Czech University of Life Sciences Prague

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Evaluation of Activities of Training Centre Agrolhutan, North Sumatra

Master thesis

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Declaration

I, Kateřina Maierová hereby declare that this thesis entitled *"Evaluation of activities of training centre AgroIhutan, North Sumatra"* is my own work and all the sources have been quoted and acknowledged by means of complete references.

In Prague, 16.4.2014

Kateřina Maierová

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Abstract

Indonesia is one of the developing countries that, unlike developed countries, have steadily growing economy. On the other hand, in 2011 approximately 50% of total Indonesian population lived in rural areas, where the main source of income is agriculture and where poverty is concentrated. In these areas agricultural education is important, especially practical trainings of agricultural techniques. One of the ways of practical agricultural education in Indonesia is private demonstration training centre AgroIhutan in Tapanuli, North Sumatra. The centre includes 15 hectares of arable land and it is used for practical high schools agriculture courses. The Centre is running like a small scale farm, and has to combine activities to be financial sustainable and at the same time to have enough demonstration fields and processes for practical trainings. Only the demonstrative possibilities are ensured nowadays. The main aim of the survey was to analyze all the activities of the centre, evaluate them, determine the greatest obstacles in its sustainability and suggest an optimized solution that would improve the situation. The survey was conducted within the three target groups working in the centre: the management, employees and external authorities. The survey methods were semi-structured interviews, informal interviews, focus group discussion, observation and field guide. For optimization of planting crops was used linear modelling software The General Algebraic Modeling System (GAMS). The main weaknesses of the centre were determined based on SWOT analyses– the lack of management, unutilized resources and financial unsustainability. The recommendations are divided into three sectors i) improvement in management, ii) improvement in production and iii) enlargement of demonstration activities. These steps and changes should improve the financial sustainability, partial food self-sufficiency of the agriculture centre (87% of self-sufficiency in consumption of rice, 100% of self-supply in cooking gas) and provide stabile background for agriculture education in this region.

Key words*: optimization, practical training, sustainability, demonstration centre*

Abstrakt

Indonésie je jednou ze zemí náležející k rozvojovým zemím, které mají nepřetržitě rostoucí ekonomiku. Na druhé straně, přibližně 50% celkového indonéského obyvatelstva žilo v roce 2011 v rurálních oblastech, kde je hlavním zdrojem příjmů zemědělství a kde je koncentrovaná chudoba. V těchto oblastech je významné zemědělské vzdělání, a to především praktické tréninky zemědělských technik. Jednou z cest praktického zemědělského vzdělávání je soukromé vzdělávací demonstrační centrum AgroIhutan v regionu Tapanuli na Severní Sumatře. Centrum tvoří 15 hektarů orné půdy a je využíváno k absolvování praxe studentů středních zemědělských škol. Centrum funguje jako drobná farma a musí kombinovat aktivity k udržení finanční stability a zároveň mít dostatek demonstračních polí a zpracování pro praktické ukázky. Dnes však plní pouze tu demonstrační podmínku. Cílem výzkumu byla analýza všech aktivit centra, jejich vyhodnocení, stanovení největších překážek v udržitelném rozvoji a navržení optimálního řešení. Výzkum byl proveden se třemi cílovými skupinami osob, které jsou zapojeni do aktivit a fungování centra: management, zaměstnanci a externí autority. Jako výzkumné metody byly použity polo-strukturovaný rozhovory, neformální rozhovory, pozorování, skupinové diskuze a terénní prohlídky. Pro optimalizaci pěstování plodin byl použit lineární modelovací software GAMS. Na základě SWOT analýzy byly stanoveny jako hlavní slabé stránky centra nedostatečný management, nevyužívání dostupných přírodních zdrojů a finanční nestabilita. Opatření ke zlepšení byly rozděleny do třech sektorů – i) zlepšení managementu, ii) zvýšení produkce a iii) rozšíření demonstračních aktivit. Tyto kroky a změny by měly zajistit finanční udržitelnost a částečnou potravinovou soběstačnost centra a poskytnout stabilní základ pro kvalitní zemědělské vzdělávání regionu.

***Klíčová slova**: optimalizace, praktický trénink, udržitelnost, zemědělské techniky*

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Abbreviations

AED - The Agricultural Extension Department

BIRU - Biogas Rumah Programme (Domestic Biogas Programme)

CULS – Czech University of LifeSciences Prague

FAO – Food Agriculture Organization

FBS - Farm Business School

GDP – Gross Domestic Product

HDI – Human Development Index

HIVOS - Humanist Institute for Cooperation with Developing Countries

IPM – Integrated Pest management

IFAD – International Fund for Agricultural Development

IFS - Integrated farming systems

ICM – Integrated Crop Management

PIDEL – Politeknika Informatika DEL

PDBP – Pakistan Domestic Biogas Programme

RSPN – Rural Support Programmes´ Network

SNV – Smart Development Works

UNDP – United Nation Development Programme

UNITA - University Sisingamangaraja XII Tapanuli Utara

1. Introduction

Indonesia is one of the developing countries which have, unlike developed countries, steadily growing economy. But still, half of the population live in rural area and their income depends on agriculture. Approximately 50% of Indonesian people live in rural areas and they are directly dependant on agriculture activities. From total population 234 million people more than 32 million (12%) live below poverty line and almost half of population lives around the national poverty line which is $22 per month. The dependency of population on agriculture activities increases the significance of agriculture education, especially the practical skills. The agriculture high schools in region of North Sumatra provide practical trainings as a part of obligatory curriculum through the practical courses at agriculture training centre AgroIhutan. The centre was established in 2002, includes 15 hectares of arable land and works as a demonstration centre for high schools students. In past it was also used for informal agriculture education and advisory centre for local farmers. Centre is running as a small scale farm, and has to combine activities to be financial sustainable and in the same time to have enough demonstration fields and processes for practical trainings. Only the demonstrative possibilities are ensured nowadays. The director of the centre addressed the Czech University of Life Sciences Prague (CULS Prague) with offer of open opportunity for university students to conduct the research at his farm and focus the survey on the analysis of farming activities, financial management, labour force and educational activities to help him identify the principle obstacles in the development of the centre. This paper is focused on the management analysis, labour force and sustainable agriculture activities. This study could serve as basic document, providing information about centre, which are key materials for any project plans with any institution and which the centre is also missing.

2. Literature review

This chapter describes the currents situation in agricultural sector in Indonesia and introduces the main circumstances which are connected with the topic of this thesis.

2.1. Development of strategies in Agricultural Sector of Indonesia

Approximately 50% of Indonesian people live in rural areas and they are directly depending on agriculture activities. From total population of 234 million people live more than 32 million (12%) below the poverty line and almost half of population lives around the national poverty line which is $22 per month. Indonesia went through a long era of extreme unsustainable approach to agriculture production and taught a lesson from it (Barbier, 1989). Since 1967 they have been trying to get self-sufficient in rice production. It was reached in 1984, when for the first time the Indonesian rice production exceeded rice consumption. On the other hand, due to the focus on highest production with all possible tools, it had a negative influence on sustainability of Indonesian agricultural development. The economic costs of gaining self – sufficient amount of food were extremely high, because of governmental subsidize for fertilizer, irrigation and pesticides. From 1970 to 1984 the use of fertilizers increased from 0.2 to 4.1 million tons, the use of pesticides increased from 1080 to 14210 tons and the total irrigated area increased from 3.7 to 4.9 million hectare. Due to the fact that farmers were not forced to pay full price of fertilizers and pesticides it resulted into their inappropriate, excessive and economically inefficient application. It lead to gradual contamination of soil and evolution of pesticide resistance pests. The same problem had occurred with irrigation, when farmers were not responsible with paying full costs of irrigation water and it was wasted and overused (Barbier, 1989). As the amount of rice production was rising, the needs of building infrastructure as roads, irrigation networks and processing equipment also grew up. Expand of cultivated area also resulted in moving families from cities to

marginal rural areas with available land. This program was also extremely expensive (US$ 9000/family). Clearly, the Indonesian high production – led approach was not successful and sustainable. In 1986 president Suharto banned 57 types of pesticides, established integrated pest management (IPM) programme and became aware about sustainable agriculture development (Barbier, 1989; Hendriadi and Alihasyah, 2007).

2.2. Current situation of agricultural sector

Even though the government forbidden to subsidize and support overutilization of chemicals, fertilization and irrigation, there are not properly followed approaches to keep biodiversity, to sustainable use of resources or waste management. Large parts of Indonesia, especially Sumatra, are covered by palm oil or rubber plantation and because of this industry thousands of hectares of tropical forest are being harshly devastated (Winter, *et al*. 2013). These plantations or huge factories are often the only source of income for rural families. Traditional agriculture due to lack of knowledge, techniques, enthusiasm, effort, infrastructure and sophisticated market access does not generate satisfactory income (World Neighbors, 2006; Saleh, 2013). People leave the agriculture activities and became dependent on expensive food imported to the country; even though the country has a capacity and potential to produce enough food. In 2012 the Indonesian Ministry of Agriculture gave priority to strategies improving the productivity of its five prime agri-food commodities – rice, soybeans, sugar, cattle and maize – towards achieving self sufficiency. The long term goal is 90% of food self sufficiency (Nunzio, 2013).

2.3. Problematic issue of agriculture in Indonesia

Nowadays approximately 50% of total Indonesian population lived in rural areas in 2011, where the main source of income is agriculture and where the poverty concentrates. 9.9% of poor population live in urban area, while in rural areas is poor 16.6% of population (IFAD, 2012). In 2011 the agriculture land covered 30.1% of total land and employed 35.9% of total population. On the other hand, annual growth of urban population is 2.5% (World Bank, 2012), people are leaving rural areas and moving to cities, where the possibility of stabile job and higher income is more likely. Even though the country is focused on production of crops with high potentially market value as a cocoa beans, coffee, nutmeg, cloves and palm oil, there is still lack of processing industry, investments, market system and education, which cause lower added value of production and low profit (World Bank, 2012).

2.4. Role of practical education

According to several studies describing factors of economic growth, one of the most significant issues in economic development is a human capital. It is made by combination of competencies, skills, knowledge, personality and cognitive abilities. Recent studies also demonstrate that for right development of these partial factors the education plays an irreplaceable role. Knowledge, skills and competencies which influence the growth of capital income are accumulated through education. Education, generally defined as *"all deliberate learning activities",* is usually used for estimation of human capital (Appleton, Mackinnon, 1993; Griliches, 1996). Agriculture educations directly affects the capacity of people to produce more output with higher efficiency, better gathering and analyzing the information and quick adaptation to new conditions, situations and technologies. Generally, the education is considered as a main factor in the process of economic growth. Hanushek and Wößmann (2007) consider a major factor in development the ability to use and produce knowledge. In this context it seems that agriculture education is a key factor for economic growth in Indonesia and for at least partial food

subsistence of country. The popularization of agriculture and offering interesting alternatives in education and practising can attract people to return to agriculture activities while using proper methods that can increase the sustainability of development (Appleton,Teal 1998; IIASA 2008).

