CHARACTERIZATION OF MILK AND VEAL PRODUCTION CHAINS OF BUFFALO UNDER CROP-LIVESTOCK PRODUCTION SYSTEM IN EGYPT

By

MOHAMED ALI ABDALLAH RADWAN
B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2004

THESIS
Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

In

Agricultural Sciences
(Animal Production)

Department of Animal Production
Faculty of Agriculture
Cairo University
EGYPT

2016
APPROVAL SHEET

CHARACTERIZATION OF MILK AND VEAL PRODUCTION CHAINS OF BUFFALO UNDER CROP-LIVESTOCK PRODUCTION SYSTEM IN EGYPT

Ph.D. Thesis
In
Agric. Sci. (Animal Production)

By

MOHAMED ALI ABDALLAH RADWAN
B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2004

APPROVAL COMMITTEE

Dr. SAMIR AHMED MOKHTAR ..................................................
Professor of Animal Breeding, Fac. Agric., Suez Canal University

Dr. RABIE RAGAB SADEK ..................................................
Professor of Animal Husbandry, Fac. Agric., Cairo University

Dr. AMAL KAMAL EL-ASHEERI ...........................................
Professor of Animal Husbandry, Fac. Agric., Cairo University

Date: 09 /06 /2016
SUPERVISION SHEET

CHARACTERIZATION OF MILK AND VEAL PRODUCTION CHAINS OF BUFFALO UNDER CROP-LIVESTOCK PRODUCTION SYSTEM IN EGYPT

Ph.D. Thesis
In
Agric. Sci. (Animal Production)

By

MOHAMED ALI ABDALLAH RADWAN
B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2004

SUPERVISION COMMITTEE

Dr. AMAL KAMAL EL-ASHEERI
Professor of Animal Husbandry, Fac. Agric., Cairo University

Dr. EL-SAYD SALAH EL-DIN GALAL
Professor of Animal Breeding, Fac. Agric., Ain Shams University

Dr. CHRISTIAN CORNIAUX
Researcher at International Centre for Research in Agriculture and Development (CIRAD), Montpellier, France

Dr. SHERIF ABDELGHANY ATTALLA
Lecturer of Animal Breeding, Fac. Agric., Cairo University
This thesis includes four parts to characterize Buffalo milk and veal chains at different chain levels, the objectives of the first part were to identify the diversity of different chains and more deeply to determine main actors along the milk value chains in three villages to understand how these chains work. Also, milk analysis was applied to study the effect of location on milk composition, milk urea nitrogen (MUN) and somatic cell count (SCC). Field visits and interview are used to collect data. Milk samples were collected from farmers through 2013/14. Results indicated that there were a short chain and a long chain. Short chain achieved higher profit for farmers and reasonable price for consumers compared to long chain. While long chain provides a lot of jobs. MUN, SCC and milk composition could be used as diagnostic tools for different regions to identify the most priority services and extension needs at village level.

The aim of the 2nd part was to suggest a methodology to characterize the diversity of dairy farming systems in Egypt to understand the traditional dairy sector. Data were collected from 65 farmers in three villages through three consecutive seasons. Based on multiple factorial and cluster analyses, six farmers’ group were identified. Milk production was a major activity in very small land farms, the sustainability of this sector facing the lack of technical support and lack of pricing system for milk and feedstuffs, more governmental and NGOs projects needed to supply farmers with high quality forage seeds, high producing animals and veterinary services. So, considering the diversity of farming systems, one agricultural policy will not fit all farmers’ categories taking into account the region and the season.

The objective of the 3rd part was to apply a SWOT analysis on a traditional milk chain, particularly buffalo skimmed milk chain around greater Cairo, which considered as one of the main dairy markets in Egypt. Main stakeholders of the chain were farmers, milk collection points, milk collection center, and dairy processing units. SWOT analysis allowed highlighting the major role of social network to explain the flexibility and adaptation of this sector to the major constraints in linked with international competitiveness and national constraints, mainly on land access. These elements could help decision makers and developers to prioritize sustainable development activities in link with agriculture global agenda.

