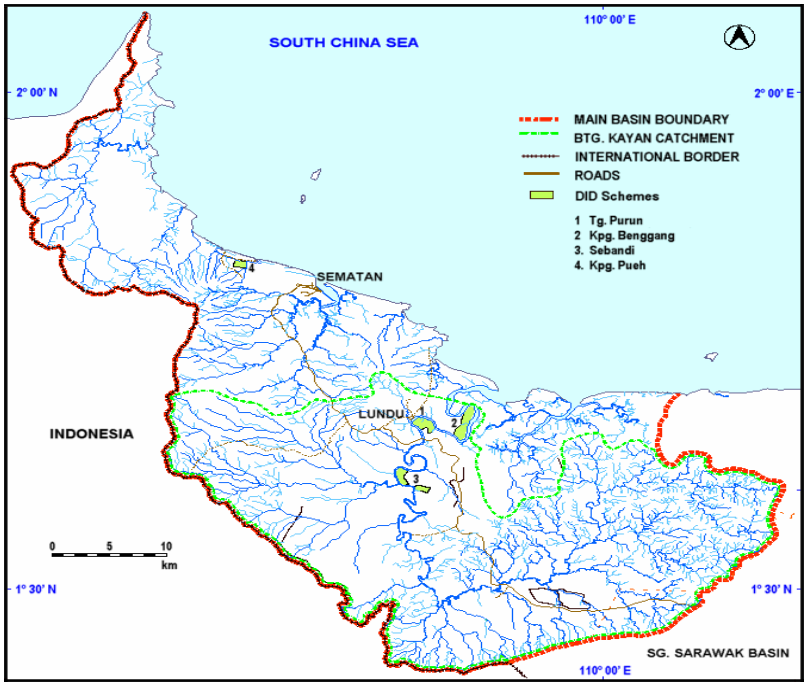

Figure 1. Map of Tanjung Purun rice scheme. Source: DID retrieved from: http://www.did.sarawak.gov.my/ November 20th,2002.

However, from 1978 onwards, the scheme was partly abandoned by most of the farmers. Today only 20% is said to be cultivated by a small number of farmers on individual basis. The rest of the area is left idle. Apparently the government had invested a large sum of money on this project, hoping that rice production would increase in line with the government's policy to be self-sufficient in rice for the state.

2 Methodology

The major challenge in the SLUSE-programme is the interdisciplinary and international approach to our objectives. Coming from different universities and countries our background differs as well as our approach to methodology. We had to agree with our Malaysian counterparts about what methods to use since we were going to collect information together.

We all experienced the difficulties in working cross-cultural and interdisciplinary because we each have different ideas about how to deal with a problem and what is important and not. Nevertheless we learnt how important it is to compromise and respect each other's weaknesses and strengths. The advantage of working interdisciplinary and internationally is that we complement each other and learn from each other.

We had 10 days to do our research in the village and we lived among the villagers, which was a good opportunity to get to know the village and the people. Unfortunately we had to move out of the village because unexpected flooding, which limited our involvement in the community.

Since very few of the villagers were able to speak English, we were given an interpreter. In view of the fact that one interpreter was not enough, our Malaysian counterparts acted as interpreters as well. Usually if a group consisted of a Dane and a Malaysian, the Malaysian asked the questions, translating the answer in English. In that way it was possible for the Dane to follow the conversation and by that ask more in depth questions if needed. However we are aware about the possibility that different interpreters/people interpret a question differently.

The different methods we applied during the fieldwork were:

<u>Socio-economic(household and village survey, changing livelihoods)</u>

- Questionnaires and structured interviews
- Semi-structured interviews with key-informants
- Group interview
- Briefings
- Village walk
- Observations
- Informal conversation

Physical and Land Use change

- Soil sampling
- Water sampling
- GPS-mapping

Biological environment

- Mist net
- Rat traps

Irrigation and drainage

- Semi-structured interviews with key-informants
- Briefings
- Observation
- Informal conversations

2.1 Household and village survey

Questionnaire, structured interview, village walk, observation, informal conversations

In order to obtain socio-economic information of the village we used various methods: questionnaire, structured interviews, semi-structured interview, village walk and observations. We applied the questionnaire to 60 households using a systematic random sampling strategy. The main objective was to obtain general information e.g. educational level and different income sources of the village. However we soon experienced problems with defining a household since it is a fractious unit. For example where does the household begin and where does it end. The problem of defining a household is that it is a conceptual construct, a functioning system and methodological unit of analysis at the same time (Rigg 1997:162). In our survey we counted people living in the house and those contributing to the income to the household. In case the production was for self-consumption the income was not included as it was impossible to calculate. This was obviously a limitation in our study as it tends to under estimate the total income.

We also carried out a structured interview in the same session if the respondent was farmer or former farmer. Again we experienced problems with definitions as many people have diversified incomes making it difficult to categorise farmers. For example how should we classify a person that is deriving 50% of his income from farming activities? In our interviews we adopted a minimalist definition, classifying all respondents as farmers if they were engaged in rice farming regardless of how much. Former farmers were defined as people that have been engaged in rice cultivation before and non-farmers as people that have never done farming.

The questionnaire generally worked out well with regards to educational level, household composition and occupation but was inadequate to provide reliable data on income.
Some reasons could be that many of our respondents didn't have a steady income and also relied on more sources of income, some of them for self-consumption. Others could be that a question was too sensitive and the respondent felt uncomfortable giving a honest answer. This hurdle was never really overcome but maybe could have been provided by another technique e.g. wealth ranking.

We also walked around the village and made general observations about facilities, shops etc. as well as having informal conversations with villagers we met. The advantages of informal conversations are that the respondent feels more relaxed and might therefore give us some unexpected information.

2.2 Changing livelihoods

Semi-structured group interview, briefings, unstructured interviews

As the interviews showed some efficiency in obtaining general information about the individuals and households, they were not very good at retrieving information on opinions and attitudes about the rice scheme.
We therefore decided to set up a group interview (farmers, former farmers and non-farmers) where we could let the respondents discuss topics and complement each other and hopefully bring up something new. According to Mikkelsen (1995:104) the dynamic of group interviews tend to lead to unexpected questions and additional information.
The group interviews went quite well and a lot of issues were clarified as the respondents corrected and supplemented each other. However we learned from the interview that the groups should be set up as homogenous groups as this will encourage more people to participate in the discussion. For example we had two groups where the first one mainly consisted of farmers and another that was more mixed. In the mixed the discussion evolved into two separate discussions whereas the more homogenous went better.

We also conducted group interviews with a group of women working in a fish-factory, and a little group of young boys (around 18 years). We got contact with the women through one of our respondents in the village survey. We got hold on the boys simply by asking them in the street if they wanted to set up a meeting with us one evening.

Other information sources were briefing sessions with DOA and community council where we received general information. After the briefing we had the opportunity to ask a limited amount of questions, which clearly was a limitation as it was not possible to go in depth with certain issues.
In addition we also had a couple of unstructured interviews where we got some valuable information. An advantage of this method was that the questions can be matched to the specific circumstances and thus increase the relevance of questions.

2.3 Soil sampling and analysis

Soil samples were taken on plots within the irrigation scheme in order to get a general overview of the soil fertility status of the area and measure the variability along fields, especially to see if there are differences between cultivated and abandoned fields. Based on a 200m sampling grid, approximately 22 samples were taken so that the total irrigation area was covered on both sides of the primary irrigation canal. We made sure that we took samples from both rice and abandoned fields and the organic material on the surface was removed before actually taking the soil. All samples were analysed a few days after using a soil test kit. Analysis included pH, electric conductivity (EC), and nutrient analysis for NO_3^-, NH_4^+, P and K. Soil texture was determined by feel.

Due to the limited time available in the field it was not possible to take more samples, so the relatively small sample size may not have been sufficient to give a representative picture of the fertility of the area; especially as tropical soils are usually extremely variable (Ahn, 1993). But on the other hand, it gives us at least an idea of the general fertility status in the area.

2.4 Water sampling and analysis

Water sampling and analysis was carried out in order to determine the water quality and the extent of possible salinity intrusion into the wet rice scheme. The water quality is important to determine since it effects the biological environment or aquatic life in the area and the water is used for irrigation of the rice fields. We took water samples in: some rice fields (with good/healthy and poor rice), the irrigation canal around the field, the drainage canal, the main irrigation canal, the sub-river and the main river (Kayan river). Samples were also taken at the inlet and outlet (discharge) point of the main irrigation canal during three consecutive days, at low and high tide to determine if tidal movement influences the measurements. The samples were analysed *in situ* for temperature, conductivity, pH, turbidity, dissolved oxygen (DO), salinity and total dissolved solids (TDS) using a hydrolab metre. Subsequently NO_3^-, NH_4^+, P, biological oxygen demand (BOD), chemical oxygen demand (COD) and microbiological contents were analysed in the laboratory for some of the samples.

2.5 Land use change

In order to get an idea of the change in land utilisation over time we digitised the land use based on three maps from DID from 1995, 1996, 1998 and our own from 2003 using GPS and simple observation. From the maps we could calculate the area utilised from the years and see which plots have changed. We also obtained information of the preceding years through our structured interviews with former farmers as well as from key-informants.

2.6 Biological environment

To get an idea of the problems that farmers face with pests in the Tanjung Purun area, questions were asked during the structured interviews with farmers and former farmers. These questions were about whether the farmers had problems with pests, which types of pests and what they did about this.
Besides the interviews, an experiment was conducted in a selected plot of the rice scheme in order to identify the pest species more precisely since the answers we got from the interviews were not always very specific. This particular plot was selected since it was known that the farmer had problems there with pests. Mist net and rodent traps were placed in the field to catch birds and rodents for two consecutive days. The pest identification was done by using a bird and mammal guide of Borneo.

2.7 Irrigation and drainage

As we didn't get a lot of technical information from our village survey we needed to complement it with semi-structured interviews from key-informants engaged in the irrigation scheme. This way we could get expert knowledge about the design and management of the irrigation scheme and at the same time triangulate our information we received from elsewhere.
We also used maps and secondary data obtained from the drainage and irrigation department (DID) in Lundu.
Another important tool to obtain information was our own observations. This helped us to put the data from interviews and informal conversations in the right context and cross check it.

3 Results

In the following we will present our results. The first three paragraphs give the baseline condition of the area. After that we will elaborate on our findings and analyse the data obtained.

3.1 Kampung Stunggang

The village of Kampung Stunggang is situated on both sides of the Kayan River in Lundu district and consists of about 300 houses (village headman). At both sides of the ferry crossing there were small snack shops. In general the infrastructure and facilities were better on the west side (Lundu side) than the east side. This observation was confirmed by one of our group interviews that informed us that the implementations of facilities (school, community hall, better roads) on the Lundu side were given higher priority. In the village there were generally well-developed electricity and water supply on an individual level.

In the village there were two mosques and one primary school. On both sides there were small kiosks selling a mix of local produced (fish crackers, fruits, sandwiches) and international commodities. Besides there are two factories supported by DOA that produced local foods: a fish-cracker factory and a bakery.