More than 2500 years ago Confucius said*: "I hear and I forget. I see and I remember. I do and I understand"*. Learning pyramid (NTL, 1954) (figure 1) confirms this statement by expression of the retention rate of each teaching method. It indicates that after method of teaching other people, the most efficient in learning process is method of practising.

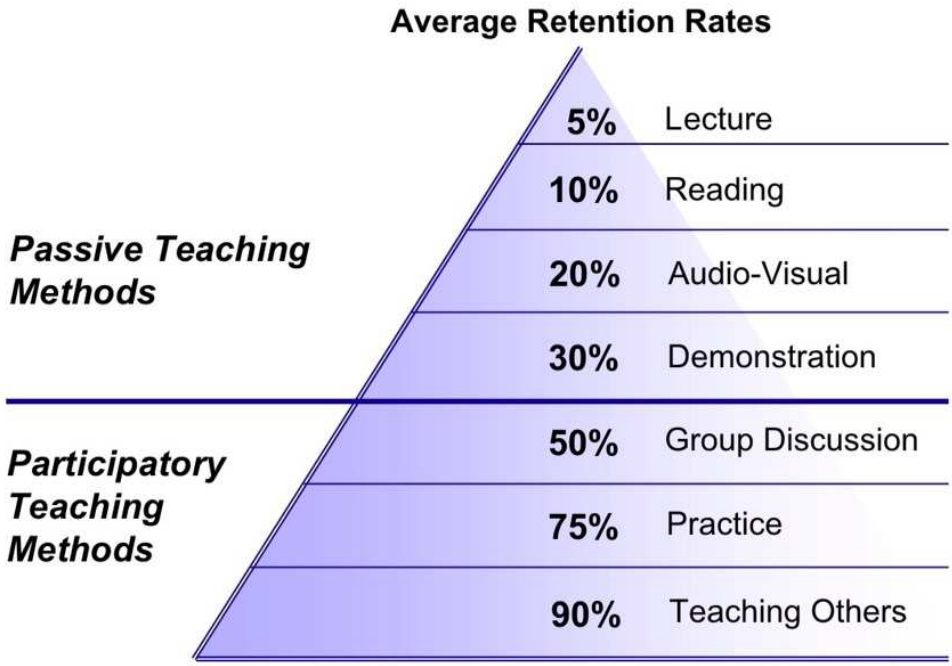

Fig. 1: Learning Pyramid including teaching methods with average retention rate (NTL, 1954)

"There is only one effective way to teach someone how to do anything, and that is to let them do it" (Reigeluth, 1999). Many experiences prove that the most powerful and efficient learning process occurs in taking action, "learning by doing" and practices. Engagement, experiences and learning by doing develop the greater and deeper knowledge, commitment than reading and listening, planning

and thinking (DuFour *et al.* 2006). Practical education is important complex program of trainings relevant for job-skills building with specific needs to achieve the target skills (Oketch, 2006).

Based on Kříž (2010) the objectives of practical education are:

- To develop practical skills and professional attitude in oneself lifetime
- To familiarize students with their future job activities
- Respond the demand of specific professional skills in the labour market
- Prepare the participants/ students to be ready to performing practical activities related with the attended course
- To facilitate the accepting and adoption of new mechanics or technologies into the length the attended course
- To learn technical method of knowhow of certain products production
- To combat the unemployment, poverty and its derivates
- To gain respect and self reliance in work

2.4.1. Demonstration centre

The practical education and training can be provided through various institutions used different models. It can includes educational institutions as agricultural schools, food technicians education centres, agriculture and food science faculties, farmers' training centres or demonstrative fields, depending on the type of students trained and type of requested skills. SD and FAO (1997) suggested the training should take account of the new emphasis on agricultural diversification instead of single commodity production. There are several models of agriculture education, such as private institution, which has agreement with school and provides trainings as a part of obligatory education by the outsourcing. Other model is the Farm Business School (FBS). The purpose of FBS is to work with farmers to help them build knowledge and skills to make their farms more profitable. They will do this by learning about business in their own local environment (FAO, 2011[2]).

Based on AED (1993), the demonstration farm is a farm unit of not less than 4 hectares nor more than 32 hectares, with any economic gains considering as an added bonus. The farm can be specialized on specific sector, as a cultivation of one crop, animal breeding or processing, but the generally, the purpose of the farm is to demonstrate:

a) New or improved varieties of agricultural and horticultural crops
b) The handling and management of soils
c) The adaptability of certain soils to certain crops
d) Improved cultural methods in the growing and harvesting of crops
e) Improved methods in farm management and in farm accountancy

The concept of demonstration field is use in various spheres, as a example serve also demonstration forests, with aim of "*developing, testing and demonstrating innovative approaches to forest management, including the use of local-level indicators to monitor progress"*(FAO, 2014). The effective education requires facilities for practical training and demonstrations. Such facilities are expensive and also therefore it might be of advantage to the government concerned to establish a training centre at one place, where all resources available could be concentrated and personnel trained at required levels and participants need to be basically literate and numerate (FAO, 1979).

2.5. Sustainable agriculture approaches

The training centre AgroIhutan is a demonstration centre, which has an interest and possibility to spread the information among the rural population in North Sumatra. Its intention is to use enormous potential of agriculture in region and provide know-how of leading sustainable and at the same time self – sufficient farm that feeds the family. This chapter provides complex proposal, reasons and information about topics that are connected to sustainability and that should be at least partly taken into consideration in practicing and learning process.

In last decade intensification, use of chemical protection, irrigation systems, machinery and fertilizers caused huge growth of agriculture production (Pretty, 2008). But with the production also increased negative impact on environment; last 35 years doubled production is linked with 6.87 times higher use of nitrogen fertilization, 3.48 times higher use of phosphorus fertilization, 1.68 time larger amount of irrigated cropland, and 1.1 time more in land in cultivation (Tilman, 1999; Tilman *et al.* 2002). The last years were intensively focused on study and development of sustainable agriculture techniques. Ikerd (1993) defines a sustainable agriculture *as "capable of maintaining its productivity and usefulness to society over the long run. …it must be environmentally-sound, resource-conserving, economically viable and socially supportive, commercially competitive, and environmentally sound"*. Word sustainable came from Latin *sustinere*, which means to keep in existence, endure, stand, implying permanence or long-term support. It is extremely difficult to determine whether certain agricultural practices are sustainable or not (Rigbya, Cáceresb, 2001).

New innovative approaches in agricultural production are needed (Pacini *et al*. 2003; Pretty, 2008); they will integrate biological and ecological processes into food production and minimize the use of non-renewable inputs that cause negative impact to the environment (Pretty, 2008). Due to the close relationships between agriculture and nature environment is not possible to exactly determine, which system or method will be successfully sustainable in different place, in different time (Ikerd, 1993, and Youngberg and Harwood, 1989), *"Sustainable practices will vary both temporally and spatially and can only truly be identified in retrospect. It is not simply a question of tools and inputs, but the context in which they are used"* (Rigbya, Cáceresb, 2001). Due to this reason, we will briefly describe some of the sustainable methods or technologies, which we will take into consideration during planning suggestions and improvement of centre. It will include a) semi-subsistence farming, b) organic farming, c) polycultures and d) sustainable agriculture approaches (integrated farming systems, integrated crop management, integrated pest management) and one example of sustainable technology, the biogas plant.

2.5.1. Semi-subsistence farming

“Subsistence and semi-subsistence farming” term has been researched many times in the last decades, but generally agreed definition was not reached yet. The main approaches to this subject are based on some criteria such as: farm size, economic size and market participation (Giurca, 2008). In this case is only market participation differentiation relevant. From this point of view, there is distinction between farms producing only for own consumption and between farms producing primary for selling. Doppler (1992) divided farms to those, that sell up to 10% of their production as subsistence farms, those that sell 10-90% as “transitory” (or semi-subsistence) farms, and those that sell more than 90% of their production as commercial farms. Very often studies just use a 50% threshold, classifying all farms selling less than 50% as subsistence farms and all those selling more than 50% as commercial (Heidhues and Brüntrup 2003). However, it is impossible to properly identify form of farms in this simplified bimodal classification, but we can estimate the training centre as semi-subsistence.

2.5.2. Organic farming

There are many arguments saying, that organic farming and sustainable agriculture are synonymous (Rigbya, Cáceresb, 2001). Lampkin (1994) provides a modern definition of organic farming*: “aim of organic farming is to create integrated, humane, environmentally and economically sustainable production systems, which maximise reliance on farm-derived renewable resources and the management of ecological and biological processes and interactions, so as to provide acceptable levels of crop, livestock and human nutrition, protection from pests and disease, and an appropriate return to the human and other resources*”. In many developed countries, there exist schemes which "certify" products as being organic. Very specific requirements, including products, farming techniques and methods of processing which are permitted, and others which are prohibited belong to these schedules. Traditionally organic farming involves using natural inputs for fertilisers and pest control, and techniques such as composting and crop rotation (Rigbya, Cáceresb, 2001). The following table, number 1, contain all main rules and principles established by IFOAM (1998).

Table 1: The principle aims of organic production and processing (IFOAM, 1998)

To produce food of high quality in sufficient quantity.
To interact in a constructive and life-enhancing way with natural systems and cycles.
To consider the wider social and ecological impact of the organic production and processing system.
To encourage and enhance biological cycles within the farming system, involving micro-organisms, soil flora and fauna, plants and animals.
To develop a valuable and sustainable aquatic ecosystem.
To maintain and increase long term fertility of soils.
To maintain the genetic diversity of the production system and its surroundings, including the protection of plant and wildlife habitats.
To promote the healthy use and proper care of water, water resources and all life therein.
To use, as far as possible, renewable resources in locally organised production systems.
To create a harmonious balance between crop production and animal husbandry.
To give all livestock conditions of life with due consideration for the basic aspects of their innate behaviour.
To minimise all forms of pollution.
To process organic products using renewable resources.
To produce fully biodegradable organic products.
To produce textiles which are long-lasting and of good quality.
To allow everyone involved in organic production and processing a quality of life which meets their basic needs and allows an adequate return and satisfaction from their work, including a safe working environment.
To progress toward an entire production, processing and distribution chain which is both socially just and ecologically responsible.

2.5.3. Polycultures

Many modern farms practise monoculture, growing only one type of animal or plant. With large populations of the same organism, though, there is greater susceptibility to all sorts of problems. Diseases and pests can grow up to large populations. One type of resource (required by that variety) can be totally depleted, while other resources on the farm are under-used. If the market becomes depressed, income can be devastated. A polyculture involves growing a variety of different crops or animals, in order to overcome such problems.

2.5.4. Sustainable Agriculture Approaches

This concept is based on good planning and monitoring the condition of the farm and market which will allow the farmer recognize and solve problems before they lead to irreversible degradation. Integrated agriculture management creates this structure, see the figure 2:

- Integrated farming systems (IFS)
    - Integrated crop management (ICM)
        - Integrated pest management (IPM)

Fig. 2: Sustainable agriculture system includes integrated approaches, (European Crop Protection Association, 2010)

These terms have been defined as *"a holistic pattern of land use which integrates natural regulation processes with farming activities to achieve maximum replacement of off-farm inputs and to sustain farm income"* (El Titi, 1992). All specific types of management are based on careful consideration of all possible techniques and choosing the most appropriate combination with respect to economical justification and reduction or minimization of risks to human health and the environment (FAO, 2014).

