Uncovering farmers' management practices

"An investigation about management competences of dairy farmers in Thailand"

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UNCOVERING FARMERS' MANAGEMENT PRACTICES

"AN INVESTIGATION ABOUT MANAGEMENT COMPETENCES OF DAIRY FARMERS IN THAILAND"

A survey of dairy farmers in Muaklek area, Thailand

Research for Master degree (MST 80433 – 33 ECTS)
Management Studies Group of Wageningen University

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"I do not believe there ever was any life more attractive to a vigorous young fellow than life on a cattle farm in those days. It was a fine, healthy life, too; it taught a man self-reliance, hardihood, and the value of instant decision…I enjoyed the life to the full"

-Quote by Theodore Roosevelt-

Preface and acknowledgements

This report completes my Master of Science in Management Studies as part of the MSc program Management, Economics, and Consumer Studies (MME) at Wageningen University. After participating in the exchange program *Organic Agriculture in Tropical regions* of BOKU University in Vienna, Austria, the concepts of tropical dairy farming and farm business management have generated an intense personal interest. It was those subjects that inspired me to investigate dairy farming in Thailand.

This research is carried out as part of the project: "Sustainable Development of the Dairy Chain in Thailand". This project is funded by the Dutch Ministry of Economic Affairs, Agriculture and Innovation and implemented by Wageningen UR in cooperation with the Thai Ministry of Agriculture and Cooperative Development, Kasetsart University, and FrieslandForemost.

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I hope that this thesis reflects the care and dedication of the people involved in this project.

Herjan Bekamp

Wageningen, August 2011

Executive summary

This research has been accomplished in scope of the master assignment at Wageningen University. The research attempts to contribute to a business oriented approach to management of dairy farmers in Thailand. Hence, this research investigated which competences contribute to management of Thai dairy farmers. After an overview of literature about business management, managerial capacity of farmers, and co-operatives (services) a theoretical framework was constructed. In this framework several important concepts were identified which consequently were converted into measurable indicators. With these indicators a questionnaire and interviews were created. Subsequently, a survey of 44 dairy farmers in Muaklek, Thailand was executed.

To address the dilemma of representativeness and the enormous variation of the population, two selection criteria's were selected namely efficiency and size of farms. Indicators for these two criteria's were average milk production per cow per day and heads of cattle, respectively. Hence, four groups of farmers were identified; group one (small and inefficient), group two (small and efficient, group three (medium/large and inefficient), and group four (medium/large and efficient). The exact criteria's can be found further on in this report (chapter 6). With these groups in mind, a seminar was organised in Muaklek to run the questionnaire (Figure I). Next, on farm meetings and observations were arranged for the interviews (Figure II). The four groups were analysed and compared with the theoretical framework. Based on the outcome of the analysis the following important results are shown next.

Figure I & II. Questionnaire and interview of Thai farmer(s)

From the questionnaire and interviews, certain important general results of the sample are described now. The average farms size was 43 heads with an average milk production of 13,3L per cow in milk per day. Weekly fluctuation in milk production up to 15% occurred. The average monthly milk sales in this sample was estimated at 113,414.- (baht). The housing system was not according to standard hygiene. This was observed in all groups. The average land size was 16 rai (2.5 hectare). Regarding animal feeds, rice straw and concentrate was mostly fed supplemented with legumes (e.g. Napier grass), and cassava pulp. Because of limitations in land size, most feeds were bought from the cooperative and local market. Concerning labour, 30% of the respondents reported to have a labourer(s) working on the farm. However, 88% of the farmer in this sample had difficulties finding new labourers due to different reasons (e.g. availability of labourers). All farmers applied machine

milking, and sold milk to one or more co-operatives or PMCs (Private Milk Collectors). Further, dairy farming was the main source of income for all respondents.

Out of the interviewed dairy farmers, average age was 45 years. Most farmers had abundant number of years' experience in dairy farming. The majority of the respondents were literate beyond primary school with 21% of the farmers finishing a university degree. Regarding training, DPO (The Dairy Farming Promotion Organization of Thailand) was the organisation where most farmers (N=30) followed additional training followed by DLD (Department of Livestock Development) (N=18), and the cooperative (N=17). A clear distinction between groups was found where farmers in group two, three and four were mostly trained by an officer of DPO, in contrast to group one who were trained by DLD. Fifteen percent of the respondents took over the farm from their parents and 52% of the respondents reported to have a successor. With respect to farming style, the majority of the farmers were full-time farmers. In group four was the biggest group of full-time farmers located.

The analyses gave different views which the most important ones are described next. First, analyses showed that full-time farmers were more willing to invest and had a higher average milk production compared to part-time farmers. Secondly, the majority of farmers owned livestock with 70-90% or even more than 90% purebred (Holstein-Friesian) cattle. It seemed that farmers gave priority to milk production at the expense of robustness. Regarding animal health, besides mastitis other animal diseases were recurrent on dairy farms in Muaklek. Tick fever was present on nearly all farms; other important animal diseases occurring on farms in Muaklek were retained placentas, cow lameness, and Bovine Ephemeral Fever (BEV). It seems that unhygienic (calving) conditions, nutritional factors, and an open housing environment are factors causing these diseases.

Regarding, optimal breeding and herd practices, this was not actively performed by Thai farmers in this sample. Consequently, older milking stock was observed on farms. Regarding animal feeds, average feeding cost per liter milk was calculated at 9,5.- with farmers placed in group four lowest (9,1.-) compared to highest (10,8.-) in group three. Moreover, farmers with more (family) labour had more incentives and possibilities to cultivate pasture. Further, it was found that respondents perceiving their farm as a commercial, and see their farm as an example farm would like to buy more land for forage and pasture production. Thus, it seemed that an ambitious group of farmers existed. However, this could not expressed in one of the existing groups.

Out of the interviewed farmers, 58% of the respondents had enough working capital to overcome short-term obligations. Hence, it seems that many farmers had a liquidity problem. Nevertheless, to meet short term liabilities, credits as payment instrument is used by all respondents. Moreover, 82% of the farmers indicated the cooperative as source of borrowing mid- and long term loan followed by Agricultural bank (43%), and Non-Systematic source (11%).

Breeding records are used and kept by A.I inseminators. Farmers are simply using records to check for heat dates, birth of cow, possible start dry period of cows, and expected date of birth calf. It seems that farmers were not recording any lactation yields. The number of times that an extension officer visited the farm was limited.

Concluding, lack of qualitative records, high debt to equity ratio, poor housing environment, and uncertainty about increasing costs of animal feeds gave arise for uncertainty and therefore risk. Farmers were trying to limit risk by selling milk to multiple marketing channels, or increasing the herd size. Furthermore, the most important competences that were identified as affecting efficiency were 1) education level, 2) being a fulltime farmer, 3) farming experience, and 4) an entrepreneurial attitude. Other factors explaining difference in groups were 1) source and variety of animal feeds, 2) available of (external) labour, and 3) availability of extension.

Based on the results and analyses, the most important recommendations for farmers and co-operatives in improving farm management are given next:

1) It would be suggested that farmers keeping 70-90% or more Holstein traits need to improve their farm management practice to reduce the effects of heat stress, and diseases incidents;
2) To overcome the gap of extension, cooperative could hire farm consultants. This would help to get farmers more entrepreneurial like using records;
3) It is suggested to improve hygienic standards on farms by using cloves during milking, a regularly and thorough cleaning of the stables as well as a renovation of the housing and milking system of farms and;
4) It seems that a small Farmer Field School (FFS) or a pilot (demonstration) farm for other farmers would concentrate information to limited number of sources. A successful pilot farm (best practice) could invite colleagues for training and visit on farm (the concept of “farmers learning from farmers”).

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List of Abbreviations

AFC	Age of First Calving
AI	Artificial Insemination
AM	Ante Merdiem
ASAL	East-Africa Arid and Semi-Arid Lands
BEF	Bovine Ephemeral Fever
BOD	Board of Directors
DLD	Department of Livestock Development
DPO	The Dairy Farming Promotion Organization of Thailand
EU	European Union
FFS	Farmer Field School
FFTC	Food and Fertilizer Technology Centre
FMD	Food and Mouth disease
FTA	Free Trade Agreement
FAO	Food and Agricultural Organization
HA	Hectare
HRM	Human Resource Management
ICT	Information and Communication Technology
IT	Information Technology
KG	Kilogram
L	Liter
MCC	Milk collection Centre

MRIU	Manav Rachna International University
N	Nitrogen
NCBA	National Cooperative Business Administration
NGO	Non-Governmental Organization
P	Phosphorus
PM	Post meridiem
PMC	Private Milk Collector
ROE	Return on Equity
ROI	Return on Investments
SCC	Somatic Cell Count
STD	Standard Deviation
TBC	Total bacteria count
TV	Television
THB	Thai Baht
UHT	Ultra High Temperature
USA	United States of America
USAID	United States Agency for International Development
WUR	Wageningen University and Research

1. Introduction

Thailand is regarded as an agricultural country. It is located in the geographical heart of South-East Asia. The nation is in the south bordered by Malaysia, to its west, it is bordered by Myanmar and to its east by Laos and Cambodia. The number of residents is estimated at 67 million. The capital, and at the same time the largest city is Bangkok with around 12 million inhabitants. With infrastructure well developed, free economy system and pro investment policies, an intensive growth of the Thai economy between 2000 and 2008 have been observed. During this period, the percentage of Thailand's population living below the poverty line has declined significantly (Sricharoen, 2006).

Thai agriculture is characterized by its strong comparative advantage compared to agriculture practices in neighboring countries; this includes e.g. superior irrigation technologies which resulted in a regional leadership in production and export of agricultural commodities (James, 2004). Moreover, the country has a large portion of land allocated for cultivation, a climate suited to the growth of a wide variety of crops, and high quality strains of agricultural products (Encyclopedia of Nations, 2010). Rice is the main staple crop of the country, and also the primary agricultural export product. Agricultural production has diversified significantly to meet domestic and world market demand. Several kinds of crops are produced for the market; this includes cassava, maize, mangoes, pineapple, vegetables, and flowers. Another special important sub-sector within agriculture for Thailand is fish and other aquatic life. This is the major source of protein in the Thai diet. In recent decades, deforestation and pollution of streams and rivers led to a decline in freshwater fish. Consequently, there is an increase in raising fish in special ponds.

More than 5.7 million Thai citizens (2007) are involved in agriculture which is about 36 percent of the whole household population. For households, farming is not only a source of food and income but also medicines, housing and savings. Agricultural co-operatives, with the concept of self-reliance and cooperation, have played an important role in raising the socio-economic status of farmers (FFTC, 2010).

Milk and dairy products were never important agricultural products in the Thai tradition partly due to problems of milk preservation, bacterial contamination and lactose intolerance (Ohmomo, 2002). Cattle and buffalo were normally used for draught other than for milk production. Till the 1960s most dairy products were imported from neighboring countries. By then, Kasetsart University started a cautious promotion of dairy cattle rearing. Relatively new technologies (e.g. artificial insemination) were introduced at this time. Through decades, Thai households began to realize the nutritional value of milk as well as a raise in household incomes and this resulted in an increase of the consumption of milk. Moreover, traditional food patterns which relied heavily on rice changed into more nutritional food since 1960 because more food was available, distribution of food within the family was better and nutritional knowledge about causes of malnutrition increased. Beginning 1980s the Thai government began to protect its local dairy industry by high tariffs and regulations.

However, domestic milk production was, and is still not capable to meet the demand from national consumers. In the department stores, supermarkets and convenience stores, various types of milk and dairy products are displayed, reflecting the rapid increase in the demand for dairy products in Thailand, mainly in urban areas. Yet, the self-sufficiency ratio is approximately 50 percent (Table 1),

despite numerous efforts to increase raw milk production. The last two decades milk production increased significantly but in the last year's milk production and consumption stabilized more or less (Table 1).

Table 1. Statistics dairy sector Thailand

Year	Raw milk produced Q x 1000 ton	No. of cattle	Import Q (ton)	Export Q (ton)	Domestic milk consumption (ton)	Self-sufficiency rate (%)
2003	731,923	5,296,839	1,196,306	263,345	1,664,884	44%
2004	842,611	5,609,790	1,268,719	313,126	1,798,204	47%
2005	888,220	6,042,039	1,142,180	317,578	1,712,822	52%
2006	826,464	6,480,876	1,115,278	253,865	1,687,877	49%
2007	822,211	6,699,999	1,003,705	268,446	1,557,470	52%

Source. *FAO statistical office, 2010a*

Hence, the country imports a substantial amount of dairy products every year (Table 1). In 2005, Thailand and New Zealand reached a free trade agreement (FTA). Import tariffs have reduced and milk (powder) quotas will increase gradually. As a consequence, the Thai supply chain needs several innovative actions to remain competitive with the dairy chain in New Zealand (Wouters, pers. communication, 13th October, 2010). Measures should be taken to achieve more economic efficient farms. Thai farmers who are able to produce efficiently, have the potential to compete national and internationally (e.g. labor costs is relatively very low) (Moran, 2008).

Dairy farming involves more than 22,000 families in Thailand (Rabobank, 2004). Further, Thai dairy farms have an average herd size of 20 heads, and achieve a milk yield of around 3000 L milk per dairy cow per year (Garcia et al, 2005). This is relatively low compared to international values (e.g. 8,400 L in the European Union). In general, Thai farm structure consists of small farms with less than 5 hectare land. The small count of large specialized farms is merely located in Muaklek area and includes stanchion, and free stall keeping.

"The structure of the Thai dairy chain does not deviate to a great extent from any dairy chain around the world, with the exception of the large volume of imported dairy ingredients to supplement local milk production" (Rabobank, 2004). Hence, the majority of the milk is marketed through dairy cooperatives, considered as the formal channel. Milk collection points form an important point that connect farmers to formal markets. Rabobank (2004) estimated that 80 percent of the milk is collected by co-operatives while the remaining 20 percent is collected by Private Milk Collectors (PMC).

At present, dairy farming in Thailand is facing several economic challenges. The main economic challenges are high costs of production and low productivity (Rabobank, 2004; Garcia et al., 2005). Garcia et al. (2005) concluded also that under the system of policy intervention (e.g. import tariffs), Thai farmers gain a comparative advantage but without governmental support, domestic milk production would be challenging to remain economical feasible in the near future.

1.1 Research problem

Thai farmers are operating in a highly complex environment; price fluctuations (e.g. concentrates and other feeds), and a high competitive environment are ruling nowadays. Milk prices as well as the margins of co-operatives are still determined by the Thai government together with the dairy industry. However, due to the new liberalization policies initiated by the Thai government, it is estimated that milk prices will decline. With this in mind, milk buyers like co-operatives are demanding for lower purchase prices and certain quality requirements for milk. To achieve these challenging propositions farmers need to realize economic efficient farming practices. At present, dairy farm returns (live-weight equivalent of revenues per 100kg cow maintained per year) in Thailand derived from milk and non-milk items (e.g. sales of cattle and manure) are between US$20-30/100kg compared to more than US$36/100kg in USA, Cameroon, and Morocco (FAO, 2010b). Thus, there is plenty of room for improvement. In order to realize maximum efficiency the farmer ought to make a sequence of appropriate management decisions throughout a time period.

As mentioned in the introduction; the dairy sector of Thailand was heavily protected by the government. Tariffs, quotas, and taxes are just a few examples of these price policies. As a consequence, local supplies have not been able to keep up with demand. Moreover, the Thai government helps inefficient domestic farmers by forcing consumers to pay higher prices for imported goods (Beghin, 2006). Inefficient farms remain in business because they could still deliver commodities cheaper to the market than their foreign competitors. Consequently, incentives to improve business processes (e.g. innovations) remained low. Thus, an inefficient distribution structure (chain) of milk arose.

Currently, In the face of an increasing market liberalization policy by the Thai administration, farmers are facing a more entrepreneurial approach to agricultural business management. With this in consideration, one option for Thai farmer is to expand their farm (number of cattle) to remain competitive. This calls for innovative action from a farmer perspective. However, innovative action requires certain competences and knowledge (e.g. decisiveness, vision) of farmers (Honout and van Lipzig, 2003).

Moreover, increasing economic efficiency for Thai farmers is only possible when the farm management is well arranged (Boehlje and Eidman, 1984). Therefore, enhancing farm management could be a strategy to accelerate profitability of farms. Farm management is defined as *the process by which resources and situations are manipulated by the farm family in trying, with less than full information, to achieve its goals* (Dillon, 1980). Many other stakeholders are also interested in how well farms are managed as well as the intention to assist in improving farm businesses. Government, co-operative advisors and extension workers are just a few of those who are interested in milk being produced efficiently and consistently.

Furthermore, managing farms request for appropriate managerial capacity of farmers. For instance, it is still common practice in Thailand to keep individual cows long after they reached their peak in productivity (Rabobank, 2004). Because lower milk yields with approximately equal level of costs occur, this will lead to reduced overall farm productivity. Hall et al. (2004) argue that Thai farmers are aware of animal diseases; however, there is low use of preventive management techniques such

as teat dipping to help prevent mastitis, proper record keeping of reproductive events, or extension and education efforts such as health management seminars to improve information supply.

Chantalakhana and Skunmun (2001) mention the fact that the ability of Thai dairy farmers to provide adequate nutrition and management to high yielding Holstein cattle has become increasing problematic. These examples show that farmers can improve their understanding that outcomes of a particular (small) decision could have a massive impact on the economic efficiency of a farm. Similarly, if a management decisions is associated with an investment, other household priorities (e.g. money reserved for school fees) will also take part in the decision making. Subsequently, most studies on this subject were conducted in developed nations; hence the role of farmers as manager in developing countries (e.g. nations located in Asia) is still somewhat a black box.

Box 1. Examples of management decisions and tools on a dairy farm

1). For the use of artificial insemination (A.I), an accurate heat detection is crucial for dairy farmers. It is estimated that the cost of each day that a cow that should be pregnant is not pregnant, cost the farmer an average of $4 in lost milk production, lost calf sales and lost cow sales, as well as additional labor costs, veterinary costs, heifer purchase costs, breeding costs and feed costs (DairyBusiness, 2011).

2). Farmers with proper health records (e.g. vaccinations, dipping/spraying, treatments etc.) have the possibility to vaccinate at the correct time, cows, and against the exact animal diseases. Moreover, this information will also provide the overall health status of the whole heard as well as it assist to keep track of expenses from health issues.

Thus, this research is concerned with the question how farmers in Thailand are making management decisions (e.g. Box 1), what are the reasons behind these decisions, and how can these decisions be improved by certain interventions to make Thai farmers more business oriented. It is important to find out which knowledge and competences are the driving forces to be a farmer's entrepreneur. In addition, identification of restrictions that affect milk production is necessary to help Thai dairy farmers manage their limited resources, and economic opportunities would help them to improve their efficiency and stay in business. This information would also assist dairy co-operatives and private organizations to provide more appropriate and effective support to their members.

1.2 Research objective

The research objective provides an overall idea of the knowledge that the research project will generate in order to contribute towards a solution for the problem. A research objective is informative, clear and useful and can be realized within the time schedule (Verschuren and Doorewaard, 2005). From the definition of the problem the following research objective is formulated:

"The aim of this study is to contribute to a business oriented approach to management for dairy farmers in Thailand by making an analysis of Thai farm management and making management recommendations"

1.3 Research questions & framework

In order to realize the objective of this research the following main research question is formulated.

"Which competences can be identified that contribute to management of dairy farmers in Thailand and how can farmers get access to these competences?"

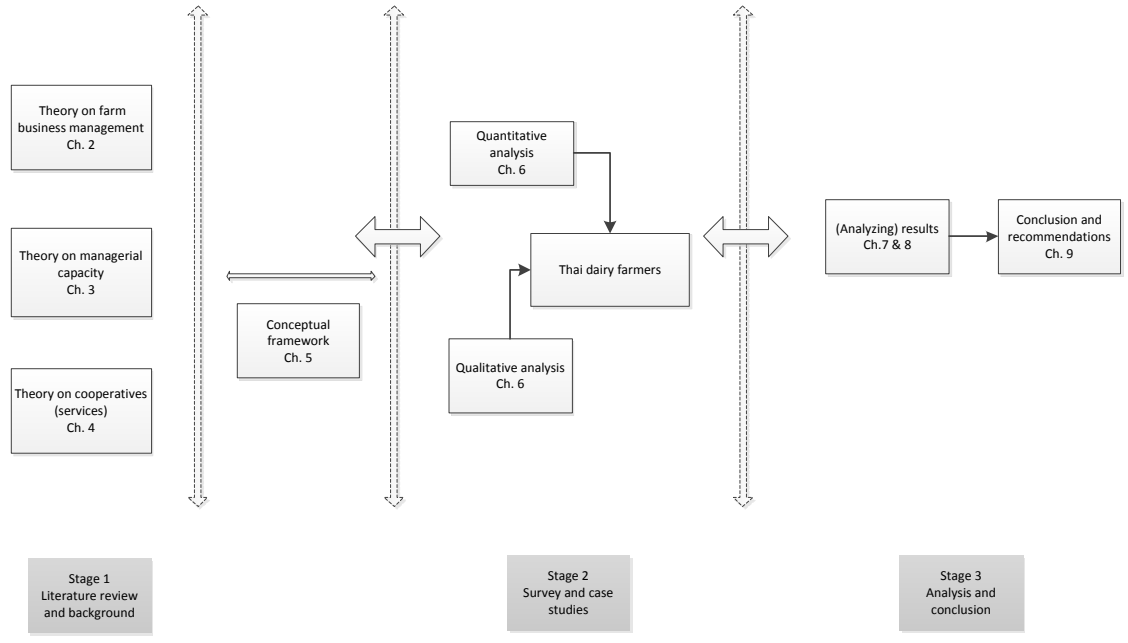
In the following section, splitting up the main research question in several sub-questions will allow this study to approach the objective in a more structured method.

1. Which main management decisions take Thai farmers currently on their farm?
2. What reasons are behind current management decisions of Thai farmers?
3. Which competences are required to make effective management decisions?
4. What possibilities exist (are available) to acquire competences?
5. Which restrictions experience Thai dairy farmers in the process to enhance their competences?
6. What feasible solutions can be put forward to solve these restrictions?

Management decisions are separated into "operational" (short range, every day decisions), "tactical" (medium range, between 1-2 years) and strategic choices (long range, 4-5 years). Further, included with the first research question is also a small part for the "how" question. A possibility exists that farmers use tools e.g. computer programs to calculated key figures upon which decisions are based. With feasible is meant that farmers have the possibility to influence and adopt solutions in a relatively simple way.

The research takes place within the framework shown in Figure one. It is a visualization of the research process that takes place in four consecutive stages. The perspective of this research is formed by the three streams of literature and background study in the first stage.

Figure 1. Research framework



The first stage consists of reviewing three streams of literature; a) *business management of tropical dairy farms,* b) *managerial capacity of farmers,* and c) *co-operatives as service providers*. From the literature review a theoretical framework is constructed which guided the empirical part of this study.

Desk research is preferred for this research project because of its applicability. The project is focused on covering a broad aspect of the topic in order to provide enough background information for the empirical part of this study. Moreover, the desk research strategy is recognized for its advantages which include: 1) it can quickly gather a large number of data and 2) reliability on the gathered material (Verschuren and Doorewaard, 2005), nevertheless also for its disadvantages which consists of exploring extensive amount of information which might be irrelevant, and wasting valuable time of the researcher.

Following the desk research, a theoretical framework is used to guide the empirical part of this project. In the second stage of the research, theory and practice were linked by a survey. This part of the research was executed during a field research period of three months (5th February till 7th May 2011) in Thailand. In the third stage the questionnaire and interviews were analyzed. The knowledge gained is used to give recommendations to Thai farmers, and co-operatives in improving farm management practices.

1.4 Definition of key concepts

Business oriented approach - business oriented is defined as farmer's capability to identify goals, measuring process, control and correct problems to ensure that the farm runs as *efficiently* as possible. (Key and Roberts, 2007). Indicators for a business oriented approach are market oriented, farming as a business (profit making and *efficient*), decision making skills, farmer *competences*, record keeping, and adoption of new technology (MRIU, 2008).

Farm management - farm management is defined as the process by which resources and situations are manipulated by the farm family in trying, with less than full information, to achieve its goals (Dillon, 1980). Good farm management includes proper and timely maintenance of the farm, breeding, feeding, disease control, milking, harvesting, and marketing.

Management decisions - management decisions are decisions that affect the profitability of the farm business (Castle et al., 1987). Quail (1990, found in Bergevoet et al., 2005) mention five elements: strategy, environment, resources, managerial preference, and organization which influence these decisions.

Competences - competences are the ability to perform specific tasks; they are the underlying knowledge, skills, abilities, personality traits, and know-how that result in effective task fulfilment (Langbert, 2000). They are (a) context-bound, (b) subject to change, (c) connected to activities and tasks, (d) and interrelated (Stoof et al., 2002).

Efficient - efficient is defined as producing a given set of outputs using the smallest and cheapest set of inputs (Farrell, 1957 found in Wang and Huang, 2006). Efficiency is a measure of input use against a certain output.

Tropical countries - tropical countries are defined as countries located between the *Tropic of Cancer* in the northern hemisphere, and the *Tropic of Capricorn* in the southern hemisphere.

Local market - the local market is a place within 20 kilometers of the residence of a farmer where he/she buy or sell agricultural or non-agricultural products.

Farmers' neighbourhood - an area within two kilometers of the residence of a farmer.

Non-systematic financial institution - private money lenders and shopkeepers who often loan money on a daily basis and charge exorbitant interest rates (Asian Development Bank, 2011).

1.5 Structure of report

Following the introduction, research problem, objective, research questions, and key concepts in the first chapter, chapter two till 5 presents the literature review. Chapter two reviews literature on business management on tropical dairy farms followed by managerial capacity (Ch.3), and co-operatives (Ch. 4). From this literature review a theoretical framework is constructed and used to assess Thai dairy farmers (Ch. 5). In chapter 6 the methodology for selecting and analysing the survey is discussed. Chapter 7 and 8 presents the results and analyses of the research**.** Chapter 9 concludes on the research by answering the main- and sub research questions. Moreover, this chapter suggests several recommendations, reflects upon the research process (discussion), and provide suggestions for further research.

The following chapter starts with the literature review of this study.

2. Business management of tropical dairy farms

In this chapter literature about business management of tropical dairy farms is central. It will start with an introduction of general characteristics of tropical farms. Subsequently, business processes and management support tools are described. It should be note that a whole book can be written about farm business management which is not feasible for this research. Nevertheless, this chapter hopes to give the reader a general impression and understanding of several processes and complexities in tropical farms. Moreover, this chapter hopes to answer partly research questions one, two and four.

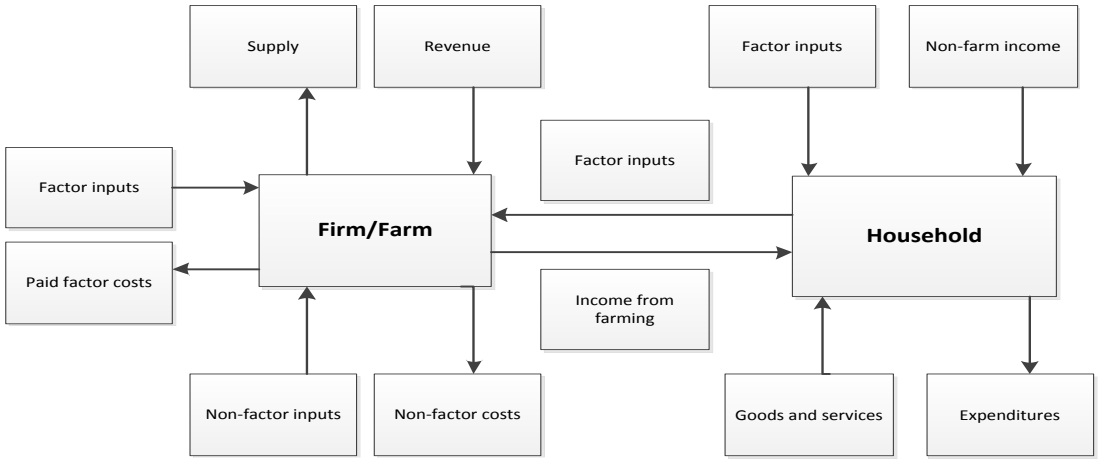
2.1 Introduction

In non-tropical and tropical countries farming is mainly organised in family farms. Most family farms located in tropical areas are family based and own around 10 heads of livestock. However, a small part of dairy farms is commercial, and large scale (>20 heads of livestock).

Within family farming, the family is the centre of planning, decision making and action taking; it is operating within a network of relations within the general community (Mazzucato et al., 2001). The close link between family members and farming activities has important implications for the livestock- and management practices (e.g. delegation of labour). Yet, a farm could also be perceived as a firm, producing agricultural outputs and a household supplying a large part if it's labour and capital to the firm (Figure 2).

A farm uses non-factor inputs (e.g. pesticides, fertilisers, concentrates) and factor inputs (capital, land and labour) to produce outputs. The costs associated with these inputs are non-factor cost and factor costs. Revenues from selling agricultural outputs deducted with non-factor costs and paid factor costs equal income from farming from an agricultural household. The agricultural household usually not only supplies factor input to the farm but also non-farm institutions (e.g. spouse working outside the farm or part-time job by a young farmer working together with a relative on the farm). Total income of the agricultural household equal's factor income plus other income. Moreover, the household is spending income on good and services. Household savings equals total income minus expenditures.

Figure 2. Structure of a typical family farm



Source: *Gardebroek and Peerlings, 2009*[1]

2.2 Business processes in a tropical dairy farm

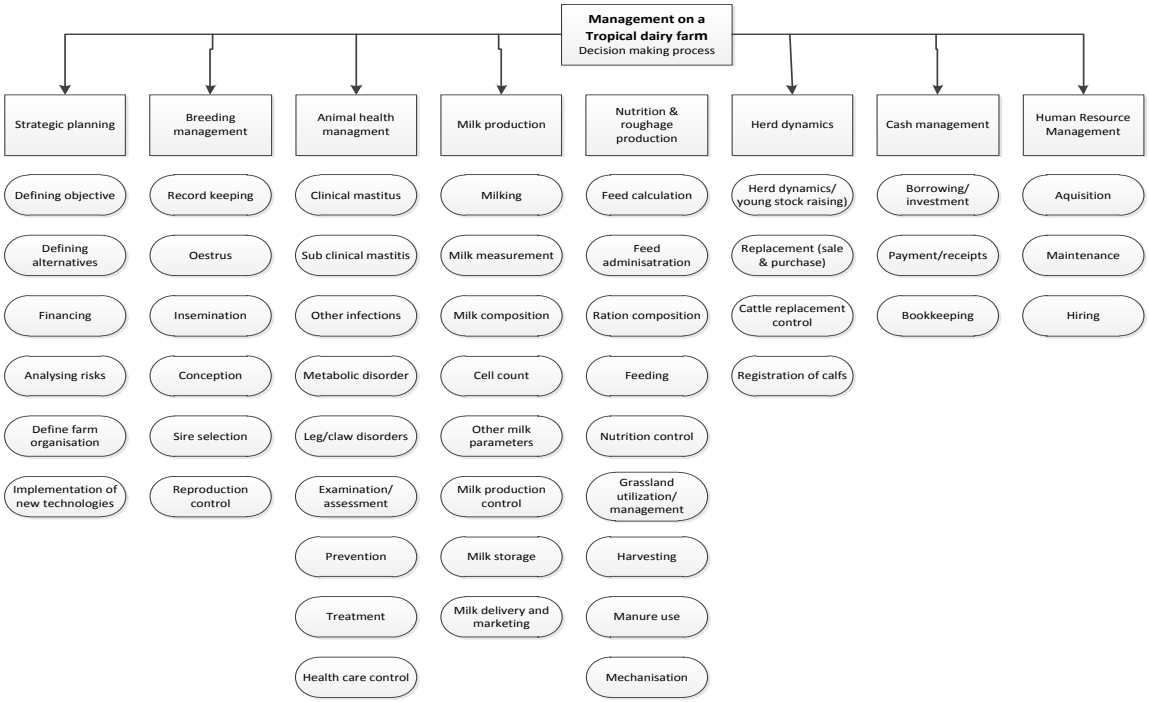
When a (family) farm grows, a range of appropriate decisions should be made by the "manager" to remain in business. This is called farm management. Farm management as carried out by farmers is defined as "the process by which resources and situations are manipulated by the farm manager in trying, with less than full information, to achieve his (or her) goals" (Dillon, 1980; Makeham and Malcolm, 1986).

McConnell and Dillon (1997) extended this definition by adding that farm management is the science (and art) of optimizing the use of resources in the farm component of farm-households, and of achieving the optimal functioning of these systems in relation to household-specified objectives. Thus, farm management for Western European farms is recognising, making and implementing of the decisions involved in organising and operating a farm to maximize production en thereby profits. Though, tropical farms can have another farming goal other than maximizing profits for instance risk minimalizing. This aspect will be elaborated in the next chapter.

Management is divided into: a strategic planning function (long-term; >1 year), and various tactical and operational functions (day-to-day and seasonal activities). On a typical farm eight main functional operations are present that fall under farm management. These includes the functions strategic planning, breeding management, animal health management, milk production, nutrition and roughage production, herd dynamics, cash management, and fixed assets labor (Figure 3) (Van Asseldonk et al., 1999). All these functions are interrelated with each other. A description of all processes is given further on in this chapter.

Figure 3. Management functions within a dairy business

[1]It should be noted that this picture (Figure 2) is a typical example a farm business from a Western European approach. However, farm business and household is often integrated in tropical countries because farming is not considered as a



Source: *Van Assendonk et al., 1999 extended by author*[2]

Strategic planning

Strategic planning is critical because farms need to identify and gain access and control over resources critical to the farm's survival (Pfeffer and Salancik, 2003). The function "strategic planning" includes defining objectives and alternatives, financing of the farm, analyzing risks, define farm organization and implementation of new technologies. First, the objectives provide the anticipated direction of a farm business. Typical objectives could be linked to increasing profits or efficiency. Moreover, not only the farmer (leader) but also the spouse, children, and grandparents can have a part in defining objective or direction of a farm. Secondly, evaluating of the current plan & objectives or direction of the farm and identify alternatives for the future is also part of strategic planning. Defining alternatives is important to consider because access to certain resources may become limited.

Imperative for a family farm is financing. In most cases the profitability of an investment is long term (e.g. milking parlour equipment) and fixed (agricultural goods are specific and immobile). In general, large investments involve borrowing substantial amounts of money implying a significant increase in financial risk of the business (Lien, 2003). Therefore, future of a farm is uncertain; this implies strategic thinking and intuition to make the right operational, tactical, and strategic decisions (e.g. Box 2). Because of the stochastic character of milk, diseases, weather, changing input costs, milk prices and other uncertainty creates risk. DeLorenzo and Thomas (1996) mention the fact that farmers frame their decisions on risk perceptions.

[2] Implementation of new technologies, milk delivery and marketing, and mechanisation added by author (2011).

Important in defining a farmer's organisation is the question whose managing, operating, bearing financial risk and working (delegation) in a farm. As most farms are organised as a family farm, other family members besides the head could also take part in the planning process and management of a farm. For instance, in certain farm businesses managing and planning is performed by both husband and wife; both of them discuss and decide what to do (Man, 2005). Sometimes labourers are hired to work on the farm which influences planning decisions.

Box 2. Risk and investments on livestock farms, western Kenya

Livestock especially cattle, goats, sheep and chicken are kept for food production, traction, hides, manure, risk diversification and as alternatives to formal financing in most African smallholder production systems (Marstrand et al., 2004). In Western Kenya, indigenous zebu cattle are used for dowry payment and bullfighting contests, besides the production purposes (Otieno, 2005). Despite the contribution of livestock to household livelihoods, Barret (2005) observed that pastoralists in East Africa's Arid and Semi-Arid Lands (ASAL) regularly suffer climatic shocks, price volatility and weak marketing infrastructure that lead to massive herd die-offs, loss of scarce wealth and investments. In such cases, smallholders are faced with difficult strategic decisions to be made about the investments portfolio to follow.
Source: *Otieno et al., 2006*

Related to risk is the implementation of new technologies by farmers. Risk-averse behaviour of farmers generally results into low scale adoption of new technologies. More explanation linked to this subject will be completed in chapter three. Moreover, important with family farms is the succession of the farm because without a successor motivation of a farmer to manage and invest in the farm business is low. Furthermore, farmers situated in developing countries who invested in better education for their children have difficulties finding a successor because, in general, it is financially more attractive and more prestigious for the successive generation to seek alternative employment outside the agricultural sector rather than to develop the dairy farm.

Breeding management

"Breeding management includes record keeping in which animal performances and action lists are processed with data recorded in the different operational functions and processes" (Figure 3) (Van Assendonk et al., 1999). One of the primary processes within breeding management is to get the cow in calf again.

An important part of this process is heat or oestrus detection. *Oestrus* (heat) lasts on average 4-24 hours with the length of the oestrus cycle varying from 18 to 24 days. During *oestrus* the cow or heifer[3] is receptive to a bull and stands for insemination (standing heat). Heat detection has a major influence on the length of the calving interval. A longer calving interval may lead to longer lactations.

Observation of oestrus is more difficult in the tropics due to anoestrus[4] resulting from poor nutrition and/or intensive suckling (Moran, 2005). Further, heat is shorter under tropical conditions than under more temperate conditions as well as most cows show the signs of heat better during the

[3] A young cow, which has not yet given birth to a calf.
[4] The cow is not observed in oestrus either because she has not into oestrus come or because oestrus was not detected.

cooler periods of the day or at night. An optimal interval time after calving is 90 days; therefore these cows should generally be inseminated for the first time between 50 and 75 days after calving.