The village was very homogenous ethnically and religiously speaking. All of our 60 respondents were Muslim and Malay. However according to the village headman even though all residents in this village were Muslims not all of them were Malay. Some of them were Iban, Bidayuh or another ethnicity.

3.2 Education

The educational level of the village reflects the village's history as traditionally inhabited by rice farmers who needed little formal education. The most common "highest level of education" obtained by all 56 respondents (4 of the 60 were not complete and therefore discarded) was "Primary School" (47 percent), followed by 'No Formal Education" and "Secondary Education" which both are about 22 percent or 13 of the respondents (see pie chart). People with a "Tertiary Education" comprise 7 percent of the respondents[2].

[2] Each of these categories include specific level of education. In category "Primary School", the level included are: completed primary 6 and primary 5 and below. Whereas in category " Secondary Education" the level included are: "Form 3 and below", "completed form 3", "form 4", "completed form 5. The Tertiary education included: "Form 6", "Diploma", "Bachelor", "Masters", Ph.D". No formal education includes: "illiterate", "Religious class", "other informal education".

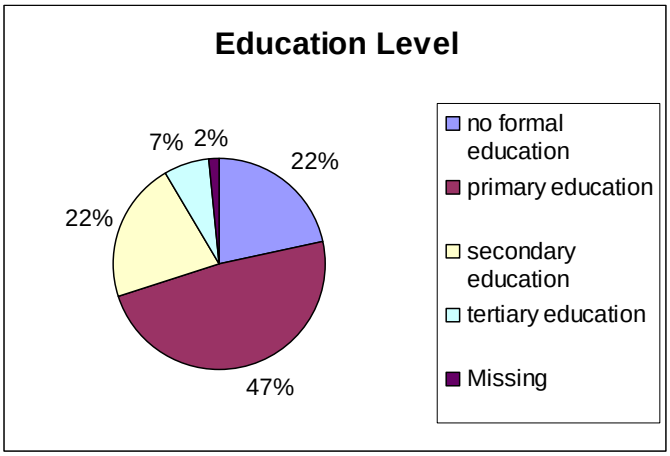

Chart 1. Education level of Kampung Stunggang
Based on 56 respondents.

3.3 Income and employment

We found that the village is differentiated socio-economically. Some of the people are rice farmers; others are governmental servants, teachers, government officials, fishermen, factory workers, shop keepers.
Our survey also showed that most of the respondents had more than one source of income for example they complemented their main income with: fruit, pepper, livestock, poultry and remittances. However those respondents with more stable and higher income tended to rely on their main income only.

The households with the highest income were mostly involved in stable jobs in the governmental or private sector. On the other hand, some households obviously received a very low income. This group mostly had a more instable income depending on market conditions. For example some were having a small business such as making furniture and boats and hence were very sensible to market fluctuations. Others received welfare from the government.

3.4 Changing attitudes towards rice farming

The information we have collected point to a change in people's way of living. Rice farming has traditionally been an important activity for the villagers, but as our collected data will show, the importance is declining. On the basis of our village survey we have categorised the 56 respondents into four categories (see table 1): 'farmers', 'former farmers', 'helped parents' (never produced rice themselves), 'non-farmers' (never involved in rice farming).

According to our survey 84 % of all the respondents have once been or are still involved in rice farming. The statistics therefore illustrate to what extent rice farming has been an important part of peoples lives in the village.

3.4.1 Farmers

Our data shows that most of the rice farmers supplement their farming with other income-generating activities. That indicates that rice production is not a particular profitable activity. This was also what many of our respondents stated in the village survey. A DOA official stated:' Rice farming is a poor mans business.' Then the question is: why are people then producing rice?

Table 1. Respondent's involvement in rice farming

	Counts	Percent	Accumulated
Farmer	10	17,9	17,9
Former farmer	26	46,4	64,3
Helped parents	11	19,6	83,9
Never rice farming	9	16,1	100
Total	56	100	

The average age of the farmers was about 53 years old, where the youngest was 34 years old and the oldest was 70 years. In a group interview we were told that, it was almost only the 50years old +, who still planted rice and their main reason for doing it was because of tradition. Another reason was also that they felt very attached to their land, because the land was a heritage from their parents. A village committee member told us that during his generation many people were keen on farming. Now his generation is too old and nobody wants to take over.

According to our survey 8 out of 10 had an education level below primary 6. The DOA official also stated that most of the rice farmers were not well educated. The low level of education is probably limiting the possibilities for the farmers to change to other occupations. Furthermore almost all of the farmers have farmed all their life and are therefore comfortable with it. In addition since most of them are old, there is no reason for leaving it for something else. Consequently most of them supplement their farming with other sources of income.

3.4.2 Former farmers

Almost half of our respondents have been farmers once, but have now stopped for various reasons. Some of them stopped because of age and often because their children discourage them to continue farming. Instead their children supported them each month or they received welfare. Many of the younger respondents left farming totally for another job(s), which was much more profitable and not so much time consuming. The reason why they produced rice before, many of them answered that it was because of tradition. Most of them have inherited their plots from their parents and have found it natural to continue their parents business. Some of the women stated that they stopped because they wanted to be a full-time housewife and one can imagine that this is also the ideal. The husband is earning the money and supports the family and the wife takes care of the house and family. This is only possible if the husband is earning enough money to

support the family or if they get some remittance from family. However many families complement their income with growing fruits, pepper and so forth.

Some of the women had found a way to combine being a housewife and earning some money. This is illustrated in the following.

> Some of the women were working in a fish cracker factory that got support from the Department of Agriculture. Those who worked shared the income and cost of that day. However some of the money was saved for future investments. The women produced, promoted and sold their product by themselves. Their product was exported to other village nearby, to Kuching and even Saudi Arabia.
> Apart from making fish-crackers, the factory is also a place for different social activities such as feasts, fun etc. Most of the women have been involved in rice farming before; few are still. According to the women the advantages of working in this factory compared to the rice field is –apart from better payment –it enables the women to combine being a full-time housewife and earn an income because the work is flexible (part time).

Apart from this example we observed that many of women derived their income from working in small shops that at the same time enabled them to take care of their children. Often we saw that the children were helping in the shop. This illustrates that children are brought up with business rather than working in the rice fields and hence are more likely to pursue other income activities than rice farming.

3.4.3 Non-farmers

According to our data 16.1% of the respondents had never been involved in rice farming; not even during their childhood. The reason could be that their family didn't have any tradition for planting rice, choose to let out their plot and/or specialize in other activities; e.g. business, fishery, fruits.

To get another perspective of the view on rice farming we decided to interview 3 young boys around 17 years old (and attending form 5), since it could give us a picture of the young peoples perception on rice farming and visions for the future, which will consequently influence the future prospects for rice production.

> Only one of the 3 boys father was at the moment engaged in rice farming. All the boys knew how to plant rice, but never wished to be a low intensive rice farmer. They considered rice farming as having a low economical status and they even considered the farmers as being narrow minded. Their parents did not encourage them to do rice farming rather the opposite. They wished their children an easy life.
> Their future dreams were to move to Kuching either to go on studying e.g. to become an engineer or an IT-specialist or just to get a good job in e.g. factory.
> However they didn't completely reject rice farming. They wouldn't mind modern rice farming.
> One day they all wanted to return since this village is their hometown.
> Another important reason is that they have responsibility to their family.

Many of the respondents from our village survey didn't see a future in rice farming, because young people were not interested. The DOA official also stated that this was one of the main problems. And as the boys told us they were not encouraged by their parents to carry on the tradition. Instead they should get a good education and later on a profitable job. This is also for the benefit of the parents since it is the children's responsibility to take care of their parents, when they are old. In one of the interviews we were told, that all the young people wanted to go to Kuching, because they are not satisfied with the job opportunities in the Lundu area. The road has also been improved in the last year, we were told, so it's easier than before to go there. Another reason could be that the young people's education level is higher than their parents and grandparents and they therefore see job possibilities further away from their hometown than before. That can be the reason why some young people view rice farmers as narrow-minded or low educated.
However it is important to mention that the boys wouldn't mind to become a modern rice farmer, since it is in line with the government's policy to promote commercial farming.
Since we only interviewed 3 boys, their opinion is probably not very representative for all young people, but nevertheless gives an indication of the trend among young people.

3.5 Perceptions on the future use of the irrigation scheme

According to DOA the government policy towards rice farming is shifting towards commercial farming. In this regard the DOA looks for farmers who are viable for commercial farming and not just farming for subsistence. Concerning the poor farmers the DOA have set up different programs i.e. traditional food program (fish cracker factory, food association), which they support in order to orientate the farmers towards non-farming activities.
There were rumours about a plan to take over the rice scheme in Tanjung Purun but according to DOA there are no concrete plans yet. Throughout our study we tried to find out who would take over but we got different answers. Land Custom Development Authority (LCDA) and Sarawak Land Development Board (SLDB) were among the possible stakeholders but we were unable to get a confirmation.

Though we were not sure about what company would take over the scheme it was certain that plans existed since many of our respondents and key-informants had heard about the idea.

Most of the farmers agree that it would be necessary to modernize the scheme and stressed it should be used for rice production like it has always been.

Our findings showed that the majority of both the farmers and the former farmers thought the planned take-over would be a good idea (see table 2). The reason stated was that it would utilize an otherwise idle and unproductive land. Some pointed out that the take over would be good because it would make rice farming more profitable and increase job opportunities; hence more people would like to cultivate their plots.

In general the people that disagree about the takeover were suspicious of the government and had little faith in the proposal. A farmer that owned the land and expressed that the

take-over was undesirable meant that the new company would not distribute the income evenly.

Our survey does not show any significant difference between farmers and former farmers and between renters or owners concerning the benefit of the take-over. This can be a result of misunderstanding or misinformation about the plan. According to the headman and DOA officials the planned take-over would be an advantage for the farmers, as it would increase the farmers income, because it would raise the productivity. The question is whether the take-over will benefit the farmers because increased productivity probably results in less demand for labour especially unskilled. Thus there is a potential conflict between farmers and the DOA's expectations about the outcome of the take-over.

Table 2. Opinions on the alleged plan to take over the land

	Owned the land		Rent the land		Total
	Farmers	Former farmers	Farmers	Former farmers	
Good Idea		12	4		16
Not a Good Idea	1	2	1	1	5
N/A	1		1	2	4
Total	2	14	6	3	25

Table 2. Based on the interview of 24 farmers and former-farmers engaged in the Tanjung Purun rice scheme. The reason why the count is 25 is because one of the former farmers both owned and rented plots and hence is represented two times in the table.

3.6 Agricultural practices

The majority of the respondents we interviewed (farmers and former farmers) had a plot of two acres or less (2 acres=0.80936 ha; Rose, 1985). Only one former farmer cultivated three acres and another four acres. The DID informed us that all the land was titled and the maximum size of a plot that could be owned was two acres. The reason why some have more is because they rent extra from others.