2.5.4.1. Integrated farming systems (IFS)

Integrated farming system´s "*goals of IFS are to sustain agricultural production, maintain farm incomes, protect the environment and respond to consumer concerns about food quality issues* (Morris, Winter, 1999), or from the Third World economical point of view *An integrated farming system is proposed as a mean of the cost of fuel, feed and fertilizer reduction with the minimum capital investment* (Chan, 1985). IFS are based on farming activities which are mutually combined,

interconnected and result into sustainable, self-reliance and subsistence system with a greater efficiency (Edward *et al.,* 1988). The main reasons for involvement of animals into cropping system is need to reduce wasting of crop residuals and use them with benefit for farmers (FAO, 1991).

2.5.4.2. Integrated crop management

Integrated crop management is particularly suitable for small scale farmer, because it minimizes the costs and purchases of inputs usually used in conventional farming. Very often is used as crop – livestock combination. Following table 2 describes key components and objectives of integrated crop management.

Table 2: Key components and objectives of integrated crop management (Natural Resources Institute 2003)

Component	Aim
Minimum tillage and soil conservation techniques	Low-cost maintenance of soil structure and fertility
Use of nitrogen-fixing plants, green manures and agro-forestry techniques	Improvement of soil fertility
Biological methods of pest and disease control	Cheap and sustainable plant protection
Crop rotations	Prevent build-up of pests, disease and weeds
Productive use and disposal of plant and animal residues	Prevent damage to soil, water, human, plant and animal health
Maintenance and improvement of ecological diversity	Avoid loss of biodiversity and damage to habitat
Minimum use of purchased inputs and non-renewable fuel resources	Reduce production costs and environmental damage

2.5.4.3. Integrated pest management:

One of the most common definition explains IPM as a *"a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks"* (Food Quality Protection Act, 1998). Its aim is to limit the occurrence of pests, by starting with environmentally friendly cultural and biological measures and end of using chemical pesticides with direct mode of action. It includes combination of cultural, biological and chemical activities such as pest-resistant plants varieties, pest attractants and repellents, bio-pesticides, use of weather data to predict the onset of pest attack and cultural practices such as rotation, mulching, raised planting beds, narrow plant rows, and inter-seeding (Tette, 1997). IPM should provide a cost effective, environmentally sound and socially acceptable method of managing diseases, insects, weeds and other pest in agriculture (Bajwa, Kohan, 2002). In case of planting cassava, we can recommend replace use of herbicides against weeds by integrated control measures. Examples of integrated weed control are combining one weeding with the use of an improved variety of cassava, planted at optimum density and combining a preemergence herbicide with late weeding (Ekanayake et al. 1997).

2.5.4.1. Biogas implementation in Indonesia

As the example of the successful implementation of the sustainable technology applied in Indonesia is the biogas digestor. The Indonesian Government has the long term ambitious goal to reduce emissions of greenhouse gas by 26% by the year 2020 and increase to share of renewable energy by 25% by 2025 in the total energy mix. These targets also include the support of establishment of biogas stations. Nowadays, the share is minor, even though the mass deployment in rural areas can deliver very significant results and due to the frequent livestock on farms. This procedure is the logical measure. As a result of bilateral cooperation

between the government of Indonesia and the government of Netherland is Indonesian Domestic Biogas Programme (BIRU or Biogas Rumah Programme) aimed at increasing the access of rural people to modern energy. Thanks to this programme more than 4500 biodigestors have been built and installed, mostly on Java, Bali and Sulawesi since May 2009. Another 4000 installations are planned for 2012. The sustainability issue is ensured by provided financial support of farmers, provided services of biogas stations for at least two years and trainings of more than 500 people for construction and installation of biodigestors. Financial subsidy creates approximately 30% (2 000 000Rp/130 EUR) of total investing cost (BIRU, 2012).

Biogas is a valuable technology that apart from providing clean cooking fuel provides gas for lighting, eliminates smoke from the kitchen, thus reduces related health problems, mainly referring to women- and produces as a by-product organic bio-slurry that can be used in agriculture (SNV, HIVOS 2009). The bio-slurry is rich with nutrients that are needed for vegetables and crop production (Ghimire, 2005). With the application of bio-slurry, biogas users can increase agriculture production and also save money with replacing expensive chemical fertilizer. More than 88% of biodigestor users are currently using bio-slurry as fertilizer, based on the biogas user survey from year 2011 (JRI, 2011). The survey also shows that 78% of users have registered cleanliness of shed improved, 78% cleanliness of yard improved, 49% of users indicate a considerable decrease of cost for chemical fertilizer (on average Rp.184 324/cultivation cycle of 4 to 6 months) and 43% of farmers claim an increase of their yields, while 28% average increase of yield (JRI, 2011; BIRU, 2012).

The combination of bio-slurry with chemical fertilizer (50:50 on the nitrogen content basis) gave the similar yield as obtained by the application of recommended dose of chemical fertilizer. The integration of slurry and fertilizer is environment friendly and reduces the cost of production for vegetables (RSPN et. al., 2013). Some papers also report, that application of bioslurry has even higher yield with comparing with synthetic fertilizers, specifically production of rice. Most of studies confirm higher quality of agriculture products, when bioslurry is applied, then synthetic fertilizers. A couple of papers report on the potential of using

bioslurry as pesticide. Studies found that bioslurry is a good alternative to synthetic pesticides in order to combat nematode manifestations. Other papers report on the effects of bioslurry as an alternative to conventional fungicides. All these factors direct to conclusion, that at least partial application of home-made bioslurry has positive impact on economic issues of agriculture production and decrease production cost (FAO,2013)[3].

This review can provide the basic information and overview about importance and potential of training centre. Based on this background study we can set up the direction of the centre – self-sufficient, sustainable, financial stabile and diverse farm.

3. Aim of the study

AgroIhutan is a training farm with great potential but with the lack of management practices and unutilized arable. Based on the request from the owner of the training centre AgroIhutan this paper aims on analysis of financial situation, labour force and agriculture activities and suggest recommendations on farming issues and marketing improvements. Thesis also aims on finding the optimal solution for the future development and provides basic materials for possible cooperation with any institution. To fulfil the principle aim of the paper, we established following specific objectives.

1. To determine the feasibility of sustainable technologies and integrated agriculture procedures at farm
2. To increase the agriculture production with respect to demonstration activities
3. To ensure the financially sustainability and stability
4. To ensure the partial food self-sufficiency

4. Methodology

This paper is based on three parts including literature review written on a summary of existing literature resources and overview of published facts, practical field survey and data analysis (figure 3).

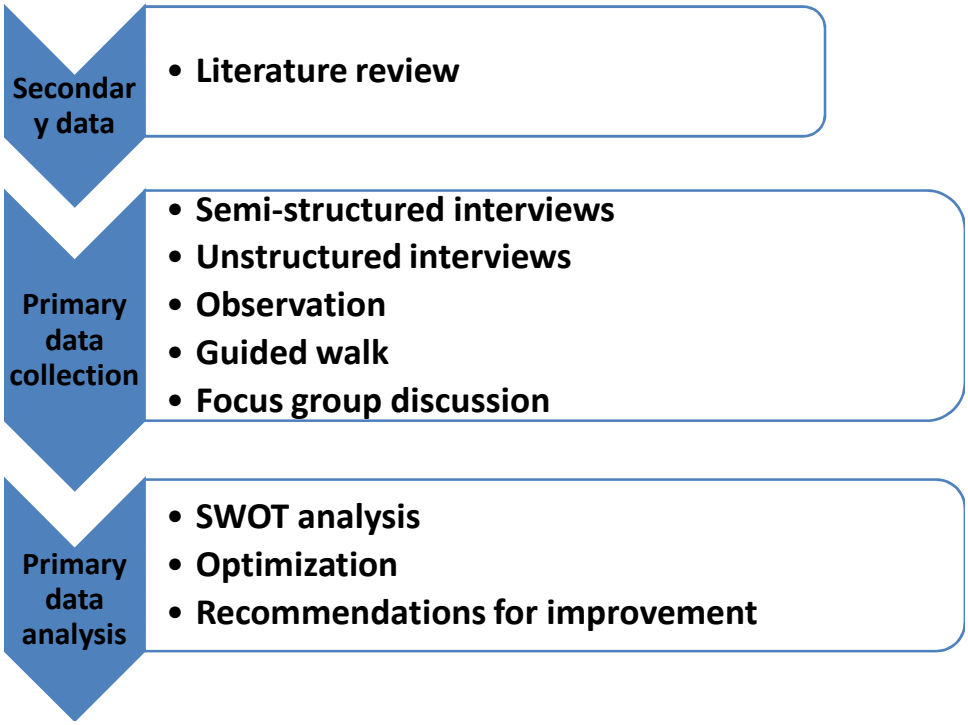

Fig.3: Scheme of working procedure in creation of the study

4.1. Literature review

First part contained theoretical preparation during October 2012 – July 2013. It included study of secondary data resources, printed books, statistical databases, publications, reports, as well as internet sources and scientific articles from academic journals (Web of Knowledge, ScienceDirect, Agriculture Economic, Journal of Development and Agriculture Economics). The used “key words” were: *demonstration farm, training centre, sustainable agriculture, Indonesia, optimization and practical education*. Materials in English, Czech and Indonesian language were reviewed.

4.2. Field survey

Second part took place in June – August 2013 in Indonesia, region North Sumatra. There was applied direct presence practical survey in the agriculture training centre AgroIhutan. Centre is placed in region North Sumatera; sub-district Sipoholon in highlands of Tapauli Utara, 50 km far from Lake Toba. The position of centre you can see at figure 4. As the source of information was also used the course Summer school at university Politeknika Informatika DEL in North Sumatra.