Further, the first three months is critical, and the most expensive period for a calf and farmers are required to invest subsequently. For instance, it is very important that a calf has colostrum (prevention of animal diseases like tick fever) within a few hours of birth as well as an easy opportunity for dehorning exists. Moreover, because of the seasonality of forage production (often cannot be altered), the best time to calf cows is at least one month after the start of the wet season because calves will be in better condition, calf weight is higher and early milk yield is improved (Chamberlain, 1989). However, in general young stock receive little attention of farmers because they do not generate income for many months (Moran, 2005). This issue results in high calf mortality and reproduction problems in a later phase (heat problems and animal diseases).

Animal health care

The function animal health care includes the observation of the health status by the farmer of a number of processes (clinical and subclinical mastitis, other infections, metabolic disorders and leg claw disorders). A major aspect with animal health is the existence of reproductive diseases like mastitis and lleptospirosis. Mastitis (*enterococcus faecium*) is an inflammation of the udder and is caused by bacteria. Two forms of mastitis exists; clinical and sub-clinical mastitis. Clinical mastitis is possible to be noticed by a farmer; however, subclinical mastitis does not show any signs of occurrence (Wellenberg et al., 2000). Sub-clinical mastitis occur in most of the cases.

Other reproductive diseases heavily present in tropical countries are leptospirosis (*Leptospira interrogans)* and tick fever (*Bovine- Baesiosis* and *Anaplasmosis*). Leptospirosis is an infection which results in thick, yellow, blood tinged milk and is usually spread during milking, when the hands of the farmer and the milking machine come in contact with the udder.

Tick fever is also heavily present in tropical countries especially in Asia. Tick fever is transmitted to cattle through tick larvae during grazing. Here, tick fever is diffused when ticks are suckling blood from cattle. Parasites are spread through the blood destroying numerous red cells resulting in anaemia, fever and weakness. Excessively fat cattle, or those in poor condition, have less chance of survival compared to cattle in good condition. Treatments of sick cattle depend on an early diagnosis and an effective veterinary drug. Moreover, it is suggested not to remove sick cattle, excite and provide them with shade, shelter and easy access to nutritious feeding and clean water.

Metabolic diseases are caused during production practices when the body reserves on calcium, magnesium or energy cannot meet the metabolic needs (Ingvartsen et al., 2003). Consequently, cows with milk fewer are at increased risk of mastitis. These kind of diseases (e.g. ketosis, milk fever) results from nutrition deficiencies during the beginning of a pregnancy when a peak lactation occurs. By then, the body reserves of calcium, magnesium or energy cannot meet the metabolic requirements. Management options and tools to prevent metabolic diseases is utilizing nutritional programs such as force feeding at calving to maximize nutrient intake as well as stress reduction in newly calved cows by giving cows enough space and straw to lie in. Further, using mineral blocks assist in the prevention of metabolic diseases.

Foot and leg problems (*cow lameness*) include laminitis, claw disease, digital dermatitis, foot rot and can be problematic for dairy farmers (Stokka et al. 2001). Cow lameness results in poor performance and substantial economic losses (Shearer and van Amstel, 2000). Moreover, reduced milk yields, lower reproductive performance, increased involuntary cull rates, discarded milk, treatment costs, and the additional labor costs to manage these cows accounts for the largest monetary loses (Shearer and van Amstel, 2000). Causes of cow lameness includes nutrition and feeding, housing and environment (hard or poorly bedded stables and too little exercise), concurrent diseases (mastitis and excessive bodyweight), and genetic influences (Uggla et al., 2008). Moreover, lameness positively correlates with other metabolic diseases mentioned in the last paragraph.

As indicated before management options to prevent cow lameness comprises a continuous supply of fresh feed (providing pasture or dirt for cattle) to avoid slug feeding, regular claw treatment, culling of cattle with severe problems, and providing a comfortable stable environment (less concrete, rubber mats and bedded free stall) to encourage cows to lie down for at least 10 to 12 hours every day.

Important with a comfortable stable environment and thereby prevention of diseases is ventilation especially in the tropics. The roof has to be high enough to release heat and moisture as well as the positioning of the stable to the south-east. This protects cattle from morning and afternoon sun and rain. Moreover, a poorly managed veterinary storage in the stable is often indicative of other poor health practices.

Other management tools to prevent infections and other diseases (transmission) include rat control, fencing cattle from potentially contaminated streams and ponds, separating cattle from pigs and wildlife, selecting replacement stock from herds that are disease free and vaccination of replacement stock. Further, imperative for prevention of diseases is vaccination, good hygiene (especially during calving), manure disposal and clean water. Particularly in the tropics where hot, high humid weather conditions is prevalent. Water should taste and look good. Moreover, important is the complete removal of manure, and thorough cleaning of all areas where fly eggs and maggots can be found. Biting flies and insects reduce milk production by causing stress (making noise in the milking parlour) as well as a medium to transfer organism to cattle which leads to diseases like mastitis. Treatment of cattle with the appropriate veterinary drugs depends highly on the right diagnosis. Involving a veterinarian in operational decision making helps to make the right diagnoses and start appropriate treatments.

Milk production

Besides the physical process of milking and the different aspects of milk delivery, the management function milk production includes the additional recording of data such as milk production, milk composition and cell count. Cow milking is one of the most important management efforts in a farm because substantial amount of time is invested in milking as well as cow milking is the core business for a farmer. Good skills and routines to manage milking depend on the practical experience of the farmer. Different methods of milking can be used, like hand milking (bucket) or machine milking. Moreover, very important for good milking management is the farmer's basic knowledge about milk

secretion and udder conformation because in general, early examination of udder confirmation can detect specific diseases like mastitis or other teat injuries.

In order to stimulate milk let down and improve efficiency of milking the farmer can provide concentrates and perform appropriate preparations (e.g. cleaning the udder teats) before milking. An important point for farmers is to record milk yields (by milk meters) for culling selection and to select breeding sires on certain production traits. Similarly, this information can be combined with recordings about health care. Losinger and Heinrchs (1996) reported that training farmers to record individual animal performance positively influence production and efficiency of the animals.

There is a huge variation in milk yield and composition. This depends on factors as genetics, stage of lactation, daily variation, parity, type of diet, age, milking methods, udder shape and season (Bayril et al., 2010). Measurement of milk production by farmers in tropical countries is mainly based on milk yield and in a lesser extends milk composition (fat, protein, and cell count).

An important factor is genetic traits of exotic- and crossbreeds for milk production. Most exotic breeds in tropical countries are cross bred of local breeds often Zebu with Holstein- Friesians and with lesser extent Jersey, Brown Swiss and Red Dane (Syrstad, 1990). However, upgrading local cattle (Zebus dairy breeds) with Holstein cattle as a strategic management decision will increase milk production but generally at the expense of disease- and heat resistance. ”The question of optimum level of temperate dairy infusion in local stock seems to vary from country to country depending on farmer experiences, veterinary services, milk price and other *socio-economic* factors” (Moran, 2008). In most tropical countries 50–75% Friesian seems optimum, although farmers with experience in dairy feeding, heat stress and other management may prefer 87% Friesian (Moran, 2008). Improving genetic (traits) may be a good tactical and strategic decision depending on the other management factors like accurate feeding. For instance, nutritional requirements for purebred Zebu cattle are different than for crossbred cattle.

An appropriate storage and milk delivery maintains quality of milk. Storage of milk is done in the same room where other farm equipment is stored. A possibility of bacterial contamination could occur. Moreover, taking samples as well as milk feeding to calves (8-12 liters a day) gives opportunity for spoilage. Furthermore, a farmer can immediately deliver milk to the collection point or store milk in a tank with a temperature of four degrees. Supply chain management is very important with milk delivery. For instance, processors may cancel already scheduled deliveries or change contractual terms (if contracts are enforced by both parties in a tropical chain).

Most farmers try to sell milk to set a profit. Thus, knowledge of the marketing structure of milk helps a farmer to make appropriate operational and tactical management decisions. These management decisions are influenced by 1) price, supply and demand trends for milk and dairy products, 2) markets available for milk and, 3) pricing structure and regulation of milk marketing.

Moreover, farmers in tropical areas have two possibilities to market their milk; through a formal and/or informal marketing channel. The formal system include commercial organizations like co-operatives. These kind of organisations play a significant role in famers development in tropical countries by mainly providing stable market access and services. More explanation regarding co-

operatives will be given in chapter four. The informal system (e.g. 80-90% of milk in India and Ethiopia is handled in the informal sector) usually consists of small scale subsistence and household production with traditional processing. (e.g. ghee or butter) and a market to informal, local middlemen and other intermediaries like traders.

Nutrition & roughage production

The physical process of feeding and recording of feed consumption is based on feed administration of concentrates and roughage and the connected processes of ration composition for an individual cow or a group of cows (cows in milk, dry cows and other livestock).

First, calculation of nutritional requirements per cow depends on the stage of milk production of the cow. Good nutrition means providing cattle with sufficient energy, protein, fibres, minerals and vitamins. Every cow has different nutritional requirements. However, the level of feed intake is primarily determined by the stage of lactation. Offer a well-balanced ration results in more milk, but also better reproductive performance. It is advantageous to divide large herds into smaller milk production groups based on feed rations as well the use of published feeding standards as a guide.

Feed additives as a management tools plays a role in enhancing milk production. The use of feeding and production records (administrations) give farmers an instrument to determine the need for a particular feed additive. Moreover, administration of nutritional intakes is important because excessive use of certain additives, concentrates, and roughages may be hazardous for livestock. However, it is very difficult to monitor nutritional intakes. Further, important knowledge for a farmer is the source of roughage, quality of the roughage, and what kind of roughage is used (grass, cassava etc.). For instance, Blackwood (2006) mentioned the fact that low quality and contaminated roughage leads to metabolic disease and causes animal losses.

Second, forage management has as purpose to optimize yield and quality of pastures. Milk production is mainly determined by the amount of energy in the diet. In many parts of the tropics, long dry seasons cause milk production to be limited by a protein shortage. Moreover, hay making is difficult in tropical regions because at the time when forage is of acceptable quality (early in the wet season) to conserve it, weather patterns is likely to be too unreliable for sun drying as well as forages grow very fast in the wet seasons that they are often too mature and consequently have reduced feeding quality at the time of harvesting (‘T Mannetje, 2000). To compensate for low forage supplies, farmers generally use more concentrate as feeding source. As a consequence, daily energy intake increases whereby a cow response with higher daily milk yields and the protein content enhancement. However, the risk of metabolic diseases increase as well.

Moreover, purpose of grass land (cattle grazing or forage production) depends on the vision (Ch. 3) of the farmer. For instance, farmers can grow expensive forages at home while purchasing the cheaper forages. Because forage is mostly a cheaper source of key feed nutrients than concentrates, it is usually cheaper to grow this forage on a farm than purchase them. External forage sources are either from roadside harvests, paddy fields, tree plantation, and forest or from other farmers.

Fruit, fish waste, vegetables and root crops (fresh or ensiled) are often added as forage supply. The ensiling of these kinds by products is relatively simple and the nutritive value is often high. Moreover, medicinal herbs are in a lesser extend used as forage supply.

In general, the optimal number of cows per hectare of forage grown on a tropical farm is estimated at 8 to 10 (Moran, 2008). However, this number deviates between countries depending on the natural endowments (e.g. fertility of the soil) in a particular country and farm management. Nevertheless, most farmers like to keep more cows than that they can feed, meaning that they must either have to purchase forages off farm, underfed their cows in milk (and heifers) with less forage, or if they aim to produce high yields of milk (more than 12 to 14 kg/d), feed excessive levels of concentrates to each milking cow (Moran, 2005). This leads to digestive problems (e.g. sub-clinical acidosis) of individual cows and an expensive way of producing milk. To improve feed quality and ration a strategy of fodder conservation with purchases of small quantities of cheap, lower quality forages (e.g. rice straw) for stock with lower daily nutrient requirements (e.g. dry cows) could be a right management decision.

A problem with on farm supplies of forages is to produce all year round. Forage growth is often apparent during periods with higher rainfall and medium temperatures. Good practice of business management is forage conservation to transfer wet season excess forages/pastures for dry season feeding. For instance, to deal with this issue farmers in Australia manipulate calving patterns to guarantee that most cows calf during spring during pasture growth and dry off during winter. However, in other areas farmers need to provide a regular cash flow. Hence, conserving forages through silages and hays during periods of peak forage growth is the best way to overcome seasonal forage supplies (Moran, 2005) or rotating pastures and short transhumance during the dry season (Somda et al., 2004). All major forages can be stored as silage. Silage can be stored in small plastic bags, steel drums, small or large pits dug into hillsides and in tacks above the ground (Moran, 2005). However, it should be mentioned that tropical pastures contain a small amount of sugar therefore difficulties arise when preparing good quality silage (Ohmomo et al., 2002).

In grass silage additives like molasses[5] and foraform can be supplemented. These by-products can be used as an incentive (taste) for cows to consume new silage offered by the farmer. Moreover, molasses can be used as sugar source in silage to increase fermentation. However, the use of these additives is more expensive and better (and cheaper) is to make use of regular sunshine.

Cattle manure is an excellent source of nutrients for pasture and crops. Nitrogen (N) and Phosphorus (P) are the primary elements of manure. Excessive disposal of manure results in groundwater contamination and surface run off. To prevent disproportionate disposal of manure farmers should plan how when to apply manure to pastures and crops to minimize risk of water pollution and run off. One major limitation related to forage production in tropical countries is the poor adoption of inorganic fertilizers (Moran, 2005). Generally, farmers use cow manure but most farmers are not aware of the gains using inorganic fertilizers.

[5] Molasses is a thick, brown to deep black, honey-like residue of sugar can or sugar beet processing.

Animal traction is the major source of power to cultivate fields in tropical farming. Especially in areas were acres are difficult to reach such as terraced areas and on valleys as well as the financial restriction and risk averse involved with buying mechanized technology. At that time animal power is the only means for a farmer to cultivate land other than hand labor. Further, farmers are vulnerable and reluctant when experimenting, or investing in mechanization technologies. Nevertheless, in good years when a farmer has enough cash flow, he/she can contract out the cultivation to tractor operators or hire tractors and equipment themselves.

Herd dynamics

The function cattle replacement includes the processes related to the purchase and culling of animals in order to realize a targeted herd size and herd composition. Herd dynamics are a reflection of all the events that affected herd numbers (births, sales, purchases, slaughter and mortality) over time (Ndikumana et al., 2000).

Purchase or sale of cattle depends on (among others) cash needs, possible genetic improvement, diseases control and risk of the farm. For instance, regarding risk, a variation in pasture growth during climatically seasons (Ch. 3) and variation in prices received for cattle are determinants of risk behavior of a producer. Related to sustainability (long term planning), this strategy is obviously doubtful. Purchasing or leasing a bull as tactical and strategic decision impact both calf and herd genetics for years. Moreover, most livestock in tropical countries is bought based on sight by the farmer. For instance, farmers frame their decision whether or not to buy on what condition, health, weight, and overall look the cow is in.

Cattle culling and replacement decisions are driven by future cow productivity, feed costs, and the current and future market value for replacements, and number of calves (Tronstad, 2010). Moreover, overall age of the herd, pregnancy and feasibility of calving date are also important drivers. Furthermore, In many (tropical) countries selection or culling of crossbred dairy cattle has not been practiced due to many reasons, such as lack of record keeping, or traditional & religious reasons which makes average milk production level in farms very low.

Calf/animal registration (e.g. tagging) is important to avoid inbreeding, disease control and ensure that insemination records match. Moreover, registration forms the start to perform recording.

Cash management

During growth of a farm business, daily financial recording will become too complex to manage from notes or a tablet. A detailed set of records is needed to make right operational and tactical management decisions. Imperative are records regarding basic bookkeeping such as assets inventory, depreciation, profit and loss (accounting), and cash flow. The daily cash book recording is entering all receipts and payment amounts in for instance a spreadsheet or books with multicolumn sheets (e.g. livestock inventory accounting).

There are a number of practical reasons for bookkeeping. However, often farmers execute bookkeeping because of the tax obligation but bookkeeping can provide numerous other data to

optimize farm management. For instance, financial books allow farmers to measure efficiency of using resources and profitability. Moreover, these kinds of records are essential as basis for solid planning and decision making. Furthermore, a farm advisor can often grasp in which area(s) the farmer is performing well & poorly and he/she can use this information to assist a farmer to plan future operations as well as an instrument for applying a loan (Makeham and Malcolm, 1986).

Regarding investments; investment and borrowing leads to additional profits and cash flow. Examples of investments and resources are stock, land, and machines. Certain investments tie up capital (e.g. machinery and buildings). Many of these resources can be converted in cash by selling them. Therefore these resources are known as own equity. To express profits, cash flow etc. several tools (formulas) exist to calculate these figures, for instance, Return on Equity (ROE), overall cost price, feeding costs per kg milk or per cow, and gross margin. These tools provide a guide to the farmer or user of the capital by allowing them to compare the investment with alternative, possible investments.

Human Resource Management (HRM)

Most family farms have the opportunity to work on the farm themselves. Often farmers with labourers have on average more cows compared to farmers without employees (Rangnekar and Thorpe, 2002). Nevertheless, if a farm increases in size, farmers are facing a decision whether or not to hire (daily) labourers.

First, farmers have to make choices about where to look for people to work in their operations, and about who's available to hire (Rosenberg et al, 1994). As in firms, personnel determine the limits of organisational capacity. Second, once a labourer is hired, farmers have to make several operational and tactical decisions like working conditions, expectations, developing competences, complaints, correcting etc. Frequently are these decisions based on intuitive thinking. The decision by farmers in dealing with workers are influenced by factors on, and off the farm including tradition, managerial philosophy and values, labour market conditions, bargained agreements, production technologies, and public policies (Dawson and Hubbard, 1987).

Decision making process on tropical dairy farms

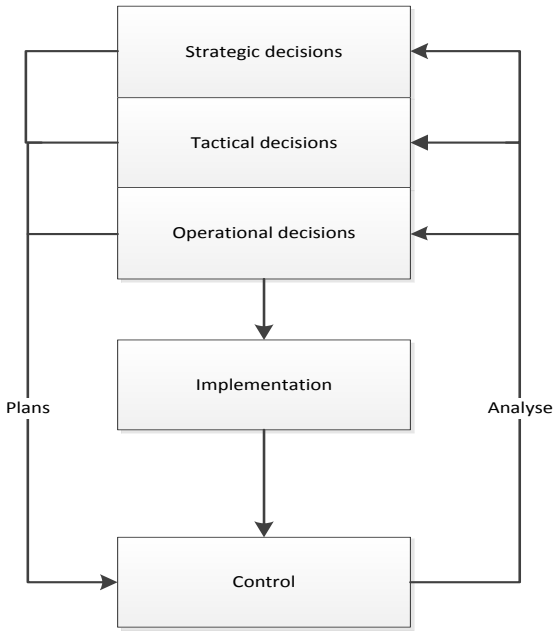
As illustrated in Figure four, management decisions on dairy farms can be considered as a cyclical process. Based on the management functions of Van Assendonk (1999) management decisions are related to basic farm structures and processes. For all farm processes, three decision levels can be identified.

Strategic decisions are the highest level. These decisions are the least structured, most risky and have the most uncertain outcome. It has an effect on the long term (>3 years) planning. Tactical decisions have an influence on the medium (seasonally) processes (1-2 years) in a farm. It supports strategic decisions. Operational decisions (days, weeks) anticipate on the actual situation of the farm. These are every day decisions, used to support tactical decisions. Between these levels of decisions involves an interaction of a farmers goal setting and interpretation, managerial capacity (Ch. 3), and access to factor inputs (e.g. land). For instance, with low capital resources, farmers lack the support

to implement new technologies as well as a possible limitation in the amount of land will result in limited internal roughage production, and therefore frame operational and tactical management decisions.

The objective and personality (values and farming styles) of the farmer impact (risky) decision making. Moreover, strategic planning like the implementation of new technologies has a substantial influence on strategic decision making of a farmer. Implementation needs resources, and control involves the evaluation of performance in whether or not a farmer meets the designated plans.

Figure 4. Decision making process



2.3 Management support

In this sub-chapter, management support for a farmer plays a central role. Management support tools are intended to help farmers to make decisions about their farm management based on findings from scientific research. Several management support tools are described. These are 1) farm records, 2) key figures, 3) ICT software 4) agricultural services 5) agricultural extension, and 6) A.I (Artificial Insemination). Certain support tools overlap each other like farmer records and key figures; nevertheless, each tool has its own specific characteristics and purpose. Further, the starting point of this sub-chapter is the presence of certain competences of farmers. The next chapter will elaborate more on this subject.

Farm records

Good farm management requires having a decent and useful set of farm records (Moran, 2008). Records provide the farm manager with data, information and knowledge (Box 3). There are four purposes for farm records: 1) they are frequently used as a service tool, 2) recordings can be used to provide data for financial analysis, 3) they can be used as an indicator of progress, and 4) they are a good forward planning tool. One other key aspect of record keeping is where, how and when they

are recorded. It ought to be a place where the farmer can have a system of storing and easily access of all paperwork. Records include farm production (milk yields, veterinary reports, other stock and forage crop production data), each of the vendors (feed suppliers, veterinarians, co-operatives etc.), creditors, milk supply centre(s) and any other farm related agents (Moran, 2008). Several types of records are specified in Appendix one.

Thus, an enormous amount of data is nowadays available for dairy farmers in developed countries that observe the status and behaviour of livestock and the efficiency of a farm. Data originates from internal (own records) and external sources (e.g. breed association, A.I units, feed companies). However, creating and assessing data is lacking in developing/tropical countries, a critical area where significantly progress needs to be made if attributes like monitoring of the farm are made to be effective (Thornton, 2010).

Box 3. Examples of farm records

Decent recording for proper fertility recording are, for instance, a cow calendar, herd fertility and health monitor chart and individual cow records. Even a regular calendar and pocket diary can be very helpful for a farmer. All data relating to the cow's reproductive status could be recorded like calving date, ease of calving, date of heat, insemination date, name of sire, fertility disorders and their treatment etc. Moreover, these data's also indicates when cows can be expected to be in heat, which cows need special attention, and which cows should be inseminated when in heat. For instance, when a cow is seen in heat, this could be marked on a calendar or chart for a close observation of the cow three weeks later.

Key figures

In Appendix two several key figures for management on a tropical dairy farm are shown. These key figures are arranged for every management function. The key figures can be used to benchmark farm processes to improve performances by adopting outstanding practices. Furthermore, key figures can be used to gain detailed information about the overall performance of a farm (strong and weak points). Moreover, it can be used as a fundament to assess and change management practises at farm level. Further, key figures give the possible to compare performances of different farms of similar size, and within a region (Hogeveen, 2005).

ICT (computer software)

The main purpose of computer software is to provide information to the farmer according to his operational (day to day management) needs. The use of computer or ICT software influence the competences of farmers with respect to the probability of adoption and the speed of adoption of innovations (Doye et al., 2000). The use of computer software increases when the farm size increases. Computerized information systems (software) have the possibility to assist a farmer by organizing and graphing datasets. Databases can be created and used by the farmer to gather information about reproduction, and health data from individual animals as well as for (feed) ration formulation. Moreover, an action list as feedback could be obtainable by computer software to

support decision making. Other long term indexes can also be provided like calving intervals, age at first calving, and replacement rates.

Agricultural services

One way to acquire information is from agricultural services. Service providers will help farmers to improve their capabilities and decision making skills. In Appendix three several services and a potential provider are outlined and described.

Agricultural extension

Extension services are advisory facilities for farmers to meet the immediate needs of these farmers as they change or improve their production and livelihood (USAID, 2010). Traditionally, agricultural extension focuses on increasing production of milk by providing training, information, new technologies, and access to inputs and services. Usually, trainings are given by consultants who are working under the umbrella of a government agency, NGO or co-operative. Research from Hashem et al. (2009) showed that farmers with different levels of training (and background) showed different sorts and level of competences.

Moreover, residential trainings can be offered in special farmer training centres. For instance, outreach clinics are established in Ethiopia where services such as advisory, treatment, control are provided to the livestock farmers. Obwona (2006) showed in his empirical work that farmers who had experienced extension services have on average a smoother decision making process which consequently resulted in higher efficiency on the investigated farms compared to farmers with limited access to extension services.

A.I (Artificial Insemination)

One of the most important extension services is Artificial Insemination (A.I). Earlier studies (e.g. Paul et al., 2011) identified A.I services as one of the main constraints of low farm efficiency in tropical areas especially in South-East Asia and Sub-Saharan Africa.

Artificial insemination is a popular, simple and relatively inexpensive treatment of livestock, in which the sperm from the male is collected, and introduced artificially into the reproductive tract of the female for conception. A.I is a routine procedure on dairy farms, and the vast majority of dairy cattle are produced in this way. The major advantage of A.I over natural breeding is the control of spreading of venereal diseases, by avoiding the direct contact between males and females. Moreover, A.I permits a dairy farmer to use improved sires for genetic improvement of the herd. Imperative is the fact that heifers and cows could be properly identified and correct administration is being kept for ideal results.

The person which is inseminating has an influence on the pregnancy rate within a herd. In hot climates, where cows have a shorter heat period, A.I services are preferred to be available during the whole day. Under tropical condition, the farmer himself could well perform the A.I. Personal factors of the farmer like motivation, dexterity and patients are important determinant for fertility success.

Moreover, proper training in A.I techniques is crucial to obtain good results. Monitoring the individual results of the technicians performing the inseminations helps to evaluate and improve the pregnancy results. Besides that, the quality of semen as well as an appropriately storage (e.g. storage tank) has a major influence on pregnancy rates. Because infrastructure in tropical countries is not adequately developed preservation of semen is not only prepared deeply frozen but also various other substances are added such as chemical buffers (e.g. phosphate), protectants against cold chocks (e.g. milk), freezing damage (e.g. glycerol), source of energy (e.g. fructose), and antibiotics (e.g. tylosin[6]).

[6] Tylosin is used in livestock as an antibiotic in treatment of infections like fever.

3. Managerial capacity of farmers

In this chapter managerial capacity of tropical dairy farmers play a central role. It starts with management ability of farmers followed by decision-making aspects, and finishing with farm performance. This chapter partly answers research question three.

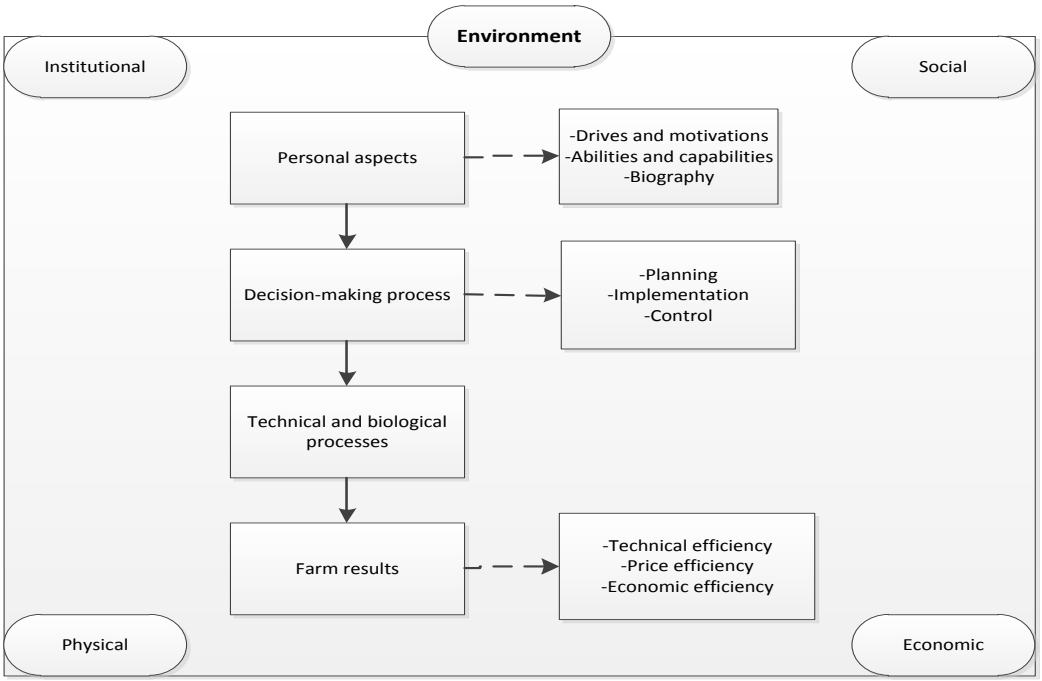
3.1 Management ability of dairy farmers

Managerial ability is defined as having the appropriate personal characteristics and skills (competences) to deal with the right problems and opportunities in the right moment and in the right way (Rougoor et al., 1998). A farmer has certain qualities which he/she uses in decision making after identifying a problem on the farm. Consequently, the farmer desires to optimize the processes on the farm. This is visualized in Figure 5.

This model considers managerial ability consisting of both personal aspects of the manager (drives and motivations and abilities) and of the decision making process (planning, implementation and control). Drives and motivation vary from a goal of the farmer, attitude towards paperwork, openness to new ideas, level of ambition, satisfaction with farming to the most preferred job at the farm (Rougoor et al., 1998). Consequently, the decision making process (Ch. 2) influences all processes on a farm (Ch. 2) which consequently determines farm efficiency.

Moreover, influences from institutional, physical, social, and economic environment of the farm affect management practices and the variety of farm performances. To conclude management seek to optimize or guide technical and biological processes at the farm.

Figure 5. Aspects of managerial abilities



Source: *Rougoor et al., 1998*

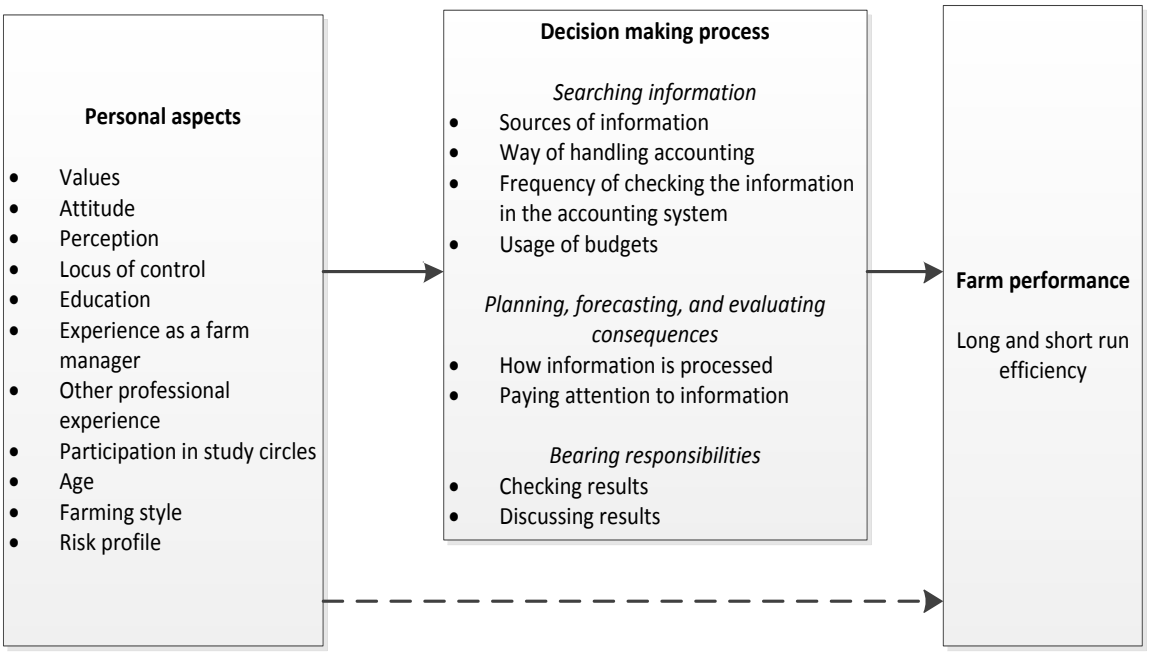
Developed from Figure 5 of Rougoor (1998), Hansson (2008) identified features and relationships presented in Figure 6 to be important determinants of the managerial capacity in farms. This model shows that personal aspects directly influence the performance of the farm. A less robust link exists between personal aspects and management systems. In general, farmers make intuitive, tacit decisions whereas management systems facilitate more analytical decision making.

The first personal aspect mentioned in this figure is values. A value is defined as traits or qualities that are considered worthwhile for someone; they represent a person's highest priorities and deeply held driving forces (McCalla, 2010). Gasson (1973) divides values of farmers into four groups: instrumental, social, expressive and intrinsic. Of these, social and expressive values are likely to affect farm efficiency negatively, because with these values the focus is on gaining prestige as well as being creative and original (Hansson, 2007).

Perception, attitude and locus of control are characteristics of a farmer's personality. Perception is defined as the way in which individuals sees the farm and world, attitude is defined as a readiness or tendency to respond in a certain way. Related to attitude of a farmer is a different farming style which will be discussed later in this chapter. Included with the education aspect are the skills, ability and motivation of a farmer to communicate and to develop relationships with other people.

A farmers (internal) locus of control indicates his or her perceived capability to influence what happens. It is believed that farmers with high (internal) locus of control are more active in seeking information and knowledge. Kaine et al. (2004 found in Nuthall, 2010) also found a relationship between producers' locus of control, and their propensity to adopt innovations and to participate in extension activities'. Experience, participation in study circles and the age of a farmer are likewise significant determinants in farm performance (Ajibefu et al., 2002).

Figure 6. Managerial abilities in connection with farm performance



Source: *Hansson, 2008 extended by author*[7]

Two important personal aspects which are identified in this research are farming styles/systems and risk profile of farmers. These two subjects are elaborated in detail below.

Farming styles and systems

The goal of this sub-paragraph is to check whether there are differences in farm management as a result of a different farming style. Hofstee (1985) defines a style of farming as a complex but integrated set of notions, norms, knowledge elements, experiences etc. held by a group of farmers in a specific region that describes the way farming practice should be carried out. "Farming styles" is a theoretical approach for understanding diversity in farming communities. The essence of this concept lies in the fact that a set of separate styles (strategies of farming) in a farming community is present of where farmers are highly aware of and from which they actively choose a specific strategy to guide their own practice (Vanclay et al., 2006).

Van der Berg and Wintjes (2000) argue that farmers deriving minor income from agricultural production generally have other aims in mind in management practices compared to full-time farmers. The Dutch ministry of agriculture (Soldaat, 1991, found in Van der Ploeg, 2003) argues that there are two farming styles i.e. hobby farmers and full time farmers. Hobby farms are farms that are maintained without expectations of being a primary source of income (Meert et al., 2005). Hobby farming can be an important strategy to increase family income and spread risk (Barlett, 1991, found in Meert et al., 2005). Moreover, farmers can perceive their farming style as hobby and adjust their practices, incentive and motives from this fact.

Hebert and Link (1988, found in Bergevoet et al., 2005) defines fulltime or entrepreneurial farmer as "someone who specializes in taking responsibility for and making judgmental decisions that affect the location, form and the use of goods, resources or institutions". Most dominant features of full time farmers are: risk-taker, provider of capital (from their own resources but also by attracting other resources), innovator, and a person who identifies possibilities of profit making (Chell et al., 1991 found in Bergevoet et al., 2005). This type of farmers can be determined by criteria like economic dependency on farming or annual working hours on the farm (Præstholm et al., 2006).

Related to farming styles are farming systems. According to the Dixon et al. (2001), a farming system is the farm household, its resources, and the resource flows and interactions at this individual farm level all together. Each of a system is characterised by a typical farm type. Moreover, the functioning of farming systems is mainly influenced by the external environment like markets.

Livestock production systems are considered a subset of the farming system including farmers where livestock contribute more than 10 percent to the farm output. In general, there are different graduations for livestock production systems like criteria's related to land ownership, agro-ecological zones, intensity of production and crop integration. Of all production systems, mixed-farm rain fed is the largest in the world (21% of the cattle population).

[7] Farming style and risk profile added by author (2011)

Risk profile

Risk behavior of farms and farm households have been widely researched (e.g. Mahmud and Bluffstone, 2007). Risk (e.g. financial-, production-, marketing risk) is a very important factor in decision making and most dairy farmers are very cautious when making long- and short term management decisions (risk averse) because their survival depends more on "surviving adverse outcomes than benefiting from good outcomes" (Moran, 2008). Substantial number of researchers (e.g. Kisaka-Lwayo, et al, 2005) found evidence that risk takers, are associated with an increasing income (farm result).

Running a farm business is generally dealing with risks from internal and external sources. External risk relates to risk arise from natural- (e.g. earthquakes, landslides etc.), economic- (e.g. formal or informal market, interest rate etc.), social- (e.g. education, lifestyle etc.) and political- (e.g. governmental policies, political ideology etc.) environment (see Figure 5).

Sources of internal risk affects the operation of each individual farm and include the health of the farm household, their interpersonal relations as influenced by personality, changing values, attitudes and aspirations (managerial capacity) as well as use of credit to finance farm development and intergenerational transfer of farm ownership (Moran, 2008).

Most farm decisions (e.g. purchasing concentrates and fertilizers) involve some kind of risk or uncertainty. For instance, managing risk and uncertainty in decision making can be executed by buying insurance, hedging or even keeping fences in good repair to keep livestock off the road.

Resource poor farmers in developing countries have been observed to choose from a wide variety of risk coping strategies involving both agricultural and non-agricultural activities. In Table 2 several options to cope with different risks are categorized in five groups. Strategies and activities listed under the five groups are interlinked with each other.