Rice was the main crop cultivated on all the plots. From the present rice farmers interviewed, all were planting rice for one season; two have been planting for two seasons before but not anymore. One reason mentioned for this was too many problems with pests when growing two seasons. All the former farmers have been planting rice for two seasons except for four who planted only for one season. This can be explained by the fact that before, when the irrigation scheme was functioning well, it was beneficial to grow rice for two seasons. Many farmers mentioned that after the implementation of the scheme they started cultivating two seasons instead of one, but it seems that the present farmers all grow only one season again at this moment.

Many of the farmers were not cultivating other crops besides rice on their plot within the rice scheme. The main reason given for this was that the plots are too small to grow other crops. The few who did, were cultivating maize in the dry season or between the rice seasons when growing rice for two seasons. Other crops mentioned by one former farmer were pepper and taro, one farmer was growing mangoes on the borders of his plot.

Most agricultural production was for self-consumption and only 12% of the farmers and former farmers were selling. One farmer was selling rice at the moment but a very little amount and only when he had surplus.
The rice yield per season doesn't seem to be very different between the farmers and the former farmers, which shows that the yield didn't change over the years. The only difference of course is that the yield from a whole year will dependent on whether one or two seasons have been planted.

The rice yield was on average 1140 kg/ha/season, although this is a rough estimate since the respondents didn't always know the precise yield (especially when they were former farmers) or they might have exaggerated the real yield. Since most respondents used local mass units (f.ex. 1 tin=4.5 gantang and 1 gantang=2.54 kg, Rose, 1985) conversion was needed to put the yield in kg/ha, which may also have affected the result. The number shows that the average yield per year (2.28 t/ha) is lower than the national average yield of 2.94 t/ha/yr in Malaysia (IRRI Agri Facts, 2002 in Mutert and Fairhurst, 2002) and is even almost the same as the average yield for rainfed rice in Southeast Asia (2.5 t/ha/yr) (Mutert and Fairhurst, 2002), even though the rice in Tanjung Purun is irrigated.

3.7 Agricultural inputs

Since the implementation of the irrigation scheme the farmers have been given subsidies from the Department of Agriculture (DOA) in the form of fertilisers, seeds, pesticides and herbicides. It was mentioned by a former member of the scheme committee of Stunggang, that these subsidies were not enough to have an acceptable productivity. The farmers had or have to buy more themselves according to their ability, which explains differences in productivity between plots. Furthermore, subsidies were only supplied for titled land. From the interviewed present farmers, 63% didn't get subsidies (anymore), from which 60% stated that they couldn't get any because they didn't own but rent the land. Another reason why some farmers didn't get subsidies at the moment was that many face difficulties with filling in the application and possibly also the change in government policy. According to an official from DOA, subsidies were intense during the 80's and the beginning of the 90's but are decreasing because the focus is more on commercial farming. Low intensive farmers like in Tanjung Purun, will get fewer subsidies and only a kind of grant (supplement). For low intensive farmers who are not viable for commercial farming, they want to find other income activities.
All farmers interviewed (both present and former) used fertilisers and pesticides even if they didn't receive subsidies from DOA. They all applied urea to their fields.

The DOA also provides machinery for ploughing and harvesting but a big minus, according to the farmers, is that the rent is very high (60 RM/acre), they have to pay the fuel themselves, the machines are second hand, not working well and it is difficult to get hold on it because of too few machines available.

3.8 Land capability and agricultural soils

The soils were generally homogeneous with a texture of sandy clay loam and in some areas sandy clay. The pH ranged from 3.64 to 5.18 (average of 4.37) (Table 3). The relatively high acidity of the soil can be mainly explained by the high rainfall in the area. Tropical soils of very high rainfall areas are in general more acid due to leaching (Ahn, 1993, p.136). Although rice is generally an acid-tolerant species and soils with a pH of 4 or more are considered as still suitable for wet rice according to Newman *et al.*(1995, p.73, 82), liming up to 5.5 is probably recommendable since most major nutrients are the most easily available to the plant within the pH range 5.5-7.5 (Ahn, 1993, p.117). Overliming though should be avoided because applications that raise the pH to levels of above 5.5-6 are probably quite unnecessary and can reduce yields (Ahn, 1993, p. 137).

The salinity level was low with an average electric conductivity (EC) of 0.14 dS/m (Table 3). This shows that there are no salinity problems since rice can tolerate up to 4 dS/m (Protz, 1981 quoted in Newman *et al.*, 1995, p. 82). In spite of this, there could be a seasonal bias since the study was carried out during the rainy season. The high rainfall might cause the salt to be diluted and hence the lower concentration of salt. Some farmers told about having problems sometimes during the dry season so a more accurate result could be obtained when studying the EC in both rainy and dry season.

In terms of the nutrients analysed, NH_4 , NO_3 and P were poorly available with concentrations of less than 10 mg/l on average for all three nutrients (Table 3). The level of K was higher with on average 80 mg/l. The low nutrient levels can be explained by leaching of nutrients due to high rainfall. The soil samples were taken during the rainy season and the nutrients, especially NO_3 which is very mobile, may have been leached to the deeper soil strata.
Compared to N, rice is more tolerant to low P levels, but this is mainly due to the fact that flooding of the soil increases its availability and uptake (Ahn, 1993, p.237). Phosphorus sufficiency is also difficult to assess, as rice cultivars can differ greatly in their ability to mobilise soil P and in their P efficiency (Otani & Ae, 1996).
The relatively high level of K found in the soil, can be explained by the fact that much of the K is taken up by the rice straw, which after harvest is returned to the field, so in general K is not a limiting factor especially not on heavy soils and for traditional rice varieties (Ahn, 1993, p.237). Although to get a better idea on the soil fertility, more accurate soil tests should be done, but due to our time and resource constraints, this was beyond the scope of this study.

Table 3. Range and average of the soil pH, EC, NO_3^-, NH_4^+, P and K content.

	pH	EC(dS/m)	NO_3^-(mg/l)	NH_4^+(mg/l)	P (mg/l)	K(mg/l)
Range	3.64-5.18	0.04-0.39	0-10	0-20	0-12	0-80
Average	4.37	0.14	<10	<10	<3	80

Since the analysis of the nutrient content only provided us with ranges, the average can't be calculated, but in this case the most frequent occurring range is given.

All the soil parameters that were determined didn't show significant differences between rice fields on one hand and abandoned fields on the other hand (see figure 2). It seems

that, according to our results, the land use doesn't influence the soil characteristics, so the reasons for leaving the land idle are not because of physical constraints. This might be incorrect as the analysis' we did were rather inaccurate so more precise analysis are needed to give a clear-cut answer on this.

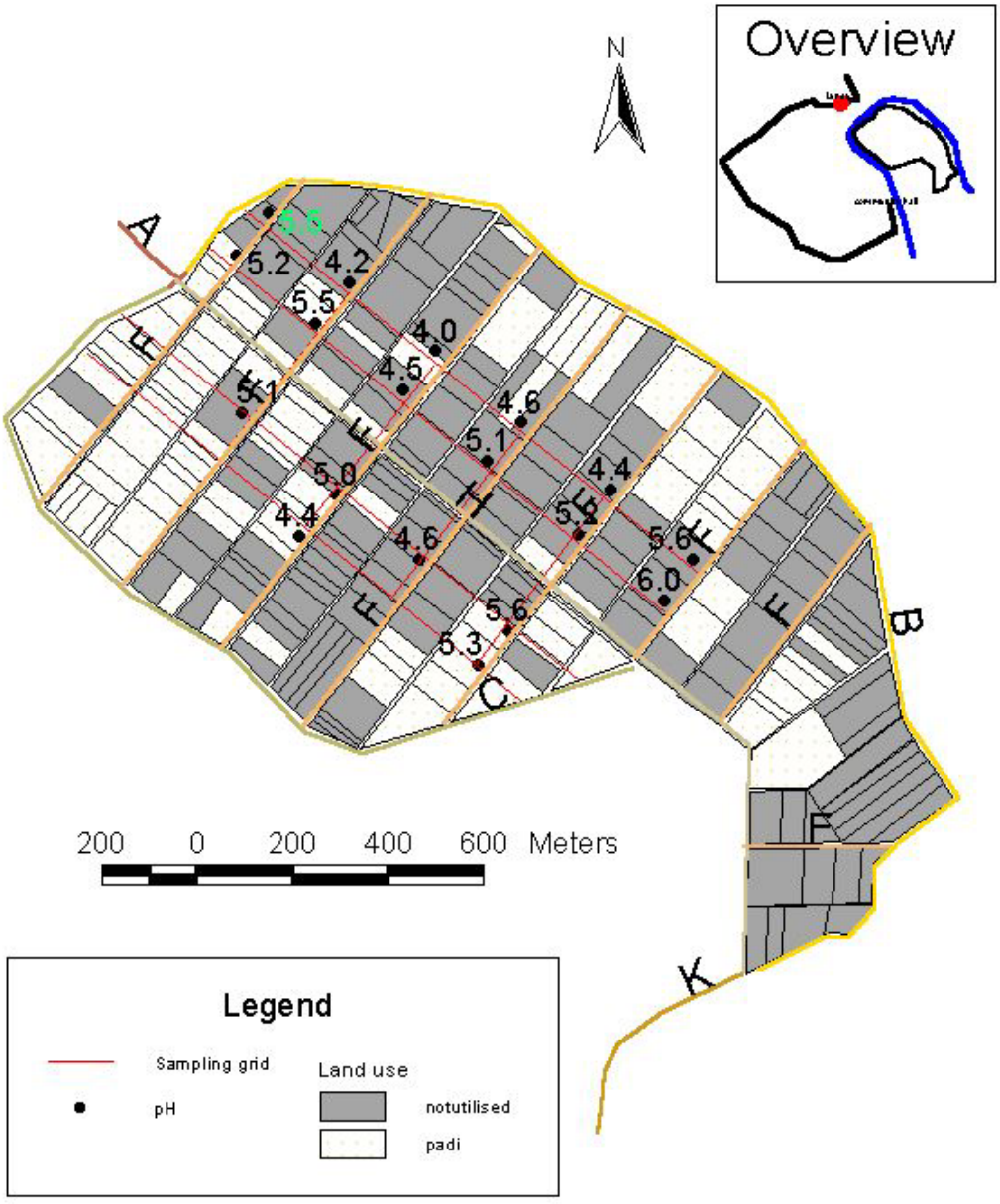

Figure 2. pH measurement in Tanjung Purun irrigation scheme.

3.9 Water quality

From testing water with the hydrolab and observing the rice plants on the fields, we found out there were no major problems with salinity. The electric conductivity at the outlet point (discharge) was on average 0.11 mS/cm compared to 0.01 mS/cm for the inlet point (Table 4). The higher value in the discharge point can be caused by the leaching of salts from the farmland. The electric conductivity didn't seem to be affected by tidal movement (values at low and high tide were the same) but the results can be affected by the sampling time (high rainfall could have influenced the salinity level).