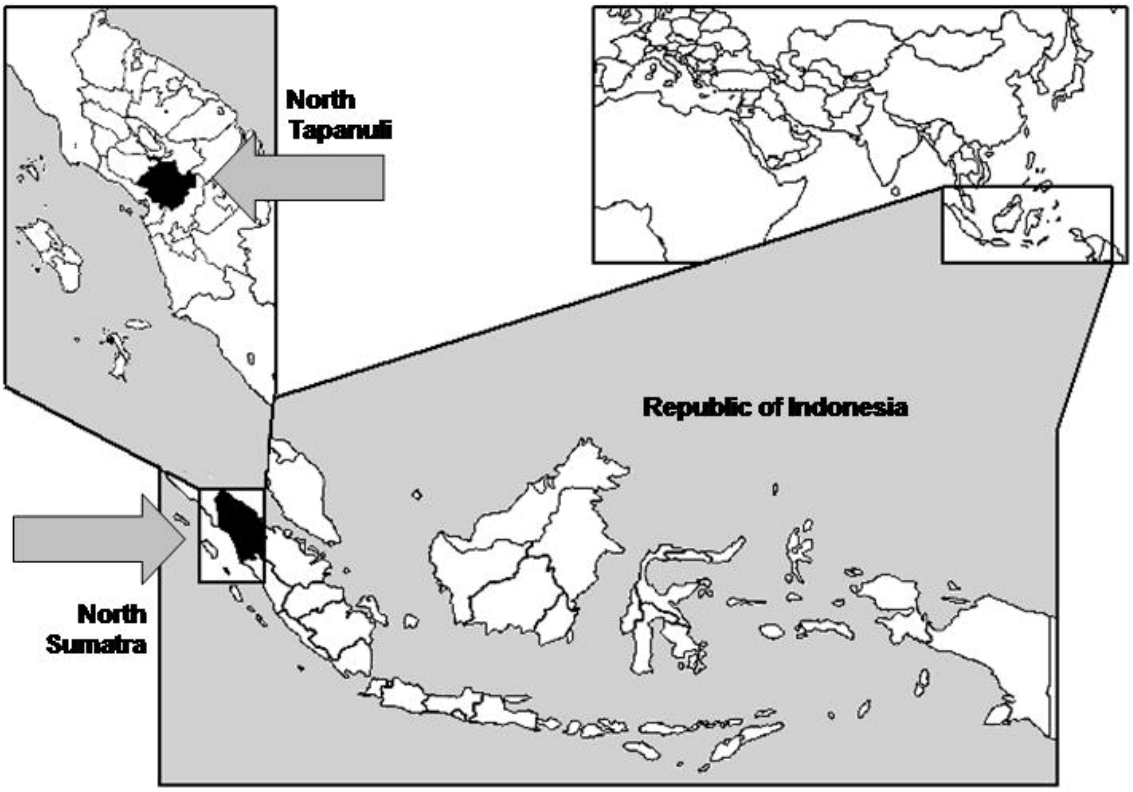

Fig.4: Map of target area (Schwarzova, 2011)

4.2.1. Target groups

The survey was focused on **four** target groups. These **three** groups cover every level of organization structure of centre: i) management of training centre (director) and ii) employees (teachers and workers) and iii) external specialist who are involved into issue of AgroIhutan or agriculture in North Sumatra and iv) high school students participating of the course. First group included only one person – His Excellency Leonard Tobing, who is owner and investor of centre, most important and most involved person in management of centre and its problems. Second target group were employees. The group included five workers and two of them were also the teachers of agricultural trainings for students. This group was the most involved in farming activities and daily program. Third group included two external people, who have an overview about agriculture business in North

Sumatra and one of them was also former teacher from AgoIhutan. Unfortunately was not possible to conduct the survey with the last group. Students did not attend the course because of insufficient organization and communication between farm and high schools.

4.2.2. Methods of survey

The survey methods – interviews, focus group discussion, observation and guided walk were chosen based on FAO recommendation (1997)[2]. As a tool for testing the data validity triangulation method was used.

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4.2.2.1. Semi-structure interviews

Three types of semi structured interviews for each of the target groups were created. There were questionnaires in Indonesian language for the employees and in Czech language for management. Both types of questionnaires have a common part and specific ones for each group. As pilot interviews, two interviews (with employees) were tested. Then the structure was modified, useless questions were removed and additional questions were added.

Interview with management contained 52 question divided into four parts: a) farm b) students c) employees and d) management.

a) Part a) consists of 14 questions about the history of the training centre, farming and off-farming activities, ways the centre works, material and mechanization background, advantages and disadvantages of the centre.
b) Part b) consists of 10 questions focused on system of teaching and lectures, the ways the communication with high schools in working and the ways how activities and lectures of students and its financial issues are managed.

c) Part c) consists of 12 questions oriented on performance of employees, farm workers and also teachers. Its task was to explain problems with labour force and to describe skills and education background of each employee.
d) Part d) consists of 15 questions that analyze the financial situation and business, currents situation, plans for future, successes and failures. They were also focused on problems with managing activities with employees and absence of director during year.

Second type of semi-structured interview for employees contained 34 questions and was divided into three parts: a) general information b) teaching and working methods and tools and c) management.

a) Part a) consists of 8 questions, which aimed on the age, sex, education background, job experience, skills and knowledge.

b) Part b) consists of 16 questions that described using of planning tools, teaching methods, harmonograms and other sophisticated instruments.

c) Part c) consists of 10 questions that detected opinions on organization of centre, found advantages and disadvantages, possible improvements, living condition, satisfaction with salary and with chosen participants on decision making.

4.2.2.2. Unstructured interviews

Survey on AgroIhutan also contained informal interviews with external specialist, who are involved in history of centre and who are familiar with problems of development in region.

Unstructured interviews included interview with Ing. Anna Schwarzova who was a teacher in AgroIhutan for one year. She was an instructor at practical

courses for high school students. She provided first awareness about centre. The second surveyed person was Assoc. Prof. Ing. David Herak PhD., who has been living for years in North Sumatra region, cooperates with AgroIhutan and has experience with reality in Indonesia and especially in Sumatra. He has great overview about agriculture in this region, about activities and possibilities in agribusiness. These people were great source of information about AgroIhutan with different “out of box” view.

4.2.2.3. Focus group discussion

Prices of farming products on the market, farming activities, plans for the future development and opinion on organization were find out within focus group discussion with director and with workers. Topics as a financial problems, possible suggestions and option for increasing affectivity of centre and financial sustainability were also discussed there.

4.2.2.4. Guided walk

First awareness and overview about centre were obtained during guided walk through whole farm area with workers. Aim of the guide walk was to get outline of the fields and farming activities and farmers showed different unknown fruits, vegetables and other agriculture products.

4.2.2.5. Observation

Interviews have been complemented by author´s observation through all farm during which were investigated possible space for improvement. Information about

farm and growing plants were verified during the observation. An excursion to the local market also took place, to get overview about sell products and the prices.

4.3. Data analysis

Third part of paper writing was during September 2013 – April 2014 included primary data analysis. SWOT analysis of training centre was created based on the results from research, which provides the identification of problems and brings plan of the strategic management approach (Reihanian *et al.* 2012; Yuan, 2013). Recommendations for improvement in three sectors – management, agriculture production and demonstration activities have been established based on the SWOT. Method of linear modelling, program GAMS (General Algebraic Modelling System) was used for optimization of agriculture activities and optimal distribution of land. This system was chosen based on study of several studies as an appropriate (Bisschop, Meeraus 1982; Cotter *et al,* 2014). Cassava, potato, groundnuts, cabbage, coffee, ginger, tomato in green house, rice and chilli are the crops considered as a primary “cash crops”. These crops were chosen based on fact, they are typical growing crops in local area and we consider important to improve its growing skills, techniques and know-how about typical local crops which creates daily diet in this locality. The bounds restricting the optimization are following:

i) the most profitable variant

OBJECTIVE FUNCTION= 2249.02196*X(cassava) + 2353.845945*X(potato) + 744.666795*X(groundnuts)+ 5247.3890295*X(cabbage)+ 3472.18952*X(coffee)+ 2042.2193475*X(ginger) + 5751.53859489*X(tomato) + 1260.5562985*X(rice) + 3866.642465*X(chilli)

ii) limitation by land capacity

CONSTRAINT (LAND).. X(Cassava) + X(Potato) + X(groundnuts) + X(cabbage) + X(Coffee) + X(ginger) + X(tomato) + X(rice) + X(chilli) = 13 ha

iii) limitation by hours of labour force

CONSTRAINT (LABOUR).. 130*X(cassava) + 230*X(potato) + 180*X(groundnuts) + 250*X(cabbage) + 90*X(coffee) + 300*X(ginger) + 250*X(tomato) + 250*X(rice) + 230*X(chilli) = 110000 hours

iv) limitation by hours of mechanization

CONSTRAINT (TRACTOR).. 8*X(cassava) + 12*X(potato) + 12*X(groundnuts) + 6*X(cabbage) + 8*X(ginger) + 5*X(rice) + 7*X(chilli) = 500 hours

v) representation of all typical crops from the locality
vi) no zero value of land for any crops
vii) no monoculture
viii) tend to be food self sufficient

These constrains were established based on simple principle: to have simultaneously farm as profitable as possible and still demonstrative. In practice we had to set up the bounds from above to ensure that the model will not recommend the monoculture, even though it would be the most profitable variant. There were necessary to set up bounds also from below to ensure the program will include as well the not profitable crops into the model and there will be preserve the demonstrative character, even though we have to calculate with donation of the financial gap from more profitable crops.

4.4. Limitations of the research

The first and the most important limitation was a language barrier. The workers in AgroIhutan do not speak English, so the communication was possible only in Bahasa Indonesia. Even though, the author was continuously training her Indonesia language skills months before and interviews were well prepared, still the conversation during interviews was arduous. On the other hand language skills of director (native Indonesan) were very helpful, as he speaks English and also Czech, so he partly operated as an interpreter.

Based on the fact, that all workers graduated at least high school, can read and write and majority has higher education, there was no limitation of complicated language during the interviews. Unfortunately it was not possible to interview the fourth target group - high school students participating in practical agriculture course, because the last course took place in September 2012 and next had not started till the end of author´s stay in centre. Author´s plan made with management should have ensured the student´s presence at farm during author´s survey on the North Sumatra. Survey should have covered the whole study course at the centre and provide data before beginning of the course and after its termination. This group could also give evidence about their expectation and its fulfilment from course and provide view from student´s perspective. But due to the lack of communication between high school and management of farm it was not possible to conduct it during author´s presence at farm.

5. Results & Discussion

This chapter is divided into two parts and presents the results of data processing corresponding with objectives of this thesis. The first part describes the current situation (history of the centre, educative activities, agriculture activities, financial and personal situation) and using the SWOT analyse the farm and the second part provides the recommendations for improvement in management, production and demonstrative activities.

5.1. Current situation

5.1.1. The history of the centre

The inception of establishing agriculture centre was in 2001 when Mr. Leonard Tobing came to North Sumatra to live there. He, as a former student of Faculty of Economics in Prague (1962-1968) and former ambassador in Czech Republic (1995–1999), decided to go back to Pagarbatu, Sipoholon district, North Tapanuli in Sumatra to take care about the heritage land of his family. He explains his acting:*" Local people were complaining about bad condition and livelihood with agriculture as a main source of income. Due to the fact, that this part of Indonesia, North Sumatra, is traditionally agricultural area with great climate and soil condition, I decided to show people that it is possible to have satisfactory income from farming. Other reason for establishment of centre was to show the importance of agriculture in food self sufficiency, which is still problematic".* In 2002 he bought first hectare of land and started the farm with corn, tomato, peppers and potato. During the time he added hectares, farming activities, employed workers and expanded background facilities. In 2006 was 15 hectares large farmwas officially certified and confirmed as an Agro Education & Research Center which was named "P4S AgroIhutan", which is now the "AgroIhutan Farming Center" (AFC). Centre was financially supported by central and local government, also. But the great part was paid from the private source of Mr. Tobing.