Table 2. Risk coping strategies and activities

1. Diversification own production	**2. Wealth accumulation**	**3. Gaining access to markets**	**4. Seeking off-farm employment**	**5. Security systems**
Expand farm area Increase productivity (technological change) Diversification of farm activities and cropping pattern	Storage saving Asset building (livestock etc.)	Credit (insurance) Input/output Knowledge	Agriculture and non-agricultural activities	Intergenerational insurance, children education Institutional- and social capital

Source: *Heidhues and Bruntrup, 2003*

1. Diversification of own production

The first strategy to cope with risk is focused at the diversification of farm production activities. Several decisions can be observed often restricted by the farmer's knowledge of their soil characteristics (e.g. fertility, erodibility etc.). "Farmers may try to increase production, either through expanding cultivated land or through introducing productivity enhancing technologies or management changes" (Heidhues and Brüntrup, 2003). For instance, farmers can plant forages early or late depending on the observed rainfall and weather pattern, adjust cropping patterns and leave fields fallow and/or vary the mulching and manuring pattern.

2. Wealth accumulation

Farmers and their household regularly save and build assets for various aims. One of the key motives is to provide assets for emergencies (Jung, 1987 found in Heidhues and Brüntrup, 2003). Moreover, food storage is an often observed risk coping strategy as well as accumulating livestock (serving as productive investment, income diversification, and risk insurance) and planting trees for the same purpose.

3. Gaining access to markets

To deal with risk, market- establishment and strengthening can be an important strategy. Access to credit, input and output markets is a precondition for raising productivity. Credit markets, apart from their vital role in enabling the acquisition of investments and modern inputs, often play a special role in dealing with stressful situations. Related to access to loans is the need for long-term (finance investments in fixed assets) and short term credits (fiancé working capital requirements). Borrowing credit is mainly short-term and predominantly informal (from friends and relatives). Short-term credit can be stretched through a variety of product-credit interlinkage arrangements: the farm pledges its future harvest against a bridging loan for working capital. Interlinkage arrangements are universally practiced by service co-operatives, which supply inputs and extend credit to their members in return for the promise of future delivery of members' harvest (Abele and Frohberg, 2003).

4. Seeking off farm employment

Diversification of household activities may extend beyond the farm production domain, and includes off-farm employment in agriculture or non-agricultural activities, often linked to temporary or long-term migration.

5. Security systems

Another particular form of asset building as a risk coping strategy is the formation of human and institutional capital (Heidhues and Brüntrup, 2003). Children are sent to school, particularly to secondary or tertiary education, to be able later on to assist their families in overcoming stressful situations. This can also be considered as a diversification strategy out of agriculture.

3.2 Decision-making aspects

Continuing from the second column of Figure two, below are the following subjects explained; searching for information, planning, forecasting & evaluating, and bearing responsibilities.

3.2.1 Searching for information

Farmers seek information from various sources in order to reduce risk and uncertainty so that expected usefulness from any given solution can be maximized (Rougoor et al, 1998). Following all steps of the decision making process will allow farmers to make a decision in a logical and organised manner. Ohlmér, et al. (1998) distinguishes four functions or phases in the decision making process: problem detection, problem definition, analysis and choice and implementation. These steps are elaborated as follows (Hansson and Ferguson, 2010): 1) identify and define the problem; 2) collect data and information; 3) identify and analyse alternative solution; 4) make the decision 5) implement the decision; 6) monitor and evaluate the results, and 7) accept the responsibility for the decision. Cowen et al. (1989) shows that use of computer records and other information management assists in observation of problems in an earlier stage. In the managerial situation, information management is an essential part to detect and solve problems.

Sources of information

Several studies in sociology recognize the importance of socio-informational networks in a farmer decision making process (e.g. Jussaume Jr and Glenna, 2009). Most of these studies focus on transfer of technology (innovation adoption). In particular, Larson et al. 1990 mentioned in their research that farmers' decisions were affected by neighboring farmer's opinions and advices, as well as by institutionalized sources such as extension and mass media (Table 3). However, relevant and reliable information from close relatives is regarded as more authentic than from entirely outside sources. Further, farmers tend to depend on or to whom they ascribe trust and allegiance (Nwankwo et al., 2010). Information or suggestions from such sources always influence decision-making. Elaborating from this fact, farmers have several possibilities to find primary and secondary information, respectively.

Table 3. Primary- and secondary information sources

Information sources	
Primary	*Secondary*
Consultants	News papers
Colleague farmers and relatives	Publication from government
Research institutes	Internet/TV/radio
Study clubs	Extension leaflets
Extension agents (training)	Community leaflets
Education	Farmers magazines
Conferences and seminars	Agricultural shows and demonstrations
Suppliers	

Way of handling & frequency of checking in accounting systems

One component of a modern information system is accounting information (observed in one of the management functions). It is crucial in planning, implementation, and control that influence farm decisions and performance (Puig-Junoy and Argiles, 2004). Results from Tomaszewski et al. (2000) showed that an information system improves efficiency in dairy farms. For instance, financial information of the farm gives a tool to identify the strengths and weaknesses of a dairy farm.

Different ratios exist for a farmer to overview the financial situation of the farm like average payment period and ROI (Return on Investments). Moreover, in certain cases farmers hire a professional accountant or use accounting programs to deal with accounting complexities. Integrated information systems like IT (Information technology) can assist famers' needs in creating data bases and data processing (costs, gross margin etc.), and optimal resource allocation.

Usage of Budgets

Another farm management tool is budgeting. The cost of establishing a farming goal is one of the functions of a budget. Moreover, other practical reasons for budgeting include determining whether or not farmers can afford new machinery or pay extra expenses of hired labour. Further, with budgeting problems can be identified in advance, therefore farmers can initiate corrective actions before any problems take out of proportional forms. However, Dorward et al. (1998) mention several drawbacks of budgeting for dairy farmers; it is too complex for use by illiterate or poorly-educated farmers and requires the use of materials which are often unavailable.

There are two types of budgets; partial and whole farm budgets. Partial budgets provide planning and decision-making frameworks to compare the costs and benefits of alternative farm practices, which focus on the changes in income and expenses resulting from that alternative (Moran, 2008). The whole farm budget provides a summary of the major physical and financial features of the entire farm business; actual and planned (Olsen, 2003).

3.2.2 Planning, forecasting and evaluating

Planning, forecasting and evaluating consequences can be seen as strategic choices for a farmer. The information acquired for decision making is used for estimating consequences and evaluating them. In problem detection (one of the phases in decision making process) consequences of possibly differences between expected and observed information are forecasted (Hansson and Ohlmer, 2008).

3.2.3 Bearing responsibilities

Responsibility has to be taken for the outcome of each decision-making process. Each process gives the farmer a deeper understanding of the problem and the options. This deeper understanding normally causes the farmer to revise the outcome of earlier processes. Checking and discussing results with for instance consultants, peer groups or other local networks is a decent resource in the process of reflection. However, it should be mentioned that farmers do not follow a common step in the sequential process.

3.3 Farm performance

The last column of Figure 6 indicates farm performance and herewith connected farm efficiency. Farm efficiency measurement enables the determination of best practices within a population of firms or farms (the sample) (Oude Lansink and Reinhard, 2004). Efficiency is defined as producing a given set of outputs using the smallest and cheapest set of inputs (Farrell, 1957 found in Wang and Huang, 2006). Inefficient farms either use more inputs to produce a given quantity of outputs than the best practice farms (input-oriented efficiency) or produce a smaller quantity of outputs from a given bundle of inputs (output-oriented efficiency).

4. Co-operatives as service providers

In this chapter, co-operatives play a central role. First, a short introduction of co-operatives is presented followed by an overview of agro-co-operative with possible services that such an organization can offer to farmers. Co-operatives are not the core interest in this research, however, most farmers in developing countries are member of a co-operative, and it is important that the reader understand what is meant by being a member of such an organisation.

4.1 Introduction

All over the world, co-operatives are playing an important role in agricultural and food industry. Agro co-operatives have been initiated everywhere in both developed and developing nations. In developing countries, agro co-operatives create the ability for the supply of agricultural inputs and assuring a market for commodities produced by isolated small farmers in the rural areas. However, agro co-operative in developed countries capture the benefits of value added, because of bulking and take advantages of introducing grades and standards allowing agro-processing value addition for the members.

According to Rhodes (1983) the definition of a co-operative is "a special type of business firm owned and operated for mutual benefits by the users (member patrons)". To conceptualize the concept of co-operatives a number of characteristics have been described: 1) the major part of the equity is unallocated and the pay-off is distributed to the members (owners) via the price level, often partly paid as a bonus based upon the volume of trade at the end of the year, 2) membership is mostly open to everyone engaged in the type of business the co-operative operates in. The membership fee is nominal and this is the only pay-off the member receives if a farmer decides to withdraw from the co-operative, and 3) each member has one vote when decisions are being made at the basic level in the governance structure of the co-operative and when representatives are being elected for higher levels (Gripsrud et al, 2000). The essence of a co-operative is frequently summarized as "member oriented, member controlled and member used" (Van Dijk and Klep, 2005). Moreover, an organisational culture and identity exists within co-operatives with commitments, solidarity, and informal communication.

Diverse organizational theories are used to explain the existence of a co-operative. For example, the market power theory, suggests that increased market power (five forces matrix of Porter, 1979) can be achieved by means of a co-operative strategy that involves collaboration among firms (Faulkner and De Rond, 2000). Similarly, Hendrikse and Bijman (2002) argue that the concept of co-operatives is a mean to countervail power vis-à-vis the processor and middlemen. Moreover, co-operatives have the possibility to share investments like machinery as well as the opportunity to developed and enhance technological knowledge for farmers (Bijman, 2007a).

Another motive to start a co-operative for farmers is the absence of missing information within a relationship between farmers mutually and the suppliers or buyers of agricultural products on the second hand (Bijman and Hendrikse, 2003).

4.2 Agricultural Co-operatives in the Context of a Free Trade Economy

In order to understand the (future) role of agricultural co-operatives in the world, one has to articulate certain general features and dynamics of agro-co-operatives taking place in the world economy nowadays.

In developing countries, the majority of agro co-operatives are becoming part of an outgrower arrangement with large retailers or exporters and have to transfer part of their authority regarding production and handling practices to external agents (Key and Runsten, 1999 found in Bijman and Ruben, 2005). This trend can be observed in all parts of the world. The result of this tendency is a change from a more producer oriented market to consumer (demand driven) markets where necessities in the field of branding, high product quality guidelines, deliveries and certain terms of payment are claimed by a retailer to co-operatives.

Moreover, co-operatives can use outgrowers arrangements for economies of scale, co-operative marketing procedures and providing credits to positively influence a stable market outlet for farmers. For instance, many farmers who join a co-operative, poor producers are initially dependent on their own stock of capital through their relations with immediate neighbours, friends and family for provision of credit, insurance and support. However, as their farm expands, these farmers need to increase their capital and information to enable access to product and factor markets and therefore co-operatives can bridge access to capital (e.g. Box 4).

Box 4. Pineapples from Farmapine, Ghana

In 1999, a new co-operative, Farmapine Ghana was established with the assistance of the Government of Ghana and the World Bank. The co-operative was based on the farmer ownership model promoted by the World Bank. By creating farmers ownership of a company through the acquisition of shares, the model aims to provide farmers with commercial access to working capital, production inputs and output markets. The co-operative had 178 members and it sourced pineapples from the members' farms, providing a guaranteed market for the producers. In addition to purchasing produce from the cooperative, Farmapine provided them with agricultural inputs, credits and technical assistance. It distributed agro-chemicals to the members and occasionally gave them credits to employ farm labour. The company also employed three agronomists who regularly visited members of the co-operatives and instructed them on a specified cultivation practice to assure the export standards of pineapples. In addition, the company scheduled harvests of the members' farms to meet the timing requirements for export. The costs of the agro-chemicals and the amount of credit provided to farmers were deducted from the value of the harvest when the company made payments to them. These various activities enabled Farmapine to bridge the information gap that had previously hindered the farmers' access to export markets.
Source: *Yeboah, 2006*

Nowadays several types of co-operatives can be distinguished including a classification of producer-, consumer and workers co-operatives. Consumer co-operatives offer consumers products or services (such as food, housing, health-care). Worker co-operatives provide safe employment and working conditions. Producer co-operatives process and/or market the commodities or services which they

receive from their members (NCBA, 2010). In addition or alternatively farmers may purchase products or services from the co-operative, which are necessary to run their own economic activities.

Co-operative services

Producer co-operatives are co-operatives whose members are businesses that join to improve their performance and competitiveness (NCBA, 2010). Similar to all types of co-operatives, this sort of co-operatives also exist to meet their member's needs and be able to provide almost any service for their members.

Belonging to a producer co-operative allows small businesses to compete with large competitors. The overall objective of these kind of co-operatives is trying to provide services at the best quality at the lowest possible cost (this is not always in reality). However, differential pricing for services exists depending on location and volumes of the products delivered. The services delivered to farmers assist them in lowering input prices by realizing savings that are provided by offering services at lower prices. Moreover, co-operatives handle their supplies tailor made to specific farmers.

Subsequently, co-operatives give a possibility to store products and equipment for the members or transfer products directly from the buyer to the members such as feed, seed, fertilizer, petroleum products, farmstead equipment, and building supplies. Various co-operatives also handle farm home items such as heating oil, lawn and garden equipment, and food. Co-operatives can also develop contracts with food processors, such as breweries or vegetable oil extractors, to maintain a continuous supply and control prices of forage by-products. More examples of services provided by a service co-operative are (NCBA, 2010):

- Negotiating prices with vendors;
- Encourage saving among members through promoting saving deposits;
- Offer production and consumption loans to members at reasonable rate of interest;
- Provide market information;
- Facilitating meetings for farmers (study clubs);
- Purchasing of supplies or inputs for the business;
- Offering private labeling or branding of products;
- Purchasing items for resale;
- Dissimilate new ideas to farmers;
- Providing joint advertising and marketing;
- Securing common billing services;
- Providing joint delivery services for products;
- Providing common reservation or scheduling services;
- Contracting for services on behalf of members;
- Providing or contracting for insurance, health care, or other benefits;
- Warehousing products for members;
- Offering training and educational activities;
- Channel donations from government and NGOs to their members;
- Providing consulting and business planning services and;

- ❖ Offer management services for members.

Co-operatives involved in dairy supply chains have more service opportunities specific for dairy farmers including (Moran, 2008):

- ❖ Contract calf and heifer rearing where the co-operative have the facility to milk rear the calves, using waste milk from the milk testing laboratory;
- ❖ Provide facilities like sheds and silos to stock cows of many farmers (cow colonies);
- ❖ Provide agricultural equipment such as tractors, water pumps; agricultural inputs such as fertilizer, seeds as well as consumption goods to members at reasonable prices;
- ❖ Grow fodder crops on communal land;
- ❖ Run an experimental farm for trials, training and innovation purposes;
- ❖ Store and ensile forage in towers or pit silos;
- ❖ Buy other bulk materials for ensiling such as agro-industrial by products;
- ❖ Feed centers to where all ingredients for total mixed rations are blended and placed in large containers and;
- ❖ Machine milking by using mini milkers if all stocks are housed in one big shed or a spate milking parlour for larger herds housed at nearby locations.

Producer co-operatives are typically organized as businesses whose members invest capital in the corporation. The members democratically elect a board of directors to make policies for the co-operative. The executive board hires a manager or chief executive officer to run the business (NCBA, 2010). The executive is responsible for hiring additional staff to handle the day-to-day operations of the business. To keep a financial healthy business a producer co-operative has to retain a part of the earnings from their members as well as extra revenues from suppliers (discount) is not returned to the members but kept within the co-operative.

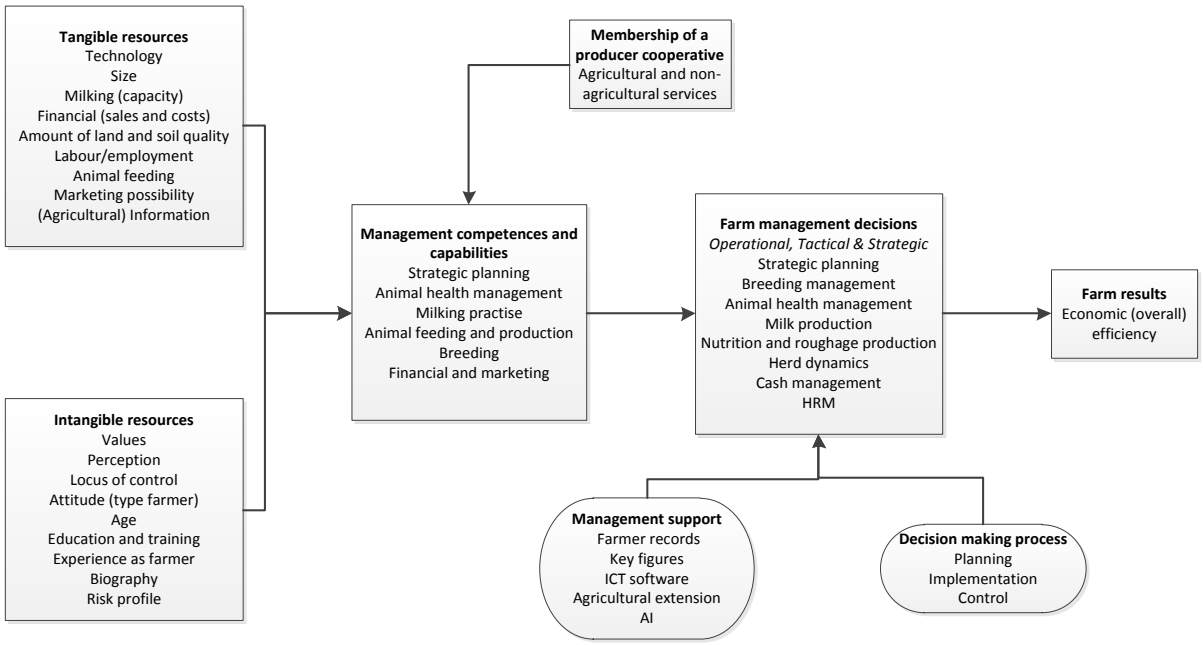
5. Synthesis and integration of literature

This chapter further elaborates upon literature described in chapter 2, 3, and 4. First, it starts with the research framework which is described in 5.1 followed by an operationalization of the research variables (5.2).

5.1 Theoretical framework

In this paragraph, the theoretical framework is illustrated, which describes the link between several concepts of the research and the answers to the research questions. In general, the literature study showed the importance of competences for farm decision making, and the relation between decisions, competences and farm results. In Figure 7, it is shown how the answers to the research questions can be found. Additionally, it provide some details concerning resources, management competences, management decisions, farm results as well as management support, decision-making process, and lastly co-operative memberships. The answer of research questions one till four has been partly found in the literature. Empirical data is still required to complete the answer of these questions.

Figure 7. Theoretical framework



As management (competences) studies are relatively new and unexplored in Thailand, the literature study could not answer the research questions, as well as the central research question completely. Thus, a survey was designed to investigate, and find out the complete answers of the research questions.

5.2 Operationalization of the research variables

All theoretical concepts identified in this research (literature review), are not direct observable by their nature. Therefore, a conversion is required to make these concepts measurable, which involves defining and clarifying abstract concepts (De Vaus, 2001). This process is called operationalization.

The operationalization matrix (Table 4) shows the most important dimensions or aspects of the theoretical concepts mentioned in the theoretical framework. In this matrix, important ideas, concepts, unit of analysis, information sources and expectations in accordance with the information found in the literature study are illustrated. It describes the way of approaching data sources from the theoretical framework.

Table 4. Operationalization matrix

Constructs	**Variables**	**Indicators (answer categories)**
Technology	Amount of investments	Size of milking barn Height of farm investments
Farm size	Number of heads	Heads of cattle Heads of cows in milk Heads of dry cows Heads of older and younger heifers Heads of calves
Milking	Milking capacity	Bucket Milking machine
Financial (sales and costs)	Idea of profitability Use of budgets Expected profitability	Animal feeding cost Labour costs Veterinary costs Bank loan costs Milk sales Manure sales Other sales
Amount of land and soil quality	Own/rented land Size Water source Soil condition	Irrigation Total amount of land owned and rented Input inorganic fertilizers Input organic fertilizers
Labour/employment	Type of labour Skills/level of labour Working experience on the farm	Family labour (wife, husband, children, grandparents) External labour Number of times and fields that a labour received training Number of months working on the farm
Animal feeding	Type of feeding Sources Availability	Grasses (Ruzi, Panicum, Guinea, Napier, Para, and star grass) Roughages (Grass hay, Rice straw, Corn stems) Legumes (Hamata, Leucena, Cavalcade) Supplements (Brewery waste, cassava pulp) Concentrates Internal source (own production) External source (Neighbour, co-operative, Relative, Local market) Percentage bought/own production
Marketing possibility	Type marketing channel Way of pricing	Co-operative PMC Local consumers
Agricultural Information	Source of information	Primary sources Secondary sources

Values	Economic and non-economic goal or view of a farmer	Instrumental Expressive Social Intrinsic
Perception	Personal preferences	Resistance to change Economic security Family tradition
Locus of control	Interest in agriculture	Pro-active Reactive
Attitude	Satisfaction with farming Commercial business	Positive Negative
Type of farmer	Full-time Part-time	Number of hours working on the farm
Age	Years	Number of years
Education and training	Highest level of education Number and source of additional trainings	Primary school Secondary school High school University
Biography	Family tradition Successor	Overtake farm from family Start farm by themselves Internal/external successor farm
Risk profile	Diversification Amount of risk averse	Sort of activities on the farm like corns fruits, vegetables, chicken, goat, goose, fish Risk neutral Risk averse Risk taker
Competences	Skills Knowledge Personality traits Abilities Experience Education	Knowledge of milking price (THB per L milk) Number of years working on the farm Highest education level (primary, secondary, high school, agricultural college and university level)
Farm management (decisions)	HRM Production Animal health Animal feeding Financial	Number of loans Height of costs Herd dynamics Occurrence and prevention of diseases Number of labourers Percentage of crossbred traits in livestock
Management support	Records Key figures ICT software Agricultural extension A.I	Use of recordings Use of extension records Use of A.I services Use of advisor Use of key figure
Records	Breeding record Veterinary records Bookkeeping Individual milking records	Person recording (husband, spouse, children etc.) Usage of different sorts of recordings
Decision making process	Individual decision making Using information	Number of people working on the farm
Efficiency	Average milk production Cost-Benefit ratio	L milk per cow/day

The operationalization matrix contains the most important concepts that are used to list the expectations and design the questionnaire, and interviews: technology, farm size, milking, financial, amount of land and soil quality, labour/employment, animal feeding, marketing possibility, agricultural information, values, perception, locus of control, attitude, type of farmer, age, education and training, biography, risk profile, competences, farm management (decisions), management support, records, and decision making process. The explanation of these concepts has been described in the literature, where the most important definition for each concept has been selected for this research. For instance, it has been suggested that a difference in farming type results in different competence and, therefore efficiency on farms. Then, the type of farmer can be found in the scale of "full or part time" while the answer can be found by indicating the number of hours a farmer is working on the farm.

Further, between an abstract term and a concrete question can take several steps or sub-dimensions such as described by De Vaus (2001). Certain constructs in this research are from a very abstract level and it was required to make more than one step to a concrete question. For instance, the construct type of labour was operationalized into 1) internal and external and in the next phase 2) internal labour was transformed to wife, husband, children, and grandparents (indicators).

It is worth to mention that the empirical data will complete the answer of the research questions, which has partly been answered in the literature study. Mainly a questionnaire and in-depth interviews have been used for the respondents to answer the different interview questions. However, because of different constraints (see 6.2 and 9.2), certain variables and answers categories' could not be transformed into a questionnaire and therefore be asked to respondents. Thus, these variables were left out from the empirical part of the research. To make this clear, the constructs in the green columns were further used during the empirical part of the research and the constructs in the red column were left out.

The methods of analysis have been chosen after the data had been obtained. The following chapter will elaborate further on this subject.

6. Research methodology

This chapter focuses on the methodology, in addition to the methodology section in the introduction. It discusses operationalization of the research variables, the research strategy, limitations and the reliability and validity of this study.

6.1 Survey

Once the theoretical framework was created through the desk research, an enormous challenge arises to bring it into the field in order to test its legitimacy. Therefore, a survey (cross-sectional design) and in-depth interviews had to be set up. In this process, a sample of farmers in a tropical supply chain was required, and a systematic data gathering process had to be followed in order to assess the sample. The dairy supply chain in Thailand with its enormous diversity in farmer's (management) practices gave an opportunity to investigate this problem. To address the huge diversity in farmer's practices, it was mandatory to identify and decisions had to be made regarding representativeness and variability of the sample. Moreover, to address the limited amount of time to interview a farmer, several decisions were made regarding the number of questions and the complexity of information supplied to the farmer. The issue about the variability of the sample was considered important. A diverse sample would provide a further understanding about the management practice of farmers.

During the first weeks in Thailand various informal meetings and calls were held with certain individuals of DPO (The Dairy Farming Promotion Organization of Thailand) and the dairy co-operative attached to this organization to acquire preliminary impressions about the research area and to get some insights about the context. Dr. Chopchai, extension director of DPO organization was contacted, and after a couple of introductory and planning meetings he enthusiastically decided to cooperate with this study. He send an invitation letter to all dairy farms targeted for this research asking them to partake in this research.

In order to gather all relevant information from each individual farm the research methodology was divided in two steps. First, a seminar was organized in which all targeted farms were invited to partake in. The seminar was held in the trainings center of DPO on 17th March 2011. During this meeting a workshop was given about improved pasture management. Afterwards, the first part of the questionnaire with pre-structured and closed ended questions was run with each farmer (Appendix 4). In order to acquire the right information 15 students from Kasetsart University[8] were hired to help farmers with any ambiguities. These students from the Animal Science department of Kasetsart University were instructed by the researcher a few days before the seminar. Secondly, on farm meetings (interviews) and observations were carried out to acquire relevant information of the second part of the survey (Appendix 5). The purpose of the interviews included finding missing answers and ambiguities from the questionnaire and to find out reasons behind certain decision making. The interviews started on 21st March and ended on 28th April 2011 with mostly 2-3 interviews each day except weekends. An interview lasted between 60-75 minutes.

[8] Kasetsart University is a public and third oldest university in Thailand. It was established on 2nd February 1943 (Bangkok) with the prime aims in promoting subjects related to agricultural sciences. The total student enrollment at Kasetsart University is over 58,000.

The questionnaire can be found in Annex four and the semi-structured interview (with open questions) can be found in Annex 5. To wrap up, triangulation through applying multiple methods (questionnaire, interview, documents) was applied in this research.

Survey selection

Addressing the dilemma about representativeness and the enormous variation of the population, during the first stages of the survey, it was considered difficult to make a representative sample of farmers under the circumstances of this research project (see subchapter 6.2). Circumstances related to time (e.g. research time in Thailand of three months), starting of the rainy season in which travelling would be more difficult, and the amount of resources (e.g. means of logistics) were limiting.

However, from the first meetings with several stakeholders (e.g. extension officers, veterinarians and co-operative directors) in the research area, two selection criteria's were concluded to select the farmers. Thus, these criteria's were based on literature, background data and discussions with experts during the field research. Background data was acquired from the dairy co-operative and experts located in this research area. It included a list of co-operative members with their milk sales to the co-operative and the number of livestock of individual farmers of the month November 2010. Based on this data, it could be concluded that the number of members of the dairy co-operative was 176, with an average of 34 heads of cattle per farmer and an average milk production per milking cow/day calculated at 11.8 liters.

Especially the last number (11.8L (liter) average milk production per milking cow) is important because this number indicates the efficiency of a farmer. Because the availability of data regarding economic results (e.g. cost price) of farmers in Muaklek was limiting, the most appropriate criteria available was average milk production per milking cow. Nevertheless, this criteria is a widely used measure of efficiency of dairy herds and can have a major influence on the profitability of a dairy farm (Kellogg et al, 2001). The average amount of milk produced by dairy herds varies greatly in Thailand. However, the majority of farmers have achieved an average milk production of between 11-13L per cow/day in 2010 (Chaimongkol, pers. communication, 11th March 2011). Moreover, included in the average milk production per cow/day are all aspects of a farmer's management. For instance, if feeding management is sub-optimal average milk production will decrease. Moreover, animal diseases like mastitis will similarly have a negative effect on this number. Hence, based on this information the following strata's of farmers are prepared (Table 5) to represent the whole population of farmers in the area (stratified sampling).

Table 5. Selection of co-operative members (farmers), Muaklek

	Heads of livestock	**Average milk production per cow**	**Definition**	**Proposed number of interviewees (sample)**	**Number of farmer actually interviewed**	**Percentage**
Group 1	0-34 with >5 cows in milk	<11.8 L	Small and inefficient	10 (25%)	11	25%
Group 2	0-34 with >5	>11.8 L	Small and	10 (25%)	11	25%

	cows in milk		efficient			
Group 3	>34	<11.8 L	Medium & large and inefficient	10 (25%)	6	14%
Group 4	>34	>11.8 L	Medium & large and efficient	10 (25%)	16	36%

Other selection criteria's were:

a) The purpose of the selected farmers is mainly animal husbandry and dairy farming;
b) Selected cases of small farms have to own at least 5 cows in milk and;
c) Farmers need to be willing to engage in the research.

Two groups are classified as efficient and two as not efficient as well as classification into small and medium/large farmers. The purpose of this classification is to acquire a large variety of farmers in the sample. Moreover, it is assumed in this study that all groups (farmers) make different management decisions. Further, to measure the quality of management competences of farmers, it is assumed that improved competences will give a desired or better farm results.

However, as one can be observe in the penultimate column the actual number of farmers interviewed in each group differs from the proposed numbers for several reasons. The most important reason is the willingness of farmers to participate in this research; it was difficult to find respondents from group one and three willing to cooperate in this project (see selection criteria c.). Mostly farmers from group four (36%) were willing to participate in this research. Therefore, it seems that a certain (selection) bias arose to more entrepreneurial farmers. This partly explains the relatively high average milk production per cow in this sample (13.3L) compared to average milk production per cow of all co-operative members (11.8L).

Anyhow, based upon these criteria's above farmers were *randomly* selected. The intention was to acquire a representative sample by reducing sampling error. To acquire a random sample, the researcher put all member numbers in a small bucket. At that point, 90 farmers were randomly removed from the bucket and invited for the seminar. An attendance of around 50% was expected, and this turned out to be correct. Consequently, the researcher chooses to interview 44 farmers due to a restriction in time, and resources. Because of special characteristics[9] of one farmer, it was decided not to use these for analyses. Data was explored by using appropriate statistical software (Statistical Procedures for Social Sciences).

6.2 Research limitations

This thesis has certain limitations. With respect to the analytical parts (research questions one till four) of this thesis examining existing studies, the limitations has to do with the reliability of the results of the analysis and another concerns the research strategy.

[9] The special characteristics of this farmer include a management by labourers, absence of a family household, and a different milking style (fishbone parlour).

As to the former issue, the researcher conducts all interviews himself and is only able to do so in Dutch or English. However, the farmers (cases) are situated in Thailand. Hence, a translator was required during the field research. This gave problems in situations of poor wording and inaccurate translation as well as a difference in response due to cultural differences. For instance, the translator was unable to ask certain interview questions to farmers because of her younger age. Yet, for particular interview questions the translator tried to simplify it for respondents, however, certain questions involving financial support the farmers could not give a good reply due to their family security in some reasons. Moreover, after translation, due to cultural and linguistic a possibility arises of different interpretations.

Regarding culture, dairy farmers in Thailand are cautious to the outside world for various reasons. Consequently, certain interview questions (e.g. financial situation at farm level) are very personal and therefore elusive to ask. Moreover, respondents might give social desirable and biased response to the questionnaire and interview questions in order not to jeopardize the cooperation or harm the relationship with their direct suppliers and buyers. The researcher tried to minimize the chance of social desirable and biased responses by creating trustworthy relationships. The names of the partners and respondents from the cases are kept confidential to increase the willingness of the farmers to cooperate.

Moreover, because of the limited number of respondents and the high variability in the sample difficulties arise to acquire highly significant and powerful relations. However, this has been solved by supplementing answers form the in-depth interviews (qualitative interviews) to support all statistical relationships.

6.3 Reliability and validity

This section is designed to assess the reliability and validity of this study. Reliability refers to the credibility of the outcomes of the research and can be perceived as high when results can be replicated by other researchers on other occasions (De Vaus, 2001). It should be emphasized that the results are measured once during the end of the dry season. It could be that different results occur when interviewing during another weather season. Moreover, because of all restrictions mentioned in sub-chapter 7.3, reliability could be questionable. Nevertheless, this study is based on literature of an extensive set of respectable sources and publications.

The validity of measures is the ability of the questionnaire and interviews to measure what they are designed for. It reduces the risk that questions have alternative interpretations (De Vaus, 2001). The questionnaires and interview questions were assessed by the research supervisors from Wageningen Livestock Research, Wageningen University and Kasetsart University. All supervisors verified the relevance and logic link between the research- objective and questions of this research and checked for ambiguity. Though, the selection bias mentioned in sub-chapter 6.1 could lower internal validity. The validity of the answers (questionnaire) during the seminar was considered reasonable to high because all students who assisted during this day are specialized in Animal Sciences, and the questions from the questionnaire were mostly straight forward. Further, a trial has been conducted with one respondent (farmer). The limited number of trials could be seen as a restriction; however,

during the trial two supervisors (Dr. Prasanpanisch and Mr. Wouters) were present to make comments and suggestions to improve the questionnaire and interview questions.

Moreover, (internal) validity is provided through the semi-structured interviews and the triangulation of data. However, the criteria's used to select groups of farmers based on efficiency and size could be re-considered.

Because external validity is concerned with the ability to generalization of the results to a wider population, the survey in this particular area (Muaklek) involves a limited number of farmers, specific characteristics (e.g. land ownership and farmer's support) and therefore cannot be used to make any generalized statements about a wider population of farmers in other (tropical) countries.

The following chapters present the empirical part of this study.

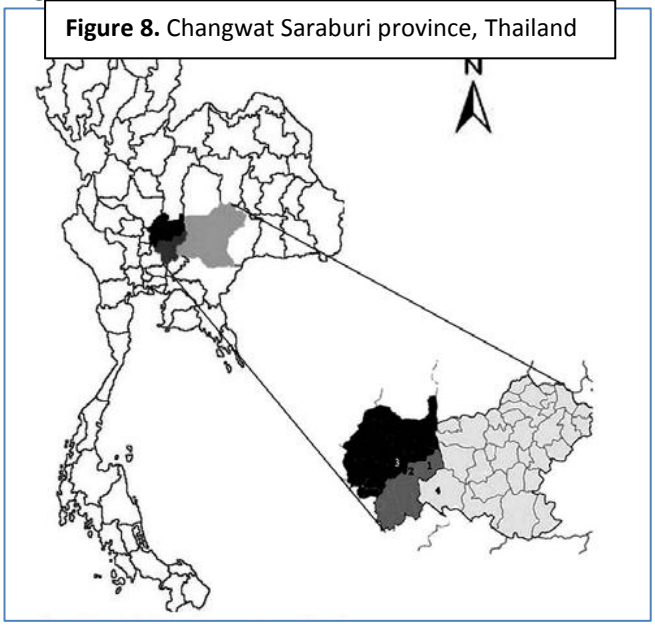
7. Results

This chapter provides the context, and results. It begins with a short description of the research area followed by results of the questionnaires, and the interviews in the next sections.

7.1 Context

The research area (Muaklek; N 14° 39 20, E 101° 11 54) is located 141 km. northeast of Bangkok, in Changwat Saraburi, on the border with Changwat Nakornaratisima. Figure 8 shows Changwat Saraburi province. The area consists of 6 tambols (sub-districts), 65 hamlets (villages) and around 7000 families. The weather in this part of Thailand is characterized as warm and tropical affected by an annual monsoon, with a rainy season from June to October, and a dry season the rest of the year. Temperatures have an average between 24 and 33 degrees with the highest temperatures from March to May, and the lowest in December, and January. The area available for cultivation is estimated around 397,320 rais. Land in Thailand is measured in rai, whereby one rai converts to 0.16 hectare (1 hectare = 6,25 rais). Most of the people in this area are immigrants from other areas in Thailand. After the construction of the Friendship highway (1971), which passes through this area from Bangkok to the Northeast region new pioneers came in. The area is also known for the Muaklek national park which is quite famous.

Figure 8. Changwat Saraburi province, Thailand



At present, Muaklek area is one the largest centers for dairy farming. The Thai-Danish dairy farm was established in 1962 in cooperation with the Royal Danish government. In 1971 the Thai government took over the responsibilities, and the project was organized under the management of the new enterprise under the name of “The dairy Farming Promotion of Thailand (DPO)”. Since then Muaklek is known as “dairy colony”, and the associated farms produced about half of the fresh milk produced in Thailand.

Over the past 25 years the government support to dairy farming through DPO and other government department (e.g. Department of Livestock Development) has been successful. Extension services to dairy farmers are offered by Department of Livestock Development (DLD) and DPO, respectively. The DLD is accountable for support of all types of livestock breeding and prevention of animal diseases in the country. However, extension services are also provided by several local co-operatives working in this area.