The pH value of the water at the inlet was 5.18 on average and 3.72 at the discharge point, with minor difference between high and low tide (Table 4). The higher acidity at the outlet is possibly caused by the soil itself which was found to be acid as well (leaching of fertilisers, pesticides). Overall, the pH value can be considered as quite acidic for wet rice cultivation since optimal values range from 5.5 to 6.
In the main drainage canal we found a quite high level of acidity. We tried to investigate the reasons by adopting more tests on different plots, the secondary drainage canal and the irrigation water, but we couldn't find out the real reason. This was mainly due to lack of information about the groundwater quality; this could possibly be a reason of the acidity because we found the acidity in the lowest point in the main drainage canal. It is possible that the drainage canal is in contact with the groundwater that is acid.

The concentration of nutrients in the irrigation water was rather low (Table 4). Only the ammonium concentration was higher and exceeded the threshold value of 0.4064 mg/l (Class II of INWQS, Interim National Water Quality Standards for Malaysia, Memon and Mohamed, 1999, (Department of Environment, 1993)). The low nutrient level can be explained by low nutrient level in the soil and high rainfall reducing the nutrient concentration and thus masking the leaching process. Additionally, the lack of fertiliser and pesticide traces in the water may be a result of the lack of their application close to sampling time rather than the limit of their geographical spread. In any case, the water discharged from Tanjung Purun irrigation scheme was quite clean and safe except that extensive treatment is required to reduce ammonia-nitrate level in the water.

Table 4. Acidity (pH), EC and nutrient content from water at inlet and outlet point, during high tide (HT) and low tide (LT)

	pH		EC(dS/m)		NO_3^-(mg/l)		NH_4^+(mg/l)		P (mg/l)	
	Range	Avg	Range	Avg	Range	Avg	Range	Avg	Range	Avg
Inlet HT	-	0.10	5-5.81	5.41	-	0	-	0.57	-	0.02
Outlet HT	0.07-0.14	0.11	3.40-3.45	3.43	-	0.01	-	0.41	-	0.04
Inlet LT	-	0.10	4.80-5.07	4.94	-	-	-	-	-	-
Outlet LT	0.01-0.24	0.11	3.50-5.20	4.01	0-0.01	0.01	0.28-1.33	0.60	0-0.01	0

Negative effects that can be mentioned resulting from the presence of a drainage system, is excessive leaching of valuable nutrients from the soil and environmental disturbance caused by the construction of ditches, canals which change the landscape and interfere with other infrastructural elements of the land.

Through the heavy rain a lot of the applied fertilizers can be washed out and most of it may be redistributed in the drainage canal. There the benefits of the fertilisers go to the weeds in the canal. This all affects the farmers badly because they get limited fertilizer subsidies and can't afford to buy more themselves. Some farmers solve this by surrounding their plots by another ditch to reduce the effect of nutrient leaching. This is a reason why we didn't find a high nutrient content in the water can be explained by the fact that the fertilisers were applied at least one month ago.

3.10 Land use change

From the land use mapping we could determine that the present area under cultivation is about 40%, which is more than stated by the headman.
Based on our maps from the years 1995, 1996, 1998 and 2003 (see Figure 3) we could not detect a pattern in the development of the areas under cultivation. Rather most of the plots are in regular use and can be left idle for some years and then suddenly utilised again. An interesting year is 1998 where the area utilised increased to about 50%. We don't know for what reasons but it could be that it is just normal variations in the utilisation of the area or maybe the impact of the 1997 Asian economic downturn that made it necessary for some people to return to farming.

However looking at a larger time span we know from our interviews that the irrigation scheme was implemented around 1970 and many of the farmers left the rice scheme in the late 1970s, beginning of the 1980s. According to our interviews there were also paddy fields in Tanjung Purun before the implementation of the wet-rice scheme. According to our structured interviews with farmers and former farmers most of them preferred that the area should be used for rice cultivation in the future.

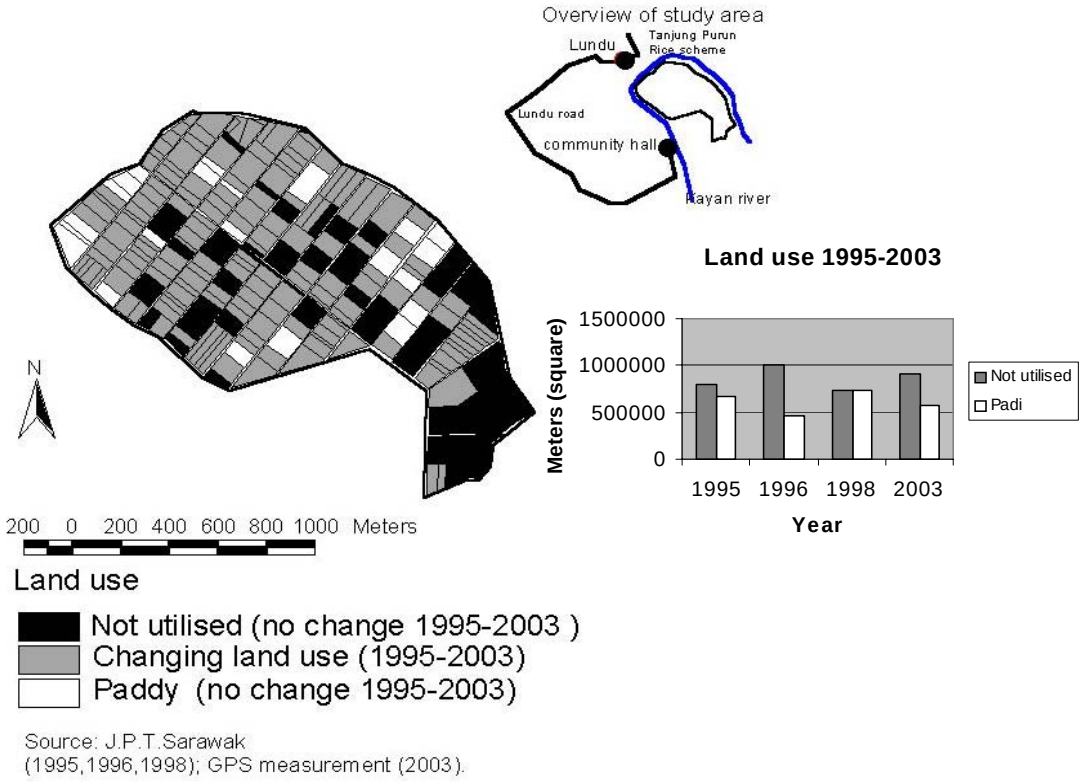

Figure 3. Land use change in Tanjung Purun irrigation scheme 1995-2003.

3.11 Pest identification

All farmers and former farmers reported problems with pests, except for two former farmers who didn't have pest problems. The reason they gave for this was that their plot was too small; the pests went to other plots. From the respondents who had pest problems, all mentioned rodents (especially rats), 63% birds, 25% insects (like f.ex. bengas) and 21% grasshoppers. They dealt with this by using pesticides and insecticides.

From the experiment done in the selected plot, twelve birds were caught of five species namely Dusky munia (*Lonchura fuscans*), Chesnut munia (*Lonchura Malacca*), Pink-necked pigeon (*Treron vernaus*), Brown-throated and Crimson sunbird (*Anthreptes malacensis* and *Aethopygo siparaja*). Besides that, two rats (*Rattus argentiventer)* were caught.

Rats are known as being a serious pest in rice, as also stated by Kushwaha (1986, quoted in Pearson, 1992). From the birds we found, munias are considered to be a rice pest since they attack paddy grains. Early and late plantings of the paddy are more seriously attacked (www.sarawak.com.my/borneo_lit/pest/page05.html). Also pigeons are rice pests but mainly eat from stored grains (Brooks and Fiedler, 1999). Sunbirds are from the nectariniidae family and are birds that eat small fruits and nectar from flowers

(http://www.montereybay.com/creagrus/sunbirds.html). Thus, they don't cause problems for the rice crop.

According to the farmers, pest problems started or increased with the implementation of the rice scheme, which can be due to more intensive cropping as stated by Norman *et al.* (1995). With the implementation of the scheme, some farmers started to grow two seasons (both in the dry and rainy season). During the dry season fewer farmers were farming their plots compared to the rainy season, which resulted in pests concentrating on the cultivated plots. In the following rainy season the pests distribute on all the plots with less density. Present pest problems can be also explained by the fact that the abandoned fields and drainage canals, that are densely covered with weeds, are a good breeding place for all kinds of pests like rats and birds for example.

3.12 Description and observations of the irrigation and drainage system

The irrigation and drainage system in Tanjung Purun was implemented in 1971 and DID was in charge of the system from '71 until '75. From '75 to '78, a Taiwanese company ran the scheme with the aim of training the farmers. After this period, the management went back to the Malaysian authorities (DID) and until now it is still under their control. From our field study, we found that there were mainly two different problems concerning the scheme: one of them is how to provide water to the plots, and the other is how to get rid of the excessive water. By visiting the scheme, we tried to get deeper behind these two problems, looking at the causes, consequences and evaluate the existing situation. Our field study in the rainy season prevented us from observing the condition during the dry season, which may be quite different, so our observations are not totally accurate.

3.12.1 Description

Drainage system

The drainage system in Tanjung Purun consists of the following (see figure 2 paragraph 3.8):

- Main drainage canal A: is a canalized stream that collects water from two or more collector drains and is ending in the river.
- Drain collector B, C: consists of two big canals surrounding the scheme, they meet each other at the end of the scheme forming the drainage canal A. There are also three mechanical control gates located in the middle of collector canal B, the end of collector canal C and middle of main canal A.
- Field drains F: are the same field secondary canals designed for irrigation, could be utilized as drainage canal in this case, they tried to combine both processes of irrigation and drainage. During the rainy season the main irrigation canal is sometimes working as drainage canal.

The objective of an agricultural drainage system is to reclaim and conserve land for agriculture, in order to increase crop yields, permit the cultivation of more valuable crops, allow the cultivation of more than one crop a year and/or reduce the cost of crop production in otherwise waterlogged land (Ritzema, 1994). Another objective is the removal of salts or other harmful substances from the soil.
We found out by interviewing DID that the designers of the drainage system in Tanjung Purun have, besides the general objectives of establishing a drainage system, more specific objectives to fit particular field requirements. These are the following:

a) Construction of bunds to prevent high tide.
b) Provide facilities for double cropping paddy.
c) Enable mechanized farming by providing farm roads to every paddy lot by means of internal irrigation ditches.
d) Boost paddy production in the area.
e) Be self-sufficient in paddy.

3.12.2 Observations

From observations of the drainage canals, we found out that all the canals were densely covered with grasses and weeds. Vegetation grown on the canal sides and bottoms can have several undesirable effects on the canal and the flow; it changes the canal roughness and by that decreases the water movement, which increases sedimentation, which again affects the canal roughness.

The maintenance or clearing of the canals (as we were informed by the DID) takes part three to four times every year. In the tropical areas, vegetation growth is very fast so the canals should be maintained for example every month. The secondary canals are totally covered with grasses and weeds since. Each farmer is responsible for clearing the secondary drainage canal next to his plot. The secondary canal passes through seven to nine plots. Since many plots are not in use, the parts of the secondary canal bordering these plots are not cleaned, which will affect the efficiency of the canal in general.
Because the slope of the plots and non-grading, soil erosion from the plots to the drainage canal occurs frequently and causes sedimentation.