5.1.2. Educative purpose of centre

AgroIhutan is the training farm with a purpose to provide vacational practical education from agriculture sector to students of high school and to local people. The centre started its cooperation with agriculture high schools in 2006. They involved practical agriculture training as a part of obligatory lectures without which students are not allowed to pass final examination and finish the high school. The courses are for 3 – 6 months, depending on requirements of particular schools. The number of students for one course is average 30, but it also has happened that at one time there were 100 students. Of course, all daily activities were very hard to manage and coordinate. The optimal number of students in one course is 10 – 15 in future. Accommodation and food, learning material, lectures with experienced instructors, excursion and external lectures for 350 000 Rp./ month (26 EUR/month) is provided to students. Students have to pay this fee by themselves, school does not support them. Since now, the centre has more than 300 graduates from high schools in Tapanuli Utara and thanks to the international cooperation also 30 students from AOC Leeuwarden (Netherlands).

Agricultural trainings and education for local farmers were other educative purposes of centre. In first years local government strongly supported these activities (information channels, organization of events). Unfortunately only a few years and nowadays trainings for local farmer do not exist anymore. Among the reasons there were mentioned lack of support of local government and high time and financial demanding organization conditions.

The intention of the centre is to provide complex practical agricultural education. The curriculum is every time established individually based on high school requests, but basically is compiled as 20% of time of theory and 80% of time for training of practical skills. During the years, centre tried various farming activities, animal husbandry (pigs, rabbits and cows) and planted different types of plants. But all activities are included in these 5 intentions and long term goals of the centre, see the table 3.

Table 3: Comparison of the plan and reality of the goals of the centre

Plan of activities (Tobing, 2008)	**Accomplished**	**Remarks/feedback**
Seeding various crops like fruits, flowers, and vegetables	✓	Cultivation of wide range of vegetable, fruits and flowers
Production and processing of small foods processed from vegetables and fruits	✓	Processing of small harvest of coffee
Improving the quality of breeding pigs, buffaloes and cows	—	There are no pigs, buffaloes or cows
Development efforts of small and medium enterprises in agriculture and animal husbandry	✓	Cooperation with agriculture companies with contacting graduates students
Intensify the interest of cooperatives among local communities in the development of high schools	✓	In past the organization of agriculture seminars and trainings for local communities

5.1.3. SWOT analysis

SWOT analysis was used as a tool for investigation and analysis of current situation of farm. The SWOT analysis approach, originated from the business, is considered as a good tool for investigation of the problem from the strategic perspective and allows identification of the requirements for management strategies improvement (Reihanian *et al.,* 2012; Yuan, 2013). In table 4 you can see the results.

Table 4: SWOT analysis of agriculture centre AgroIhutan

Strengths	**Weaknesses**
Natural capacity and background for different farming activities Skilled and educated workers Good quality mechanical equipment Wide range and high quality of facilities Well known within area Good experience with agriculture trainings for local farmers Well known director of AgroIhutan with great overview and experience from other countries	Unutilized capacity of land Lack of labour force No financial sustainability Missing constant all-year director Lack of book keeping Non-continuity of students trainings Lack of partner schools Remoteness of centre Decision making depends on director No added valued products
Opportunities	**Threats**
Food self-sufficiency Students as a labour force Potential in processing of products Production out of main season Biogas plant installation Coffee production Bee keeping Advisory centre for farmers Internet access Cooperation with other countries Cooperation with CULS Prague Foundation and support from government Agro touristic business Business contacts to hotels/companies for selling final products	No partner high school Lack of finance for investments No support from government Non responsible labour force

Strengths

The training centre has a great natural capacity and is well mechanically equipped for various agriculture and alternative activities. As Apina (2009) mentioned in his study from Sudan, the biggest limitation and obstacle in adoption agriculture practices is lack of knowledge and materials. In the table 5 we can see, that 4 from 5 employees has passed or are passing third level of education and one has passed secondary education. The higher educated employees work and operate more effective (Nótari *et al.,* 2013) and moreover the workers have practical skills gained in daily farm operations. In combination with available material means and facilities (electricity, generator, kitchen cars, machines for processing, tractors, power pump, roaster and chopper, class, dormitories, teachers room, toilets, bathrooms, terrace, TV, projector, computers) and good reputation of the experienced director the farm has a great potential to be demonstrative and advisory centre. Still there is recommendation to focus on improvement of practical skills of employees in spheres such as management, marketing, processing and animal breeding.

Table 5: Skills and education background characteristics of employees

Position	Sex	Age	Education	Working in centre	Specialization	Previous job experience
Deputy director	M	66	University of North Sumatra in Medan	3years	Composting, soil improvement, cultivation, fertilizers	Palm, rubber plantation (PTPN3 Sumatera Utara)
Worker/ administr	F	24	Ongoing - University Sisingamangaraja XII Tapanuli Utara	6years	Cultivation, pesticides, fertilizers,	-

ator			(UNITA)		administration,finance	
						-
Worker I	M	22	- Ongoing - (UNITA)	4years	Poultry breeding, animal husbandry	
Worker II	M	23	Ongoing - (UNITA)	2years	Cultivation	-
Worker III	M	24	-	4months	Cultivation	-

Weaknesses

On the other hand, the biggest weakness of the centre is that it is not using the capacity. They use only 40% (6.1 ha) of land and 60% (8.9 ha) is unutilized. You can see the detailed distribution of the land in figure 5.

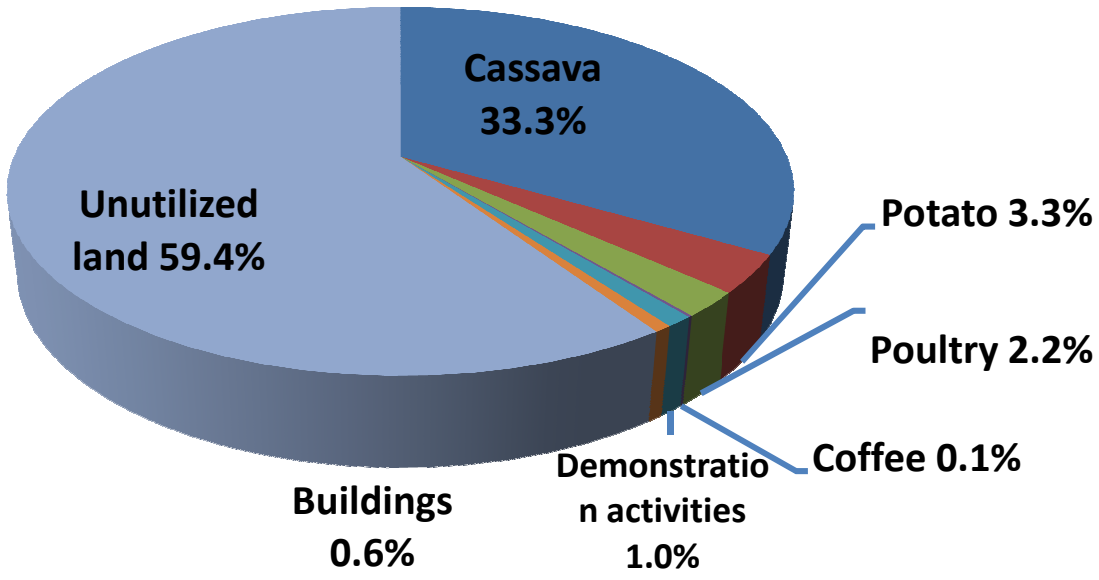

Fig. 5: Current distribution of land (%)

This weakness is connected to the lack of labour force. From 5 employees are four students and they spend 2-3 days per week at school, not at centre (see

the figure 6), so there is a problem of deficit of available labour force for activities at fields.

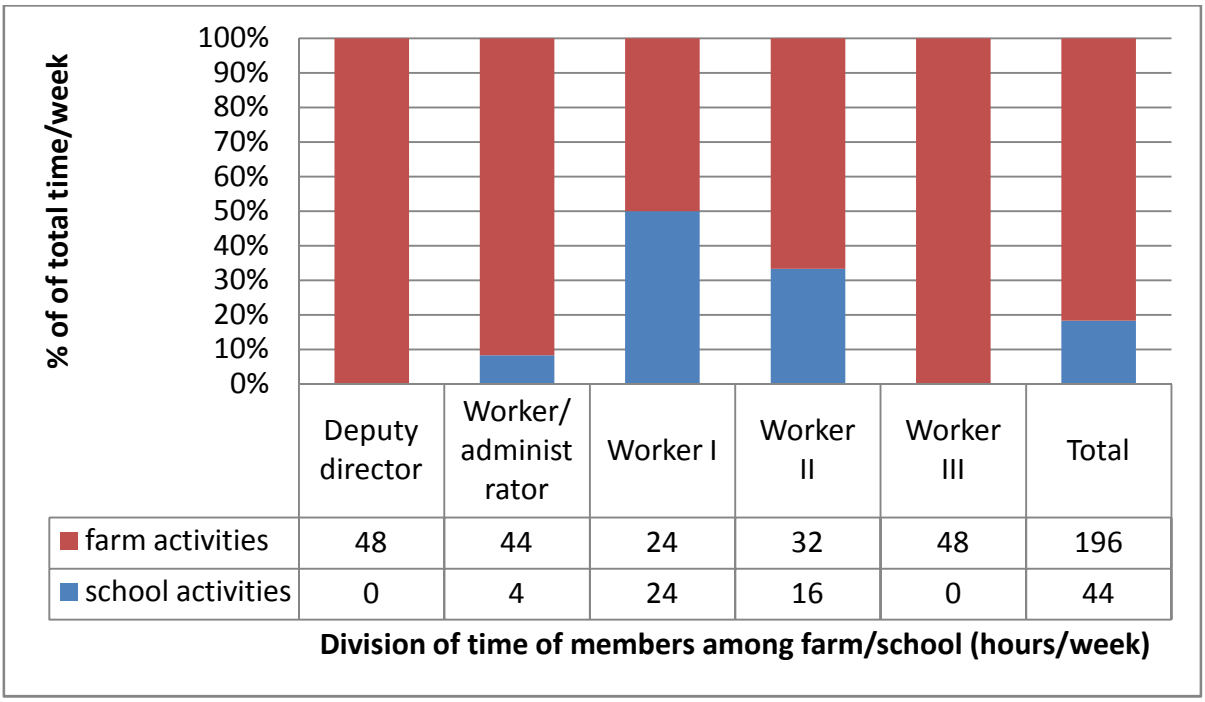

Fig. 6: Distribution of time among school/farm activities (July 2013)

The lack of partner schools, non continuity of student´s courses, missing constant all-year director, problem with decision making while the director is missing and lack of book keeping were identified as next problems. All these deficiencies we can be considered as a management failure. In this case is registered the statement of Lerman (2004), who says, that in developing countries in semi-subsistence farms the workers are not illiterate and many of them were previously employed in the former corporate farm. However, they are experienced in specialised agricultural activities they often lack the ability to manage an integrated farm (Sarris et al. 1999; Rizov et al. 2001). This may lead to a negative effect on resulting performance and management of farm, when director is absent and responsibility for organization issues is on deputy director. Whereas the fact, that three from five workers in centre are students without any managerial skills. The centre sell just fresh and not processed agriculture products with no added value for the lowest purchase price, as cassava to manioc factory, which process

cassava to flour. The remoteness of centre is weakness, but in comparison toothers weaknesses, it is negligible and unalterable.