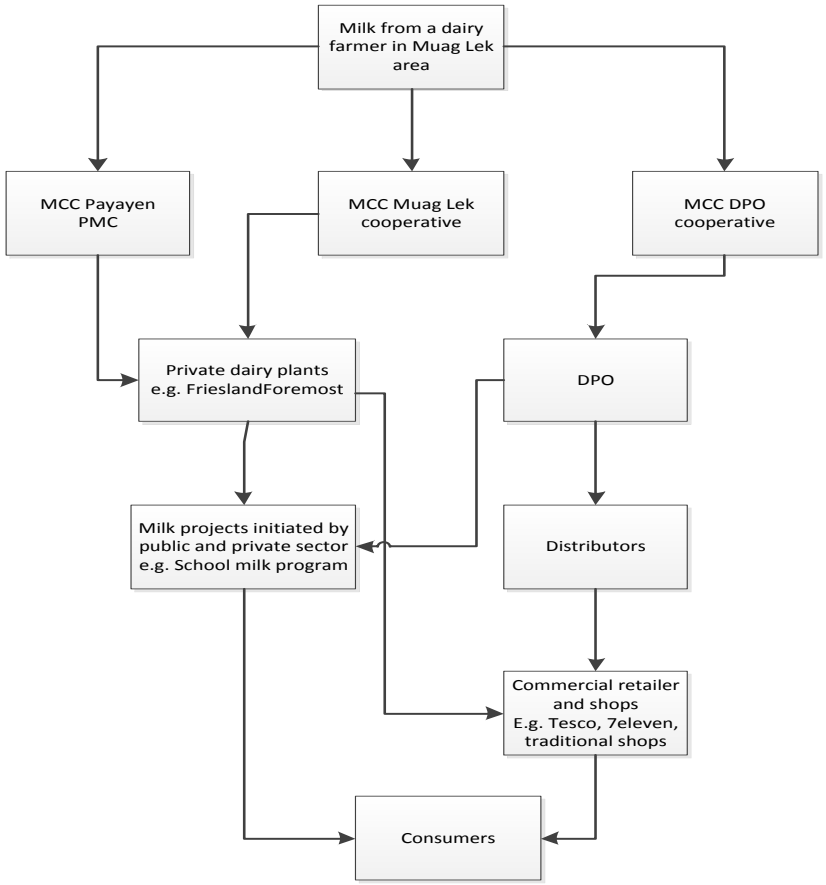
Thus, three production co-operatives are established in Muaklek area namely DPO co-operative, Muaklek Co-operative, and Payayer Private Milk Collector (PMC) (Figure 9). The main business activities consist of collecting member’s milk and make profits by selling it to milk processing plants.

Secondary business activities entail procuring animal feeding, dairy equipment, and consumable products for sales to their members. Nowadays, farmer members can directly contact the co-operative for loans. Members are directly involved in the affairs of the co-operative. Usually, the general assembly consist of the total members. According to the present Co-operative Act issued by the Thai government, the general assembly of members will elect the board of directors (BOD) with a maximum number of not greater than 15 persons with a two-year term. The BOD formulates the policy of the co-operative, and appoints a manager and staff to run the business of the co-operative.

Different payment schemes occur between co-operatives. Two co-operatives are accepting all milk produced of their members. However, one of the co-operatives (Muaklek co-operative) has a liter milk price which is based not only on quantity but also on composition and bacterial contamination of the bulk milk. Hence, contaminated milk is rejected by this co-operative.

The co-operatives transfers' raw milk to the processing plants where milk is processed into UHT- and pasteurized milk, yoghurt, ice cream, cheese, and butter. After processing, dairy products are being transported by a distributor to commercial retailers, shops, and schools (school milk program). The school milk program is a special long term project initiated by the Thai government to develop children's health, and physical appearance such as weight, and height. School Milk program is a vital part of the Thai dairy market, it accounts for more than 30% of the total liquid milk market (FAO, 2002). The end consumers are located throughout whole Thailand.

Figure 9. Milk marketing channel in Muaklek area, Thailand



7.2 General characteristics of sample

In this sub-chapter general characteristic of the sample is given following the theoretical framework of chapter 5. The chapter is divided into two parts namely (tangible) characteristics, and household & social characteristics of farmers. Two farmer's examples are included (Box 5 and 6) to give the reader a clear picture of farming in Thailand.

7.2.1 Characteristics of dairy producers

In this paragraph the (tangible) characteristics of the sample plays a central role.

Farm size and milk production

Out of the total interviewed dairy cattle producers, the mean overall farm size was 43 ± 23 (17-100) while means estimated for group one was 27 ± 6.3 (19-34), two 24 ± 5.4 (17-34), three 72 ± 15.0 (56-82), and four 57 ± 22.1 (35-100). Other herd sizes can be found in Table 6.

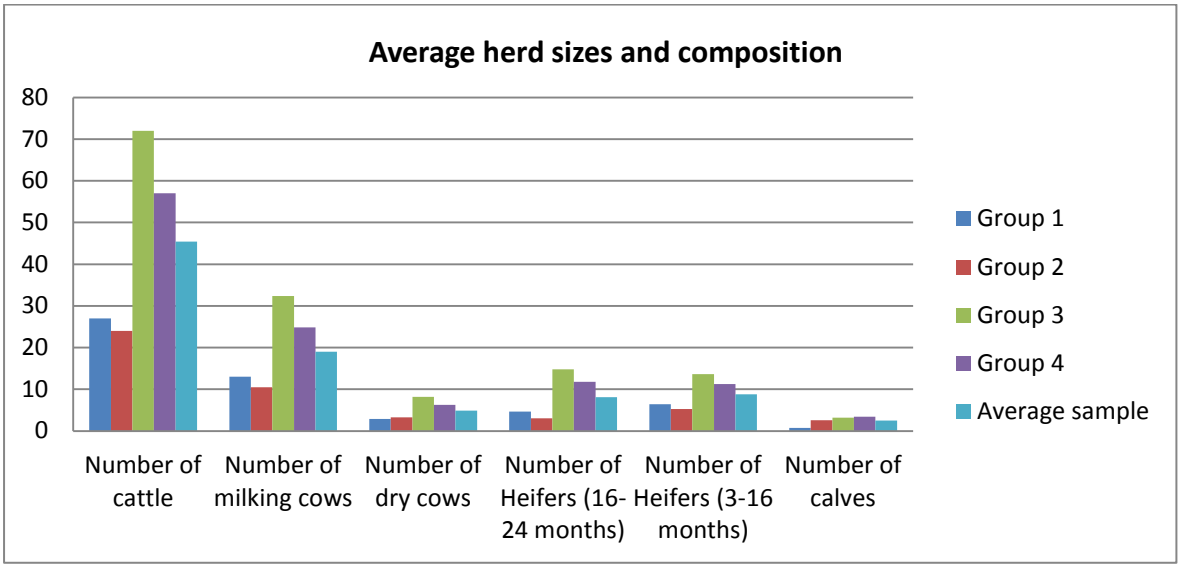
Here, one can see that the mean number of cows in milk in group three (32 ± 4.7) differs significantly compared to 25 ±10.7 in group four. Hence, group three would be better in terms of average total livestock holdings, and total cattle size. Moreover, total livestock holdings in group one (13 ± 3.5) were found to be higher compared to group two (10 ± 3.5). However, the average number of dry cows is higher in group two compared to farmers in group one. Furthermore, the average number of calves owned by farmers in group one is one compared to two calves holdings in group two.

Table 6. Means and standard errors for herd size (groups)

	Mean cows in milk (STD, range)	**Mean dry cows (STD, range)**	**Mean number of heifers (16-24 months) (STD, range)**	**Mean number of heifers (3-16 months) (STD, range)**	**Mean number of calves (STD, range)**
Sample	19 ± 10.7 (5-50)	4.9 ± 4.1 (0-20)	8.1 ± 7.2 (0-30)	8.8 ± 5.7 (0-27)	2.5 ± 2.8 (0-10)
Group 1	13 ± 3.5 (7-18)	2.9 ± 2.0 (0-6)	4.6 ± 3.4 (1-12)	6.5 ± 3.1 (2-12)	0.7 ± 1.0 (0-3)
Group 2	10.4 ± 4.7 (5-18)	3.3 ± 2.9 (0-8)	3 ± 3.2 (0-11)	5.3 ± 3.1 (0-10)	2.5 ± 2.8 (0-10)
Group 3	32.4 ± 4.7 (29-37)	8.2 ± 3.6 (2-11)	14.8 ± 6.5 (7-23)	13.6 ± 6.2 (6-20)	3.2 ±2.8 (0-7)
Group 4	24.9 ± 10.7 (17-50)	6.3 ± 5.0 (0-20)	11.8 ± 7.9 (2-30)	11.3 ± 6.5 (3-27)	3.4 ±3.1 (0-9)

To make a clear overview of mean herd sizes, Figure 10 is presented. Here, it is evident that the number of calves is rather low compared to the number of dry- and cows in milk owned by dairy producers. Moreover, the average herd size of 43 heads in this research area (sample) is somewhat higher compared to the average herd size of farmers (herd size of 20) in whole Thailand. One of the explanations for the higher herd size could be the specialization of dairying in this particular area.

Figure 10. Mean herd compositions (groups)



Regarding housing of animals, a typical farm in Muaklek consists of an open milking barn, and a small shed or stable with a concrete floor to provide cattle with shadow, and an opportunity to rest (Figure 11). The animals are usually let free during day time to graze around the farm, and are corralled at night time in an open shed. Free grazing occurs mostly during the rainy season when sufficient grass is available.

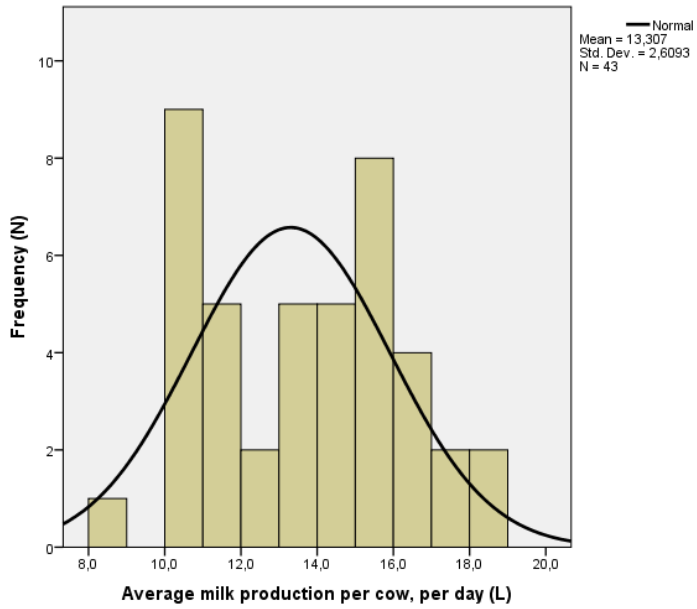
The housing is not according to the standard hygiene (Figure 12). Moreover, it was observed that the number of cows exceeds the housing capacity of the stable. Especially farmers in group three and four have problems with the housing capacity. Consequently, a part of the cattle has to rest on a muddy floor. It was observed that older, smaller, and cattle with leg problems have difficulties to acquire a clean and shadow place in the shed or stable. A clear difference of farm building set up between groups could not be observed. However, three farms (7%) have no electricity and/or pipe water supply.

Figure 11. Typical cattle shed in Muaklek area

Figure 12. Unhygienic farming environment

The average milk production per cow, per day (L) in this sample was estimated at 13,3 ± 2.6 (8.1-18.3) while the average milk production in group one is 10.1 ± 0.92 (8.1-11.8), group two 15.0 ± 2.0 (12.2-18), group three 11.1 ± 0.74 (10-11.8), and group four 15.0 ± 1.3 (13-18.3). Figure 13 gives the distribution of milk production. In this graph, two blocks can be seen. Cows producing between 10 to 11L belonging to the first group (bar on left side of graph), and cows producing 15 to 16L (bar on right side of graph). This representation, with the mean and variation in milk production gives a reasonable to good fit for the Normal distribution.

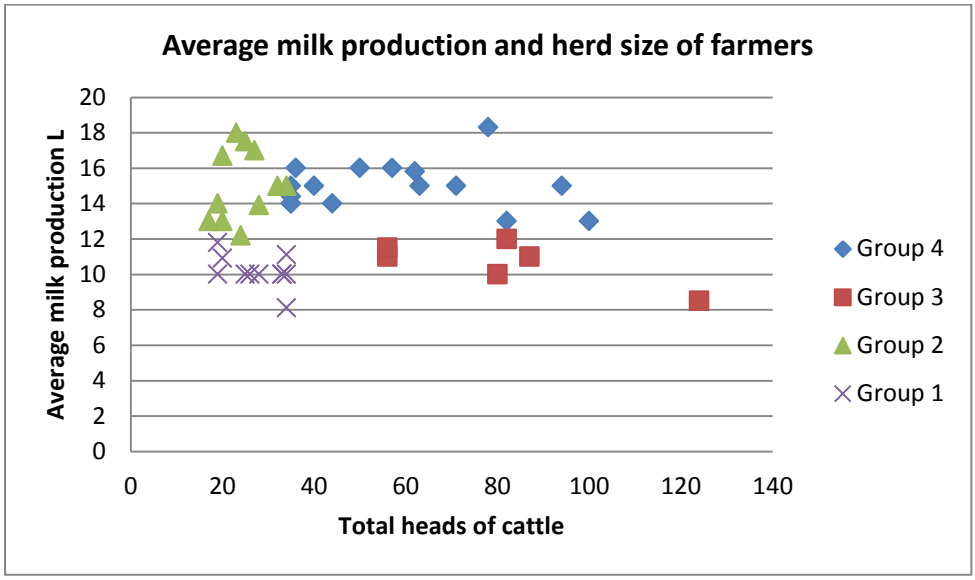
Figure 13. Distribution of average milk production records and the normal distribution curve



Complete groups based on milk production and herd size is presented in Figure 14. It should be noted that respondents were selected on these characteristics (see sub-chapter 6.1). Nevertheless, one can see that the average milk production is somewhat higher than the average milk production estimated before the field research (11,8 L). This is caused by the fact that farmers assigned in group three turned out to be actually group four. These farmers were selling milk to more co-operatives whereby the researcher initially had only information of milk sales to one co-operative.

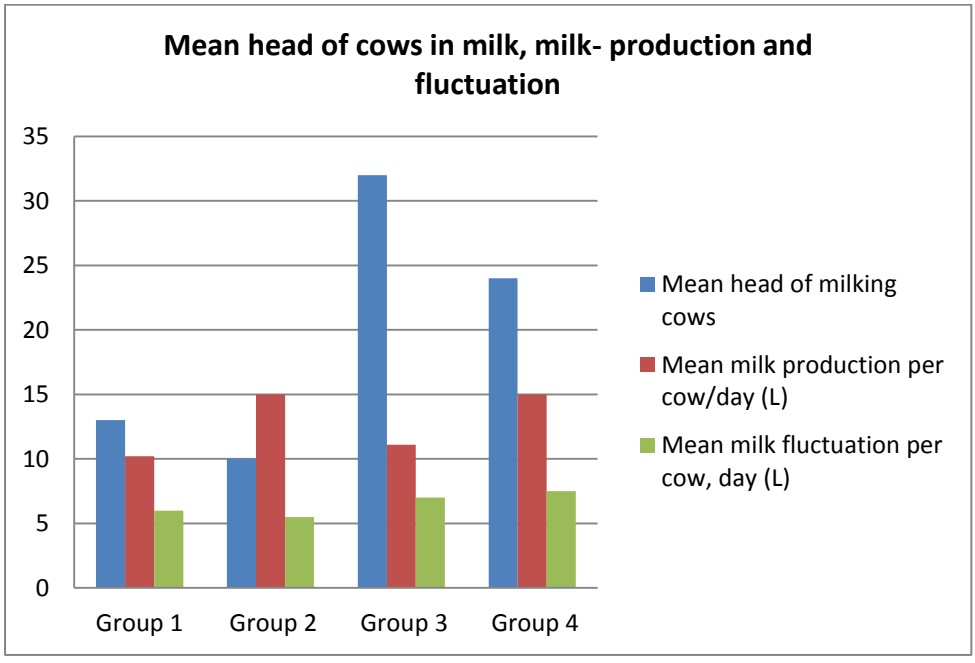
However, a limited number of farmers remained in group three whereby average milk production is lower compared to group four. Nevertheless, a large variability exists between groups three and four.

Figure 14. Average milk production per cow, per day (groups)



A basic comparison of milk production and fluctuation between groups is presented in Figure 15. From observations of the monthly co-operative paper, it could be observed that large fluctuations in weekly milk production occur. This could be up to 15% difference. Moreover, the amount of milk fluctuation can be seen as equal between all groups of producers (see also Figure 15). According to respondents, the milk fluctuation is caused by diverse weather patterns, lactation period of individual cows, and the number of cows in the dry period[10].

Figure 15. Mean heads of cattle, milk production, and milk fluctuation (groups)



[10] Dry period is the period during the lactation cycle when the milking cow is not lactating, i.e. the period between the end of a lactation and the beginning of the next.

Financial (sales and costs)

Means of milk sales and all major cost pools are calculated and presented in Table 7. Here, one can see that average milk sales in the sample is estimated at 113,000.- ± 70,000.- ranged from 23,000.- to 318,000.- baht[11] (rounded). The average milk sales for group one was 61,000.- ± 24,000.-, group two 64,000.- ± 32,000.-, group three 173,000.- ± 27,000.-, and finally group four 164,000.- ± 69,000.- baht. Feeding costs ranged from 34,000.- ± 12,000.- in group two to 109,000.- ± 31000.- baht in group three. Veterinary costs ranged between 1928,- ± 1744.- (group two) and 7300.- ± 2224.- baht (group three). Mean cost of borrowing money is estimated at 8198.- ± 7706.- (group one), 9173.- ± 6924.- (group two), 9460.- ± 11,000.- (group three), and 14,000.- ± 19000.- baht (group four). Finally, mean labour costs were in group one 1727.- ± 4819.-, group two 1500 ± 3202.-, group three 11,000 ± 7416.-, and group four 5938.- ± 10,000.- baht. Larger farms have more cows in milk that produce more milk and thus receive higher revenues from sales. Moreover, larger farm have more cattle which receive more feeding and veterinary treatments, and thus higher expenses for feeding and animal health.

Table 7. Means and standard errors for milk revenue, and feeding costs, veterinary costs, bank loan cost, and labour costs (groups) (x1000 baht)

	Sample means (STD, Range)	**Group 1 (STD, Range)**	**Group 2 (STD, Range)**
Total milk sales	113 ± 70 (23-318)	61 ± 24 (37-124)	64 ± 32 (23-128)
Feeding costs	66 ± 45 (12-200)	34 ± 12 (12-50)	41 ± 14 (15-60)
Veterinary costs	4.6 ± 5.1 (0-30)	2.0 ± 1.7 (0-6.5)	3.3 ± 3.1 (0-11)
Bank loan costs	10 ± 13 (0-70)	8.2 ± 7.7 (0-25)	9.2 ± 6.9 (2.5-25)
Labour costs	4.3 ± 7.8 (0-35)	1.7- ± 4.8 (0-16)	1.5 ± 3.2 (0-10)

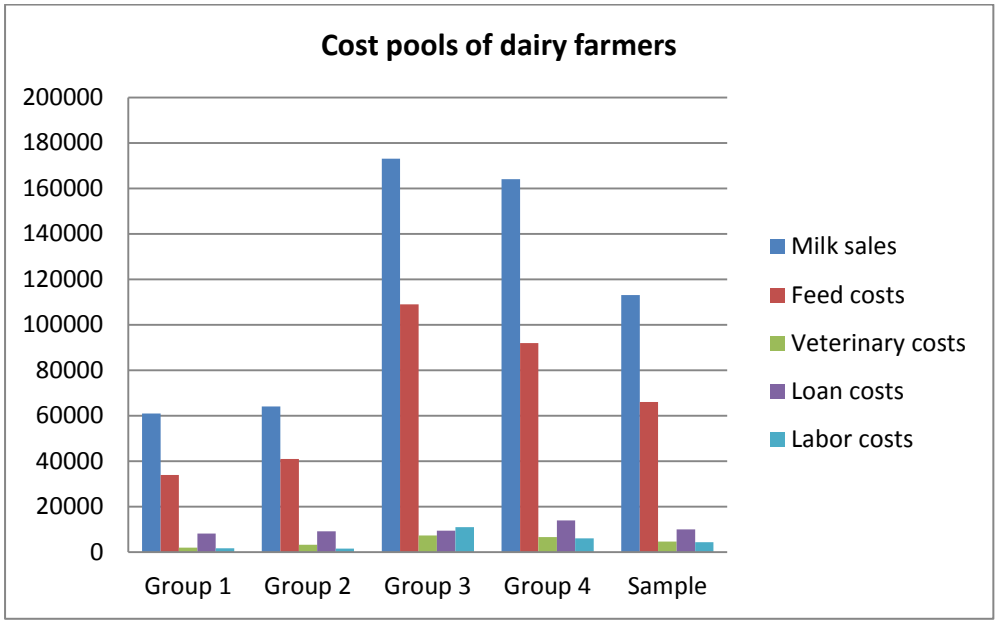
Table 7. Cont.

	Group 3 (STD, Range)	**Group 4 (STD, Range)**
Total milk sales	173 ± 27 (141-204)	164 ± 69 (67-318)
Feeding costs	109 ± 31 (60-135)	92 ± 50 (45- 200)
Veterinary costs	7.3 ± 2.2 (4.5-10)	6.6 ± 7.0 (0-30)
Bank loan costs	9.5 ± 11 (0-27)	14 ± 19 (0-70)
Labour costs	11 ± 7.4 (0-20)	6.0 ± 10 (0-35)

To make a clear overview of the mean cost pools between groups, Figure 16 is presented. Because labourers are mostly hired by the groups with a large herd (group three and four), external labour cost of group one and two is nil.

[11] Conversion rate for Thai baht 44.10 THB-1 EURO (6th July 2011).

Figure 16. Overview of main cost pools of farmers (groups)



Farm land size and soil quality of dairy producers

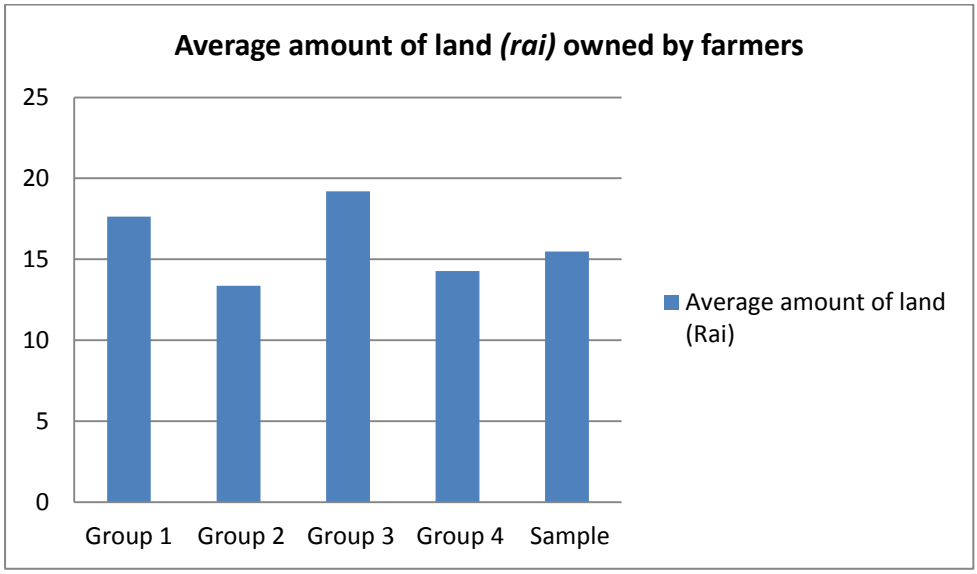
The overall average land size in the research area was 15.5 ± 11.9 (1-45) rai per household, but this varied between groups considerable (Table 8). The largest holding was in group three (19.2 ± 10,1 (12-37) rai/household) followed by group one (17.6 ± 11.9 (1-45) rai/household), group four (14.2 ± 10.1 (1-45) rai/household), and finally group two (13.2 ± 8.9 (2-31) rai/household). Both "inefficient" groups of farmers have the largest holding in land size. Moreover, 18 (42%) of the respondents cultivate 10 (1,6 ha)or less rais of land. This means that milk producers run dairy farming within their own residence compound. These producers indicated that land size is among the main constraints for expanding their dairy farm.

Table 8. Mean (± STD) and range total farm land size *(rai)* of households (groups)

	Mean area of land *(rai)* *(ha)* **(STD)**	**Range *rai*** *(ha)*	
		Lowest	Highest
Sample	15.5 *(2,5)* (11.9)	1 *(0,16)*	45 *(7,2)*
Group 1	17.6 *(2,8)* (11.9)	1 *(0,16)*	36 *(5,8)*
Group 2	13.4 *(0,8)* (8.9)	2 *(0,32)*	31 *(5,0)*
Group 3	19.2 *(1,2)* (10.1)	12 *(1,9)*	37 *(2,2)*
Group 4	14.2 *(2,3)* (14.4)	1 *(0,16)*	45 *(7,2)*

To give a clear overview of farm land owned by dairy farmer in the research area, Figure 17 is prepared. It should be noted that farmer who own land do not or partial cultivate land for roughage production during the dry season.

Figure 17. Mean land size (rai) (groups)

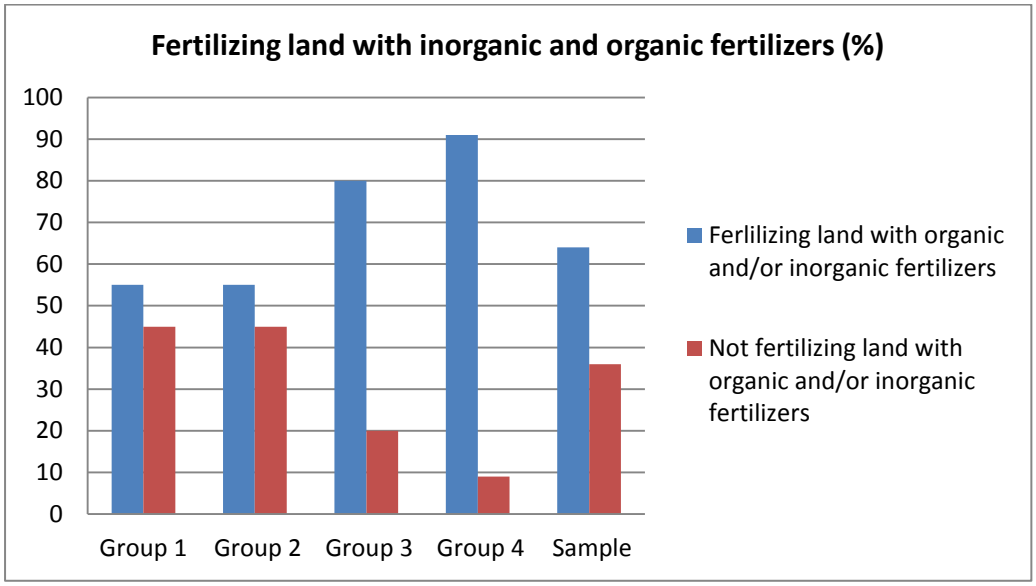


Waste disposal is one of the major issues of dairy producers in the area. More than half of the interviewed dairy producers in all groups (32) (Figure 18) used animal dung primarily to sell and fertilize land. Manure from cattle can play a vital role for roughage production. Because cattle are housed in free stall barns, farmers flush and remove animal manure with water. Solid manure is stockpiled before being sold. Dairy farmers bound the amount of released waste water by using the least amount of flushing water. Most of them accept that flies were a problem on the farm.

Several reasons are mentioned by respondents to use manure instead of chemical fertilizer though the most important one is the reduction of cost by reducing the amount of chemical fertilizer and the improvement of soil quality. A limited number of respondents are using manure to fertilize fruit trees. On the other hand, respondents who are not using manure (12) argue that the limited opportunity for labor, restricted amount of grass land and the opportunity to sell manure as their main reasons.

Further, manure handling on grass land is only applied during the rainy season. Hence, during the dry season manure is sold to possible buyers or stored on mostly an earthen floor. An earthen floor could give especially during rainy season an opportunity for possible leaching, pollution of surface water and therefore unhygienic conditions.

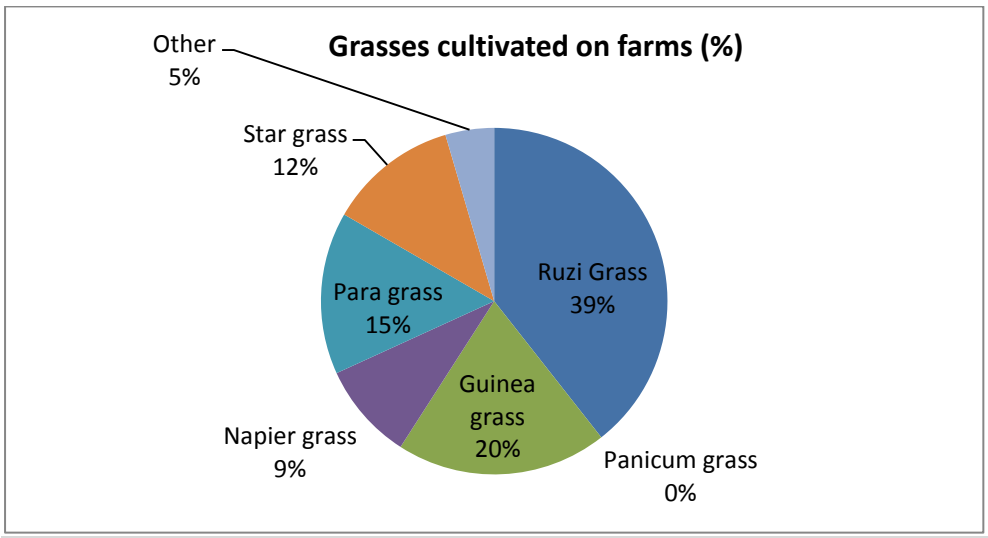
Figure 18. Fertilizing land with fertilizer/manure (groups)



Animal feeds and feeding systems

Animal feeds and feeding are the major inputs in any dairy activity. Common feed resources in the studied area varied between groups. Farmers who grew forages (38) have a whole variety of grasses cultivated at their farm (Figure 19). Frequently mentioned is Ruzi grass (39%). This grass is commonly grown in Thailand. According to farmers, Ruzi grass is a good producer of seeds, however, this sort is less persistent compared to Napier grass. Because of their high productivity, Napier grass is grown by 9% of the respondents in Muaklek. Twenty percent of the farmers grew Guinea grass. This sort of grass is known for their extensive resistance to drought. Fifteen percent of the respondents grew Para grass. This type of grass has similar characteristics as Ruzi grass as well as Star grass which 12% of the respondents cultivate. Unfortunately, it was not possible to diversify the variety of grasses to particular groups.

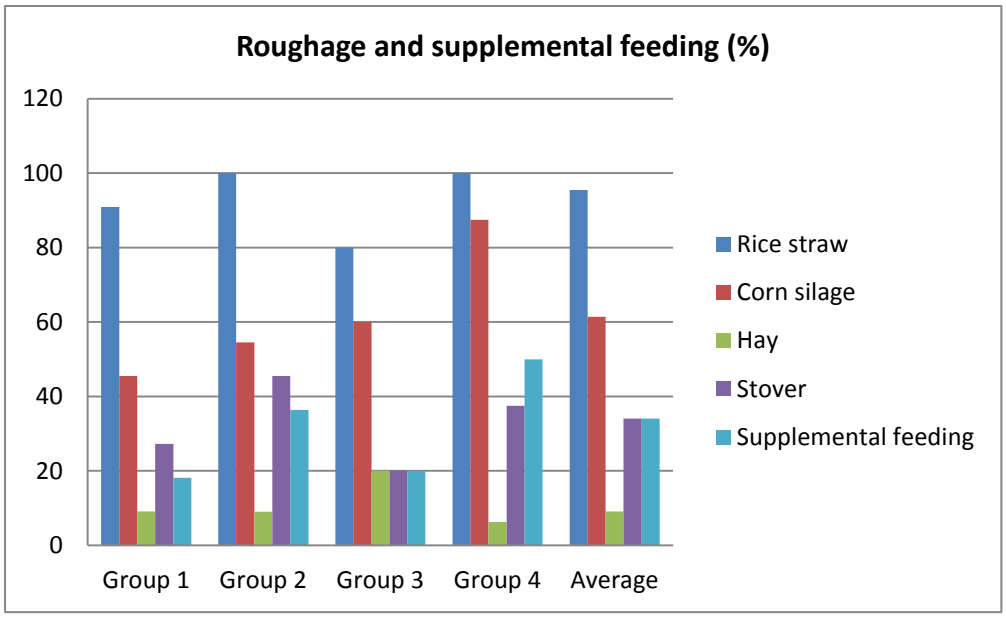
Figure 19. Percentage grasses cultivated on farm



Like in most countries, both conventional and non-conventional feed resources are used in the study area. Roughage and concentrates resources commonly used by dairy producers includes 42 (98%) rice straw, 28 (63%) corn silage, 4 (9%) hay, and 14 (33%) corn stems (stover[12]). Rice straw was used by all groups (farmers), corn silage as feed resource was mostly used by farmers in group four, hay was equally distributed between groups, and stover was mostly used by producers in group two and four (Figure 20). One farmer fed cattle with solely concentrates and corn silage. Moreover, respondents indicated that they gave priority to lactating dairy cows, while others did not give any special attention.

Further, in groups one and two, cows are grazed along roadsides or tethered and grazed in the backyard of the residence. Supplemental feeds or nonconventional feed resources provided to cattle are mostly given to farmers in group two and four compared to producer placed in group one.

Figure 20. Roughage use (groups)



Several feeding sources exist for a farmer to buy roughages. First, four (9%) of the respondents indicated their neighbourhood as the primary roughage source, secondly, 36 (82%) co-operative, and lastly 18 (41%) local market. None of the respondents is buying roughage from relatives. Figure 21 shows the distribution of feeding sources between groups of farmers. The main feeding source for all groups is the local co-operative that is providing a variety a feed stuffs. The neighbourhood as feeding source is mostly used by producers from group one compared to farmer in group four who are most likely to buy animal feeds from the local market.

[12] Stover is the leaves and stalks of corn (maize), sorghum or soybean plants that are left in a field after harvest. It can be directly grazed by cattle or dried for use as fodder.

Figure 21. Sources of roughages (groups)

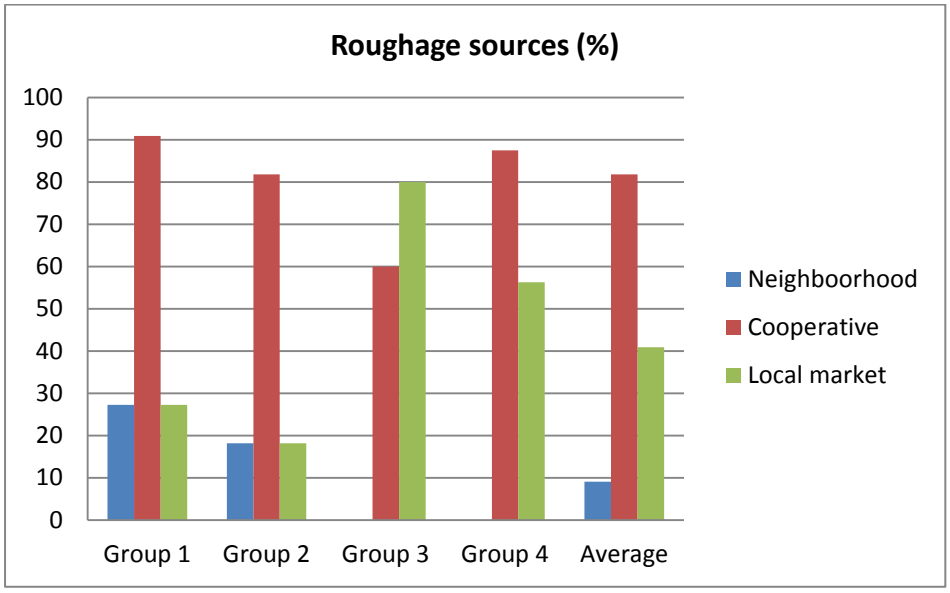
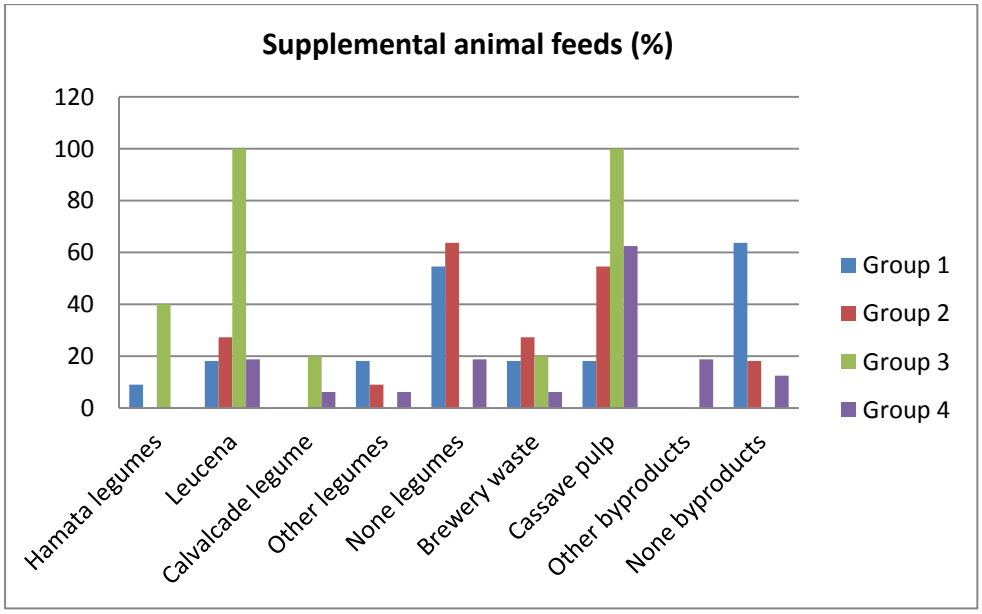


Figure 22 shows a variety of supplemental feeding given to livestock. In this figure several types of legumes and other by-products are sorted by group. Cassava by-products were often used by every group of farmers. The sort of by-product fills up the rumen of the milking cow in a relatively cheap way. Further, this by-product gives a higher energy level; however, protein content is relatively low.