Observing the drainage system showed us further that there is clearly a problem with the control of the gates. Especially the valve gate (one way flow gate) on the main canal is not functioning well. It is supposed to be opened; taking the water from the field to the river, when it is low tide and closed during the high tide so the water from the river can't enter the field anymore. Another gate out of work is the one in the middle of the drainage canal (C) because of a problem related to concrete (the structure of the concrete is very weak). When the gate is in this condition, it can't function and the plots can't be protected from flooding by river water since the gate is open permanently. The people working there informed us that the river has flooded three times during the last ten years causing total damage of the plots and loss of crops. What makes things worse was that there was not any kind of insurance for the farmers.

In the drainage system, we could note that the agricultural land is likely to suffer from drainage problems, which are mentioned before. Although, these problems are not only related to the system type, but also to the topography of the scheme since the fields are not levelled properly. The sloping should be 1-3% according to Ritzema (1994) to have a continuous drain of water.

After the interview with the DID we found out that the drainage system continues working all year round certainly with less load during the two months when the average rain is between 50-150mm (thus in the dry season). On the other hand, the irrigation system is not operating more than two months a year, as the DID officials informed us.

It is not clear how the DID manages the irrigation process, but it is clear that the capacity of the system is not high enough for opening more than two irrigation canals at a time which is one limitation. Another limitation for the management is that the water can't reach all the secondary irrigation canals and therefore the plots. We were informed about this from different sources. This is related to the micro-topography of the scheme. We could not determine the number of the canals the water could not reach because we were not in the irrigation season. Even if the secondary canals have been provided with the maximum water carrying capacity, the water can't overcome slope barriers.

In the main irrigation canal (see photo 1), we observed cracks in the concrete, which causes leaking. Because of this, high power is required to be able to provide the same amount of water to the plots, which is reducing irrigation efficiency.
One of the suggestions we heard about from the DID, is that they have to replace the irrigation canal by a water pipe system. This plan doesn't seem very realistic and practical because if they do not correct the slope, problems like for example waterlogging are not going to be solved. The only advantage is that this plan will raise the transport efficiency of water by minimizing the loss in water. Since water is not the limiting factor in Malaysia, this water pipe system won't be a proper solution also because these systems cost a lot.

Photo 1. In front of the photo, the drainage canal with the main irrigation canal behind.

4 Discussion

In this part we want to discuss our findings in relation to the theoretical considerations in the introduction. First we will discuss the different topics we have been dealing with and afterwards relate it to the irrigation scheme in order to give some reasons for the abandonment of the rice scheme.

According to the information we obtained from the interviews and land use map, we know that the Tanjung Purun scheme has developed from fully utilised to partly abandoned.

Some possible socio-economic reasons for the abandonment of the scheme are that present farmers are old and have to supplement their low-intensive farming with other income sources, and the younger generation is not interested. The last reason can be explained by the low income and status of low-intensive farming, better job opportunities due to higher education and/or better infrastructure. Our findings are very much in line with Rigg (2001), who notes that people re-orientate totally or partly towards non-farming activities, because of higher profitability, improved infrastructure and more job opportunities. These factors affect the involvement in the scheme.
The Malaysian institute of Economic Research (2002) states that the policy is now to deregulate and commercialise the rice sector, which is also confirmed by DOA. This new policy influences the incentives to do rice farming in our scheme, because the focus is no longer on low-intensive farming; subsidies are cut down and consequently rice farming becomes less profitable. The new policy is also an important factor that explains the turn away from low-intensive rice farming in Tanjung Purun.

The most important physical and biological factors we found that limit the rice production in the area and hence discourage people to farm in the scheme are pest problems, flooding and soil fertility. Most of the present farmers didn't want to cultivate for two seasons because of pest problems which is in line with Norman *et al*. (1995) who states that intensive cropping increases the possibility of pest and disease outbreaks. In addition, we also found that the presence of abandoned fields and weed growth in the drainage canals increased pests.
Floodings in the past 12 years might also be a cause to give up farming because of yield loss. Because of the risk, farmers may choose to farm extensively (lower output). This reason is supported by Greenland (1998) who asserts that many farmers tend to use very limited inputs other than seeds because the risk factor is too high.
From the results of the soil and water analysis, we could not conclude much because the low accuracy of the tests and the seasonal bias. Salinity and nutrient level were low and the acidity rather high (levels exceeded values suitable for rice). The high acidity doesn't match with the statement of Greenland (1998) that wetland soils don't become acid after continuous cultivation, but further analysis should be done. Since we didn't find any significant difference in soil characteristics between cultivated and abandoned plots physical constraints are probably not a reason for leaving the land idle.

Technical aspects that influence the abandonment of the scheme are the limited access to and poor state of machinery, unsatisfactory design, poor maintenance and lack of management of the irrigation scheme. All these aspects constraint the farmers for cultivating properly and efficiently.

Besides the above stated constraints, there seems to be a future for the rice scheme. Many of the respondents could see a potential for the scheme if some of the physical, technical, and economical problems are dealt with. Most people agree on a take-over of Tanjung Purun because they believe that many problems could be solved. The young people we interviewed did not mind being a rice farmer as long as the scheme would be commercialised.

All the topics discussed above influence the feasibility of the irrigation scheme.
The discussion indicates that there are various internal and external reasons for the abandonment of the rice scheme but it is difficult to rank them because they are all somehow intermingled.
In the following we will outline three different scenarios to illustrate how these factors can be connected: Firstly what is likely to happen if the rice scheme is left decaying? Secondly, what will occur if the irrigation scheme is improved in accordance with what the farmers have requested? Thirdly what will happen if the rice scheme is commercialised? We are aware that many more scenarios exist, but we have chosen these three because we find them realistic.

4.1.1 Decaying irrigation scheme

If the rice scheme is left decaying, the most likely outcome will be that the farmers gradually leave farming because of age and declining interests due to lower profitability. The former farmers will continue their present occupations as the situation is status quo and hence nothing to encourage them to change activity. The non-farmers have no reason at all to go back; both because they are not into farming traditionally and the profitability of the farming will not make them reconsider. The young people will look for other opportunities due to the above stated reasons as it makes farming unattractive. The low involvement in the rice scheme will then discourage the government to invest further in the rice scheme because of low return. This will reinforce the above tendency of the farmers, former farmers and non-farmers.
In short, if the rice scheme is left decaying then the result might be that the rice scheme is totally abandoned in the end.

4.1.2 Upgrading of the irrigation scheme

In scenario two, we imagine that the rice scheme is upgraded according to the needs of the farmers e.g. improved levelling, weeding and management. A likely outcome would be that the farmers would invest more labour in farming (cultivate two seasons). Some of the former farmers might also have renewed interest in returning to farming since it is becoming more profitable. Other will not return, because the benefit of farming rice does not exceed the present income plus the cost of changing activity. The opportunity cost of the non-farmers will be even higher; because they have never been involved in farming thus they are not likely to participate even if the scheme is improved. The young people

will still look for other activities, since it is still low intensive farming and therefore not appealing.
In sum, an up grading will only delay the tendency of leaving farming; mainly because most of them, who then are farming, are old.

4.1.3 Commercialisation of the irrigation scheme

In the third scenario the government decides that the rice scheme should be commercialised which implies huge investments in the scheme e.g. further mechanisation, aggregation of plots into larger units, fewer operators and hiring skilled workers (know-how about farming). Most of the farmers and former farmers thought it was a good idea if the scheme was taken over since most of them believed that they would benefit from it irrespective of whether they were owners or renters.
However we imagine that the take over and commercialisation will have a huge impact on the farmers especially the old and uneducated as these probably have to find another job. All this of course depends on the labour availability in the nearby area, how a contract is formulated and if you are a renter or an owner. A renter is depending on the future demand for his/her labour either in rice field or somewhere else, as their labour is their only asset. Owners are in a better position, because they can refuse to give up their land if the contract is not beneficial and rented.

In this scenario more former farmers will most likely consider returning to farming compared with scenario two as the opportunity cost is less in their view (of course depending on the formulation of the contract), because it's now more lucrative to do rice farming. But in our case the take over is demanding educated farmers, so the demand for former farmers depends on, as in the case of farmers, their skills and the labour availability. If there is a labour surplus, many of the former farmers are not demanded, so they would therefore continue their present work.
Many of the former farmers, who own some land in the scheme, would probably prefer to let out their land instead of giving up their current occupations. Like the farmers they are in the position to refuse selling their land if a contract is not beneficial. Some non-farmers would maybe consider changing to rice farming, depending on their opportunity cost and again education. According to our interview with the young boys, they would not mind doing commercial farming and the reason could be that their opportunity cost is lower, because they are young and still haven't decided their future path.

In brief, if the rice scheme is commercialised both winners and losers will be created, because of the difference in their qualifications, ability to negotiate a given contract and if they are owners or renters. There is also a possibility that a given company would hire migrant workers, because they are more skilled or/and demand a lower salary. There will always be potential problems, when people from outside take over the land owned by locals.

All this might increase the income gap in the village and raise tensions and conflicts between different people.
One of the positive outcomes of a commercialisation and take over is that it might renew the generation in the rice sector.

Whether a commercialisation of the scheme will benefit the village depends on the distribution of the benefit among the villagers, the creation of other job opportunities to compensate for the loss of jobs.

5 Conclusion

From our study we can conclude that there was no single factor that has caused the decline of the participation in the Tanjung Purun irrigation scheme. Rather we found a wide range of reasons that are intertwined. At a technical level we found that the design management and maintenance was not properly. For example, some plots didn't receive water while others were waterlogged. Biologically there were problems with pests such as rats, birds and insects. According to our soil and water analysis there were no major physical constraints for producing rice reserving the inaccuracy of the instruments.
Concerning the change in land use, we found that the land was used for wet rice before the implementation of the scheme. The scheme was implemented around 1970 and was in the beginning fully utilized. From the end of 1970's and during the 1980's there has been a decline in the area cultivated. From the maps we obtained and our GPS-mapping has showed ups and downs within the last years (1995-2003). The future use the Tanjung Purun area should be for rice production.

We also found that people in general considered rice farming as non-profitable, which is underlined by the fact that most of the farmers complemented their farming with other income generating activities and most of our respondents were not engaged in farming.
Since many of our respondents are former farmers, it reflects a general change from farming to non-farming activities in the village. Young people are not interested in low-intensive farming, but wouldn't mind commercial farming.

We found that the rice sector is under de-regulation and there is an increased focus on commercial farming. This will influence the profitability of low-intensive farming, as subsidies from the poor farmer will be removed. To simulate how the different factors influence each other, we have carried out three scenarios.
According to scenario one the rice scheme will gradually be abandoned due to age and lack of interest. According to scenario two the abandonment will only be delayed. In scenario three tensions might arise between the villagers, but a positive effect is the potential generation renewal. However implementing a commercial rice scheme runs the risk of increasing the income gap between the villagers if the benefit is not evenly distributed.