The financial unsustainability is big obstacle in development. Only deputy director as an experienced full time employee get the proper payments . Others workers are living for free at farm, get income from sold agriculture products and occasionally get some extra money from the director. He supports students in study, so after one year of trial period of working in centre the director pays their school tuition fee, which is approximately 3 ml. Rp (220EUR)/ year for each student. For the entire duration of 11 years of existing centre, the director has already invested approximately 750 ml. Rp (55 000 EUR), which is 5 000 EUR/year. The land cost 50 ml. Rp (3700EUR) and its value is increasing. The central and local government supported centre several times financially, by animals (cows) or by machinery (computers. machines). Even though the farm exist for 11 years, the finance situation is not satisfactory. Centre is financially unsustainable because the director has subsidized the money gaps every month (average 4500 EUR/year). It can be caused again by unutilized land and lack of labour force. The book keeping is very inadequate, so we had to calculate the year profit from data obtained from interviews and from knowledge of reality.

Table 6: Current financial situation and financial plan

	Current	Plan
Returns (EUR)	3531	34974
Variable costs (EUR)	1246	1907
Fix costs (EUR)	6734	6734
Total costs (EUR)	7980	8641
Profit (EUR)	**-4449**	**26333**

From the table 6 is obvious, that the farm is not profitable and it confirms the fact, that the director has to donate approximately 4500 EUR per year. As variable cost we calculate fertilizers, seeds, pesticides, herbicides, mechanization and milling the rice. As fix cost consider electricity consumption, food consumption,

payments of employee, tuition fee for students, property management, transport costs, water consumption and other costs (see the annex 1 and 2).

Opportunities

The great potential and opportunity for the centre is in sophisticated agricultural management and improvement of planning of crop planting and crop rotation. Production of the crops out of main season, especially vegetables, its planting in green houses, where the vegetable is protected against rain can increase the purchase price up to 100% - 200%. The price of vegetable out of dry season in much higher than in rainy season. There is also potential in processing of products, the farm has a quality background in machinery for making cassava chips, roaster for roasting the coffee and other small hand machinery. Moreover if workers get enough skills and knowledge, there is possibility to process the fruit (for jams, ice cream, juices). The coffee production is very common in this region, thanks to good natural condition. The planting is not demanding activity but it has high potential in processing and selling roasted coffee as a Batak product in cities. Expanding on market with new brand can help the business to gain contacts on hotels, companies, aircompanies of director. The enlargement of demonstration activities, cooperation with CULS Prague and government, good experience from past with trainings for the locals and sensible communication with schools can have a significant influence on development of the centre. As the effect of good management can be partial food self-sufficiency, continuous student´s training and expansion of farm.

Threats

Because of often absence of director as a main manager and decision maker in centre it is necessary to have responsible, skilled and authorized employees to keep centre working well. In other case the farm will stagnate and any changes and development will be very hard to make. The lack of support from government can decrease interest of farmers or high schools for practical agriculture trainings. Also the lack of finance support would decrease attendance because of no willingness or no possibility to pay fee for trainees. In case of no interest from side

of high schools in practical training, centre would miss sense of main purpose and would have also problem with lack of labour force

5.2. Recommendations for improvement

Based on data obtained during practical research and its analysis we divided the recommendations, which should lead to significant improvement of effectivity and sustainability of training farm to three categories:

1) Improvement of management
2) Improvement in production
3) Improvement of demonstrative purpose

5.2.1. Improvement of management

Reorganization of structure of centre and better management of labour force and finance is needed. Due to the fact, that the director is often out of the farm, because of his duties, other workers in centre are very important, especially deputy director, who take the responsibility about centre. Still, the important decisions making are postponed till the director´s arrival, which is not known in advance. The educative activities of centre are often interrupted, because of lack of management and communication between the management of farm and schools. It leads to the situation when farm do not have students even for one year, as happened at 2012/2013. Each student have to pay 350 000 Rp (22.3 EUR)/month for food, accommodation and services to farm. The ideal capacity of farm is 10 students per course; it was established based on discussion with director and workers/teachers. Calcutaling with ideal situation, when the capacity of centre is full: 5 members of staff and 10 students. Even if we take into consideration, that students are not qualified and skilled, still it means the 200% increase of full time labour force from current situation. Students are help the meals, cleaning and farming activities.

The current situation of financial management is poor. The director has to donate every month the money gap by his own investment. The book keeping is very chaotic. There is missing the cash flow analysis and future conceptual business plan. The decisions are made up thoughtless and regardless of the future. There was citrus orchard on farm few years ago. Then, because the students plucked the unriped fruit and damaged the trees, the management decided to terminate the planting the citrus trees. Later, the management decided, to renew the citrus orchard and plant the new trees. Based on fact, that it takes a few years for the tree became a fruitful, these decisions do not act coherently and conceptually. Based on Shepherd´s *et al.* (2007) conclusion, this study recommends authorization of the constant director, which will have the skills, experience, competencies for decision making and will be responsible for changes. Who will have the coherent future plan and goals and tend the farm on this direction.

5.2.2. Improvement in production

5.2.2.1. Redistribution of land

Change in approach to exploit the potential of training centre and division of arable land to the part primary production and part primary demonstration can lead to a clear division of land. It can also ensure the awareness, that primary production part generate the greatest profit, and is better to grow it on larger area. Then the crops from production part will require a slightly different approach in growing and marketing - business-oriented. Generally to focus effort on profit maximization profits, because the economic sustainability and independence of the farm depend on the successful production.

The total land area is 15 ha, currently only 6.1 ha is utilized, and 8.91 ha are unutilized, as you saw at figure. The ideal suggestion of redistribution of land (13 ha) have been modelled in linear modelling program GAMS.

The General Algebraic Modelling System (GAMS) program suggested following land distribution see the table. The variable cost includes the cost of fertilizers, pesticides, herbicides, seeds, milling the rice and mechanization. These indicators were found from interviews or observation and calculated. At the table 7 you can see that currently the farm plant only the cassava, potato and coffee, the others crops are not at farm.

Table 7: Recommended distribution of land its economical indexes in comparing with current situation (red numbers are current).

Plant	Land (ha)		Variable costs EUR/ha		Purchase price EUR/kg		Yield t/ha		Gross margin EUR/ha	
Cassava	5	2.2	297	239.1	0.05	0.2	16.6	16.6	548.7	2249.0
Potato	0.5	3.6	446	279.6	0.2	0.2	9.5	16.0	1631.3	2353.8
Coffee	0.2	2	202	139.6	0.62	9.6	0.1	0.5	-141.2	3472.2
Groundnuts	0.2		179.9		1.2		1.0		744.7	
Cabbage	2.0		282.6		0.3		23.8		5247.4	
Ginger	0.2		247.3		0.3		9.7		2042.2	
Tomato	0.3		157.0		0.9		8.6		5751.5	
Rice	0.5		71.9		0.4		4.4		1260.6	
Chilli	2.0		309.6		0.9		6.0		3866.6	

On the next figure 6 you can see the recommended distribution of land between “cash crops”, demonstration activities, buildings and roads and unutilized land. We recommend to keep 1.2 ha (8%) of arable land as an unutilized to preserve a scope for changes, infrastructure and possible new buildings.

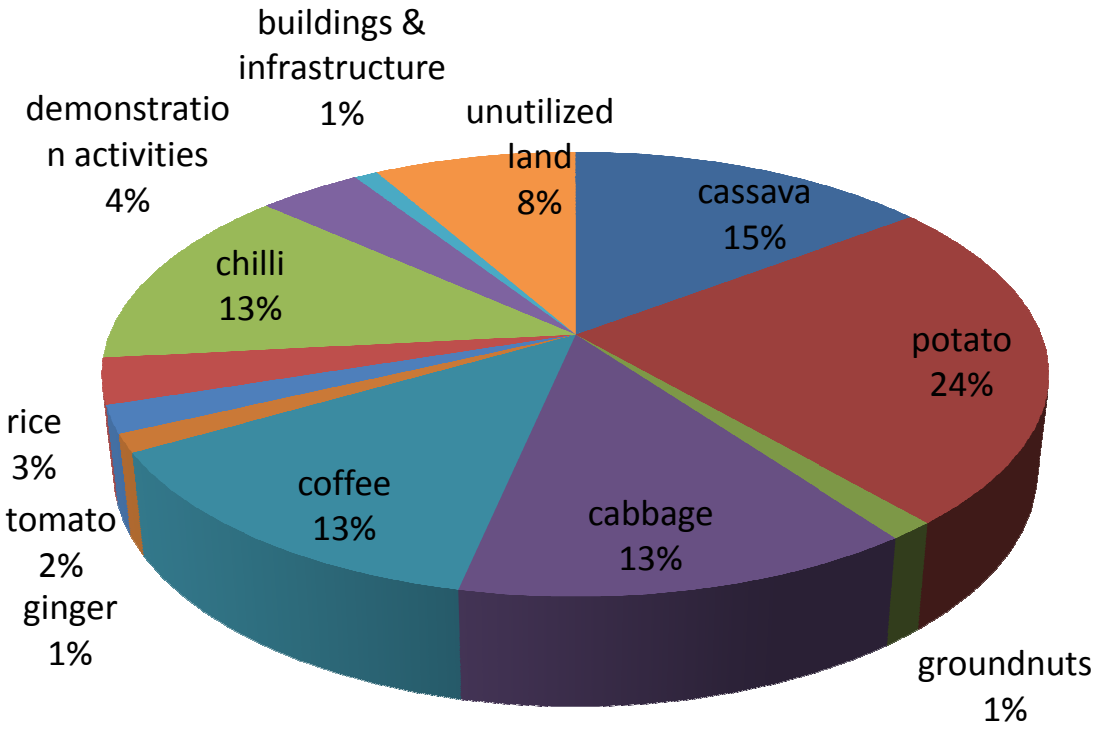

Fig. 6: Recommended distribution of land

On recommended land should be 0.5 ha of rice, even if it is unprofitable crops. Rice is the main part of the daily diet and local people usually grow it by themselves, so we suppose it is important to have good knowledge how to grow it. 0.5 ha of rice field will produce approximately 2150 kg/year (without 100 kg of seeds conserve for the next season as a seeds). When the Indonesia´s average consumption of rice is 165 kg/capita/year (OECD – FAO, 2013), than for 15 members of household is necessary 2475 kg/year. It means that this rice production should almost cover the consumption of rice and farm would be from 86.9% self - sufficient with rice production. The tomatoes planting is recommended in green houses. This vegetable is one of the most common ones and many people grow them on the small fields. But during the rainy season it not possible to produce them in open fields, and the only possibility to plant tomatoes is in covered green houses. The purchase price of the tomatoes increase up to 100% -

200% during the rainy season. Potatoes are not very common crop in Indonesia, but it offers the opportunity to popularize it and add this crop to daily diet of local people. The conditions for growing are good and the first yield of potato from centre was satisfactory. The chilli and ginger are really often use in Indonesian cuisine and they are used in many forms, dried, fresh, milled into powder or in case of young ginger – making juice. There is also space for conservation or other processing. On the annex 3 you can see the recommended proposal of the land.