Other legumes and by-products were pineapple, palm cake, chestnut bean, soy bean, sticky rice, red beat, and sodium bicarbonate. A substantial number of farmers used molasses as by-product. This by-product of sugarcane can be added to cassava and stored for several weeks. According to farmers, molasses works as a vehicle for other nutrients (e.g. minerals) and give taste to other animal feeds. None of the respondents indicated to use medicinal herbs to feed livestock.

Figure 22. Distribution of supplemental feeding (groups)



Box 5. Characteristics and management of an interviewed farmer (1) (group 4)

In one of my interviews, I found a dairy farmer with a high average milk production of 18,3L per cow. This young farm household, living in Muaklek was rearing 78 heads of cattle with 30 rai of land. The family consisted out of four persons where both husband and spouse were working full-time on the farm, and two children. Both children were still in primary- and secondary school. Further, the farmer hired two full-time labourers for mainly milking and feeding of the cattle. The housing included two stables, shed for rice straw storage, and a milking barn. Moreover, some years ago he bought a tractor of which he was very proud of. The tractor was used to move dung to a place where it was put in bags for sale.



To be clear on the exact herd characteristics; 30 cows in milk, 20 dry cows, 10 older heifers, 10 younger heifers, and finally 8 female calves were counted on the farm. The total milk production was 15400L in February 2011. This resulted in a total milk sales of 251000,- with the main cost pools of 200.000.- for animal feeding, 30.000.- veterinary and 10.000.- bank loan costs. He was trying to save some money every month, however, this was not always possible. I asked him how he distinguished the profit from all costs of his farm. He said by head, however, he would like to have training in bookkeeping because he thought this would help him improving his financial management. However, both husband and wife were recording some information about their cattle. This included calving date, parents, date of A.I, and date of birth. Nevertheless, he trusted the A.I inseminator; therefore decisions about a particular bull were taken by the inseminator.

The main animal disease problem on their farm was tick fever. To prevent this disease, he was cutting all the grass around the farm during rainy season. He was worried about Food and Mouth disease (FMD) because recently an outbreak of this disease occurred. Therefore, to prevent this disease he tried to reduce the number of cars and people on the farm. To feed the herd, the farmer gave rice straw, corn silage (4kg daily/per cow), ruzi grass (during rainy season) to their cattle supplemented with cassava by-product and brewery waste.

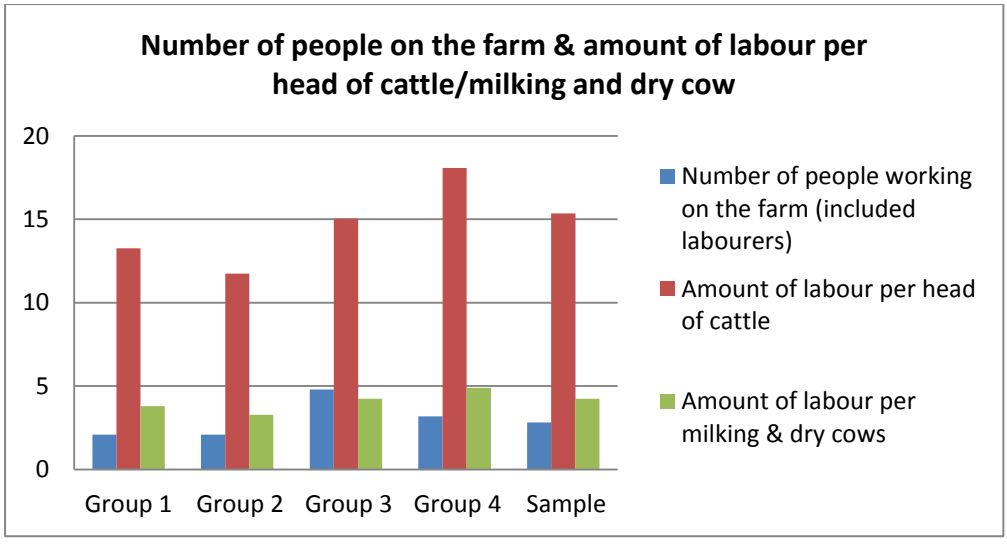
The respondent was very open during the interview, and interested in new technologies. However, he argued that it would be very difficult to introduce innovations because of various reasons. For instance, recently he experienced the usage of a feed mixer to lower feeding costs but the cost to buy such a machine was too high (400,000.-).


Labour & employment

Like most dairy production systems of Thailand, family members are the major source of labour for any dairy activities in the studied area, such as indicated for Garcia et al. (2005). Results of the interviewees showed that the average size of the household is four (± 1.56). Two family members are full time working on the farm. Occasionally (e.g. during holidays) children are assisting the spouse and/or husband with their work. Most routine dairy activities like feeding, milking and nursing of sick animals were operated by all family members. However, 30% of the farmers reported to have a labourer working on the farm. These farmers are mostly placed in group three and four (Figure 23). Furthermore, it could be observed that the amount of labour per head of cattle/milking & dry cows were the highest in group three and four.

Labourers were mostly used for milking and feeding of the cattle. Because employees are performing the same work every day, it is not necessary for a farmer to instruct or schedule these people. A quarter of these labourers were living with their families at the same residents of the respondent. 88% of the respondents found it difficult to find farm labourers. Moreover, because no contracts are enforced by farmers, labourers can switch easily from one job to another. According to farmers, if training to a new labourer is given, afterwards a huge possibility exists that he will resign. Notable is the fact that wages were also significantly rising for the last 3-4 years according to producers.

Figure 23. Number of people working on the farm (groups)



Marketing of milk

All farmers (100%) applied machine milking. Raw milk is being transferred in 50L milk cans and delivered to the nearest MCC in the morning and evening, respectively. There is limited possibility to store raw milk on the farm. Farmers relatively far away from a MCC hired a private collector to pick up their milk (morning and evening). This was done at fixed times. However, because it takes a long time before milk of the first farmers is being transferred (in tropical weather conditions) to the co-operative, there is a risk that milk deteriorates. Thus, farmers in the beginning of a round have in

general a lower milk price than farmers in the end of the private collector round, according to respondents.

Farmers have different possibilities to market their milk (Figure 9). All respondents sold milk to at least one co-operative. Seven respondents (17%) reported to market their milk to two co-operatives. Notable, one farmer sold milk to all co-operatives, and PMC. As been mentioned in sub-chapter 7.1 payment is based on the quality of the milk. In this regard, quality is partly regarded as the somatic cell count (SCC) of milk. The SCC is quantified as cells per ml of milk. In general, values less than 100,000 cell/ML are quantified for unaffected cows and greater than 300,000 cells/ML for infected livestock.

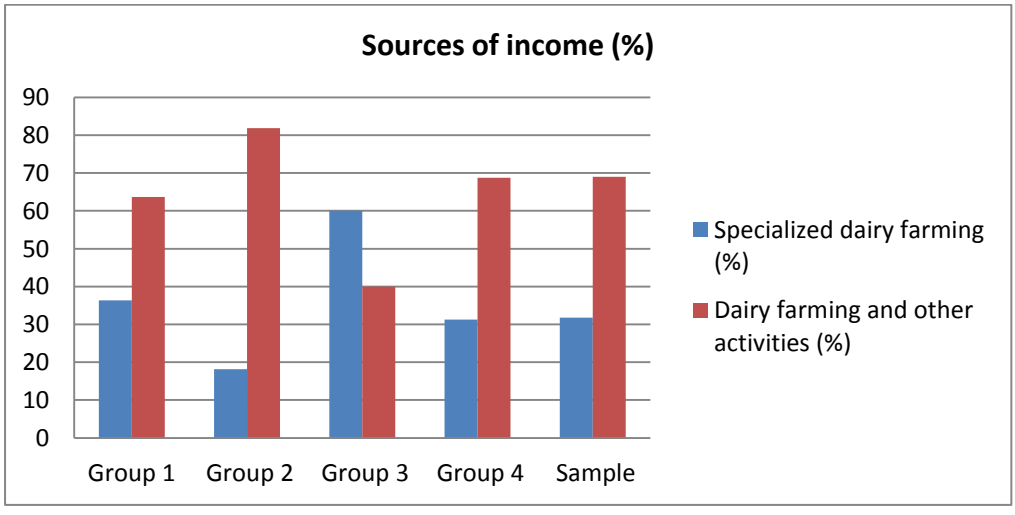
Table 9 shows different grades which were formulated by the co-operatives based on the SCC with a variety of payments per L. The highest milk price is determined at 16,30. Based on Table 9 and the answers by the respondents could be concluded that only 45% of the farmers were grade one. The remaining 55% received a lower milk price for their milk.

Table 9. Grades and L milk payment accordingly

Grades	**Milk price/L (February 2011)**
1st grade	16,30 THB
2nd grade	16,00 THB
3rd grade	15,70 THB
4th grade	15,40 THB

Concerning other source of income except dairy farming (milk sales), the majority of the respondents gave a positive answer (Figure 24). 29 (67%) of the respondent undertakes other activities ranging from manure selling (55%), cultivating corn (9%), growing vegetables (5%), and fruits (10%) to rearing goats (2%), goose (7%), and chicken (26%). A minority of the respondents (9%) owns a small shop at their farm. However, for all farmers, dairying is their main source of income. Research from Yeamkong et al. (2010) also concluded that the majority of Thai farmers in Muaklek depended on their dairy business as the sole source of income.

Figure 24. Sources of income (groups)



Nevertheless, manure is sold to the neighbourhood, cultivating corn to feed livestock and the purpose of the other activities is mostly home consumption. One respondent who owned gooses argued that these birds assist him by defending his farm to intruders. According to him, these birds could be seen as a replacement of a dog. Moreover, several farmers indicated that chicken is not only used for home consumption but also as a defence of flies and insects because this kind of animals eats flies and their eggs, respectively.

Box 6. Characteristics and management of an interviewed farmer (2) (group 1)

In another interview, I found a farmer (52 years) located in a urban area of Muaklek sitting in front of his shop. In this shop different consumer articles were sold like food and booze. Behind his house was a small farm on exactly one rai of land. This was an example of landless farming. The farmer indicated land as one of the main constrains on his farm. It was observed that the farm was unorganized.


The farmer was rearing in total 34 head of cattle divided into 15 cows in milk, 4 dry cows, 5 older heifer, 8 young heifers, and 2 female calves. The average milk production was 10L/cow per day. The family consisted out of 4 person of only he was working full-time on the farm. According to him, farming was in the family for many years and needed to be continued in the future. Therefore, one of the children helped him irregular on the farm but, nevertheless, was intending to take over the business. However, he was still studying. The daughter moved to Bangkok to start a family in the city. Interesting was the fact that the daughter visited the farm regularly to collect milk. Consequently, she took part of all milk produced to a PMC. Moreover, because of her educational background (accounting), she was performing bookkeeping as well as a financial gatekeeper for her father. If the father needed money for some kind of farm investment, he had to ask for money and permission from the daughter. Further, the daughter payed for the construction of a large house.

The total milk production was 2305L in February 2011. This resulted in a total milk sales of 37571,- with the main cost pools of 12.000.- for animal feeding, 3500.- veterinary and 25.000.- bank loan costs. Thus, this farmer had a loss in this month. Moreover, the farmer had multiple borrowing sources which had a substantial impact on the profitability of this farm. To overcome infertility and disease problems, the farmer was using two heads of Brahman cattle (Zebus) to crossbred with Friesian Holstein cattle/traits. He was not performing- and using any breeding records and/or other recordings.

The main animal disease problems on his farm were tick fever and mastitis. He executed nil to prevent these diseases except spraying of cattle. To feed the herd, he gave rice straw, stover, corn silage (4kg daily/per cow), and an unknown legume which he cut down the road during evening time. Other feeding was bought from cooperative and neighbors, respectively.

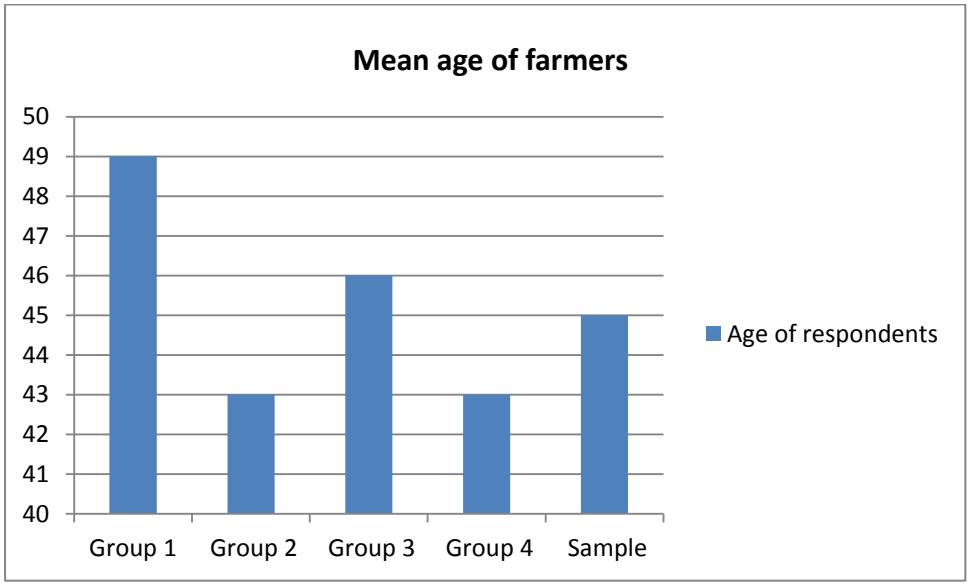

7.2.2 Household characteristics and social profile of respondents

In this paragraph the intangible characteristics of the sample plays a central role.

Age & education of respondents

Out of the total interviewed dairy cattle producers (N=43), average age was 45 ± 11.9 (27-68) years (Figure 25). The overall mean (±STD) age between groups were one 49 (10.9), two 43 (13.8), three 46 (14.7), and four 43 (10.7), respectively. A substantial number of farmers (N=11) were found to be older than 51 years. This is consistent with the trend that less young, new farmers are starting a farm because of various reasons. One reason, according to farmers includes the attractiveness (available facilities) to live in a large city. Most respondents (55%) are male, however, because the majority of farms are organised as a family farm both husband and spouse were collaborating during the research.

Figure 25. Mean age of farmers (groups)

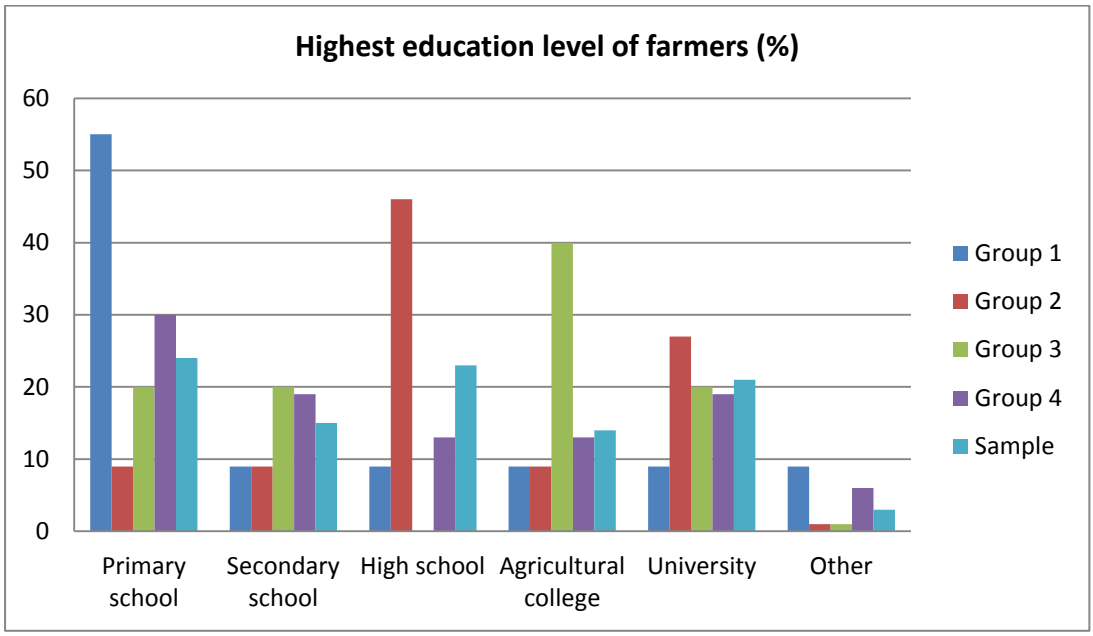


With respect to educational status of the respondents, the majority of dairy producers were literate beyond primary school. The overall highest educational levels of farmers were 26% primary school, 23% finished high school, 21% university, 16% secondary school, and 14% agricultural college. More than 35% of all producers had a college- or university degree. In general, these results indicate that dairy cattle owners in the study area are mainly literate and educated.

Figure 26 shows the highest educational level of farmers in every group. Here, one can see that most farmers in groups one had primary school as highest education level. Moreover, high school was the highest education level of farmer in group two. Agricultural college seems to be the highest education level of farmers in group three. Farmers in groups four were from different educational backgrounds. This result suggests that milk production per farm and per cow increased with the level of education of the farmer. The large number of Thai dairy farmers that finished primary school found in this research was also reported in literature (e.g. Yeamkong, et al., 2010). As mentioned in

the research of Yeamking et al. (2010), these farmers may present a challenge when promoting new technologies or disseminating knowledge for improving dairy production and management.

Figure 26. Highest education level of producers (groups)



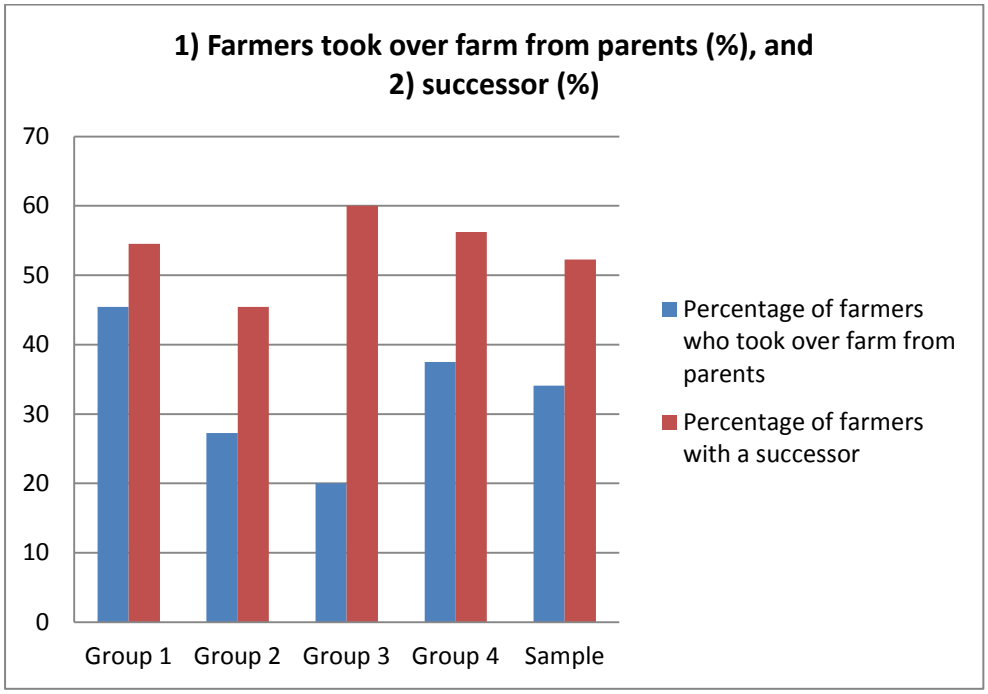
Biography

Regarding biography, 14 respondents (34%) took over the farm from their parents, this varied between groups considerable (Figure 27); the largest percentage is found in group one (45%) followed by group four (38%), group two (27%), and finally group three (20%). The remaining 29 (66%) farmers stated that they started the farm by themselves. According to farmers, this high percentage is linked to the perception of independency (to make own decisions) when managing a farm, a potential stable and high income as well as the high number of immigrants in this area.

Succession is a process which involves the transfer of assets; in the Thai case mostly cattle to a successor to establish a new farm business. In addition to succeeding of the farm, respondents benefitted also from the transfer of skills and, less intangible assets such as a detailed knowledge of farm operations.

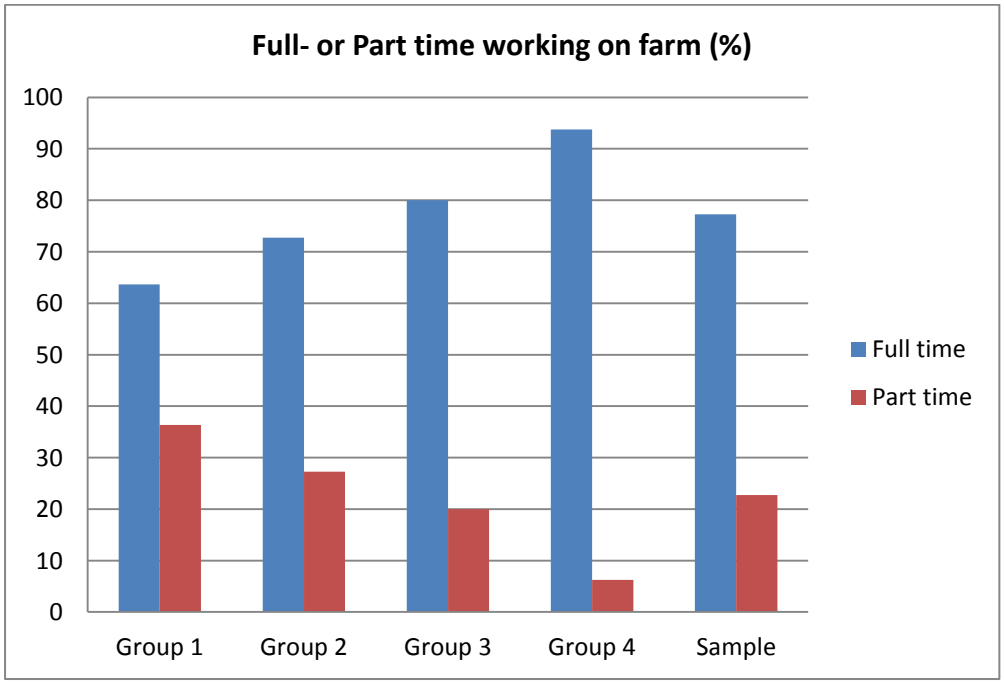
Regarding intergenerational successors, 52% of the respondents reported to have a successor divided into 55% in group one, 45% group two, 60% group three, and finally 56% group four (Figure 27). Eighteen percent of the farmers do not yet know whether someone will take over a farm because children or relatives were too young to confirm whether or not they will take over the farm. 22% of the respondents discussed the fact that their children finished a study (e.g. university), and consequently have a secure job in another sector.

Figure 27. Biography and successor of farmers (groups)



With respect to farming styles of the respondents, the majority of dairy producers reported to be a full-time farmer (Figure 28). Out of the total households, 77% reported to be a full time farmer, while 23% have another job to supplement income outside the farm. Most of the farmers in group four are full time (93%), followed by group three (80%), group two (73%), and finally group one (64%).

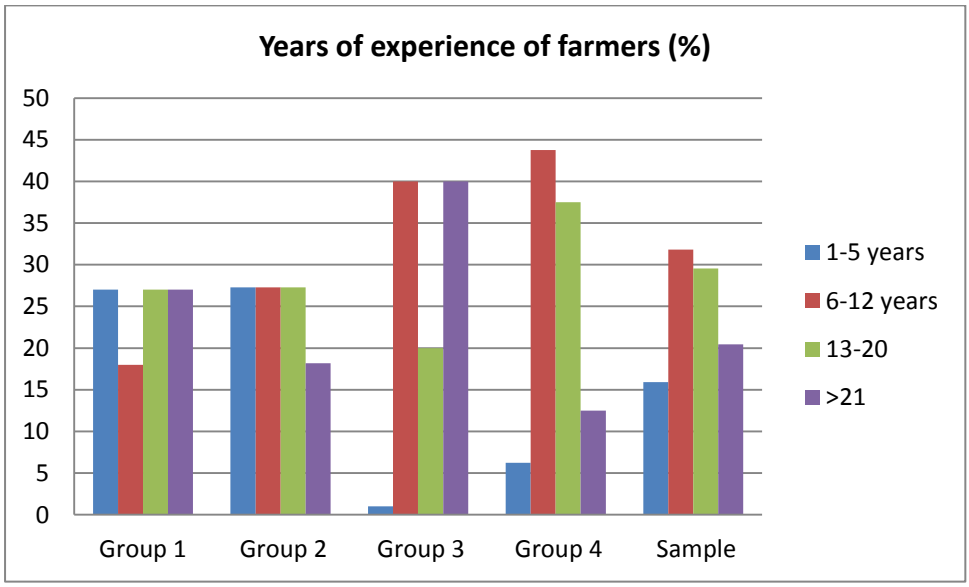
Figure 28. Full and part time farmers (groups)



Farming experience

In terms of farming experience, it could be noted that the majority of the farmers (81%) have more than six years' experience. Almost 50% of the respondent reported to have more than 13 years' experience in farming. According to respondents, this is consistent with the trend that less new farmers are starting a dairy farm, and the average age of 45 years in this sample. Furthermore, Figure 29 presents an overview of years of farming experience between groups. Here, one can see that the highest percentage of farmers with less than 5 years' experience are placed in group one and two while the majority of farmers placed in group three and four have more than six years' experience in dairy farming. This result suggests that farmers with more years of experience are more likely to have a better understanding and skills to appropriately operate larger dairy herds compared to less experienced farmers. Another explanation could be the fact that more farmers in group one and two just started up the farm compared to farmers in group three and four who own a farm for numerous years. Though, this could not be seen in the results.

Figure 29. Overview of number of years farming experience (groups)

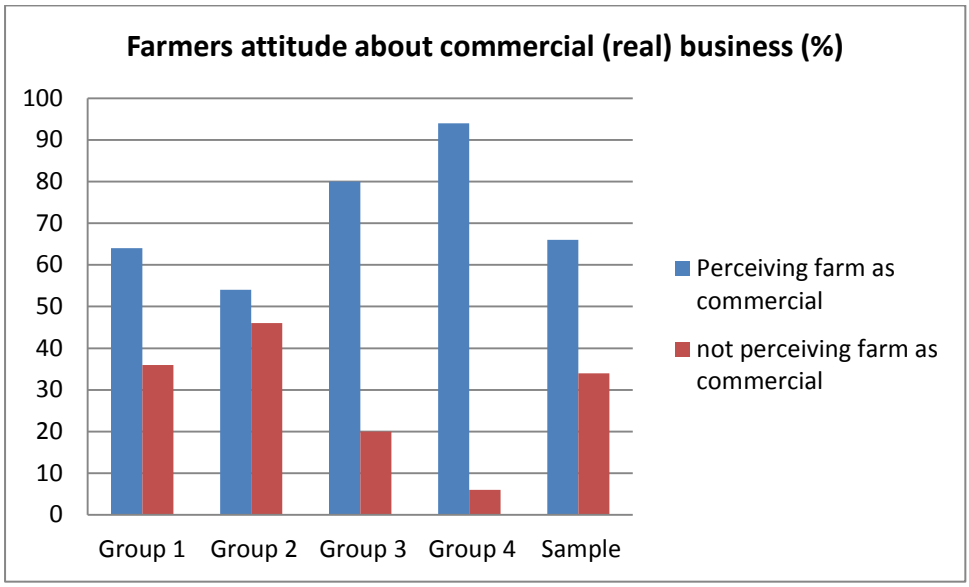


Attitude & Perception of farmers

Concerning attitude, 67% of the respondents perceive their farm as a commercial (real) business while group one 63%, group two 52%, group three 80%, and finally group four 92% (Figure 30). Linked to attitude, is the query whether farmers see their farm as an example for other farmers; 20% argue yes where 23% thinks that their farm could improve significantly before stating an example (pilot) farm (improvement in e.g. milk yield, size etc.). Moreover, farmers argued that an example farm would imply receiving guests which may bring in diseases or requires time to guide around as well as some farmers bluntly refuse unknown visitors to visit the farm.

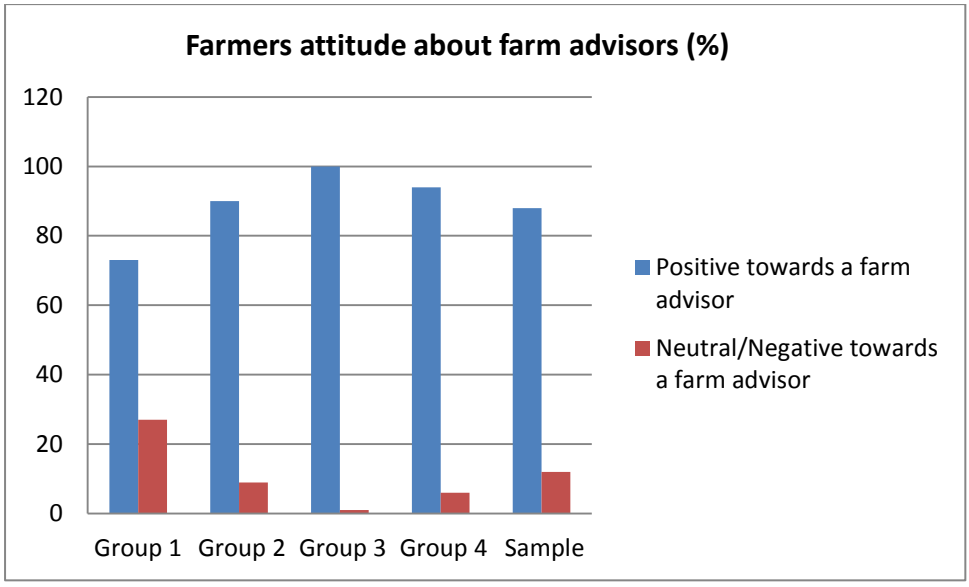
Additionally, during in-depth-interviews respondents were asked for the reason behind the decision to start and continue farming. Safeguarding income now and for the future was mentioned most frequently, followed by continuing family tradition.

Figure 30. Attitude towards commercial (real) business (groups)



To acquire the degree of openness for new ideas (attitude), respondents were asked if they feel positive if an advisor would visit their farm. 38 respondents (88%) showed a positive response to this question. Between all groups was a positive attitude for farm advisors (Figure 31). It indicates that a major part of the farmers are open for news ideas and are ambitious. Noteworthy is the response of one farmer; “I would only like to have an extension officer to visit my farm if it is for free”.

Figure 31. Attitude about farm advisors (groups)

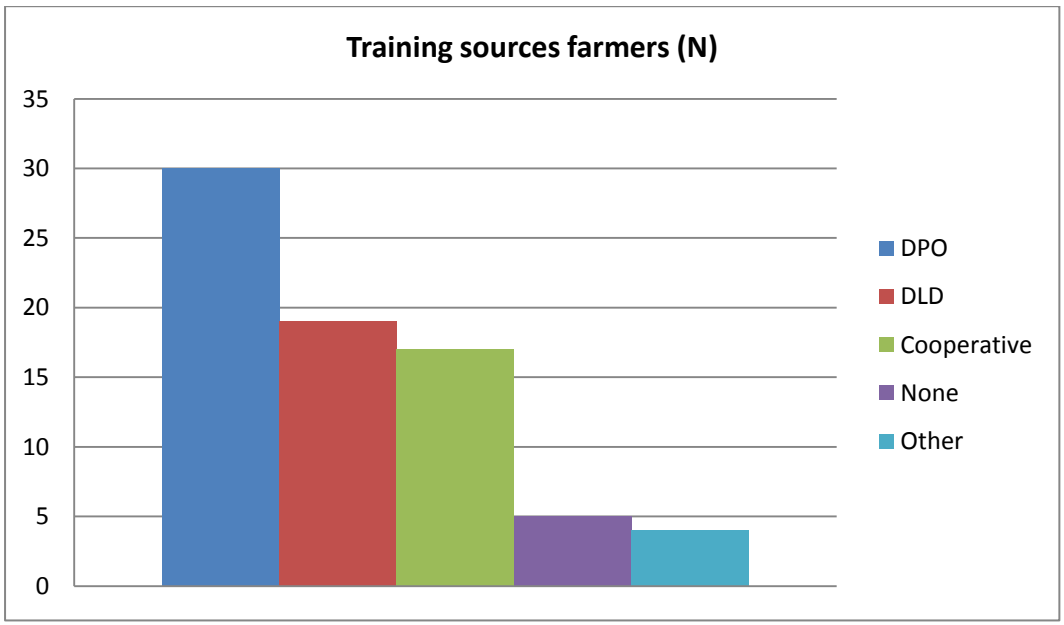


Agricultural training

Agricultural training of dairy farmers in Muaklek is completed by several organizations. In Figure 32 an overview is presented whereby DPO is the organization where most farmers acquired additional training (30) followed by DLD (18), co-operative (17), others (4), and five respondents did not receive

any training. To become a member of a co-operative it is obligated to participate in trainings. However, in this sample only 17 respondents received training from a co-operative. Thus, this means that the spouse, children or husband of the interviewee received training. Most farmers received training in the fields of animal feeding and (hygienic) milking. Two respondents did not recall in which fields they received training.

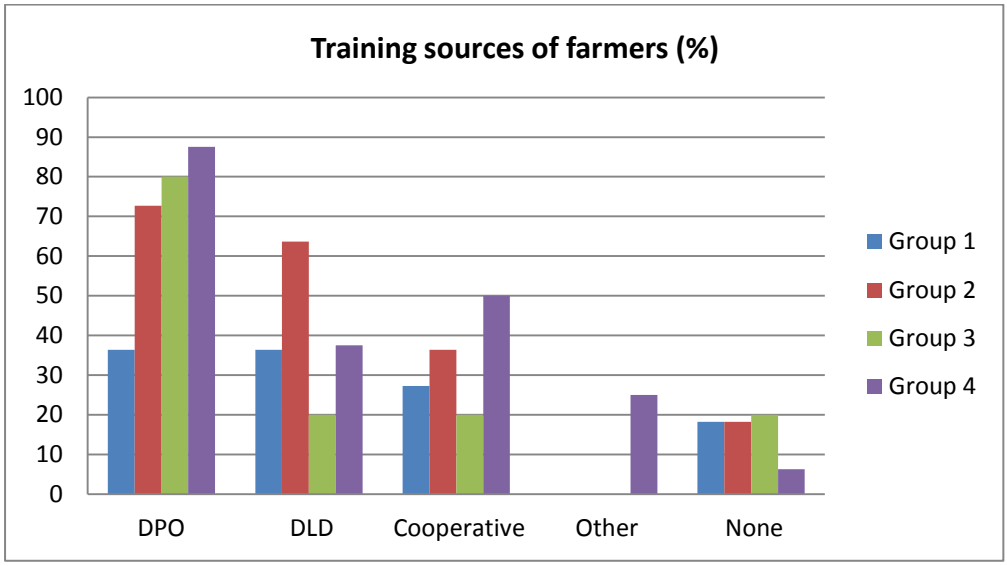
Figure 32. Overview of training sources (sample)



A clear distinction between groups exists regarding agricultural training (Figure 33). Most of the farmers in group one received training from DLD (38%) and DPO (37%) while farmers in group two mostly received training from DPO (71%) and DLD (63%). Farmers placed in group three reported DPO (80%) as their main training source whereas farmers in group four reported DPO (87%), and co-operative (50%) as their main training sources. Thus, as one can see respondents from group two and four received substantial more training from different sources than respondents from group one.

Nevertheless, during the in-depth interviews older farmers indicated that agricultural training of DPO could last four weeks in previous times. However, because of financial cuts nowadays training from DPO only lasts one or two weeks. Moreover, a limited number of farmers followed other trainings like participation & trainings within a project. All these respondents are placed in group four which could be seen as extraordinary. It might be that these farmers are selected on certain size criteria's or that farm owners have a positive attitude towards gaining new knowledge.

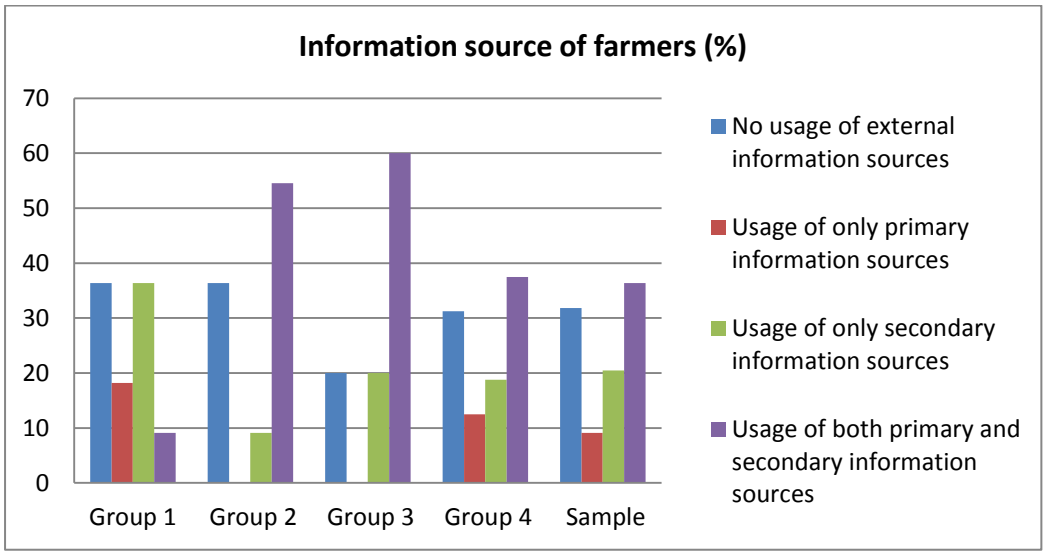
Figure 33. Training sources (%) (groups)



Agricultural information

In sub-chapter 3.2, information is recognized as an important determinant in a successful decision making process of farmers. Because of this, choice of an appropriate medium is crucial in agricultural information delivery. The usage of information for decision making in this sample between groups indicated that the majority of farmers in group one used information mainly from secondary sources or none while farmers in group two used information from both primary & secondary and none. Further, farmers in group three and four indicated a usage of both primary and secondary sources. Farmers who participated in this study reported a preference for interpersonal sources of agricultural information. Figure 34 gives a clear distribution of (agricultural) information sources. It was not possible to rank the relevance of all different sources of information used by farmers as well as assign a degree of priority to the different types of information sources.