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7. Appendices Time table

	Morning	Afternoon	Evening
	Departure Copenhagen-Kuala Lumpur-Kuching		
Wednesday 15 January	Arrival in Kuching. Lodging at Telang Usan Hotel.Briefing in hotel.		
Thursday 16 January	Joint preparation and consolidation of field study plan at UNIMAS		
Friday 17 January	Travel to Kpg Stunggang	Met with the community board and headman. Went to the rice scheme and continued informal discussion.	Refinement of questionnaire
Saturday 18 January	Tested the interview on villagers.	Refinement of questionnaire Discussions with supervisors.	Preparing presentation of final project plan
Sunday 19 January	Presentation of final project plan at District Council, Lundu	Presentation at Lundu district hall. Went to the beach. Village walk (Karen, Esther, Martin, Wong, Sarmed)	Agreed on sampling strategy for questionnaire. Discussions with professors about soil, pests. Agreed to set up mist nets
Monday 20 January	Final adjustments to questionnaire. Met with Kristine and Tina. All doing the questionnaire	Questionnaire (all)	Questionnaire (all)
Tuesday 21 January	The community hall flooded and we moved to hostel.	Moved to hostel. Questionnaire (Karen, Esther, Wong, Normie, Kamar). mist net and rat traps (Martin, Sarmed, Harry,Samsudin)	Questionnaire (all)
Wednesday 22 January	Questionnaire (all)	Questionnaire (all- wong) Water samples (Wong) Pests(Harry, Samsudin, Sarmed)	Questionnaire (all)
Thursday 23 January	Soil sampling (Martin, Karen, Sarmed). Water sampling (Wong)	Soil sampling (Martin, Karen, Sarmed). Water sampling (Wong). Inviting people to group meeting (Esther, Martin, Normie)	Interview (Esther, Normie, Karmar)
Friday 24 January	Interviews (Karmar, Esther, Normie)	DoA meeting (Karen, Sarmed, Kamar, Normie,Martin). Community council meeting. (Samsudin, Harry, Wong, Esther)	GPS measurement (Sarmed, Harry, Karen, Martin) Interview (Wong, Esther, Normie). Interview (Samsudin, Martin)
Saturday 25 January	Free	Preparing group interview	Group interviews (all)
Sunday 26 January	Land use mapping GPS (Esther, Karen) Soil analysis (Wong)	Land use mapping GPS (Esther, Karen) Soil analysis (Wong)	Soil analysis (Wong). Interview (Martin, Esther, Karen, Normie, Sarmed)
Monday 27 January	Free	Preparation of presentation (Esther, Martin)	Farewell party and presentation in community hall (all)

Tuesday 28 January	Leave for Kuching	Leave for Kuching	Free
Wednesday 29 January	Preparation for presentation	Preparation for presentation	Preparation for presentation. Exchanged Date from field work.
Thursday 30 January	Presentation at Unimas	Presentation at Unimas	Farewell dinner and party
Friday 31 January	Free	Free	Free
Saturday 1 February	Departure from Kuching to Kuala Lumpur		
Sunday 2 February	Arrived at Copenhagen Airport		

29. Do you think it is a good idea?_____

(X) Yes, why? on the land, instead of leaving it idle.

( ) No, why not?_____

30. Would you be willing to participate in this new scheme?

(X) Yes, why good idea, it rich farming

(X) No, why too old

Irrigation System

Please state your opinion about this system according to the scales below:

(1) Disagree
(2) Agree

1.	This system greatly increases the quality of my wet rice yield	(1,2) depends
2.	This system greatly increases the quantity of my rice production	(1, 2) depends
3.	This system greatly increases my family income	(1,2) depends
4.	This system has negative environmental effects	(1)
5.	This system brings health problems	(1)
6.	This system has fulfilled your objectives	(2)
7.	This system should be abolished	(1)
8.	The failure of this scheme should be given serious attention	(2)
9.	I do not see any positive results from this system	(1)
10.	The irrigation system should be used for another agricultural production	(1) 65 % -
11.	The management of irrigation system is good	(1,2) 70% efficiency (not 100%)
12.	The maintenance of irrigation system is good	(1,2) ~~2 5~~ 60 %
13.	I hope that this system can be reactivated	(2) it depends on the farmers themselves also Cooperation between farm
14.	This type of scheme should be implemented elsewhere	(2)

No, if anything is broken, it can take more than one week to fix it.

When you

22. Do you think the irrigation system is important? Need to change, establish a new one or develop the existing one? It's ok, no complaints from him

23. Do you think there is a salinity problem? Where? Why? No

24. Are you going to continue with wet rice planting for the next 10 years? Why?

Children try to discourage him to work

25. Do you prefer another job? Why?

26. What are your expectations for the future of the rice scheme?

If any company is interested in developing the scheme, it's ok for him, & he's willing to rent the plot out, since he's too old to farm.

27. What are your expectations of rice production in the future?

He thinks they should as much as possible be self-sufficient in rice instead of leaving the land idle.

28. Have you heard about the plans of taking over the rice scheme?

(X) Yes, from whom? LCDA (got a letter.)

Have you been consulted officially?

( ) No

The land should only be used to wet paddy. Nothing else.

17. What was the rice scheme area used for before the implementation of the scheme?

Paddy rice

18. Does this scheme bring significant difference in your yield and income?

(X) Yes, how much? In the season it's two seasons, Lit.

(X) No, why? If it goes back to one season - back to square one (depends on the surroundings.) It has a field plot one season you have to do the scheme

19. Were you informed/consulted about the decision to implement the scheme?

(X) Yes, how? ministry of agriculture, local government

( ) No

20. Have you ever been given any training on wet rice planting?

(X) Yes, by whom? agriculture department Taiwan gave demonstration.

Are you able to apply the skill(s) learnt?

(X) Yes (but he was too busy to apply all the skills (he was also a government servant) and he hired people.

( ) No, why?

( ) No, why?

21. Do you think the drainage is effecting the rice production? Why?

For him Good state. Seems that there are certain problems with other fields. Lack of cooperation between different farmers. If one farmer block the water. Some other farmers do not get any water

13. How is the production of rice done

Manually

(X) Yes

At which stage of production? all

Why? because of limited access

(

Mechanically

( ) Yes, what kind of mechanization is used?

At which stage of production?

Why?

(

14. What type of labour do you use? Costs?

He hires people (contract) 300 Rm/ acre (clearing, planting, harvesting -100 each

15. When was most of the rice scheme abandoned? Between 7 - 10 yrs back.

16. What do you think the reason(s) is/are?(internal,external) His generation tradition. do it because they are here. The second generation is not interested and no profit, hard work.

Even though the rice production ~~do back~~ does not make a big (4) profit, he does it because of tradition. Also because his plot was in the scheme and he didn't want to abandon it.

10. Do you have any problems with pests?

(X) Yes

What types? rats, insects, birds.

How do you deal with this? poison (coconut mixed with poison (for rats)) Mr hires people to do it.

( ) No

11. Do you use the irrigation system provided?

(X) Yes, how often? By whom? Depends on the requirement. - stage of the production

( ) No, why?

12. Do you receive any subsidies?

(X) Yes

What type/form? (eg irrigation system: DID) poison, fertilizer, seeds

Where do you get it (specific)? agricultural department's agricultural department

Did you get it when you need it? Yes. The programme checked when and what

If the government would increase the subsidies, would you like to increase your plot or rice production?

No, he can not go beyond that.

( ) No, why?

6. Have you tried other varieties before? Why? Yes, local only ones - acheer. It's a matter of strategy

7. How much rice do you harvest in season 1? approx. 1000 kg. rice / acre 2R

In season 2? Same 1 c

8. Do you use any fertilizers for rice farming?

(√) Yes

What type(s) is/are used? Urea

How often/much is used (amount/year/ac)? 2

Twice / season

( ) No, why?

9. Do you use any pesticides for rice farming?

(√) Yes

What type(s) is/are used? Weedkiller, insecticides

How often/much is used (amount/year/ac)?

Twice / season

( ) No, why?

INVOLVEMENT IN RICE PLANTING

1. Do you own or rent a part of the rice scheme (Tanjung Purun)?

   Own.....(Y) / N

   For how long? heritage from father years, 30 years under his name

   How big is your plot? 3 acres (2 plots)

   Rent.....Y / (N)

   For how long? _____ years

   How big is your plot? _____

   How much is the rent? _____

2. Why do you use that particular plot for rice farming? Because it was a heritage

3. How much of the land do you use for agriculture purpose? 1 plot is for social obligation, 1 for farming

   How much of the land is used for rice planting? all

   What other crops do you plant on that particular land? _____

   What is it for? (Sale, Self)? Why? self own - consumption

4. How many seasons per year do you grow rice? twice during scheme before and after ones a year

5. Which variety of rice is produced? Seed source? Why? During scheme ation, the seeds were provided agricultural department.

Malinja

before and after the scheme it was local crops (achch)

Strategi - if local crops you have to coordinate with other farmers.

Prefers both. It's a matter of strategy. (to avoid risks)

Questions for farmers who are involved in rice farming at the moment

10. How long have you been involved in rice farming?_____years

1. Have you ever taken part in any wet rice irrigation scheme?

( ) Yes, why?_____
Which one and why?_____
When?_____
( ) No, why?_____

Questions for farmers who are not involved in rice farming at the moment

12. Have you been involved in rice farming before? When?

Yes, since they knew how to walk

13. How long have you been involved in rice farming? 50 + years

14. Have you ever taken part in any wet rice irrigation scheme?

(X) Yes, when did you stop producing rice in the scheme? 2 years ago

For how long time were you engaged in the rice scheme? since the scheme started

For what reasons did you stop?_____

due to health, retired

( ) No, why?_____

7. Source of Income (Year 2002): Please mark (X)

Source (per year)			Total
Agriculture	Paddy / Rice	Sell	
		Self	
	Vegetable		
	Fruit		
	Other crops (Please specify):_____		
Livestock			
Fishing			
Government Servant			
Private Sector			
Support from children			500 Rm / mth
Business Specify:_____ _____			
Other Sources Please specify:_____			

8. Household Information (Household information of a particular house only)

Relation (a: Husband) (b: Wife) (c: Son) (d: Daughter) (e: Others)	Age	Occupation	Income	Residing together in Stunggang (Y/N)	Level of Education
b	64	housewife		Y	illiterate
d	24	Teacher	500 RM	Y	Bachelor in law

6. Level of Education: Please mark (X)

No Formal Education	Illiterate	
	Religious Class and "sekolah pondok"	
	Informal education and not illiterate	
Primary Education	Completed Primary 6	X
	Primary 5 and below	
Secondary Education	Completed Form 5	
	Until Form 4 only	
	Completed Form 3	
	Form 3 and below	
Tertiary Education	Form 6 (Higher School Certificate - HSC)	
	Diploma	
	Bachelors	
	Masters	
	PhD	

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APPENDIX A (1)

HOUSEHOLD SURVEY OF KAMPUNG STUNGGANG

Respondent No.: 160
Village: Block 5
Interviewer/group: Esther & Jenna
Day / Date: 23/1-23

RESPONDENT PERSONAL PARTICULARS

1. Age: 1435
2. Sex: M
3. Religion: Please mark (X)

Islam	X
Others. Please specify:_____	

4. Ethnic Group: Please mark (X)

Malay	X
Melanau	
Iban	
Bidayuh	
Chinese	
Others. Please specify:_____	

5. Marital Status:

Single	
Married	X
Divorced	
Widower / Widow	

ASSESSMENT OF WET RICE SCHEME IN KAMPUNG STUNGGANG

REASONS FOR FAILURE AND FUTURE PERSPECTIVES

FINAL SYNOPSIS

SLUSE JOINT COURSE ILUNRM

Group 4: Kampung Stunggang

Danish Students:

Esther Sørensen
Martin B. Jensen
Sarmad Al-Kufaishi
Karen M. De Mey

Malaysian Students:

Samsudin Bin Zawawi
Sharifah K. Bt. Wan Mohammad
Wong Ming Kui
Normi Sawawi
Pudun Dawat

Submitted December 6th, 2002

Introduction

Kampung Stunggang Melayu, Sarawak, is situated along the Kayan River about 2.5 km from Lundu city and 10 km from the South China Sea. The majority of the 1259 people from 229 households, are Malay and live primarily in individual houses often build on stilts.