5.2.2.2. Own processing of coffee

The farmers' information needs are not only related to crop production, but also to postharvest processing, marketing and postharvest storage as well. It brings increasing importance of farmers' access to source of relevant and reliable information (Glendenning *et al.*, 2010). There are great conditions for planting coffee and almost every the local farmers has small coffee plantation in the area. Most of the farmers sell the raw green coffee beans to Starbucks Company for very low price 9000 Rp/kg (0.6 EUR/kg). There is intention to create own brand of coffee with Batak connection (Batak is local entity) at farm and use the business contacts of director to sell the coffee from farm as premium good to final customer. The students can be involved in process on creating brand, packages, logo, promotion and use this opportunity to get practical skills from marketing and selling. The centre has own roaster machine, which has sufficient capacity to roast coffee from farm. The farm can pack the coffee by themselves, or use the cooperation with other coffee company in region, the Lintong Coffee. The next figure shows the economical analysis of different approaches in selling the coffee. There is significant difference between profit of raw beans sold to Starbucks Company and profit of processed roasted and packed beans. It was calculated from different cost of processing, which included costs of marketing, packaging and transport to bigger city. As is obvious from the graph 7, currently there is a negative profit in selling coffee and is necessary to increase the purchase price or decrease the production costs.

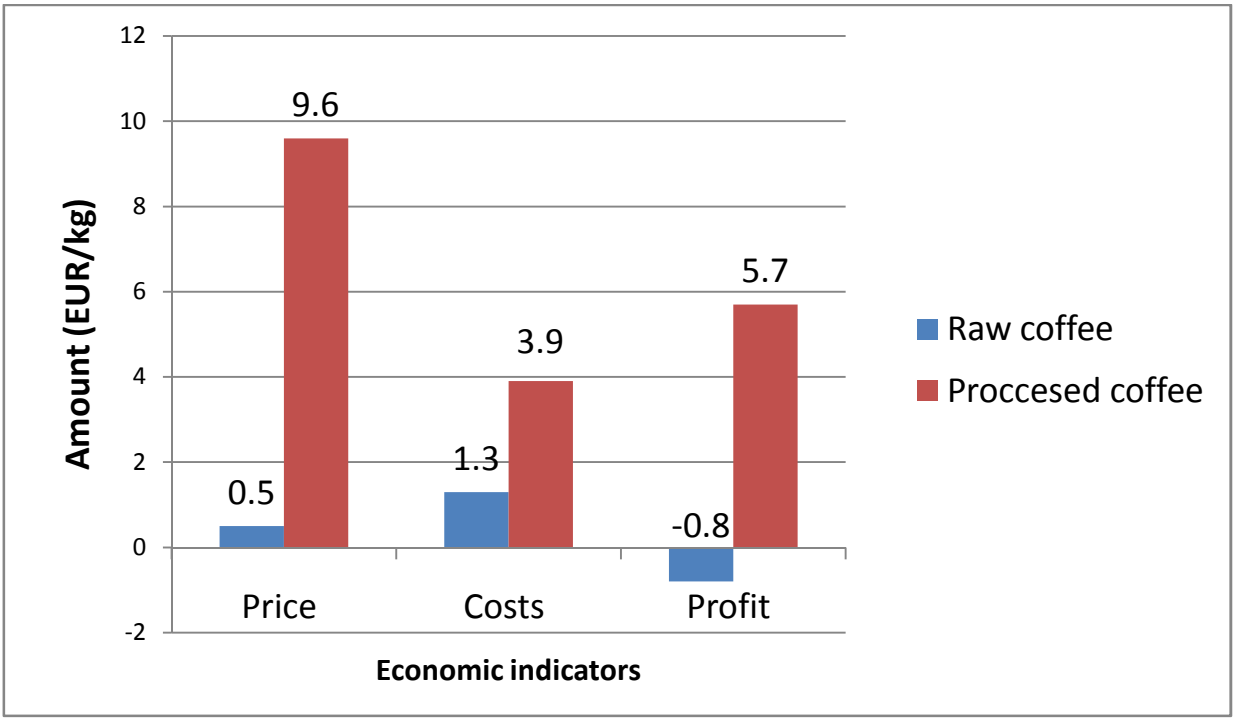

Fig.7: Economic analysis of raw and processed coffee beans

We have to take into consideration the difficulties connected with processing coffee, but AgroIhutan is a training centre and it should support the development of region and lack marketing is one of its the weaknesses. FAO (1997)[1] declares, that added value of processed products can be one of the significant shift in development. The increasing interest about branded packed local products and customer´s willingness to pay higher price for it have been registered in Asia(Minten, *et al.,* 2013). The marketing activities includes the focus on final customers can provides an important contract for stabile buyout of agriculture products. It can be high quality coffee from North Sumatra, one of the best locations for growing coffee in Indonesia with Batak brand, testifying the traditional approach of farm.

5.2.3. Improvement of the demonstrative purpose

5.2.3.1. Pigs breeding and biogas production

The main enlargement of demonstration activities is focused on installation of biogas plant. Based on described situation in literature review about biogas projects in Indonesia we recommend its installation at centre. The farm has in its education programme to provide know-how about animal husbandry, but nowadays no animas are bred at the centre. In past, the farm bred the cattle or pigs, so there is the history and knowledge about animal breeding. I will be necessary to establish new pigs breed and provide it welfare conditions by appropriate sheds. The size of plant is calculated from necessary gas for participants of farm. There are 5 workers/employees and constant presence of 10 students must be calculated in. It means that we calculate with continuous consumption of cooking gas for 15 people. Based on formula

$$vol = HRTmax \times min\ fee$$

Where:

vol= required volume of digester

HRT max= the maximal hydraulic retention time

Min fee= the minimum feeding

the necessary daily consumption is equal to biogas plant of 13 m^3 which produces between 3.38 m^3 (min) – 5.6 m^3 (max) of gas in warm climate (JRI Research, 2013), see the table 8 with detailed calculations.

Table 8: Plant size range warm climate (Author´s compilation based on JRI Research, 2013; Ghimir 2009)

Plant volume	m^3	13.16
Gas storage volume	m^3	3.04
Digester volume	m^3	10.13
Min feeding	kg/day	84
Max feeding	kg/day	127
Min daily gas production	m^3/day	3.38
Max daily production	m^3/day	5.06
Avg feeding	kg/day	105
Avg gas production	m^3/day	4.22
Constuction costs	EUR	650
Daily savings	EUR	0.75
Investment return	year	3.70

This type of plant needs approximately 90 kg of pig slurry per day. When we calculate with average daily pig slurry production 5.75 kg, we need to breed at least 16 adult pigs. Total feed to get 110 kg weight of pig is 230 kg/pig/season. The typical composition of pig´s feed is feed mixture (cereals, minerals, vitamins), especially for piglets, which is possible to buy, and potato, cassava, vegetable and cooking waste in ratio 1:3. It means 57.3 kg of store-bought fodder and 172.5 kg of farm crops. The price of mix feed is 0.5 EUR/ kg and farm crops will be chosen from unsaleable products and cooking waste. If we calculate with 16 pigs, it means we need maximum 917 kg of mixed feed, which cost 354 EUR and 2760 kg feeding crops from farm per year, which is 2.27% of total production of potato, cassava, cabbage and other vegetable, see the table 9.

Table 9: Calculation of feed consumptions and costs for pigs

Number of pigs	16
Amount of farm feed (kg)	2760
% from total crop production for feed	2.27
Amount of cereal feed (kg)	916.8
Total price of cereal feed (EUR)	354
Total manure per day (kg)	92

The subsidized price of 3 kg of LPG for cooking is in the area of AgroIhutan 19 000 IDR (1.2 EUR), and unsubsidized price of 12 kg of LPG, which use AgroIhutan, cost 90 000 IDR (5.7 EUR). The standard family (average 5 members) consume 2 kg of LPG during 6 – 10 days. With 15 members of household the centre would spend 7500,- Rp (1kg of LPG) per day only for LPG needed for cooking. The biogas production is 3m³/day, which is equal to 12 hours of stove gas consumption. It means, it is enough for cooking for whole day only from biogas. For Indonesia Domestic Biogas Programme (BIRU, 2013) have been chosen Chinese type of reactor, as a most suitable digester (see the annex 4). If the construction price of this type of biogas plant costs 10 239 500 Rp (650 EUR) (BIRU 2011) without financial subsidy, the investment will return after 3.73 years, see the figure 8.

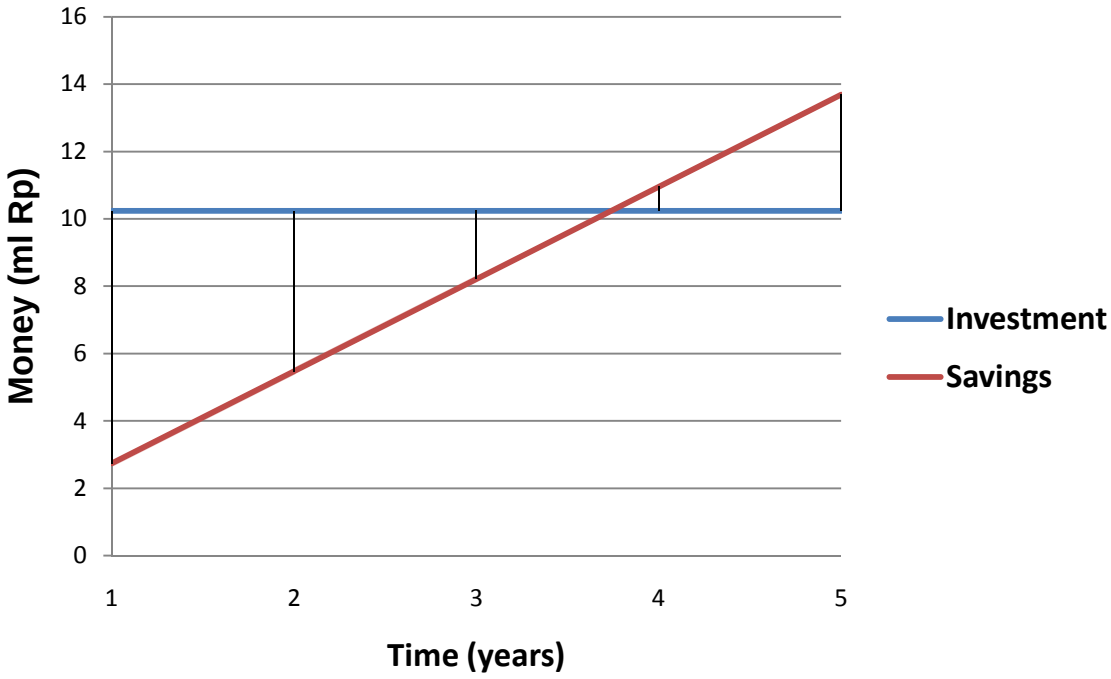

Fig.8: Return of investment of biogas plant

The risks and difficulties in use of biogas plant are mostly connected with the overestimation or over sizing the plant, carrying and loading the slurry to the mixer regularly or there is occurred a leak of gas (JRI Research, 2013). The manipulation with plant is not highly demanding, but still requires the trained

manipulators to prevent any obstacles (FAO, 1991). It is also necessary to clean the plant regularly, approximately every 5 years, but it is not expensive procedures, or it is possible to manage it by them.