Figure 34. Information sources of farmers (groups)



7.2.3 Synopsis of farming practice (systems) in the study area

Farmers in this study were typical of small-, medium, and limited number of large scale domestic milk producers. Average farm size in this sample was 43 heads with 19 cows in milk. Average milk production per cow, per day in this sample was estimated at 13,3L while a milk fluctuation up to 15% difference occurs. Over 30 percent of the farmers in the study employed wage labor, while family members are also a major source of labor for any dairy activity.

The vast majority of farmers have no land to cultivate forages or roughage. Just over nine percent of farmers in the study cultivated more than 10 rai of land. The remaining farmers cultivated land under total rain-fed conditions. Rainfall is unpredictable and drought is a serious problem in the dry season. The seasonality of forage production affects pasture growth determining short growing seasons constrained by moisture and temperature. Uncultivated land was usually in fallow or was not cultivated due to lack of resources and interest. There was a high incidence of farm fragmentation in the study area, as farmers operated land in many different locations in response to their inability to access adequate land in contiguous parcels. The majority of dairy farms must purchase roughage, concentrates and other supplemental feeds is used in addition to roughage.

Some of the farmers are more or less within a peri-urban dairying system (in Muaklek town) but they still rely on the use of crop wastes and residues, such as corn stover from neighboring farms and co-operative, as a source of feed supply. There is a general tendency for the number of cows in milk owned by each farmer to increase. Moreover, there is a steady objective of dairying to be the specialization in Thai livestock farming systems such as indicated by Chantalakhana and Skunmun (2001), and Yeamkong et al (2010).

All farmers applied machine milking. Milk is being sold to one or more co-operatives or PMCs. The primary purpose of keeping cattle in the area is for milk sales. However, the majority of farmers have more sources except milk sales like manure selling (67%), rearing chickens (26%) for both home consumption, and market purposes.

Average age of dairy farmers in this sample was 45 years. Generally, the majority of farmers were mainly literate and educated. Just over 34 percent of the farmers took over the farm from the parents whereas 52% of the farmers have a successor. In terms of farming experience, 81% of the farmers in this study have more than six years' experience. Moreover, most of the farmers received training from primarily DLD, and DPO. Lastly, the vast majority of farmer's prefer an interpersonal medium for receiving agricultural information, and knowledge.

8. Analyses and discussion of results

This chapter is planned to analyse and present the outcomes from the literature study and the results from the questionnaire and interviews in order to answer the central research question. The literature study gave different aspects of business management on tropical dairy farms, and managerial capacity. Moreover, a section was prepared about co-operatives and their particular characteristics. Thus, in this chapter, an analysis and discussion of all results will be central. Hereby is the literature used as an assessment framework for analysing the results.

8.1 Influence of farmer characteristics on management capabilities and farm decisions

This sub-chapter presents an analysis of farmer's characteristics on management capabilities and farm decisions.

Cattle husbandry and (strategic) management practices

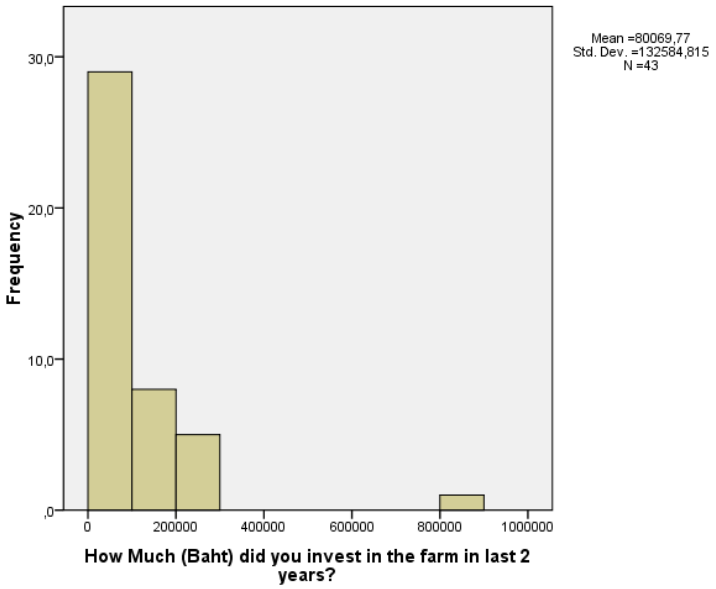
As Pfeffer and Slancik (2003) claim "strategic planning is critical for a farms survival"[13], this could also be observed during the in-depth-interviews. Thirty-five respondents (81%) indicated to make some kind of (financial) planning or intention. However, it was not clear in what way farmers were making planning's.

Regarding farm investments (<2 years, >5000.-), 9 respondents (20%) did not make a large investment (e.g. stables, cattle, tractor) during the last two years. This type of farmers was satisfied with their income, had limited financial resources, not profit oriented, or were not sure about a possible successor.

The average amount of farm investment was 80.000.- in this sample (Figure 35). One respondent indicated an investment of 800.000.- on stables, storage facility for rice straw, and a tractor. This young farm household just started a large farm, and the spouse had a fulltime job outside the farm household. Further, one respondent argued to expand the barn for calves by himself with wood from the surrounding nature. Nevertheless, without the outlier (800.000.-) the average amount of investment would decline to 60.000.- This amount could be seen as replacement investments (e.g. new wooden fences or roof for an existing barn).

[13] Strategic planning is one of the primary functions of the framework of Van Assendonk et. Al (1999), explained in the literature part of this study.

Figure 35. Amount of farm investments



Further, from Figure 36 could be concluded that full-time farmers (type of farmer) are more willing to invest in farm innovations. This is in line with previous research of Chell et al (1991) which is mentioned in chapter two. Moreover, fulltime farmers have on average 30% more livestock and 15% higher average milk production per cow (Figure 37) compared to part-time farmers. This seems evident because full time farmer are economic dependent on dairy farming.

Figure 36. Relationship investment planning and farming style

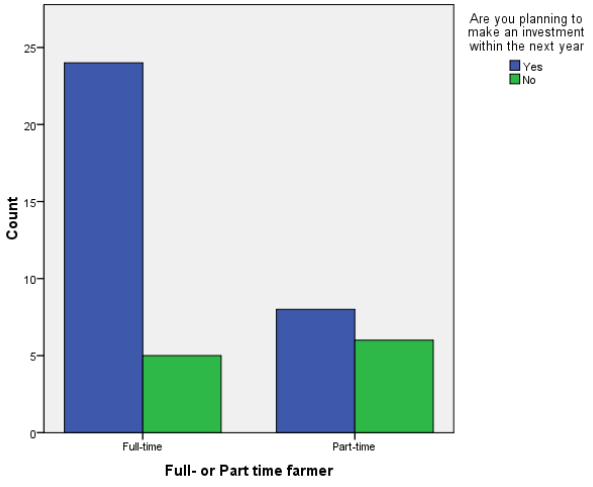
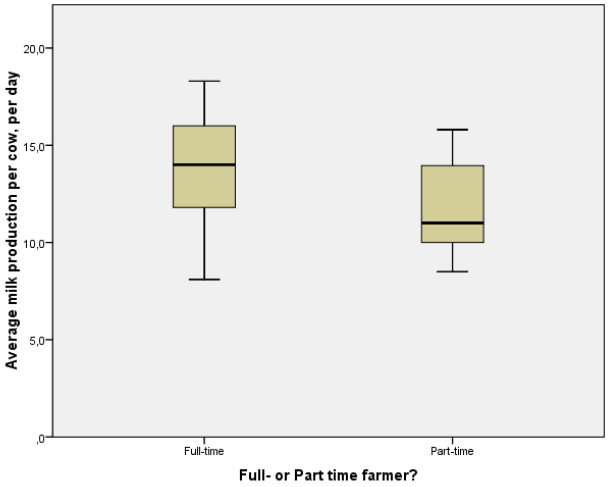


Figure 37. Relationship milk production and farming style



28 respondents (65%) were satisfied with the average milk production on the farm. The correlation analysis based on data of all farmers indicated that there was a positive correlation ($r = .317$, $P < .004$) between satisfaction of the level of milk production and planning to make an investment within the next one or two years. Therefore, it seems that a group of farmers exist in this sample

that is not satisfied with milk production per cow nowadays, and is planning to make an investment to improve milk production. However, these respondents cannot be expressed in a particular group.

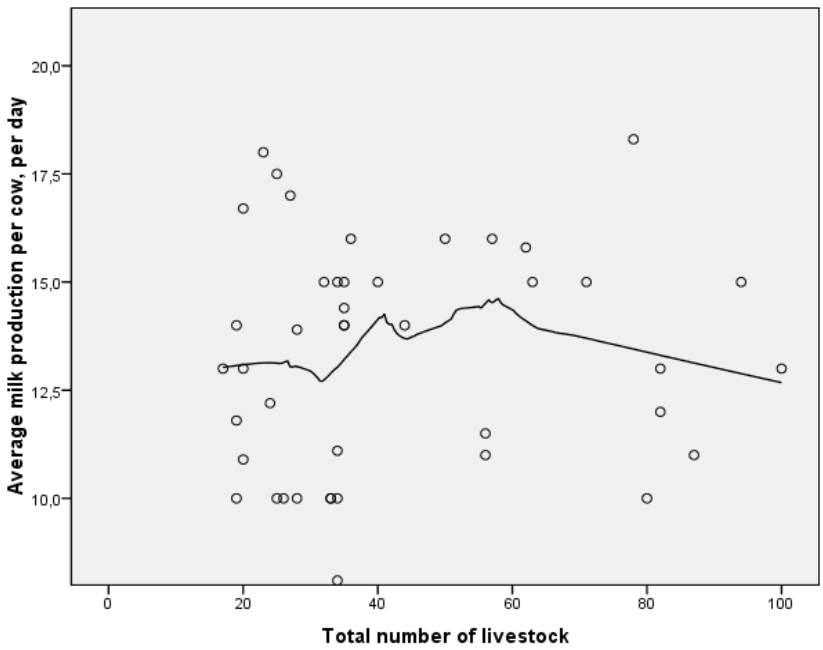
Nevertheless, a positive relationship between satisfaction of milk production and planning to expand the cattle herd within the next one or two years could not be found. Therefore, it can be concluded that these respondents wishes to improve average milk production per cow on the farm with the existing herd and not by buying (improved) cattle.

Human Resource management (HRM)

As mentioned before, 88 percent of the respondents indicated to have serious problems hiring a labour. This could be observed in all groups. Hence, this means that most of the farm activities is performed by the farmer themselves with family labour like spouse/husband, children and/or grandparents. This observation is consistent with outcomes from the research of Yeamkong et al. (2010).

Nevertheless, out of the interviews, farmers indicated that around 50 heads of cattle the managerial capacity of the farmer (household) is reached. Without hiring labourers an increase of the number of livestock would have a direct negative effect on the average milk production. This can also be seen in Figure 38. Although the slope is not steep, and the number of respondents with more than 60 heads of cattle is limited in this Figure, it indicates a lower average milk production per cow starting with farmers who own more than 55 heads of livestock. Thus, the need for labourers could also be observed from this picture. However, it should be noted that some of the large farms have already limited amount of external labour.

Figure 38. Relationship (moving trend/loose fit line) between number of livestock and average milk production per cow/day on a farm



Milking practices

Out of the interviewed farmers, all farmers milked their cows by machine, and twice a day. None of farmers milked the cows thrice or once a day. The high percentage of milking twice a day is similar to the milking frequency practised in many parts of Thailand. Time of milking is normally in the early morning (≈5.30AM) and early evening (≈16.00PM) for twice/day milking. Consequently, buckets with concentrate and cassava pulp were prepared in a feeding slot. Accordingly milking is completed by the whole farm household because labourers are often not available. Because milking capacity (small milking barn) is insufficient milking takes significant amount of time. Hence, an explanation for the low average milk production in group three can be found in the high number of cows in milk. A high number of cows in milk (>25-30) without labourers is difficult to manage in a right way (e.g. small milking barn). Moreover, all farmers in group three indicated difficulties in finding labourers as well as problems to manage time every day to fulfil all tasks correctly on the farm.

Moreover, because in rural areas milk is collected at fixed times by private milk collectors, these farmers with a large herd get into time stress, according to respondents. Hence, all milking procedures is done quickly. For instance, respondents complained of the long cleaning time before starting milking of the cows especially during rainy season. This is due to poor housing conditions. Further, it seems that older farmers had more problems during milking. For instance, physical problems occur during handling of the milking machine.

Animal health practices

The price that dairy farmers receive for their raw milk generally has the biggest bearing on farmer profits besides all the costs of farm inputs. As indicated before, 55% of the respondents received the full milk price of milk (16.30.-/L). Hence, this means that 45% received a lower milk price. According to farmers, the lower milk price is due to two reasons namely (1) unhygienic environment, and (2) mastitis. The lack of hygiene affects the total bacteria count (TBC) and therefore also the milk price. These intrinsic reasons can be influenced by farmer's management skills in producing and collecting of milk. It could be observed that a part of the respondents were trying to reduce mastitis and unhygienic environment by for example cleaning the barn every day.

Nevertheless, Sharif (2007) argues that mastitis affects the milk quality in terms of an increase in somatic cell count (SCC). Consequently, other components will also be affected at high levels of SCC like milk protein, fat, sugar (lactose) content. Hence, it seems that mastitis has an enormous impact on the milk quality, and therefore income of dairy farmers in this sample.

Genetic traits is a determinant for sensitivity to animal diseases (especially mastitis), and heat resistance such as indicated by Moran (2008). Analyses of the interviews showed that farmers in Muaklek often cross exotic breeds with Holstein-Friesian dairy breed. Holstein-Friesian dairy cows are known for their high milk production, however, there are also known for low robustness against harsh environmental conditions. These characteristics were also noted by other authors such as Syrsted (1990), Moran (2008) and Combellas et al (1981). These authors also argue that 50-75% Holstein traits (crossbred) appear to be optimal in tropical countries.

However, the majority of the respondents (86%) own livestock with 70-90% or even more than 90% purebred (Holstein) traits. It seems that famers give priority to milk production at the expense of robustness. This could also be observed during the qualitative interviews whereby farmers argued to select Holstein-Friesian bulls to increase milk production. Additionally, because of the large Holstein-Friesian traits in cattle, heat stress could be observed. Heat stress in dairy cattle leads to milk depression, and reduced fertility as reported by Hansen (2007). In this sample was infertility one of the main problems that numerous farmers reported in the questionnaire.

Nevertheless, the majority of respondents (95%) were trying to prevent or reduce the occurrence of mastitis by cleaning udder and teats with simply water or water added with chloride, massage cream, pre-dipping, and post- dipping. Rubber gloves were not used during milking. Conversely, according to a small part of the respondents (5%) mastitis is common disease, and can be treated easily. Moreover, one farmer argued that prevention was useless because after milking cattle graze in a (muddy) environment, its measures will be wiped out again. Hence, this farmer was not performing any prevention measures. The data regarding SCC of this particular farm was not available.

Recurring to animal health, besides mastitis, other animal diseases are recurrent on dairy farms in Muaklek. Tick fever is present in nearly all sampled farms especially in farms where cattle graze free. However, it was not statistically shown that the area of land available for grazing would have a correlation with the presence of tick fever on a farm. Nevertheless, according to farmers tick fever can be often observed during the rainy season because at that time most cattle are grazing outside. To prevent this disease farmers gave calves antibiotics and elderly livestock were monthly sprayed with insecticides. If tick fever was determined, veterinary drugs (antibiotics) were given for about one week by the farmer or veterinarian, respectively. During this time it was not allowed to deliver milk from this particular milking cow to the co-operative. With this respect, proper training should be given to create awareness among producers in different aspects of veterinary practise.

The interviews also showed an increase trend of retained placentas[14]. Though retained placenta is a complex problem, it seems that in this case unhygienic calving conditions, nutritional factors and occurrence of milk fever are causing cows to retain their placenta after given birth. Another animal disease which is mentioned regularly is Bovine Ephemeral Fever (BEF, three days sickness). Mosquitos act as vector. As a consequence of BEF infected animals stop eating and drinking as well as a sudden drop of milk production up to 50%. Because of the open environment (e.g. open stables), it appears that cattle are sensitive for insect, flies, ticks etc. as disease carrier.

Moreover, it looks that the high production pressure has a negative influence on the resistance of the animals. However, this could not be approved statistically. Nevertheless, during observations of animals owned by farmers in group four was a significant difference in the general body condition detected compared to cattle from farmers in all other groups.

Recurring to the muddy environment due to poor housing conditions, this fact gives opportunity for cow lameness. This occurred especially during the rainy season whereby large amounts of rain water

[14] If the placenta is retained longer than 24 hours, the condition is classified as retained placenta or retained foetal membranes. Consequently, cows need to be treated with antimicrobials later in lactation.

were flowing throughout the farm. One of the outcomes from the in-depth interviews was the fact that farmers were cleaning the stables more during the rainy- compared to dry season. Hence, it seems that farmers recognize the unhygienic point and were taken measures to remove mud.

Calf rearing practices

Two dairy producers (5%) in Muaklek practised partial suckling prior to milking, whereby colostrum are given freely. Most farmers let the calves suck with their mother before milking or provided a small part of milk in a bucket to their calves (bucket feeding). Solely respondents answered during the interviews to use inferior quality milk (milk with high somatic cell count) to feed their young stock. Colostrum feeding for early weaning calves lasted for 4 to 7 days. Out of the interviews, it seems that a part of the efficient farms have a lower age of first calving (AFC) of their heifers compared to less efficient farms.

Breeding and herd practices

The optimal number of cattle per hectare of forage grown is estimated at 8 to 10 depending on farm management, such as indicated by Moran (2008). However, the average number of cattle/hectare calculated between groups in this sample is for group one 10, group two 11, group three 24, and finally group four 25 heads per hectare. As a consequence, the majority of the farmers purchased forage and silage from co-operative or private sellers.

The process for achieving an optimal herd composition has not been practiced actively by farmers in Mueklek. Several examples of sub-optimal herd compositions are shown in Table 10. The consequence of this inefficiency was an increase of expenditure whereby only cows in milk are generating income. However, a limited number of replacement stock is required to substitute old and unproductive cows in milk. Further, 29 (67%) respondents reported to sell none heads of livestock for the last 12 months. Consequently, the majority of the farms keep the entire (older) milking stock. A part of the problem of excessive number of milking- and dry cows compared to the (small) size of the stable could be explained by this fact. Moreover, it seems from interview results that farmers bought a limited number of new stock in the last 12 months. Thus, it seems that farmers have no culling policy or it could be that farmers use a large number of livestock as a risk coping strategy (e.g. insurance or payment of school fees) as mentioned in sub-chapter 3.1.

Remarkable is farmer four (see Table 9) which was not rearing any young cattle instead he bought only replacement (milking) cows. Hence, this farmer has a different strategy of milking whereby only cows in milk and dry cows are kept. There was no rearing of replacement cattle in this particular farm.

Table 10. Examples of herd dynamics in Muaklek area, Thailand

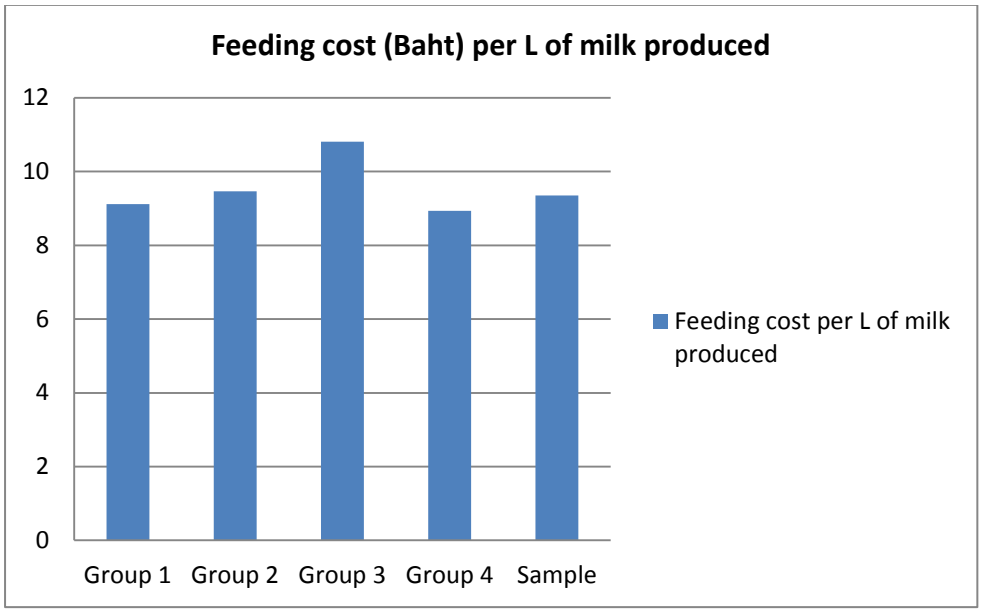
	Herd characteristics (heads)					
	Optimal (%)	*Farmer 1*	*Farmer 2*	*Farmer 3*	*Farmer 4*	
Cows in milk	100	13	9	17	18	Cash in
Dry cows		3	0	0	6	Cash out
Heifers (16-24 months)	30	3	0	26	0	Cash out
Heifers(3-16 months)	25	10	1	12	0	Cash out

Calves	25	5	10	2	0	Cash out[15]

Animal feeding practice

In Figure 39, feed cost per liter of milk for each group is presented. This analyses showed that the average feed cost per L milk in this sample was 9,5.- while for group one 9,0.-, group two 9,5.-, group three 10,8.-, and finally group four 9,1.-. Thus, it shows that farmers in group two and three have the highest feed cost per liter of milk produced.

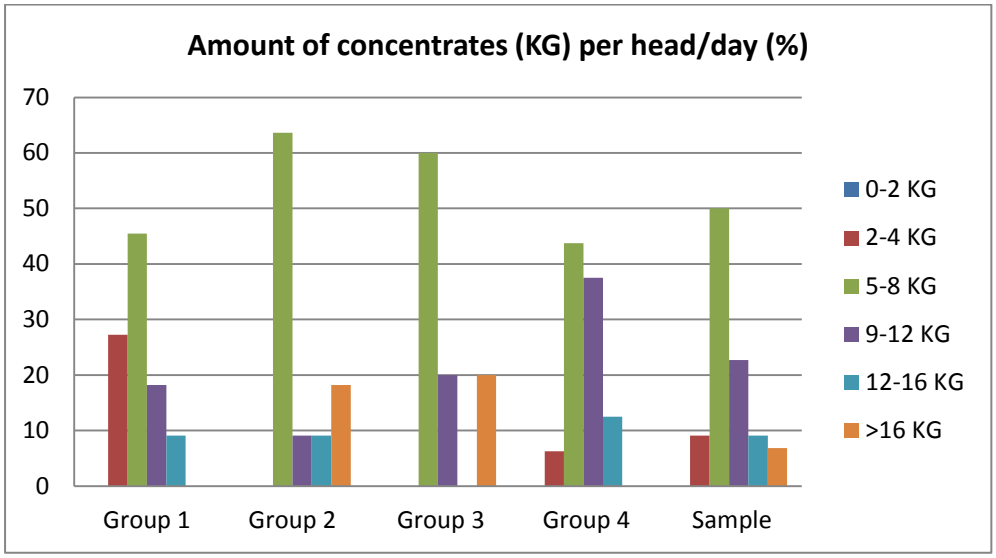
Figure 39. Feed cost per L of milk produced



Out of the total interviewed dairy cattle producers, 50% provided cattle 5-8 KG concentrate per head/day, 22% 9-12 KG, 9% 2-4 KG, 9% 12-16 KG, and finally 7% >16 KG per head/day. More information can be found in Figure 40. Here, one can see that groups two and four provided more concentrate compared to farmers in group one. It was not possible to present a possible relationship between the amount of concentrates and average milk production per day. However, to compensate for low quality forage, it seems that farmers used more concentrate.

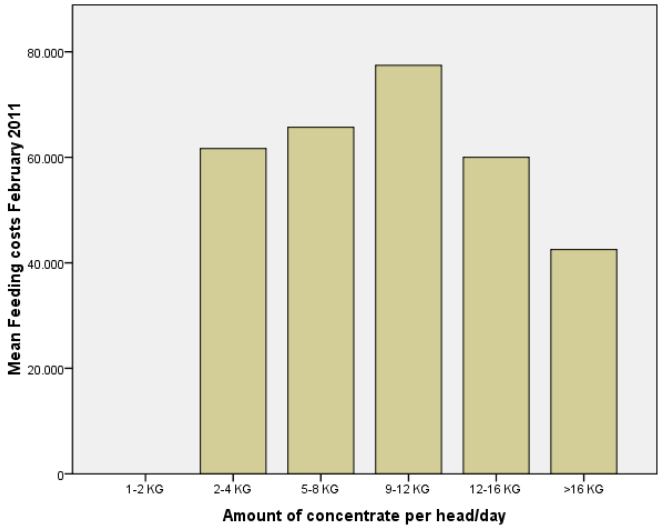
[15] *Cash in* includes the part of the farm that is generating income. Thus, cows in milk are producing milk which is sold to the cooperative compared to dry cows, heifer, and calves who are only generating costs at one point (*cash out*). For instance costs related to animal feeding, vaccinations etc.

Figure 40. Amount of concentrate (KG per head) provided to cattle (groups)



In Figure 41, the amount of concentrate[16] is compared to feed costs[17]. As one can see, feeding cost is rising with the amount of concentrate provided to cattle. However, after the third column feeding costs is declining because respondents are given less supplemental feeding. As a consequence, milk production will remain high in the short term; however, in the long term (metabolic) problems will arise. Further, farmers placed in group three and four bought separate ingredients for a lower price and mixed these themselves into a concentrate ration (compound ration).

Figure 41. Feed costs and amount of concentrate provided to cattle



38 (88%) of the respondent indicated their willingness to grow more forage or pasture if this was feasible. The correlation analysis based on data of all groups indicated that there was a positive

[16] Concentrates (grains) are feeds that contain a high density of nutrients, usually high in crude protein content.
[17] Feed cost are all cost related to the feeding of cattle. This includes both roughage, and concentrate as well as costs linked to purchased feeds.

correlation (r = .460, P < .009) between the spouse, and children assisting in farm work, and willingness of a farmer to buy or rent more land to grow forage and pasture. Thus, it seems that farmers with more (family) labour have more incentives and possibilities to cultivate pasture.

Land is one of the important prerequisites for any farming activity. According to a majority of the respondents (23), ownership of land would reduce production costs significantly. For instance, costs for rice straw and concentrate could be decreased considerably. One farmer argued that the quality of fresh grass is of better-quality than rice straw. Another respondent desired to expand land for their children to start a dairy farm. Yet, it seems that limitations of land-tenure ship are related to the Thai system of land possession.

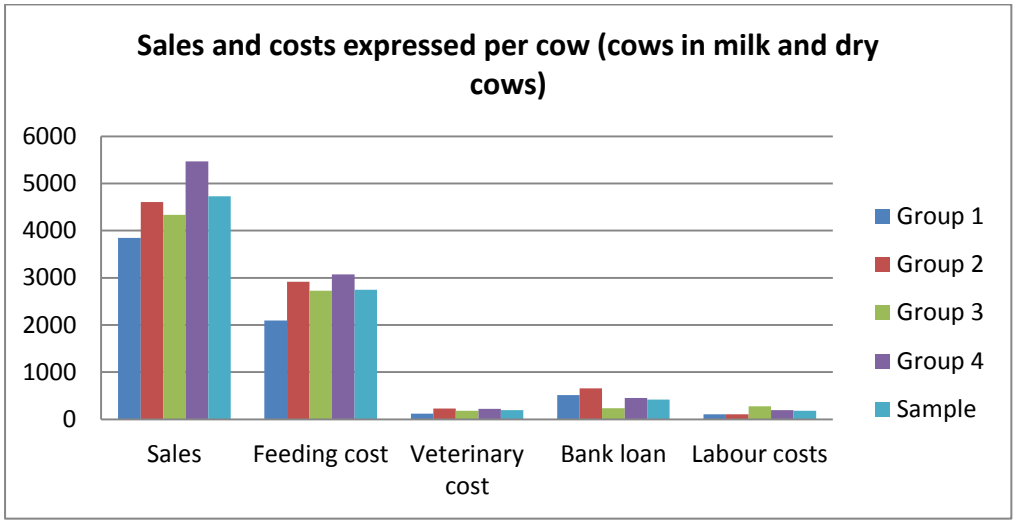
Thus, one of the big challenges of almost every producer (all groups) in this area is the minor land size they own. Because of the difficulties to acquire land in this area, farmers do not have extra land to develop improved animal feeds or do not have access to land to cultivate pastures. Irrigation of land is not been practised by any respondents.

On the contrary, five respondents (12%) indicated that the amount of land was sufficient to grow enough forage or pasture. It was found that respondents perceiving their farm as a real business (p= <.05) and see their farm as an example farm (p= <.05) would like to buy more land for forage and pasture production. Hence, it seems that a group of farmers exist that has a positive attitude towards farm improvement and expansion (ambition), although this cannot be expressed in the existing groups.

Financial practice

Figure 42 shows an overview of milk sales and several cost pools expressed per cow (cows in milk and dry cows, respectively). Here, one can see that group two and four have the highest sales per cow. Nevertheless, the feed costs are also the highest in these groups. Further, costs for loan(s) are the highest in both small groups (one and two). This means that small farmers have a higher burden from loan(s) compared to larger farmers.

Figure 42. Sales and costs expressed per cow (cows in milk and dry cows) (groups)



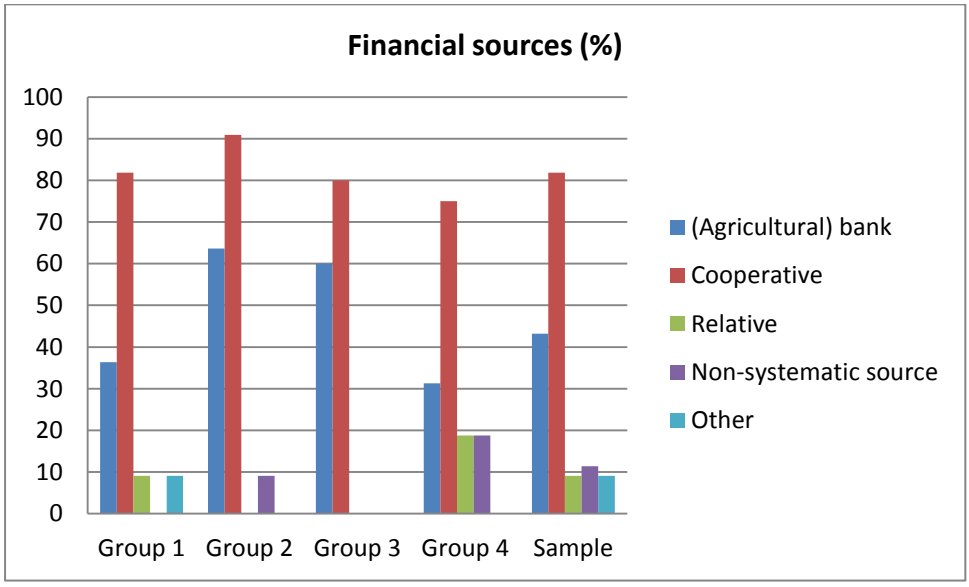
Out of the interviewed farmers, 25 (58%) of the respondents had enough cash flow (working capital) to overcome short term obligations. The remaining respondents (42%) indicated to have neutral or negative working capital. Thus, it seems that many farmers have a liquidity problem. Because most farms are organized as a family farm, whereby farm and private (household) are closely intertwined, this problem not only relates to the farm but also to family needs (e.g. buying clothes or other consumer goods).

Previous studies (e.g. Giesen and Bakker, 2000) have shown that it is quite common for farmers to use the financial resources from the household to solve financial problem at the farm, by cutting down family expenditures, causing financial problems to the family household. Consequently, this means that the farmer is unable to finance replacement investments that are essential to remain competitive (e.g. replace buildings and investments in new technologies).

Nevertheless, 43% of the farmers in this sample indicated a bank as borrowing source for mid- and long term loans while the percentage in group one was 36%, group two 63%, group three 60%, and group four 32%. Assuming that a bank is often used for acquiring long term loans for investments (indicator), it seems that farmers in group two and three invested in the farm business or household.

Eighty-two percent of the farmers indicated a co-operative as source for their loans while this group is divided into 81% group one, 91% group two, 80% group three, and 75% group four, respectively (Figure 43). Nine percent of the farmers, mainly from group four indicated relatives as a borrowing source, and finally 11% of the farmers acquired a loan from a non-systematic source. These farmers are primarily placed in group two and four. One farmer indicated to have another source for borrowing. Because of culture issues, it was not possible to acquire the height of loans.

Figure 43. Financial (borrowing) sources (groups)



The number of borrowing sources is differentiated into 4 (9%) of respondents with no loan at all, 17 (40%) to have one loan, 18 (42%) with two loans and 4 (9%) with three loans or more. The amount of money payed every month on interest and payment is significant higher with the number of loans.

Six of the 8 respondents who indicated to have an informal financial source (relative and/or non-systematic) are placed in both groups with a high number of cattle. It seems that these farmers are more sensitive for financial issues. For instance, one farmer (group 4) argued for extra money to fund his farm because he could not pay all expenses anymore. This makes sense because usually loans from a non-systematic source have a higher interest than loans from systematic sources because of the higher risk involved for the funder.

Out of the interviews it appeared that farmers were using two or more co-operative memberships to acquire multiple long term loans as well as a possibility to market milk of inferior quality to a co-operative which accept all milk delivered. Moreover, the correlation analysis based on data of all groups indicated that there was a positive correlation ($r = .374$, $P < .015$) between farmers who acquired a loan from a non-systematic source and sales of milk except the co-operative to another PMC. One of the possible explanations for this positive correlation could be related to 1) a risk coping strategy (mentioned in Ch. 3), 2) an obligation to deliver milk to more marketing channels, and 3) a higher milk price.

To meet short term liabilities and overcome liquidity problems, credit is used by all respondents. Not only services of the co-operative are bought through credit but all farm- and consumer goods is credited. Hence, this means that animal feeding (concentrate, cassava by-product etc.), television, car, veterinarian, A.I inseminator etc. is payed thru credit. Short term credit is overextended through milk sales-credit linkages. The farmer is guaranteeing its future (higher) milk sales against credits. Moreover, in most of the cases the respondents knew most supplier(s). Hence, a relationship based on mutual trust (informal way) has been built up which guarantees favourable payment conditions for the respondents.

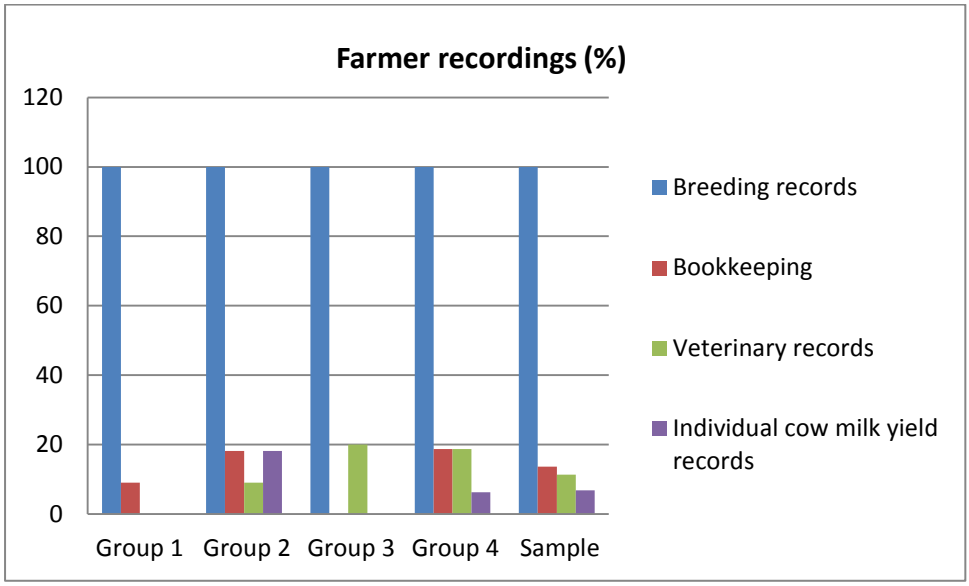
8.2 Influence of management support on farm decisions

In this sub-chapter of the report influences of management support (farm recordings, key figures, ICT-software, agricultural services, extension and A.I) on farm decisions is central.

Farm records

All respondents (100%) have breeding records (Figure 44). However, recording were only found on informal sheets. Farmers were only using (hard copy) records to check for the birth of cow, date of insemination, possible heat period, dry period, and expected date of birth. Further, respondents were using breeding records to check for fertility problems (Figure 45). As can be read from subchapter 2.3, record keeping in modern dairying is a prerequisite for any decisions and control over certain production and reproduction performance of dairy cattle in the farm, and to measure the profit of market-oriented farms. However, it seems that this kind of records are mostly filled in and used by the A.I inseminator as a service tool. Despite the importance of farm records in this area, it is not practised as the owners do not have adequate experience, and were not aware of the benefits.