The Malays dominate the coastal zone and their main defining characteristic is their Islamic religion, although their language and certain customary practices also delimit them. Nevertheless, the Malays themselves comprise a heterogeneous population. The majority originated from those of the autochthonous peoples of Borneo who converted to Islam. (King, 1992)
The Malays are traditionally small-scale traders, live from sea and inland fishing, rice agriculture (usually paddy rice cultivation), coastal gathering and more recently also commercial agriculture (King, 1992). In Stunggang, a small-scale industry (fish and prawn crackers, local biscuits and crafts) has developed and has possibly become an important income activity as well as off-farm work, since Lundu is situated nearby.

In 1972, the government implemented a wet rice scheme in Tanjung Purun, Lundu. There were two government agencies involved in this scheme: the State Agriculture Department, Sarawak and the Department of Irrigation and Drainage, Sarawak. This wet rice scheme covers an area of about 140 hectares and is located on a low-lying irrigated area.

However, in 1986, this scheme was partly abandoned by most of the farmers. Therefore, today, only 36 hectares are still cultivated by a small number of farmers on individual basis. The other 104 hectares are left idle. Many of the farmers have changed to other alternatives as sources of income.

The government had invested a large sum of money on this project hoping that rice production would increase in line with the government's policy to be self-sufficient in rice for the state. However, this attempt could not reach the objectives and instead the large sum of fund injected in this project went into waste. Consequently, the large area of land left idle is economically redundant.

This study will define and investigate the causes for the failure of the wet rice scheme and if possible make recommendations to re-utilize the area for wet rice cultivation or other economic activities.

This proposal will start with placing the study within a context of the political and economic development in Malaysia. After that, some factors that influence the dynamics of rural areas will be described in order to get a better understanding of the effects of the wider structures of the society on the village. Afterwards the government policy on rice, during and after the Green Revolution, will be presented since this probably played an important role in the implementation and abandonment of the wet rice scheme. Following, the characteristics and problems related to rice production will be briefly reviewed because these could be major constraints and causes of the failure of the rice scheme. Finally, the different methods that will be applied during the field trip are presented along with the time plan.

Literature review

Development policies

Already during the 1st World War Borneo exported tobacco and rubber, but earnings did very much depend on the world prices. The Depression in the 1930's had a negative effect on exports. During the 2nd World War the exports were exposed to fluctuations in world prices. In the post-war years a production and export boom was evident. In the 1960's Sarawak became a part of a newly established political entity –The Federation of Malaysia (Cleary&Eaton, 1995).

In the early- and mid-1960's Malaysia followed an import substitution strategy named Import Substitution Industrialization (ISI) (Cleary&Eaton, 1995). The aim was to protect infant industries and create new ones, reduce the dependence on foreign technology and capital and by that developing and diversifying the domestic industrial structure (Dicken, 1998). But the multinational corporations (MNC) began to seek low cost labour areas in Southeast Asia, so in 1968 Malaysia found it necessary to switch from ISI to Export Orientated Industrialization (EOI) and opened Export Processing Zones[1] (EPZ's) in 1972 to attract MNC (Rasiah&Shari, 2001). The switch was made possible by governmental actions like rapid liberalization, devaluation of the currency and of course the significant labour resource (Dicken, 1998).

Much of the economic development and with that social and infrastructure development has passed by the Bornean part of Malaysia. Some reasons for that are the more expensive labour cost (because of higher cost of living), the lack of proper infrastructure and difficulties in diversifying its economic base. Sarawak and Sabah for example act as suppliers of exportable primary products to the more developed core - peninsular Malaysia and other countries. Despite that, Borneo has experienced a clear improvement in living standards. (Cleary&Eaton, 1995)

Rural change in Southeast Asia - some trends

Immense changes are taking place in Southeast Asia following the rapid growth the region as a whole has experienced during the last decades. Malaysia is now characterised as second generation NIC (newly industrialised country) along with Thailand. The industrialisation and the ongoing debate on globalisation have caused some authors to question agriculture's role in the so-called global economy. In brief, the focus point in agrarian study has long time been to intensify the rural side in order to extract surpluses that could spark of an industrialisation. However some authors argue that with the economic globalisation, the rural sector has lost it centre stage of global affairs (Rigg, 1999).

[1] Is …"a relatively small geographically separated area within a country, the purpose of which is to attract export orientated industries, by offering them especially favourable investment and trade conditions as compared with the remainder of host country. In particular the EPZ's provide for importation of goods to be used in the production of exports on a bonded duty free basis." (Dicken, 1998)

Politically, agriculture plays a minor role in national agendas due to its increasing irrelevance in relation to transition to industry. At the same time structural transformations are taken place as agriculture integrates into wider structures eroding distinctiveness and autonomy of the traditional (subsistence) farming systems.
One of the trends following from what has been labelled de-agrarianization is diversifying economies (income re-orientation) and mobility (spatial relocation) (see below).

(Bryceson, 1997a: 4 in Rigg, 1999:6)

1. Occupational readjustment
2. Income-earning reorientation
3. Social re-identification
4. Spatial relocation
5. Spatial interpenetrating

According to Rigg (1999:6) the underlying forces of these dynamics are:

1. **Economic** The changing balance of return to labour between farm and non-farm activities and the widening availability of non-farm opportunities to people living, or attached to, rural areas.
2. **Social and cultural** The shift in aspirations, especially among the young, away from agricultural and towards non-agricultural pursuits.
3. **Political** The prevailing neo-liberal culture and the emergence of the structural conditions, globally, nationally and locally, which promote spatial economic integration, industrialization and, more particularly, rural industrialization.
4. **Infrastructural** The markedly improved network of communications and the corresponding increase in mobility, which has led to a transport revolution in rural areas.

Agriculture

Rice is a very essential crop in Malaysia. Firstly it is the main source of food and secondly rice farming also provides the main livelihood for about 296000 people of whom 116000 are entirely relying on rice farming (Malaysian Institute of Economic Research, 2002).
In 1960's a major change in rice industry began with the introduction of miracle rice varieties, which were catalyst for the "green revolution".

Before 1992 the rice industry was an integral part of rural poverty relief. Different measures were implemented to improve the living standards of farmers for moral, social and economic reasons of the government. That meant considerable governmental investments to modernize the industry to raise the productivity and efficiency and by that increase the income of the farmers. Investments were directed to physical infrastructure (road, irrigation and drainage system) and production cost subsidies (fertilizers, seedling etc.).

The rice industry was highly regulated and an important issue on the national agenda. The aim was to increase the output, so that the self-sufficiency would reach a minimum of 65 percent (for the country as a whole, 70% for Sarawak) (Malaysian Institute of Economic Research, 2002). One strategy was to designate suitable areas especially in Sabah and Sarawak for large-scale rice production by the private sector.
After 1992 major steps towards deregulation and commercialisation were taken. The government wanted to look beyond the self-sufficiency target and treat the rice industry as any other industry that contributes to the economic development and growth. Rice production should therefore be based on large-scale plantations and implementation of high-tech technology. The industry should be fully developed and exploited by the private sector and let the price mechanism function with no government intervention since any governmental intervention would distort the market for rice.
(Malaysian Institute of Economic Research, 2002)

Rice production

The limit of new land for rice production was reached in most of South and Southeast Asian countries by 1965. The major source of growth shifted from crop area expansion to increase in yields per hectare, by adopting new technology (mechanisation, new varieties) and use of fertilizers. (Creistan & Keijiro, 1994)

Rice is grown in mainly four diverse production environments, identified on the basis of water availability: irrigated land, tidal wetland, deep water, and upland.
The irrigated areas, which are most favourable for rice production, are producing the highest yields and are not seriously affected by the dry season. Dry periods are often one of the main problems when cultivating rice, especially in areas where rainfall varies highly during seasons and from year to year. Irrigation on the other side requires mechanization, certain level of technology, technical staff and power sources, which are not available in many cases. These requirements add extra expenses on the farmers and might be a constraint for wet rice cultivation in Kampung Stunggang.

Other problems for wet rice production can be related to water quality (Mitchell & Shrubsole, 1994). In modern agriculture, it is very often that saline water must be used for the irrigation of crops because of limited good quality water resources due to for example seawater intrusion (Linghe *et al.*, 2001). Since Kampung Stunggang is close to the sea, seawater intrusion might cause problems if the water enters the irrigation system.

According to Gupta (1990) a number of factors influencing the salt tolerance of the rice crop are the rice variety and its growth stage. Mass and Hoffman (1977), found that rice is most tolerant during germination stage, but later becomes very sensitive during early seedling growth. This sensitivity decreases and the rice becomes increasingly more tolerant with maturation. Soil fertility also influences the crop tolerance (towards salinity). It is found that crop is less affected by salinity with increasing fertility. According to Protz (1981, quoted in Norman *et al*., 1995) soils with salinity level of less than 4 dS m^{-1} in the top 25m are suitable for wet rice production in Malaysia. Also drainage control is necessary to avoid accumulation of salts (Norman *et al*., 1995).

Objectives and research questions

General Objective

The general objective of the field study is to investigate the reasons for failure of the wet rice scheme in Kampung Stunggang Melayu by assessing the suitability of the area for wet rice cultivation as well as the changing livelihoods. Also the future expectations among the villagers will be discussed.

Specific Objectives

i. a. To describe the prevailing physical environment, land use and agricultural practices and determine the soil characteristics in terms of type and nutrient content.
   b. To investigate the existing irrigation system.
   c. To determine the water quality and the extent of salinity intrusion into the wet rice scheme.

ii. a. To describe the demographic structure of the community of the Kampung Stunggang Melayu in order to assess the labour availability.
   b. To describe the difference in sources of income especially between the farming and non-farming group to evaluate socio-economic incentives for engagement in wet rice cultivation.

iii. To examine the governmental or institutional role regarding the wet rice scheme.

iv. To define the major changes in land use and livelihood during the last decades and evaluate the community perception on the future use of natural resources in the area.