5.2.3.2. Application of sustainable approaches

One of the aims was to create sustainable proposal of performance of the farm. Next figure 9 shows the proposal of integrated farm system of AgroIhutan included animal and crop production, biogas digester and family consumption, based on previous analysis.

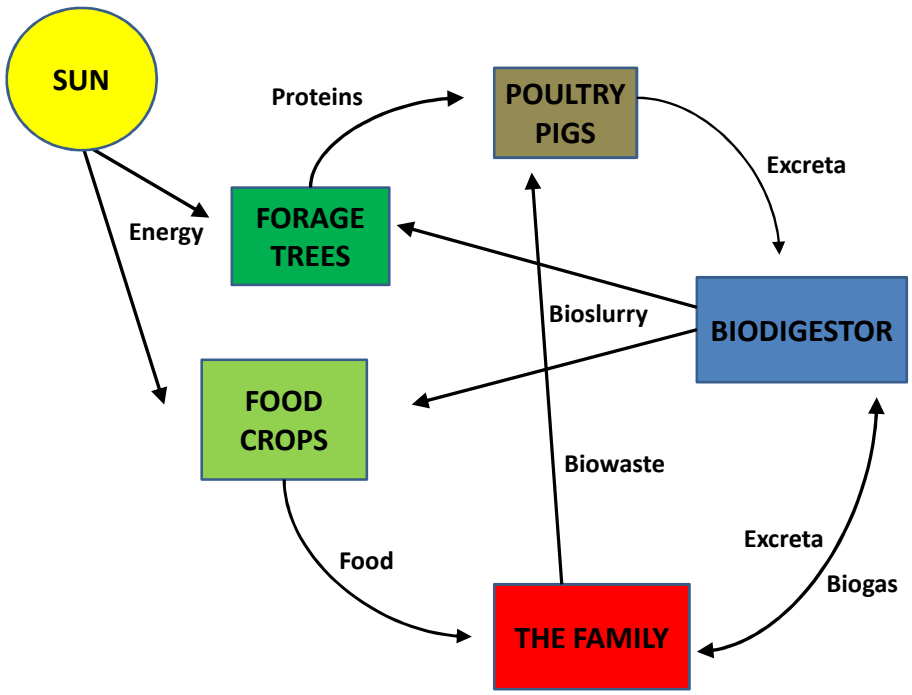

Fig.9: An example of an integrated farming system of AgroIhutan Centre

Crop – animal – pond - family systems are highly efficient: animals are fed by crops waste, residuals and cooking waste. Biological waste of animals (urine,

manure) is used as a material for biogas digester. Bio digester produces the biogas for family consumption (cooking) and digestive is use as a fertilizer for water plants (or as a feed for fishes, if there is applied fish breeding).

Due to the lack of time and scope of this paper was not possible to pursue and contain all possibilities which can be applied at farm. Nevertheless it is recommended to focus on them in future and implement them in next steps of development. It includes the expand of livestock production following the cultivated plants and crop rotation, the reorganization and management of poultry breeding, implementing of the irrigation system, introduction of the fruit conservation, drying and generally the processing of products, at least for own consumption and demonstrative purpose, bee keeping and fish breeding.

6. Conclusion

The aim of this study was to evaluate the activities of farm, provide the financial, agriculture and personal analysis and suggest the recommendations which will lead to improvement in these sectors. These results will also serve as a background material for possible cooperation with institutions. There has already been the interest and communication between management of farm and CULS Prague about options and possibilities of cooperation in future, so this aim was fulfilled.

The established specific objectives are evaluated as following. To fulfil the condition of application of sustainable technologies and integrated agriculture procedures was designed the diagram of integrated farming system of AgroIhutan based on principles of polyculture, semi-subsistence, integrated farm management and organic farming. Based on this system the farm will decrease the utilization of chemical fertilizers by 50% while preserving the yields, save 0.75 EUR per day for LPG gas for cooking and enlarge the farm for animal production. The increase of

the agriculture capacity with respect to demonstration activities was accomplished by recommended redistribution of land using the modelling software, which ensures the optimal division of land among the crops. This step ensures the decrease of unutilized land from 60% (8.9 ha) to 8% (1.2 ha) and increase of the diversity of “cash crops” by 200% (from 3 to 9 crops). The financial sustainability and stability will ensure the increase the production capacity and its profitability. The current profit is negative, -4449 EUR/year and is necessary to donate the working of farm, and this proposal suggests the system with 26333 EUR/year. The food self-sufficiency is ensured in production of rice for 86.9% and by self-sufficiency in consumption of cooking gas, which is produced by own biogas plant. The increase of the crop production and introduction of the animal production will also enhance the self supply of food.

Due to the limitation of this paper it was not possible to cover all aspects and issues which are involved in performance of the farm. Main lack is in financial analysis, which is demanding for information and time. None of them was enough. There is recommended to focus on deep analysis of cash flow, book keeping, costs and profit. It is also recommended to concentrate on improving of practical skills in various spheres as a diversification of demonstration activities such as bee keeping, fish breeding, planting various plant, fruit production and animal breeding and also in managerial skills, teaching, manipulation with biogas plant, processing of agriculture products and marketing.

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Annexes

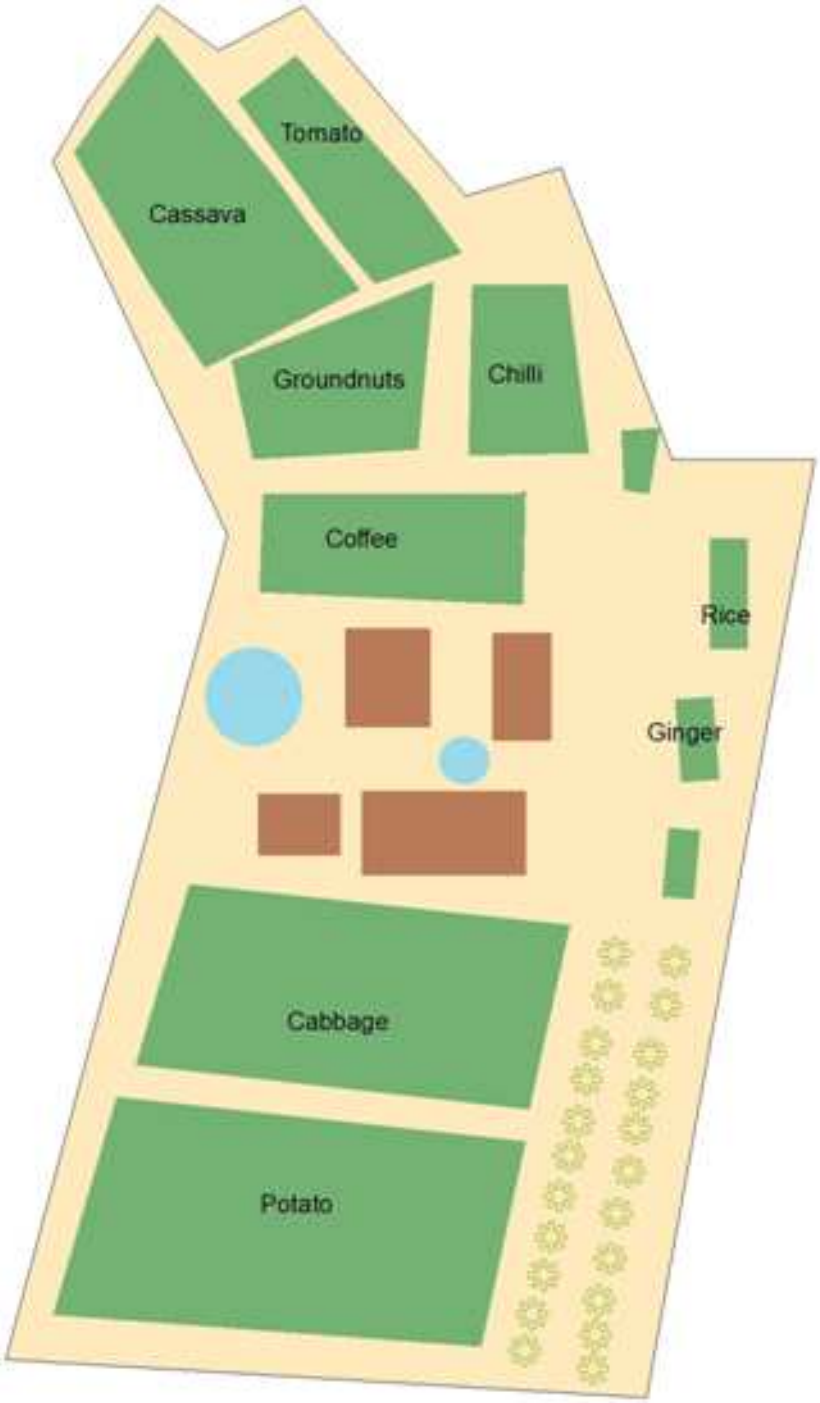
Annex 1: Calculation of variable costs

Inputs	Product	Units	Value	Non subsidized
	NPK	US$/Kg	0,19	0,74
	TS-36	US$/Kg	0,16	0,70
Fertilizers*	KCl	US$/Kg		0,65
	Urea	US$/Kg	0,19	0,74
	Compost	US$/Kg	0,06	0,09
Seeds	Sowing doses	Kg/ha	20,00	Maize
	Price	US$/Kg	7,38	
	Sowing doses	Plants/ha	5714,29	Ginger
	Price	US$/plant	0,25	
Herbicides	Roundup	US$/L	5,74	
Pesticides Fungicides	Antracol	US$/L	6,15	
	Buldok 25 EC	US$/L	12,3	
Mechanized Labors**	Ploughing	US$/Ha	65,60	
	Tillage	US$/Ha	32,80	
Rice milling		US$/Kg	0,09	
* Farmers use the subsidized fertilizers.				
** Generalized annually as: rice 1 plough and 1 tillage, maize 1 plough and ginger 2 ploughs.				

Annex 2: Calculation of fix costs

Fix costs	EUR
Electricity	264
Consumption	3960
Payment	600
Water	120
Property management	800
School fee	390
Transport	400
Other costs	200
Total costs	**6734**

Annex 3: Proposal of the use of the farm land.



Annex 4: China dome digester (ISIS, 2006)