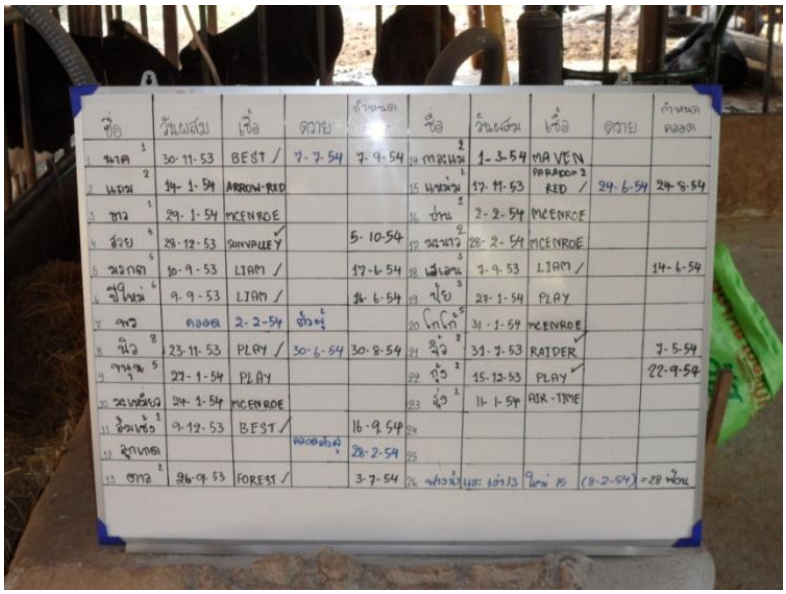
Figure 44. Percentage of producers practicing different recordings (groups)



Only 6 respondents (14%) kept records about sales and expenses on the farm. Most of these farmers are grouped in two and four (Figure 44). These producers recognised the importance of comparing revenues with all expenses. Official farm transactions are recorded and when cash changed hand. However, the other 38 producers (86%) only observed the monthly co-operative paper with all cost- and revenue pools. In this co-operative paper all sales and costs by the farm business and household are presented. Though, most respondents have financial transactions outside the co-operative umbrella like expenses from private suppliers. These are not included in the monthly financial statement by the co-operative. Hence, a possible miscalculation of profits can be identified. A frequently heard response “I roughly know all sales and costs by mind and therefore the profit of my farm”.

Five respondents (11%) were keeping records about veterinary treatments. Only producers in group three and four were found recording some veterinary parameters like treatments and veterinary costs. Further, two producers were making the recordings themselves; the remaining three were using bills of the private veterinary service, and veterinary services of DPO. All five respondents were using records for inspection of the veterinary cost post of the co-operative paper with the received invoices. Nevertheless, two respondents from group three and four were analysing treatments of individual cows to make a decision whether or not to continue with this particular cow. It could be observed that both respondents mainly used veterinary records in case of mastitis treatments.

Figure 45. White board with breeding records of a dairy producer



Three respondents (7%) reported to complete individual milk records of cattle. These respondents can be found in group two and four. Frequently, a white board is used for individual recordings. First of all, milk produced of individual cows is measured to identify possible drop in milk production. Consequently, if a farmer is observing this issue a possible cause is searched. Nevertheless, milk records on a white board are only temporary. It seems that farmers do not record lactation yields for feeding- or culling purposes.

Nevertheless, most respondents argued that the lactation period and weather conditions have a large influence in the fluctuation of milk production. Hence, the extra benefits of individual milking records to find other reasons behind milk fluctuations were not recognised. After a few days recordings are being whipped out from the white board.

Key figures

Key figures are not being calculated and used by any of the respondents. It seems that this kind of management support has low priority and in general respondents are not aware how to calculate and use any key figures. Nevertheless, a program has been set up by DPO to assist farmers with the usage of key figures. Because of the recent start of this project, results cannot be presented yet.

ICT software

Five respondents (11%) indicated to use a computer for 1) searching for information about new technologies and strategies to reduce costs on the internet, and 2) back-up of hard copy records. A few years ago DLD introduced special software for farmers to record farm parameter like herd dynamics and financial statements (accounting). However, at this moment and in this sample solitary one farmer was using this program to calculate limited amount of data. Yet, this limited amount of data is used to determine the exact starting date of dry period, and the phase of lactation of every individual cow with the corresponding feed rations.

Services

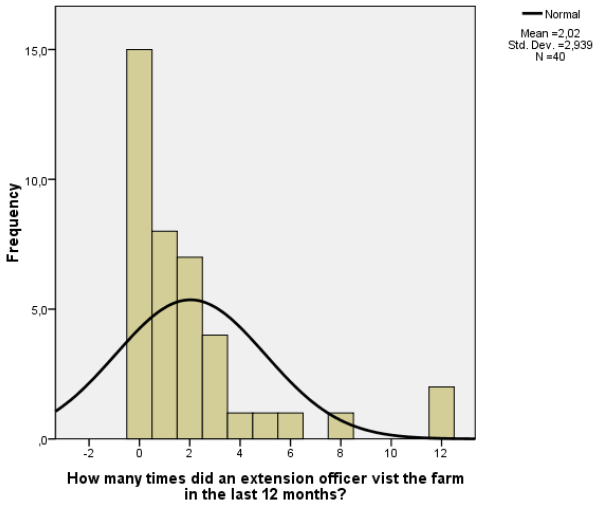
Producer co-operatives have the possibility to offer several services to farmers (chapter 4). Because the producer co-operative operating in Muaklek is relatively small, (financial) power to buy and store bulk amounts of animal feeds is difficult to achieve. Nevertheless, co-operatives in Muaklek offer farmers a marketing possibility, short and long term credits, warehousing, selling human feeding (e.g. rice), encouraging saving among members through promoting saving deposits, and facilitating seminars. Further, through this co-operative international agencies and NGOs have initiated dairy development programs. Such programs provide farmers support through technical services, seminars and training. However, because of the nature of this research, it was difficult to exactly measure the impact of these services for farm decisions because all farmers have access, and consequently are using co-operative services.

Agricultural extension

Out of the interviewed dairy producers, 24 (55%) received extension services. To make an overview of the number of times that an extension officer visited the farm in the last 12 months, Figure 46 is prepared. Though, it was not clear during the research whether the purpose of the extension officer was to provide farm information or offer services like veterinary assistance and A.I.

Nevertheless, one can see that most respondents (15) never received an extension officer on their farm for the last 12 months. Furthermore, there was one respondent who received 12 times extension which means that an extension agent visited this particular farm every month. This farmer (from group 3) is a member of the executive board of one of the co-operatives. This representation (Figure 46), with the frequencies gives a poor fit for the Normal distribution (e.g. the large frequency of zero times extension).

Figure 46. Overview of the number of times an extension officer visited the farm



Compared between groups, group three (3.4 ± 4.88) and four (2.14 ± 3.25) were found to have the highest number of times (average) that an extension officer visited their farm (Table 11). This shows

that the proportion that received extension was lower in groups one and two, compared to farmers in group three, and four. Because farmers placed in group three were performing below average, it seems that these farmers received substantial more extension. A positive relationship between average milk production per cow and the number of times that an extension officer visited the farm could not be found.

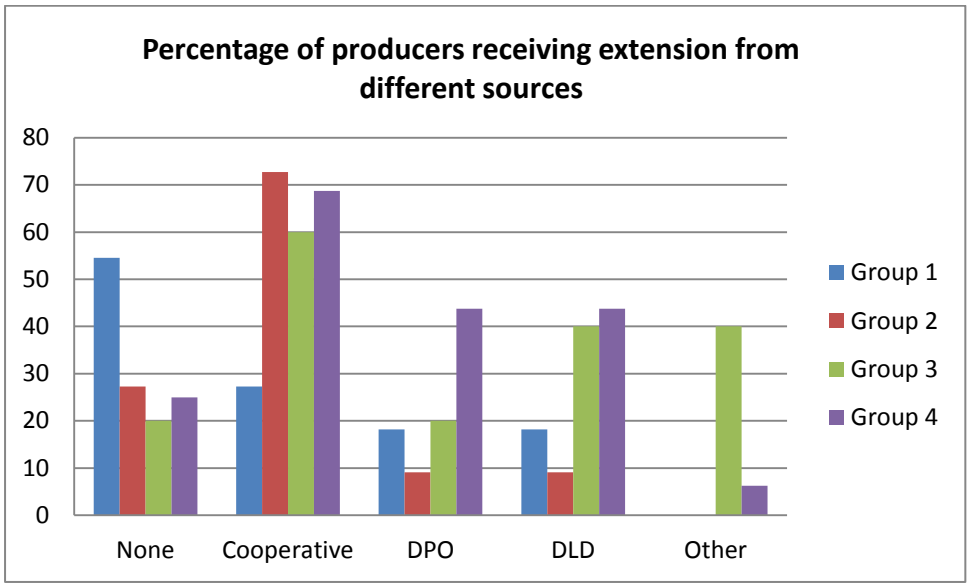
Table 11. Means and confidence interval for the number of times that an extension officer visited a farm (groups)

	Mean number of times extension officer (STD)	**95% confidence interval**	
		Lower	Upper
Group 1	1.18 (2.44)	-0.26	2.86
Group 2	1.81 (1.78	0.76	2.86
Group 3	3.4 (4.88)	-0.88	7.68
Group 4	2.14 (3.25)	0.19	3.73
Sample	1.98 (2.89)	1.09	2.81

Respondents indicated that (1) improvement of milk quality, (2) prevention of animal diseases and, (3) improved animal feeding were the main purposes of an extension officer to visit their farm. Producers received extension from co-operative (61%), DLD (32%), DPO (27%), and others (7%).

In Figure 47, an overview of extension sources among groups is shown. Here, one can see that most producers from group one (55%) received none extension officers in the last 12 months. Further, farmers from all groups received mostly an officer deployed by a co-operative. Farmers placed in group three and four received extension from multiple sources.

Figure 47. Percentage of producer (groups) receiving extension from a particular source (groups)



Conversely, Figure 31 shows that most farmers were willing to receive an extension officer on their farm. This can be observed in all groups. Hence, a possible gap for extension can be identified. Increasing the number of extension staff can serve as technically facilitators of farmer's

experimental learning. Nevertheless, some farmers were not interested in extension officers as noted by one farmer who argued “extension officers can give me advice but I will not follow”.

A.I services

All sampled farmers (100%) were using A.I. Respondents reported to have two sources to procure an inseminator; DPO and private service. In general, A.I services by DPO is cheaper compared to private A.I services. The question whether to use private A.I services instead of DPO depends on the availability of the inseminator. Farmers argued that DPO list their A.I request on a waiting list. Consequently, it takes substantial time before insemination takes place whereby the possibility exists that heat (oestrus) of the cow is already finished. Especially in tropical weather conditions where heat period of cattle is shorter than under more temperate weather conditions. Therefore timely insemination is important. Probably, a part of the fertility problems could be explained by this fact. One farmer used only DPO to keep the relationship with this organisation on-going, therefore he had the possibility to acquire other benefits from this organisation.

It seems from the in-depth interviews that younger farmers were using a private A.I source more often than older farmers. However, this cannot be approved statistically. Nevertheless, this is in line with the fact that older farmers witnessed the start of DPO 40 years ago. The main selection criteria of farmers for a particular bull (A.I) includes 1) potential milk production, 2) price of semen, 3), sire fertility and, 4) body confirmation. No difference in selection criteria’s between groups could be observed.

8.3 Impact of management capabilities and farm decisions on farm results

In this sub-chapter, the impact of management capabilities and farm decisions on farm results is central. A general estimation for efficiency is the sales quantity or value achieved per unit of resource/cost (baht) employed. This has been completed in different fields of the farm, and presented below.

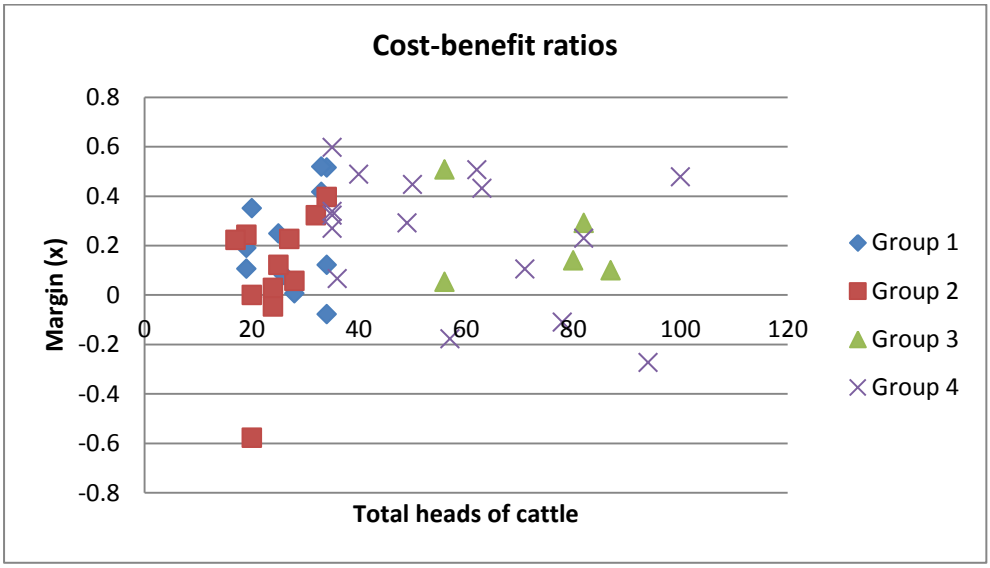
First (1), the overall costs-benefit ratio[18] (economic efficiency) are calculated based on the data and presented in Figure 48. To this effect, the monthly total production cost and gross return values were estimated for all four groups. The average efficiency ratios are 0,23 for group one, 0,09 group two, 0,22 group three, and finally 0,25 for group four (Figure 48). Although farmers in group two have a higher average milk production compared to group one, the cost-benefit analyses showed that the farm efficiency is lower in group two compared to the other groups. Further, one can see that the majority of farms have a positive ratio.

[18] It should be noted that it was not possible to make a comprehensive cost/benefit analyse because certain cost pools were not included.

$$x = 1 - \frac{(\text{FC+VC+LC+ELC})}{\text{Total (monthly)milk sales}} \qquad (1)$$

FC = Feeding costs (baht)
VC = Veterinary costs (baht)
LC = Loan costs (baht)
ELB = External labour costs (baht)

Figure 48. Cost-benefit ratios (groups)



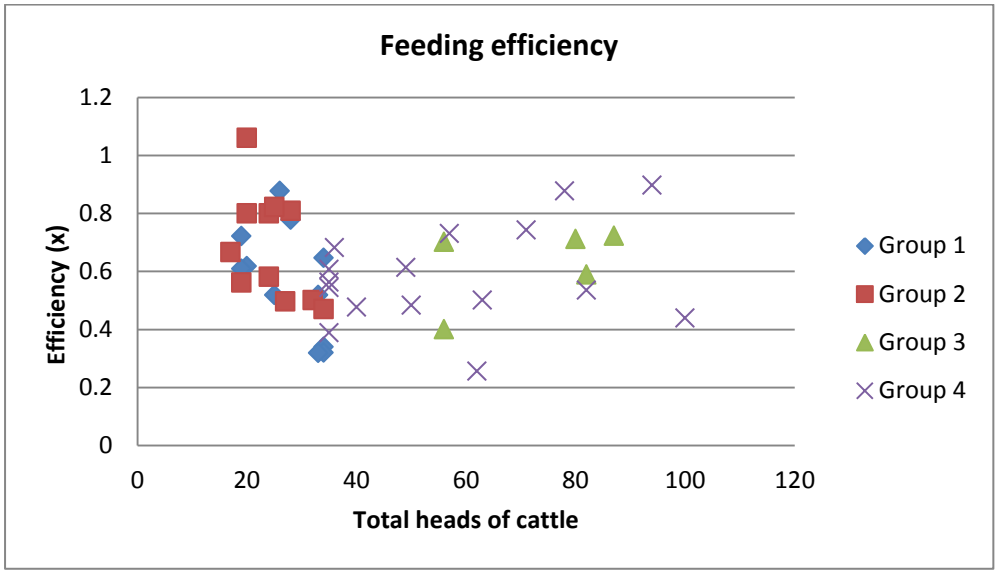
Secondly (2), feeding efficiency (allocative efficiency) is calculated and presented in Figure 49. The average feeding efficiency in this sample was 0,61 (61%) which means that 61% of the milk sales is needed to cover the feeding costs. The ratios between groups were group one 0,57 (57%), group two 0,69 (69%), group three 0,38 (38%), and finally group four 0,59 (59%). The feeding ratio explains the lower cost-benefit outcome of farmers from group two.

From earlier results seems that a higher amount of concentrate, stover, and supplemental products are explaining factors that have an influence of this higher feeding ratio. The leading share of feeding costs for farms was in line with a study done by Garcia et al. (2005). Moreover, because forages (e.g. rice straw and concentrate) are expensive at this moment, substantial costs are made for animal feeding.

$$x = \frac{\text{FC}}{\text{Total (monthly)milk sales}} \qquad (2)$$

FC = Feeding costs (baht)

Figure 49. Feeding efficiency ratios (groups)

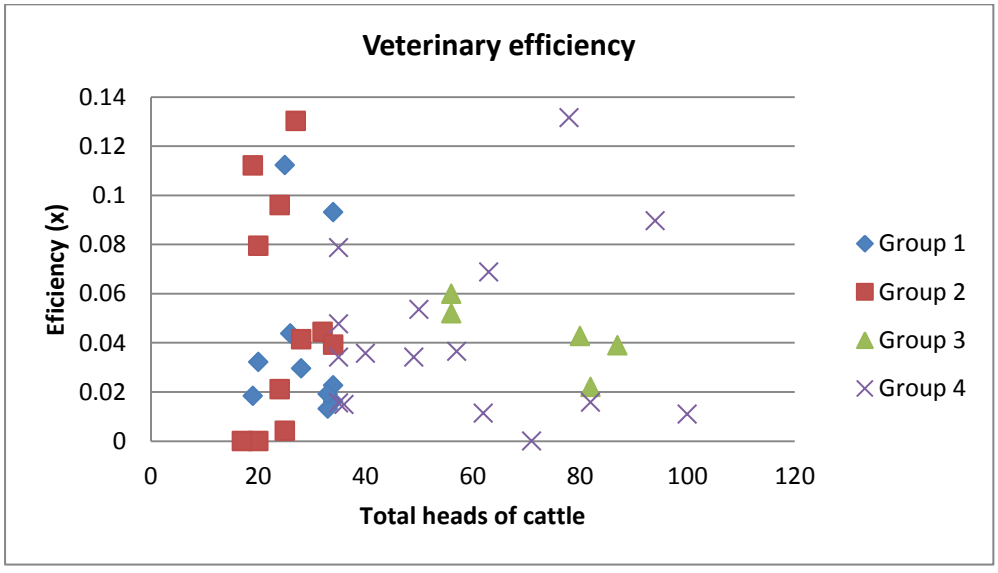


Third (3), veterinary efficiency ratios are calculated and presented in Figure 50. The average veterinary efficiency in the whole sample was estimated at 0,04 (4%) which means that 4% of the milk sales is needed to cover veterinary costs. The ratios between groups were group one 0.036 (3,6%) group two 0,052 (5,2%), group three 0,043 (4,3%), and finally group four 0,042 (4,2%). Out of the data cannot be concluded that owners of larger farms are not able to provide the same level of care, and supervision per individual cow as owners of smaller farms as mentioned in work of Kivaria et al. (2006).

$$x = \frac{\text{VC}}{\text{Total (monthly) milk sales}} \qquad (3)$$

VC = Veterinary costs (baht)

Figure 50. Veterinary efficiency ratios (groups)

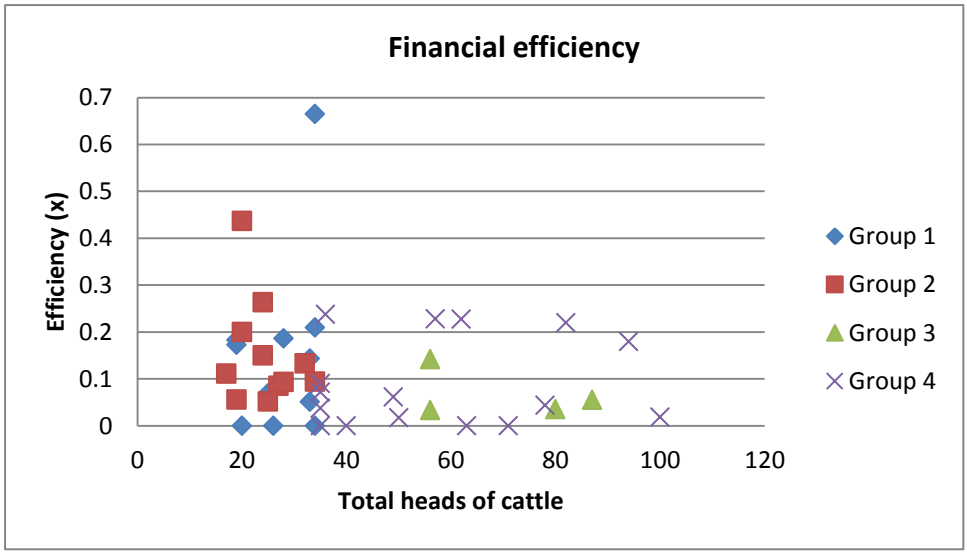


Fourth (4), financial efficiency ratios are calculated and presented in Figure 51. The average financial efficiency in this sample was 0,12 (12%) which means that 12% of the milk sales is needed to cover financial obligations. The ratios between groups were for group one 0.15 (15%) group two 0,15 (15%), group three 0,08 (8%), and finally group four 0,07 (7%). This result suggests that larger farms with ability to produce more milk have less financial pressure compared to smaller farms.

$$x = \frac{\text{LC}}{\text{Total (monthly) milk sales}} \qquad (4)$$

LC= Loan costs (baht)

Figure 51. Financial efficiency ratios (groups)

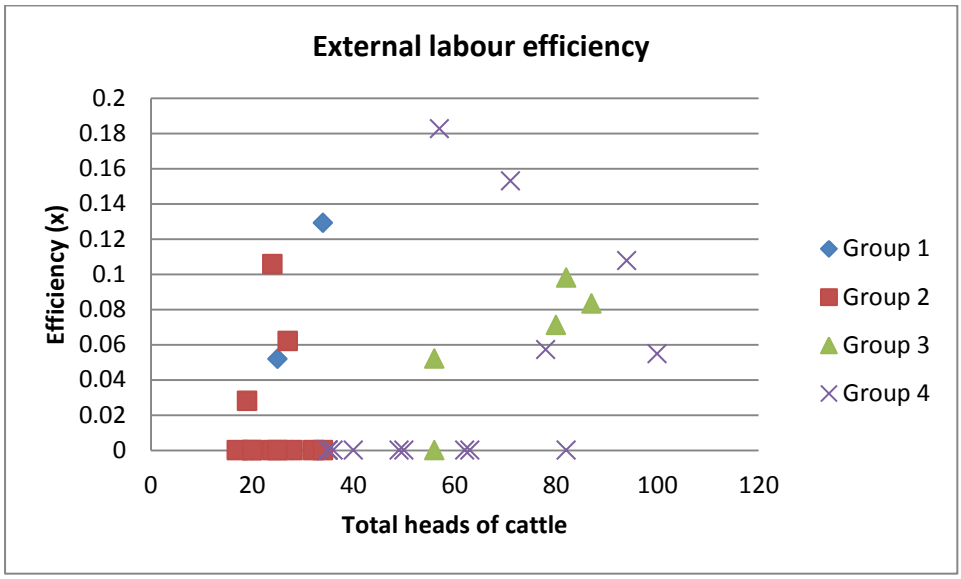


Fifth (5), external labour efficiency ratios are calculated and presented in Figure 52. The average external labour efficiency in this sample was calculated at 0,02 (2%) which means that 2% of the milk sales is needed to cover external labour costs. The ratios between groups were deliberated for group one 0.016 (1,6%) group two 0,018 (1,8%), group three 0,060 (6.0%), and finally group four 0,034 (3,4%). Hence, this Figure suggest that small-scale farms are more efficient compared to larger farms if the comparison is described in terms of external labour costs. It should be noted that internal labour (e.g. children) is not included and rated. Though, it seems that the milking process is the most time consuming task in most farms.

$$x = \frac{\text{ELC}}{\text{Total (monthly) milk sales}} \qquad (5)$$

ELC= External labour costs (baht)

Figure 52. Labour efficiency ratios (groups)



Summary

To summarize this section, a table is prepared where all groups are ranked on different efficiency ratios calculated in this sub-chapter. This will give a good insight into those groups that have good and bad overall performance. In this table the options are sorted by economic, feeding, veterinary, financial, and (external) labour efficiency.

The overall ranking is calculated by taking the sum of all separate efficiency rankings. The ranking per group provides a more detailed overview of the performance in different fields of farmers, and a prioritisation of the competences can be identified (Table 12).

Interesting to see is that group four is ranked the highest which means that this group of farmers are the most efficient, however, group two is ranked last. This group of farmers were classified as "efficient" during selection; however, it seems that during the analyses this group were less efficient in financial terms. In the conclusion, a match is searched between the different competences (see Ch. 7 and 8) in where group four is superior compared to other groups.

Table 12. Ranking of groups of farmers based on efficiency criteria's (N=43)

Ranking	Economic efficiency	Feeding efficiency	Veterinary efficiency	Financial efficiency	Labour efficiency	**Overall ranking**
Weight	1	1	1	1	1	1
1 (High)	Group 4	Group 3	Group 4	Group 4	Group 1	Group 4
2	Group 1	Group 1	Group 3	Group 3	Group 2	Group 1 & 3
3	Group 3	Group 4	Group 1	Group 1 & 2	Group 3	
4 (Low)	Group 2	Group 2	Group 2		Group 4	Group 2

The following chapter presents the conclusion, recommendations and discussion of this study.

9. Conclusion, recommendations, and discussion

This chapter starts with the conclusion, followed by recommendations, discussion, and finally suggestions for future research are mentioned.

9.1 Conclusion

The objective of this research was to contribute to a business oriented approach to management for dairy farmers in Thailand by making an analysis of Thai farm management and making management recommendations. To achieve the objective, a central research question which is *"Which competences can be identified that contribute to management improvement of dairy farmers in Thailand and how can farmers get access to these competences?"* has been formulated. To be able to answer this question 6 sub-questions have been developed and answered with help of a literature study, and a survey. In the literature review tropical farm businesses, managerial capacity of farmers, and co-operatives (services) have been studied. Moreover, the survey was conducted in Thailand and results from the questionnaire and in-depth interviews were analysed. The research questions and their most pertinent aspects are shown below.

Research question 1. Which main management decisions take Thai farmers on their farm?

This research question has been mainly answered with help of the literature study, interviews, and analyses. To answer this question, an overview of main management decisions is prepared in Table 13. Here, the analyses from all groups gave a variety of management decisions at different levels. Obviously, this Table is somewhat suggestive, however, it will give a first picture in which direction dairy farmers in Muaklek have to take management decisions. The most important decisions will be explained next.

The first aspect is records. The literature part of this research showed that records are imperative for successful farm management. Thought, results showed that farmers are not or hardly keeping any records for tactical and strategic decisions. For instance, management decisions regarding culling (based on milk production) are not or barely done by Thai farmers.

Related to the previous aspect (recording) is herd replacement. The choice whether or not to buy or sell cattle has important consequences for farm management. Literature showed that records are imperative for optimal herd compositions. Without records, sub-optimal herd composition will arise. This was also concluded from the analyses; it showed that the herd composition on Thai farms can be improved significantly.

The scarcity of certain resources like land and labor has important consequences for Thai farm management. Labor is one of the important considerations of Thai farmers in a management decision. For instance, for the adoption of silage making farmers need to have sufficient labor. Another important operational decision for dairy farmers is whether to buy all forage and roughage or cultivate forages from own land or roadside grass. This decision has large implications for farm processes. For instance, if a farmer intends to purchase roughage for own use, he/she must have available and sufficient funds.

Lastly, a strategic decision whether to choose for one or more marketing channels for milk is an imperative point for Thai farmers. To acquire multiple co-operative memberships, farmers have the possibility to deliver lower quality milk to separate co-operatives and can acquire additional short and long-term loans.

A summary of important management decisions can be found in Table 13.

Table 13. Overview of management decisions of Thai farmers

Decision levels/ Management functions	Operational decisions	Tactical decisions	Strategic decisions
Strategic planning	❖ Visiting seminar, trainings etc.	❖ Usage of ICT software	❖ Defining objectives (diversification) ❖ Full- or part-time farmer
Breeding management	❖ Sire selection ❖ Dry period ❖ Check of heat	❖ Source of A.I	❖ Traits for A.I (breeding objective)
Animal health management	❖ Check-up of milk before milking for clinical mastitis ❖ Dip udder teats ❖ Cleaning udder with water ❖ Number of times cleaning of barns	❖ Culling cows with mastitis or other diseases ❖ Veterinary treatment or prevention measures ❖ Source of veterinarian	❖ Separate milking units ❖ Vaccinations
Milk production	❖ Cattle manure handling ❖ Feeding of milk to calves		❖ multiple co-operative memberships (marketing channels) ❖ Investment in milking- barn and equipment
Nutrition and forage production	❖ Source and amount of roughages and concentrate purchased ❖ Usage and source of roadside grass ❖ Feed ration (supplement feeding)	❖ Cultivating of own land (season) ❖ Usage of chemical fertilizers	❖ Buy or lease land
Herd dynamics		❖ Selling & buying cattle	❖ Maximum herd numbers
Cash management	❖ Credits	❖ Short term	❖ Savings

	❖ Allocating sales	loans	❖ Mid/long term Loans
HRM	❖ Training of labourers	❖ Hiring labourers ❖ Full- or part-time labourer	

Research question 2. What reasons are behind current management decisions of Thai farmers?

This research question has been answered with help of results from the questionnaires, and interviews. A large motive for short-term decisions is to overcome short-term risk *(risk profile)*. For instance, a variation in milk price is an example of risk that influence dairy farming in Thailand. Because generally Thai farmers have borrowed money from several sources, financial risk arise how much income (high debt to equity) is required for farmers to pay interest to the money lenders. Related to this fact is the uncertainty about increasing cost of concentrate, and other animal feeds for Thai dairy farmers. Further, because of poor housing conditions, natural threats give opportunity for production risk. Moreover, the lack of qualitative records makes it difficult to make effective decisions with a desired outcome. Therefore, farmers are trying to limit risk by for instance selling milk to multiple marketing channels, or increasing the herd size.

Related to increasing cost of feeding is the supplementation of other additional feeds like cassava pulp *(animal feeding)*. To challenge high feed costs, every farmer has its own feeding strategy. The limited opportunity for extension (providing of information) could be an explanation for the variety of feed stuffs given to cattle. Nevertheless, because larger farms may produce more milk, the feed cost per liter milk is also increasing. This was also observed in this research whereby both groups with a large herd size had a higher feed cost per L milk produced compared to both groups with small herds.

Interviews showed that farmers have two main reasons to choose for multiple marketing channels *(marketing possibility)*. The first reason is the fact that the possibility exists to sell all milk regarding any quality standards to a market outlet. Secondly, the possibility arise to request for several loans by multiple co-operative memberships. Further analyses showed that farmers with multiple marketing channels had acquired loans from a non-systematic lender.

Moreover, results and analyses showed that farmers have multiple loans used for a variety of farm- and household activities *(financial)*. The height of these loans could not be uncovered. Though, it seems that farmers have a large debt. Hence, limited financial space is available to start (large) investments. Because most farmers have restricted amount of collateral (e.g. land), therefore interest is often high for loans, a huge limitation for new investment arise. The analyses showed that farmers started limited number of investments in the last two years. Farmers with the decision to increase stock, hence more assets, have the possibility to borrow more money. However, this could not be shown in this research. Another aspect is liquidity of farmers; considerable number of farmers have neutral or negative working capital. Hence, credits were borrowed from several sources to overcome seasonal shortage of money for farm and household, respectively.

Furthermore, results from questionnaires and interviews showed that farmers used two sources for A.I insemination namely DPO and private services. The majority of farmers argued that the long waiting list and convenience as their main reason for selecting a specific A.I source. Costs are not one of the criteria's to select a particular A.I supplier. Related to this subject is genetics of cattle owned by farmers. Results showed that the majority of farmers rear cattle with at least 70-90% purebred traits to acquire a high daily milk production.

Lastly, results showed that farmers have difficulties finding and keeping labourers *(labour and employment)*. To overcome this restriction, both spouse and husband are working together on farm activities. Moreover, during holidays children are assisting with farm work. However, to supplement income spouse or husband was working outside the farm during working hours. Before and after working, she/he would assist during milking and feeding of livestock.

Research question 3. Which competences are required to make effective management decisions?

This research question has been answered with help of results from the questionnaire, interviews, and analyses. To answer this question, all results are compared with the groups. These groups were ranked based on an efficiency criteria. Hence, a comparison can be made with the anticipated outcome, so which competences have certain groups which will result in a desired efficiency level?

Farmers from group four were ranked the highest, and therefore the following four competences were identified as important factors in this particular group which determines efficiency. These are mentioned and explained in Table 14. Moreover, during the research several other factors were likewise identified as important determinants for farm efficiency. Therefore, these factors are also listed in the table.

Table 14. Most important competences and other factors affecting efficiency (size)

Competences	**Explanation**
Education level	It seems that education level is a competence which influences efficiency on farms. Results showed a difference between group four and the other groups; most farmers placed in group one attended primary school while farmers in group two attended high school as highest education level. Nevertheless, nearly 40% of the farmers in group four attended either agricultural college or acquired a university degree. Thus, education level is considered to be a determinant to make effective management decisions. This is in line with previous research of Yeamkong et al. (2010).
Type of farmer	The analysis of the survey results indicated that farmers from group four were mostly full-time while farmers from the other groups are in a less extend full-time. In general, full-time farmers had a higher average milk production and are willing to invest in farm technologies compared to part-time farmers. Moreover, most farmers in group one were part-time. Hence, full-time farmer is a contributing factor to make effective management decisions.
Farming experience	Results showed that in general farmers have abundant amount of farming experience. The majority of farmers in group four have more than six years' experience. Thus, it seems that these farmers have competences to manage large dairy herd.
Entrepreneurial attitude	Results showed that an entrepreneurial attitude is an important competence which is required to make decent management decisions. Over 80% of the farmers placed in group three and four perceived their farm as commercial. Thus, farmers with large herds seem to have an attitude towards commercial farming.

Other factors	**Explanation**
Animal feeding	The analysis showed that farmers in group four used more corn silage, concentrates and supplemental feeding compared to farmers placed in the other groups. This implies a different feeding strategy, resulting in diverse efficiencies.
Labour	Results showed that the use of external labour per head of cattle was the highest among farmers in group four. This suggest that these farmers have the possibility to get enough labour to fulfil all operations in the farm correctly. Moreover, it was showed that larger family farms (farmers with children, grandparents etc.) had a positive influence on improved farm management (e.g. incentives to cultivate pasture).
Extension source	Results showed that farmers from group four received substantial more extension from DPO compared to farmers in the other groups. This implies that the extension officer from DPO have the possibility and capacity to influence farm efficiency in group four considerable.

Research question 4. What possibilities exist (are available) to acquire competences?

Different possibilities to acquire competences are available for Thai farmers. In chapter four of the literature review several services from co-operatives are mentioned which could be provided to farmers. Producer co-operatives can offer tailor made dairy services to dairy farmers like running an experimental farm for training and innovation purposes. Moreover, several management support instruments are available for dairy farmers to acquire competences (sub-chapter 2.3). In paragraph 3.2.1 information sources, accounting systems and usage of budgets are mentioned as instruments to attain abilities.

External, several organizations are offering possibilities to farmers which could increase their competence. First, there is DPO; a livestock promotion organization initiated by the Thai- and Danish government to support dairy farming in the area. This organization can be seen as very important; most farmers received training and other support (e.g. A.I and veterinary services) from this organization. Moreover, DLD offer services to farmers and is assisting farms by taking measures to prevent animal diseases. Highly important are the producer co-operatives which are providing farmers with all necessary intangible and tangible instruments to enhance their competences. For instance, several seminars are organized by these co-operatives.

Internal, several formats and whiteboards are available on farms to start different recordings and calculate key figures. Moreover, television and in some cases internet is accessible. Further, the background (e.g. environment of parents and family) and experience of farmers were important factors to acquire competences.

Research question 5. Which restrictions experience Thai dairy farmers in the process to enhance their competences?

Results from the survey showed several restrictions which limit Thai farmers to enhance their competences. First, a gap was identified between the need by famers and the possibility to acquire extension services. Extension officers could enhance farmers' competences by experimental learning, training and (extension) advices. Secondly, breeding records are not or partially used for management decisions as well as records about veterinary treatments of cattle and bookkeeping

(budgeting) is performed by a restricted number of farmers. The importance of these tools was not recognized by farmers.

Research question 6. What feasible solutions can be put forward to solve these restrictions?

This question is answered through the recommendations mentioned below in section 9.2.

9.2 Recommendations

This section gives recommendations for Thai dairy farmers endeavouring to improve farm management as well as recommendations for co-operatives to assist farmers with improving business management. All recommendations are based on the results, analyses and conclusion in chapter 7, 8, and 9.1.