Research questions

In order to reach the above-mentioned objectives, the following research questions have been formulated.

a. What is the prevailing physical environment, land use and agricultural practices?
b. What is the prevailing soil type within the study area? What is the level of nutrient in the soils in terms of nitrogen, phosphorus and potassium? Is it suitable for wet rice?
c. What is the condition of the existing irrigation system? What were the objectives of building the irrigation system? Have the objectives been fulfilled?
d. Is saline water present in the wet rice scheme area? If yes, what is the level of salinity? Is the wet rice variety tolerant to that level?
e. What is the demographic structure in terms of following parameters:
   - Age
   - Religion
   - Ethnicity
f. What is the socio-economic condition in Kampung Stunggang Melayu in terms of educational level, source of income and total income?

g. What are the differences in income level between farming and non-farming group and within the farming group according to various farming activities?
h. What is the institutional/government role in the wet rice scheme?
i. What were the major changes in land use and livelihood during the last 20 years?
j. How does the community perceive the future use of natural resources in the area?

Methodology

1. QUESTIONNAIRES

Questionnaires will be conducted to get general data about the whole village, like demographic structure (e.g. age), educational level, income activities, use of natural resources, agricultural practices, etc. By this, it is possible to obtain a big superficial (compared to in depth interviews), amount of data in a relatively short period. The questionnaires will be in Malay, so it could be possible to distribute it to some of the villagers without supervision, although it should be applied with caution.

About 60 respondents will be selected to answer the questionnaire, out of all the population in the study area. The sample will be randomly selected to avoid bias, but structured in a way that it represents the social-economic spectrum of the village.

The statistical software SPSS for Windows version 11 will be used to analyze the data obtained from the questionnaire; frequency analysis and correlations between important variables will be applied.

2. INTERVIEWS

Interviews will be applied to key informants as for example the headman of the village, the extension officer, elderly people, but in principle it can be anyone with knowledge about a specific topic (e.g. irrigation system). Also informants from the Department of Irrigation and Drainage (DID) could be interviewed to determine the role of that institution regarding the irrigation system.

Focus groups, consisting of approximately 5 people, will be formed to discuss certain topics related to the wet rice scheme. Groups of male farmers, female farmers, non-farmers and young people will be interviewed. This can give us information in an efficient way, without having to interview a lot of individuals who may possibly give us the same information. A further advantage is that the people in the group can complement each other. Focus groups could also be good to start some discussions within the group and capture inequalities, disputes or different points of view. A disadvantage may be that some people don’t dare to speak up in the group. It is up to the interviewers then to create a more relaxing atmosphere so those people feel more comfortable.

3. SOIL AND WATER SAMPLING

The soil sampling will be used to measure the soil fertility (analysis of pH and nutrient content (NPK) using standard soil test methods), soil electric conductivity (EC) and soil texture (determined qualitative by feel *in situ*). These analyses will give us an idea of the suitability of the area for wet rice cultivation. The sample points will be determined *in situ* according to land use characteristics preferably within the irrigation scheme. If there are farms outside the scheme but within our study area, these farms will also be sampled according to their size.

Water sampling will be conducted to measure the water salinity because this may be a problem for the rice cultivation as the area is near the sea. Water samples from the river will be taken at the inlet point, e.g. the pump house, and the outlet point of the irrigation canal. The need for sampling within the irrigation scheme will be determined *in situ*. If the irrigation system is completely abandoned by the farmers, in other words, the farms are not irrigated by the water from the canal, the need for sampling within the scheme is not justified.

4. IRRIGATION EFFICIENCY ASSESSMENT PROCEDURE

General observation guided by the following checklist will be carried out to assess the efficiency of the irrigation system. The assessment will take a qualitative approach instead of the more technical environmental engineering approach due to lack of time and experience.

- Type of irrigation system.
- Slope of bed.
- Roughness of canal material.
- Elevation of head canal relative to the field.
- Course and curve of the irrigation canal.
- Field leveling.
- General irrigation practice.

5. OBSERVATIONS

Observations will allow us to get a general idea of the village, available natural resources, infrastructure, level of technology, public services, labour mobility. It can also be an appropriate method to investigate and estimate irrigation system problems.

6. VILLAGE WALK

A village walk will give a visual overview of the village, the infrastructure, fields and can be used to select the sampling sites. Also a tour on the river would be good to analyse differences between the both sides of the village in terms of housing, economic activities etc.

7. INFORMAL CONVERSATIONS

Throughout our stay in the village it is unavoidable to get involved in informal conversations with people now and then. This will inevitable give us useful information. Since the circumstances are informal it is probable that we get information that is not otherwise obtainable.

8. LITERATURE AND SECONDARY DATA

Literature and secondary data will be used as a supplement to our findings. Both will be obtained in libraries, universities, regional institutes and departments, on the Internet, etc.

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Appendices

Questionnaire

Household Members (name, address)						
Sex	1=F 2=M					
Age	1=0-6yrs 2=7-12yrs 3=13-20 4=21-30 5=31-50 6= 50<					
Religion	1=Muslim 2=Christian 3=Hindu 4=Buddhist 5=other[2]					
Ethnicity	1=Malay 2=Chinese 3=Indian 4=Other					
Marital Status	1=married 2=unmarried 3=widow(er) 4=divorced 5=other[3]					
Side of the river	1=east 2=west					
For how long have you been living in the Village	1=always 2=<5 yrs 3=5-10yrs 4=10<yrs					
Educational Level	1=Religious school 2=1-6yrs 3=7-9yrs 4=10-11yrs 5=12-13yrs 6=other 7=none					

[2] Write down the religion
[3] Specify ”the other”

Sources of income[4]						
1=rice farmer 2=other crops farmer[5] 3=animals[6] 4=gardener 5=other farm activities 6=fisherman 7=labour[7] 8=factory worker	9=trader/ business 10=shop owner 11=teacher 12=public servants[8] 13=private employee[9] 14=remittance 15=other					
The most profitable source of income[10] (1=rice farmer, 2=other crops farmer, etc)[11]						
Total income						
If doing non-farm work						
What[12]						
Where						
Why						
Since when						
If doing farm work						
What[13]						
Where						
Why						

[4] it's possible to choose more than one
[5] Specify

[6] Specify
[7] working for others. Farm and non-farm activities. Remember to specify what.
[8] Specify
[9] Specify
[10] It's possible to choose more than one
[11] Use the numbers from above
[12] Use the numbers from above
[13] Use the numbers from above

Since when					
Ownership (house ,car, field ,size of field Look around!!					
Future expectations,dreams					

Interviews

Questions for the key informant(s)

1) Who owns the rice scheme?

2) How is the rice scheme divided (between farmers)?

3) What is the price of rice(aprox.) globally and locally?

4) When was (most of the) rice scheme abandoned?

5) Why did it happen?

6) Have you got other examples of failure in rice schemes?

7) Did they face similar problems?

8) Who owns the machinery (channels, gates,..) in the irrigation system?
    a) Now?
    b) Before?

9) Who manage the irrigation system?
    a) Now?
    b) Before?

10) What type(s) of rice is normally produced?
    a) Why?

11) What type(s) of rice is normally exported?

a) Why?

12) Is anything else (other crops) produced in the rice scheme area?

a) Why?

13) Is the work done manually or is some kind of mechanization used?

a) Why?

14) What is the governments role in:

a) Establishing the rice scheme/system?

b) Maintaining the rice scheme/system?

c) Investigation of why the rice scheme failed?

15) What are your expectations for the future of the rice production (in general)?

16) What are your expectations of the future of the rice scheme?

Questions for those who have been or are at the moment engaged in the rice scheme

1) Do you own or rent a part of the rice scheme?
    a) If rent/own– for how long?
    b) How big is your plot?
    c) Why do you use that particular plot?
2) What is your income from producing rice?
3) Are you engaged in other farming activities?
    a) What activities (1,2,3..)?
    b) Where?
    c) For whom?
    d) The income(1,2,3..)?
4) When was most of the rice scheme abandoned?
5) What do you think the reason(s) is (are)?
6) What was the rice scheme area used for before the implementation of the scheme?
7) How much rice do harvest each season (aprox.)[14]?
8) How many season per year do you grow rice`?

[14] Maybe a comparison with an other ”standard” field is needed.

9) Type of rice produced?

    a) Why?

10) Do you use fertilizers and what kind?

    a) How much?

11) Do you irrigate your field?

    a) If so, how often?

12) Do you get any subsidies (fertilizers, price,..)?

    a) If so, where do you get it?

    b) If not, why?

13) Is the production of rice done manually or is some kind of mechanization used?

    a) Why?

14) Is there any labour input?

    a) Do you hire labour?

    b) Do you use family labour?

15) What is your production for?

a) If export, why?

b) If for the local market, why?

c) If for own consumption, why?

16) Do you produce anything else on your plot than rice?

a) Why?

b) What is it for (for sale, own consumption)?

c) Explain why?

17) What are your expectations of rice production in the future?

12) What are your expectations for the future of the rice scheme?

Tentative Time Plan of Field Work

Date	Morning	Afternoon	Evening
Tuesday 14 January	Departure Copenhagen-Kuala Lumpur-Kuching		
Wednesday 15 January	Arrival in Kuching. Lodging at Telang Usan Hotel. Briefing in hotel.		
Thursday 16 January	Joint preparation and consolidation of field study plan at UNIMAS		
Friday 17 January	Travel to Kpg Stunggang	Initial field work – familiarise with area, making appointments, talk with head-man, testing of questionnaires	Refinement of proposal, methodology, questionnaire
Saturday 18 January	Initial field work – testing interview, observations	Further adjustments of proposal, interview,…	Preparing presentation of final project plan
Sunday 19 January	Presentation of final project plan at District Council, Lundu		
Monday 20 January	Household survey	Household survey	Household survey
Tuesday 21 January	Household survey	Household survey	Household survey
Wednesday 22 January	Interview with key informant from DID, other government department and perhaps market survey		Household survey
Thursday 23 January	Interviewing of focus groups and in-depth interviews of farmers		
Friday 24 January	In-depth interviews with farmers and non-farmers		
Saturday 25 January	Field observations and sampling (soil and water)	Field observations and sampling (soil and water)	Interview of key-informants
Sunday 26 January	Field observations and sampling (soil and water)	Field observations and sampling (soil and water)	Interview of key-informants
Monday 27 January	Interview of key-informants	Interview of key-informants	Collecting missing information or data
Tuesday 28 January	Preparation of debriefing at Ocean Park Resort		
Wednesday 29 January			
Thursday 30 January	Debriefing at District Council Departure from Lundu	Lodging at Telang Usan Hotel (Kuching)	Farewell dinner in Kuching
Saturday 1 February	Departure from Kuching to Kuala Lumpur	Departure Kuala Lumpur-Copenhagen	
Sunday 2 February	Arrival Copenhagen Airport		