1. Case results showed that farmers have problems with reproductive performance. The majority of farmers own livestock with 70-90% or even more than 90% purebred Holstein traits. Thus, it would be suggested that farmers keeping 70-90% or more Holstein traits need to improve their farm management practice to reduce the effects of heat stress, and diseases incidents. For farmers who cannot adjust their farm management it might be more appropriate to keep cattle with a lower percentage of Holstein traits.

2. Dairy farmers that wish to become more entrepreneurial have to start thinking as a business organisation. Management support is crucial in order to stimulate and sustain entrepreneurial and innovative behaviour. Without support from for instance records, little incentive exists to change and to execute entrepreneurial activities. Hence, it would be suggested to use breeding record for decision making and not only for observation.

3. Results showed that a possible gap for extension exists. Co-operatives could improve management skills of dairy farmers by hiring a full-time farm consultant. Farm consultants can assist farmers with developing their knowledge of soils, crops and livestock, to improve animal health, quality and yield of livestock. Moreover, farm advisors could also support farmers with developing their financial and business management (entrepreneurial) skills to increase farm profitability and growth.

4. Case results showed that a substantial number of farmers have difficulties with bookkeeping and savings. Moreover, in certain cases farmers indicated to spend more money compared to the amount of sales. Besides a close observation of farmers by the co-operative, it seems that trainings and seminars could improve financial management of dairy farmers. Nevertheless, particular farmers are not interested in improving knowledge about dairy farming and should be excluded from these trainings. Moreover, the co-operative could play a central role by facilitating guidelines and restrictions for farmers regarding borrowing large amounts of money and credits (deleveraging).

5. It could be observed that agricultural information is fragmented in the research area. Thus, farmers acquire knowledge about animal feeds and other farm business information from several sources. These sources are mostly secondary like television. Hence, it seems that a small Farmer Field School (FFS) or a pilot (demonstration) farm for other farmers would concentrate information

to limited number of sources. Moreover, a FFS could enhance farmers' analytical abilities in finding sustainable solutions to management problems. Furthermore, within a FFS goals and self-discovery activities for farmers should be developed to stimulate business thinking. New technological options could be developed and executed on a small scale (experimenting) that suites local conditions of farmers. Extension workers could assist in the FFS and spread new technologies in the area. Nevertheless, realizing of a FSS would be challenging. A more simple and feasible solution would be a demonstration farm. A successful pilot farm (best practice) could invite colleagues for training and visit on farm (the concept of "farmers learning from farmers"). Records to compare and analyze farm performance are essential to make this concept successful. However, this particular (pilot) farmer should be well-known and trusted by the farmer society.

6. Despite most co-operatives in Muaklek are relatively small in size, it seems that these organizations have enough (financial) power to buy concentrate feed and other forages cheaper than individual farmers. Moreover, to overcome short supply of forage during the dry season, a co-operative storage system could be set up whereby hay is bought during the end of the rainy season and distributed to all members in the dry season.

7. It could be observed that the hygienic situation on farms is a serious issue in the research area. This problem (e.g. risk) has a serious influence on the occurrence of animal diseases especially mastitis. Therefore, it is suggested to improve hygienic standards by using rubber cloves during milking, a regularly and thorough cleaning of the stables as well as a renovation of the housing and milking system of farms. Further, rubber mats can be used in the milking barn to make cattle more comfortable.

9.3 Discussion

Continuing on the introduction of limitations mentioned in sub-chapter 6.3, this sub-chapter elaborates exhaustive on this subject. Within this research framework each stage was tried to be verified with the respondents in a questionnaire and in-depth interviews. According to respondents the questionnaire and interviews were too elaborate especially with translation. The number of questions could be reduced and less stages of the framework could be investigated. However, this reduces the applicability of this research because all stages are important to improve management practices. Moreover, because different efficiency measures were used during the analyses of the groups (see 8.3) with diverse outcomes, the efficiency criteria (average milk production) could be re-considered or supplemented with other parameters like feeding cost per kg milk.

The majority of the questions in the questionnaire and interviews had to be simplified to make it understandable for farmers taking into consideration the cultural background. Because of the cultural barrier, it was not possible to rate how important certain information sources were. Hence, it was difficult to make exact distinguishes and in-depth analyses with all data.

This research investigated within the theoretical framework the extent in which intangible and tangible aspects have an influence on management competences, consequently farm management decisions, and lastly farm results. Hence, the framework is build up in four succeeding stages.

However, a possibility exists that a direct relationship occurs between intangible & tangible resources and farm results.

Furthermore, this study could be seen as explorative and constrained to be completed within a certain amount of time. If the study could have been conducted over a longer period of time, the response rate could have been higher. This would give a more insightful view of dairy farm management in Thailand. Nevertheless, this study can be considered as a step towards providing first insights.

9.4 Future research

Since it was not possible to research innovativeness as a competence of dairy farmers in Thailand, it would be interesting to include this specific subject in a further research. Moreover, to address the possibility of other groups (for instance age or education), and the variety of answers by respondents, the researcher have developed an own framework of farming styles. This subject is explained below. It would also be interesting to investigate this matter further in a following research.

Farming styles

Based on the in-depth interviews a framework for different farming styles was prepared extended from the hobby as farming style. In looking at the diversity of Thai farmers work of Nell and Schiere (1998) and Van Der Ploeg (2003) is used to identify farming styles. These authors argue that such a framework for different farming styles explains priorities, *goal* and preferences of the farmer and the type of messages the farmer might be interested in. Furthermore, to which extend is a farmer willing to make a certain difficult strategic decisions depends on the drives and motivation (Figure 5, pp. 23) which can partly be explained by the type of farmer.

Regarding Thai farmers, four different styles could be identified namely Hedonismship (pleasure), Craftmanship (production), Tendership (family and nature) and Entrepreneurship (market) (Figure 53). It displays that maximization of the short- or long term economic results (profit) as good management is by no means always the main aim of the respondents. Farmers develop their own ideas of good management from a wide range of sources, first and foremost from the relationship with the parents but also from discussion with other farmers, and extension messages. Thus, with which ideas is a farmer grown up and surrounded (culture)?

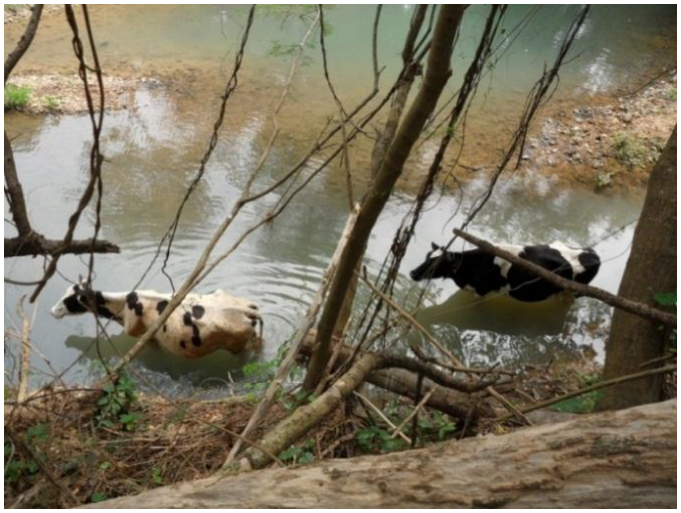
Figure 53. Farming styles

Dairy farming is generally perceived to be labor-intensive than other agricultural production. This is an issue for a number of interviewed farmers, who pointed out that milking and feeding of the cows in milk takes too several working hours and consequently less leisure time is available (Hedonismship). Certain farmers did not put manure on the accres and collect records because it took too much time. Multiple farmers pointed out that farming is for them the most skillful career and try to keep this career alive to make our father (the king) proud of us (Craftmanship).

Moreover, several farmers pointed out that raising cattle is like nursing children and that they will not sell any of their "'children" (Tendership). Other farmers have the conservation of nature as their main guiding principle for "good" farm management (Tendership). Lastly, numerous farmers pointed out that their main objective of farming was to gain profit (entrepreneurship). Other criteria for this group included records kept by themselves as well as these group of farmers would like to acquire knowledge how to reduce cost on their farm (visiting seminars about business management) compared to other groups of farmers (e.g. Tendership) which desired to acquire knowledge how to remain sustainable with the adjacent nature (Figure 54). Moreover, restrictions in certain resources like absence of electricity are important determinants for a certain farming style.

A clear difference in efficiency between the four groups was clear. However, because of the nature of this research, it was difficult to quantify a difference in average milk production (efficiency). Nevertheless, based on the interviews respondents which operated to make a profit are more efficient compared to farmers which were family/animal oriented. For instance, animal oriented farmers will keep all their young livestock which have to be managed (sub-optimal herd composition) and therefore have a higher average age of their cattle.

Figure 54. Nature farming; cows that adapt to the dynamics and production systems in nature



Moreover, during this research it was observed that different groups of farmers took diverse management decisions as well as a difference in recordings could be observed. For instance, a respondent placed in the craftsmanship group focused heavily on breeding records especially exterior characteristics compared to an entrepreneurial farmer who is concentrated on "milk production accounts" of the breeding records and the "cost- and profit statements".

Appendixes

Appendix 1

This Appendix presents numerous records.

General	Description
Farm diary	A small notebook in which to record the key facts and figures of the farm business and the day-to-day activities as they occur is the most useful, practical (and often the only) form of record keeping. Farmers who do use a diary find that important facts and figures that could easily be lost or forgotten are permanently recorded for future reference, though they may not be easy to find quickly.
Unit costs	Of all major farm inputs, such as fertilisers, fuel, irrigation water, concentrates and/or their ingredients, purchased forages, stock purchases. These are necessary for routine bookkeeping and also to monitor seasonal changes and hence to plan future purchases.
Unit returns	from all farm outputs, such as milk, cull cows and heifers, sale steers or bulls, manure, excess feed, to plan future sales.
Livestock inventory accounting	The main purpose of livestock accounts is to monitor net losses and gains in income, and to distinguish the increases and decreases due to changes in market value. When quantifying total livestock value you have to take into account both changing herd size and change in unit price.
Key financial records	Such as interest and principal repayment schedules, to plan repayments and personal expenses.
Livestock	
Calving dates	To follow through different stages of each cow's lactation and to assess weight for age of young stock. Also to update annual livestock inventory as stock change classification, e.g. from calves to yearlings. They are also useful to identify cows that are due to be mated or closer animal observations if they suddenly and unexpectedly change
Regular milk composition data	If provided by the co-operative or processor, to closely monitor the effects of diet.
Mastitis treatment and other routine vaccination and drenching	For individual cows and other treatments requiring milk not being sold. The drug withholding period must be followed to ensure milk quality is not compromised.
Yields of forage crop	To better utilise fertilisers and plan forage purchases
Routine monitoring of feed offered	(Forages as well as concentrates) and actually consumed, which can indicate if cows are on heat or sub clinically sick.
Live weight and body condition of adult cows	To monitor milking performance during the entire lactation and better plan feeding programs.
Live weight and body condition of young stock,	To monitor feeding management required to achieve growth targets
Dates when each cow is on heat	To manage artificial insemination (AI) programs as well as predict expected dates of calving.
Dates and results of pregnancy diagnoses	If undertaken, to predict expected calving dates.
Animal sickness, veterinary visits and drug treatment	To follow through animals' responses to treatment. With replacement heifers, it also provides a guide as to whether the heifer's lifetime productivity might be compromised
Stock purchases and sales of culls	To update livestock inventory
Stock deaths and probable	To update livestock inventory and also monitor

causes	general herd health
Age when culled	From the milking herd, reason for culling and number of lactations while in milking herd
Milk and concentrate intakes of young calves	Plan weaning and calculate total rearing costs.
Other dairy enterprise sales	Such as stock fattened for sale, cow manure and any excess forages, for accounting purposes.

Source: *Moran, 2005*

Appendix 2

This Appendix presents key figures differentiated to several business processes.

Key figures for tropical farm management	Optimal number
Strategic planning	
Turnover ratio	>3
Operating profit margin	20-30%
Reproduction	
Live weight at mating	250 to 300 kg
Live weight at first calving (depending on breed type)	400-500 kg
Age at first calving	28 to 30 months
Calving interval	12 month
Calving rate	85%
Stillborn calves	2%
Period between calving and first insemination	60 days
Number of insemination per animal before pregnancy	1.8
Percentage pregnant animal after first insemination	>50%
Percentage oestrus detection by the farmer	60%
Number of calves per 10 cows in milk	7-8
Health care	
Calf mortality	4% to 6%
Calf mortality 0-24 months	8%
Milk production	
Kg milk per cow/day	2700–4000 kg/lactation
Fat en protein %	>3.7% protein, >4.0% fat
Nutrition and roughage production	
Feed Conversion Ratio (FCR)	0.7
Herd dynamics	
Heifer wastage rate from birth to second calving	20-25%
wither heights by 15 month	115 to 120 cm
wither heights by 24 month	125 to 130 cm
Non pregnant heifers	5%
Heifer calves born	36%

Percentage extracted animal by fertility problems	<5%
Cash management	
Return on Farm Equity (ROE)	2-10%
Farm equity/assets ratio	>0.6
Current ratio	1.5-2
Asset turnover ratio	40-50%

Source: *own composition, 2011*

Appendix 3

This Table offer numerous agricultural services for farmers offered by possible providers.

Services	Description and possible provider
Selection of most suitable forage crops for the soil type and local climate	Agronomists working for co-operatives or suppliers of seeds can advise for the optimal agronomic practices such as irrigation.
Sampling and analyzing soils for essential plant nutrients	Western farmers plan fertilizer programs for their forage crops. Fertilizer agents undertake this activity is developing countries (e.g. Asia).
Purchasing concentrate feeds	Co-operatives often have the power to buy concentrate feed cheaper than individual farmers. Co-operative usually includes formulated rations as part of their service to farmer-member.
Purchasing forages	Farmers often spend considerable time each day walking around e.g. paddy rice fields and along roads to harvest forage for their stock. Sometimes, non-farming villages supply farmers via direct sale or a “grass market”.
Nutritional management of the dairy herd	Nutritionists can advise on availability and costs of alternative feeds, cheapest source of liquid nutrients for calves. Co-operatives usually employs nutritionists or from other free agents.
Testing feeds for nutrients contents	There are university, government or private laboratories that undertake this service, generally for a fee. It is important for co-operative managers routinely test the range of feeds.
Animal health	Dairy co-operatives and government veterinarians are frequently the major source of advice on biosecurity and on veterinary drugs and procedures for farmers. Co-operatives may employ foot trimmers to routinely check housed stock.
Best practice for breeding management and artificial insemination	Dairy co-operatives or government livestock officers usually supply inseminators who give advice on breeding. In certain areas commercial suppliers of dairy semen can be observed.
Milking cow performance such as herd recording	These providers are important to monitor long term changes in cow milk yields and reproductive performance and other measure of genetic improvement. Co-operative frequently have computer programs to facilitate such recording and help to plant breeding programs.

Milking machines	The performance and efficiency of milk machines should be checked every year. Moreover, checks should be made of temperatures of milk storage equipment. Advice on chemicals for washing and sanitizing machines, buckets, sieves and teat washing clothes.
Routine maintenance of farm machinery	All machines require regular attention such as grease and oil changes. The protocols should be provided by machinery agents.
Milk testing	Most farm gate milk payment is based on measures additional to milk weight/volume such as composition and milk quality. Because of the economic importance, milk testing is routinely undertaken by co-operative and/or processors.
Milk transport to milk collection centers	When distance to a milk collection point is rising, it is cheaper to pay someone to collect raw milk from the farm and transport it to the central location.
Monitoring farm business management	These services can be supplied by the co-operative staff or government staff. Lending agencies may also assist but they often need budget detailing farm costs and predicted financial benefits.
Contractor for capital improvements programs	Because of high labor cost in western nations, farmers have access to wide range of contractors with specialized skills for a diversity of tasks.
Co-operative service provider	Co-operatives provide a wide range of services for their members. These services will be elaborated in the next chapter
Service provision as part of development projects	Foreign governments, international aid agencies and NGOs have initiated dairy development programs. Such programs provide farmers support through technical services, credit and training.

Source: *Moran, 2008*

Appendix 4

This Appendix presents the questionnaire used in this research.

เลขที่ (Number) _____

กลุ่ม (Group)_____

Research into management of dairy farms in Thailand

Herjan Bekamp *(Herjan.Bekamp@wur.nl)*

Date: 17 March 2011

1. ชื่อ – สกุล (name farmer)_____ที่อยู่ (address)_____

   เพศ (Farmer's gender) ☐ ชาย (Male) ☐ หญิง (Female) อายุ (age) _____ปี

   จำนวนสมาชิกในครอบครัวทั้งหมด (How large is your household?)_____ คน (persons)

   ท่านสำเร็จการศึกษาในระดับใด (What is your highest education level)

   ☐ ประถมศึกษา Primary school ☐ มัธยมศึกษาตอนต้น Secondary school ☐ มัธยมศึกษาตอนปลาย High school

   ☐ วิทยาลัยเกษตร (ปวส./ปวช.) Agricultural college ☐ ปริญญาตรี University ☐ อื่น ๆ _____ Other namely:

   ท่านเป็นสมาชิกขององค์กรใด ต่อไปนี้ (Do you participate/member of the following organisations?)

สหกรณ์ Cooperative	☐	ใช่ Yes	☐	ไม่ใช่ No
อสค. DPO	☐	ใช่ Yes	☐	ไม่ใช่ No

2. จำนวนสมาชิกในครอบครัวที่ปฏิบัติงานภายในฟาร์มโคนม _____ คน

   How many persons within your household are working on the farm?.....persons

3. ใครเป็นผู้ปฏิบัติงานในฟาร์ม

   Which family members are assisting in farm business activities (working on the farm)?

   ☐ สามี/ภรรยา Wife/husband ☐ บุตร/ธิดา children ☐ พ่อ/แม่ grandparents' ☐ ลูกจ้าง labourers

   ☐ อื่น ๆ _____ Others namely:

   3.1 หากมีลูกจ้าง มีลูกจ้างภายในฟาร์มจำนวน _____ คน

   If labourers, how many external labourers do you employ on the farm? .....labourers

   ลูกจ้างและครอบครัวอาศัยอยู่ภายในฟาร์ม ☐ ใช่ Yes ☐ ไม่ใช่ No

   Is the entire family of the labourer living on the farm?

   3.2 ลักษณะการจ้างงาน ☐ เต็มเวลา ☐ บางเวลา

   Do you labourers work fulltime or part-time? ☐ Part-time ☐ fulltime

   ในกรณีที่จ้างเป็นบางเวลา ลูกจ้างทำหน้าที่อะไรบ้าง _____

   If part-time, which farm activities do your part-time labourers carry out?

3.3 ลูกจ้าง หายากหรือไม่ ☐ ใช่ ☐ ไม่ใช่

Is it difficult to hire another labourer? ☐ Yes ☐ No

3.4 ลูกจ้าง (เต็มเวลา) ทำงานในฟาร์มของท่าน มาแล้วเป็นระยะเวลา _____ ปี

How long is the fulltime labourer working on your farm? ..... years

3.5 ลูกจ้างได้รับการฝึกฝนเกี่ยวกับงานฟาร์มหรือไม่ ☐ ใช่ ☐ ไม่ใช่

Did you labourers receive any training in dairy farming? ☐ Yes ☐ No

หากใช่ ลูกจ้างของท่านได้รับการฝึกอบรมจากที่ไหน _____

If yes, where did he/she receive training? _____

4. ท่านได้รับมรดกตกทอดธุรกิจฟาร์มโคนมต่อจากพ่อแม่ Did you take over the farm from your parents?

☐ ใช่ (Yes) เพราะ _____

☐ ไม่ใช่ (No) เพราะ _____

5. อาชีพเลี้ยงโคนมเป็นอาชีพหลัก หรือ อาชีพเสริมของท่าน

Are you fulltime (no payed jobs outside the farm) or part time farmer?

☐ อาชีพหลัก (Fulltime) ☐ อาชีพเสริม (Part time)

6. ท่านทำฟาร์มโคนมมานานเท่าใด

For how many years are you a dairy farmer?

☐ 1 – 5 ปี (years) ☐ 6 – 12 ปี ☐ 12 – 20 ปี ☐ มากกว่า 21 ปี

7. ท่านคิดว่ามีบุคคลภายในครอบครัวที่จะรับสืบทอดอาชีพเลี้ยงโคนมต่อไปหรือไม่

Will any of your family members continue (successor) your farm after retirement?

☐ มี (Yes) ได้แก่ other namely: _____

เพราะ why _____

☐ ไม่มี (Yes) เพราะ why _____

8. ท่านคิดว่าฟาร์มของท่านเป็นรูปแบบธุรกิจหรือไม่ Do you see your farm as a real business?

☐ ใช่ (Yes) ☐ ไม่ใช่ (Yes)

9. ฟาร์มของท่านสามารถเป็นฟาร์มตัวอย่างให้ฟาร์มอื่นได้หรือไม่ ☐ ได้ ☐ ไม่ได้

Do you see your farm as an example farm for other farmers? ☐ Yes ☐ No

เพราะ (why) _____

ข้อมูลผลผลิตฟาร์ม (Farm production data)

ปัจจุบันราคาน้ำนมดิบ _____ บาท/ลิตร What is your milk price for one liter of milk?.....Baht/litter

ฟาร์มของท่านขายน้ำนมดิบที่ใด (ตอบได้มากกว่า 1 ข้อ)

To whom do you sell the milk from your farm?(more answers possible)

☐ สหกรณ์โคนม (Milk-cooperative) ☐ อสค. (DPO) ☐ ศูนย์รับน้ำนมเอกชน (Private Milk Collectors)

☐ อื่น ๆ (Others namely) _____

10. จำนวนสัตว์ภายในฟาร์ม ณ ปัจจุบัน How many heads of livestock do you have at this moment?

โครีดนม (Cows in milk)		ตัว (Head)
โคดราย (Dry cows)		ตัว
โคสาว (อายุ 16 – 24 เดือน) Older heifers (16-24 month)		ตัว
โคสาว (อายุ 3 – 16 เดือน) Young heifers (3-16)		ตัว
ลูกโค (เพศเมีย) Calves (female)		ตัว

11. ระดับสายเลือดของโคนมภายในฟาร์มของท่าน (โฮลสไตน์ฟรีเชียน, เจอร์ซี่)

What is the (indication) percentage crossbred (Holstein, Jersey bred) in your livestock?

☐ น้อยกว่า 70 เปอร์เซ็นต์ (<70) ☐ 70 – 90 เปอร์เซ็นต์ (70-90) ☐ มากกว่า 90 เปอร์เซ็นต์ (>90)

12. ฟาร์มของท่านมีการใช้การผสมเทียม (AI) หรือไม่ (Do you use AI?) ☐ มี (Yes) ☐ ไม่มี (No)

13. ท่านมีวิธีการรีดนมอย่างไร ☐ Bucket (รีดด้วยมือ)

How do you milk your cows? ☐ Milking machine (รีดด้วยเครื่องรีดนม)

14. ฟาร์มของท่านมีปริมาณผลผลิตน้ำนมเฉลี่ย_____ลิตร/ตัว/วัน

What is your average milk production (L) per cow/per day at this moment? .....Liters

ปริมาณน้ำนมดิบที่ฟาร์มของท่านผลิตได้ (เดือนที่แล้ว) _____ ลิตร

How much milk (L) did you produce last month? .....Liters

ปริมาณน้ำนมดิบที่จำหน่ายได้ (เดือนที่แล้ว) _____ ลิตร

How much milk (L) did you sell last month? .....Liters

ปริมาณน้ำนมที่ให้ลูกโค (เดือนที่แล้ว) _____ ลิตร

How much milk (L) did you give to the calves last month? .....Liters

15. ปริมาณผลผลิตน้ำนมภายในฟาร์มของท่านมีความผันแปรหรือไม่

Does the milk production on your farm fluctuate much?

☐ มี (Yes) ปริมาณในการผันแปร (how much fluctuation?)

○ 0 – 1 ลิตร (L) ○ 2 – 3 ลิตร (L) ○ 4 - 6 ลิตร (L)

○ 7 - 9 ลิตร (L) ○ 9 - 11 ลิตร (L) ○ มากกว่า 12 ลิตร (L)

☐ ไม่มี (No)

16. โรคที่พบในฟาร์มของท่าน (What are the major diseases on your farm?)_____

โรคเกี่ยวกับสัตว์ที่ท่านกังวลมากที่สุด (Which animal diseases do you worry about?)_____

ข้อมูลรายรับ – รายจ่าย (Income – Outcome data)

17. เดือนที่แล้วท่านมีรายรับจากการขายน้ำนมดิบ (บาท)

Can you indicate approximately your income from milk sales last year? (Bath)

☐ 0 – 5,000 บาท ☐ 5,001 – 20,000 บาท ☐ 20,001 – 40,000 บาท

☐ 40,001 – 60,000 บาท ☐ 60,001 – 100,000 บาท ☐ มากกว่า 100,000 บาท (>100,000)

เดือนที่แล้วท่านมีรายรับจากการขายมูลสัตว์ _____ บาท

Can you indicate your income from manure? _____ Bath

เดือนที่แล้วท่านมีรายรับจากการขายสัตว์ _____ บาท

Can you indicate your income from cattle sales? _____ Bath

18. ท่านมีภาระหนี้สินหรือไม่ ☐ มี (Yes) ☐ ไม่มี (No)

Do you have a loan?

หากมี เป็นการกู้ยืมจาก (If yes, where did get your loan from?)

☐ ธนาคาร (Bank) ☐ สหกรณ์ (Cooperative) ☐ ญาติพี่น้อง (Relative)

☐ แหล่งเงินกู้นอกระบบ (Nonsystematic source of money) ☐ อื่น ๆ (Other namely)___

19. ท่านมีการสำรองเงินทุนหมุนเวียนหรือไม่ เช่น ซื้อโคสาว/อาหาร/ อื่น ๆ

Do you save a part of your income for investments (e.g. buying heifers/feeding ingredients etc.)?

☐ มี (Yes) ☐ ไม่มี (No)

20. รายจ่ายค่าอาหาร (เดือนที่แล้ว) _____ บาท

What were you total feeding costs last month? _____ Baht

รายจ่ายค่าดูแลสุขภาพสัตว์/ ค่ายารักษา (เดือนที่แล้ว) _____ บาท

What were you total veterinary costs last month? _____ Baht

รายจ่ายค่าชำระหนี้ (What were your total costs of the bank loan last month?)_____ บาท

ค่าจ้างแรงงาน (What were your total labour costs last month?)_____ บาท

ข้อมูลการจัดการแปลงหญ้า (Forage management data)

21. ขนาดพื้นที่เลี้ยงสัตว์ของท่าน (What is the total land area used for pasture production, including land rented?)

เป็นเจ้าของเอง (Rai owned)_____ ไร่ เช่า (Rai rent)____ ไร่

พื้นที่ปลูกพืชอาหารสัตว์ (What is the total land area used for crops, including land rented?)

เป็นเจ้าของเอง (Rai owned)_____ ไร่ เช่า (Rai rent)_____ ไร่

22. ชนิดของหญ้าอาหารสัตว์ที่ปลูกภายในฟาร์ม (ตอบได้มากกว่า 1 ข้อ)

Which grass do you grow on the farm? (more answers possible)

☐ หญ้ารูซี่ (Ruzi grass) ☐ หญ้าแพนนิคัม (Panicum grass) ☐ หญ้ากินนี (Guinea grass) ☐ หญ้าเนเปียร์ (Napier grass)

☐ หญ้าขน (Para (Mutica) grass) ☐ หญ้าสตาร์ (star grass) ☐ อื่น ๆ _____ (Star grass) (Other namely,.....)

23. จำนวนอาหารหยาบและหญ้าหมักที่ซื้อเทียบเป็นร้อยละเท่าไหร่กับการผลิตใช้เองในฟาร์ม

How much roughage and silage do you buy approximately compared to own production?

☐ 0 - 25 ☐ 25 - 50 ☐ 50 - 75 ☐ 75 - 100

ชนิดของพืชอาหารหยาบที่ซื้อเข้า (What kind of roughage?)

○ หญ้าแห้ง Grass hay ○ ฟางข้าว Rice straw ○ ต้นข้าวโพด Corn stems ○ อื่น ๆ _____ Other namely,.....

แหล่งในการซื้อ From whom buy the forages/roughages? ○ เพื่อนบ้าน Neighbour ○ ญาติพี่น้อง Relative ○ สหกรณ์ Cooperative ○ อสค. DPO ○ พ่อค้าเร่ Local market (stranger) ○ อื่น ๆ _____ Other namely,...

24. ฟาร์มของท่านมีการใช้ปุ๋ยจากมูลสัตว์สำหรับใส่ในแปลงพืชอาหารสัตว์หรือไม่

(Do you fertilize your land with fertilizer and/or manure?)

☐ ใช้ (Yes) เพราะ (Why)_____

☐ ไม่ใช้ (No) เพราะ (Why)_____

25. ท่านมีการจัดการระบบชลประทานหรือไม่ ☐ มี ☐ ไม่มี

Do you use irrigation?

26. ท่านมีการให้ปุ๋ยเคมี/ปุ๋ยคอกแก่แปลงหญ้าหรือไม่ ☐ มี (Yes) ☐ ไม่มี (No)

(Do you use cattle manure to fertilize pasture or forage crops?)

27. ถ้าหากท่านมีที่ดินเพิ่มขึ้น (ซื้อ/เช่า) ท่านจะใช้ที่ดินเหล่านั้นสำหรับการปลูกพืชอาหารสัตว์หรือไม่

If you could get (buy/rent) more land will you use it for growing forage or pasture?

☐ ใช่ (Yes) เพราะ (why)_____

☐ ไม่ใช่ (No) เพราะ (Why)_____

ข้อมูลการจัดการอาหาร

28. ชนิดของวัตถุดิบอื่นให้ร่วมกับหญ้าอาหารสัตว์ (What other products do you add to the forage?)

☐ ถั่วฮามาต้า (Hamata legumes) ☐ กระถิน (Leuceana) ☐ ถั่วคาวาเคด (Cavalcade legume)

☐ อื่น ๆ (Others namely)_____

29. วัตถุดิบอื่น ๆ ที่ใช้ในฟาร์ม (Which type of supplements do you add to the feeding?)

☐ กากเบียร์ (Brewery waste) ☐ กากมันสำปะหลัง (Cassava pulp) ☐ อื่น ๆ _____ (Other)

30. ฟาร์มของท่านมีการซื้ออาหารข้นมาใช้ภายในฟาร์มหรือไม่ (Do you buy ready-made concentrate?)

☐ ใช่ (Yes) ☐ ไม่ใช่ (No)

31. ปริมาณอาหารข้นที่ให้ในแต่ละวัน (ตัว/กก./วัน) How much concentrates do you give your cattle every day?

☐ 1 – 2 กก. (kg) ☐ 2 – 4 กก. (kg) ☐ 5 – 8 กก. (kg)

☐ 9 – 12 กก.(kg) ☐ 12 – 16 กก. (kg) ☐ มากกว่า 16 กก. (kg)

32. ปัญหาที่ท่านพบจากการให้อาหารข้นจำนวนมาก What are the problems when using more concentrates?

☐ ต้นทุนการผลิตสูง (Higher production costs) ☐ Acidosis (Acidosis) ☐ กีบ (lameness) (Lameness)

☐ อื่น ๆ other namely_____

33. ท่านมีการทำกิจกรรมอื่นนอกเหนือจากการเลี้ยงโคนม หรือไม่

(Do you have other farming activities besides dairy on the farm?)

☐ ไม่ (No) เลี้ยงโคนมเพียงอย่างเดียว (ขายน้ำนมดิบ และ/หรือโคนม) Only dairy farming (milk sales cattle sales)

☐ ทำฟาร์มโคนมและอื่น ๆ (*Dairy farming and additional activities from dairy farming:*)

☐ ฟาร์มโคนม และ (Dairy farming and)

○ การทำปุ๋ยคอก (*Manure*) ○ หญ้าแห้ง (*Hay*)

☐ ฟาร์มโคนม และพืชชนิดอื่น (Dairy farming and other crops)

○ ข้าวโพด (Corn) ○ ผลไม้ (*Fruits*) ○ ผัก (*Vegetables*)

☐ ฟาร์มโคนม และสัตว์ชนิดอื่น (Dairy farming and other animals)

○ ไก่ (*Chicken*) ○ แพะ (*Goat*) ○ ห่าน (*Goose*) ○ ปลา (*Fish*)

☐ อื่น ๆ other, namely_____

ข้อมูลการฝึกอบรม/ส่งเสริมการเลี้ยง

34. ท่านเคยเข้ารับการอบรมหรือไม่ (Did you attend additional training?)

☐ เคย จากหน่วยงานใด ○ อสค.(DPO) ○ กรมปศุสัตว์ (DLD)

If yes, from whom did you get workshop/seminars/training? ○ สหกรณ์ (Cooperative) ○ อื่น ๆ other, namely_____

ในหัวข้อใด (ที่เกี่ยวข้องกับการผลิตโคนม) In thefield of (related to dairy farming)?_____

☐ ไม่เคย (No)

35. ในระยะเวลา 1 ปี เจ้าหน้าที่มาให้คำแนะนำหรือส่งเสริมในฟาร์มของท่าน จำนวน _____ ครั้ง

How many times did an extension officer visit the farm in the last 12 month? _____times

36. เจ้าหน้าที่ของหน่วยงานใด (Where did the extension officer come from?)

☐ อสค. DPO ☐ สหกรณ์ Cooperative ☐ กรมปศุสัตว์ DLD ☐ อื่น ๆ Other namely,_____

37. ท่านต้องการให้มีเจ้าหน้าที่มาให้คำแนะนำฟาร์มของท่านหรือไม่ (Did you request for the advisor to visit the farm?)

☐ ต้องการ (Yes) ☐ ไม่ต้องการ (No)

38. ท่านมีการวางแผนกิจกรรมภายในฟาร์มหรือไม่ (How do you plan your farm activities?)

☐ มี (Yes) ☐ ไม่มี (No)

39. ท่านมีความพึงพอใจกับปริมาณน้ำนมที่ฟาร์มท่านผลิตได้หรือไม่

Are you satisfied with your level of milk production per cow on your farm?

☐ พอใจ (Yes) ☐ ไม่พอใจ (No)

40. ถ้าหากผลผลิตน้ำนมของฟาร์มท่านลดลง ท่านจะทำอย่างไร

(If the milk production of your cows drops. What are you going to do?)

- ลำดับแรก รอและสังเกตว่าเกิดอะไรขึ้นในวันต่อไป ☐ ใช่ (Yes) ☐ ไม่ใช่ (No)
  First, wait and see what happens for the next day
- ลำดับแรก หาสาเหตุว่าเกิดจากอะไร ☐ ใช่ ☐ ไม่ใช่
  First, look for the cause
- มันคือส่วนหนึ่งของระบบธุรกิจ ☐ ใช่ ☐ ไม่ใช่
  "It is part of business"

41. ท่านมีการวางแผนที่จะขยายฝูงโคนมภายในปีหน้าหรือไม่ (Do you plan to expand your cattle herd within next year?)

☐ ใช่ (Yes) ☐ ไม่ใช่ (No)

42. ในช่วงละยะเวลา 2 ปี ท่านมีการลงทุนภายในฟาร์มของท่านหรือไม่

(Did you make a large investment in your dairy farm during the last 2 years?)

☐ ใช่ (Yes) ได้แก่ what did you invest_____

จำนวนเงินที่ลงทุน (How much approximately)_____ บาท

ท่านมีการวางแผนที่จะลงทุนภายในฟาร์มอีกหรือไม่ (ปีหน้า)

(Are you planning to make an investment within the next year?)

- ○ มี (Yes) ได้แก่ what did you invest_____
- ○ ไม่มี (No)

☐ ไม่ใช่ (No)

43. ท่านมีการใช้ข้อมูลจากภายนอกมาช่วยประกอบการตัดสินใจในการลงทุนต่าง ๆ หรือไม่

(Do you use external information to make a decision in a certain investment?)

☐ ใช่ (Yes) ชนิดของสื่อ/ข้อมูล (If yes, what kind of media/information?)_____

☐ ไม่ใช่ (No)

44. แหล่งที่มาของข้อมูลเหล่านั้น มาจากไหนบ้าง (And from whom do you acquire this media/information (source)?)_____

ข้อเสนอแนะ (*Comments*)_____

_____

_____

Appendix 5

This Appendix presents the second part of the interviews questions.

Research into management of dairy farms in Thailand

Herjan Bekamp

Interview 2nd part

Name farmer:
Date:

A. Finishing 1st part of interview question of the seminar

What is your average milk production (L) per cow, per day at this moment? ……L

Does the milk production per cow on your farm fluctuate much?
Yes No, How much? ……..L

Asking missing answers from first part of interview.

B. Qualitative part

Do you keep breeding records on the farm?
Yes No, If yes, how do you use these records?
……
……

Do you do bookkeeping?
Yes No, Why?
……
……

Recording hand or computer?
Hand Computer

Do you keep recordings of veterinary treatments?
Yes No why?
……
……

Do you keep milk yield recording of individual cows?
Yes No why?
……
……

What purpose do you use these records?

……
……

Who of the family is keeping and consulting records?
……

What extra records would help you to improve you farm management?
……
……

What are the major diseases on your farm?
……
……
……

Which animal diseases do you worry about?
……
……
……

What do you do to prevent these diseases?
……
……
……

What are your selection criteria's when choosing a bull for insemination?
……
……

Which other sources do you use when selection a bull except AI inseminator?
……
……

Which options do you have to reduce the overall costs on your farm?
……
……

In what way could the co-operative help to reduce these costs?
……
……
……

What are the major problems on your farm?
……
……
……

What can you do yourself to solve these problems?

……
……
……
What can the co-operative do to solve these problems?
……
……
……

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