The aim of fourth part was to characterize the veal supply chain using survey analysis for different actors along the chain and to understand the preference of some meat consumers to veal meat through comparing meat quality parameters of buffalo meat categories in Egyptian market including meat quality analysis of veal, fattening males and culled females. Survey analysis results indicated that 65 % of Egyptian farmers sold veal as early as possible. About 61 % of these farmers sold their animals for economic reasons, 14 % for technical reasons and 25 % for both reasons. Fat content and cholesterol levels were lower in veal meat compared with fattening calves or culled females; the same trend was observed for shear force values and cooking loss percentage. These results explained why the veal meat is regularly consumed by elders, sick peoples and employees with limited physical activities, veal showed high tenderness and more attractive color, in contrast veal contained lower fat and cholesterol levels.

Key words: Buffalo, chain, crop/livestock production system, SWOT, skimmed milk, veal.
DEDICATION

I dedicate this work to whom my heartfelt thanks; my mother, my wife, my brothers, my sister, my friends and my lovely sons Ahmed, Omer and Ali for their patience, encouragement and help, along the course of my study.
First I would like to express my deepest thanks to “Allah” the sustainer of the world for making me capable of carrying out this work.

I have the pleasure to express my deepest gratitude, great thanks and sincere appreciation to Dr. Amal Kamal El-Asheeri Professor of Animal Husbandry, Faculty of Agriculture, Cairo University for her direct supervision, great support, as well as helping in data collection from the commercial farms.

I am deeply grateful and thankful to the spirit of Dr. El-Sayd Salah El-Din Galal Professor of Animal Breeding, Faculty of Agriculture, Ain Shams University for his close supervision, useful guidance and fruitful assistance during this work.

My deepest thanks to Dr. Sherif Abdelghany Assistant Professor of Animal Breeding, Faculty of Agriculture, Cairo University for his close supervision, useful guidance and fruitful assistance during this work.

My deepest thanks to Dr. Christian Corniaux Researcher in International Centre for Research in Agriculture and Development (CIRAD), Montpellier, France, for suggesting this work and his close supervision.

My deepest thanks are extended to Dr. Veronique Alary Researcher CIRAD/ICARDA (International Center for Agricultural Research in the Dry Areas), Rabat, Morocco; for her valuable suggestions and unlimited help and advices.

My deepest thanks to Eng. Omer Mamdouh and his family, Zahren family and Mr. Ramadan El-Kataani, who have facilitated our meeting with actors along the chains and for their supports all over the study.

Also, I would like to express my gratitude to Inter-institutional Agency of Research for Development in France (AIRD) for founded my study through the dairy project.

Sincere thanks and deep appreciation to Dairy project teams for unlimited help and cooperation.

My deep appreciation to my colleagues in Animal Production Department, Faculty of Agriculture, Cairo University for their great help and encouragement.
## LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG</td>
<td>Average daily gain</td>
</tr>
<tr>
<td>CFM</td>
<td>Concentrate feed mixture</td>
</tr>
<tr>
<td>Cfu</td>
<td>Colony forming unit</td>
</tr>
<tr>
<td>CIE</td>
<td>Commission International de l’E´clairage</td>
</tr>
<tr>
<td>CLS</td>
<td>Crop/livestock system</td>
</tr>
<tr>
<td>CP's</td>
<td>Collection points</td>
</tr>
<tr>
<td>DPU's</td>
<td>Dairy processing units</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>Ha</td>
<td>Hectare</td>
</tr>
<tr>
<td>IR</td>
<td>Infra-red</td>
</tr>
<tr>
<td>Kgf</td>
<td>Kilogram force</td>
</tr>
<tr>
<td>L. dorsi</td>
<td>Longissimus dorsi muscle</td>
</tr>
<tr>
<td>MCC</td>
<td>Milk collection center</td>
</tr>
<tr>
<td>MCPs</td>
<td>Milk collection points</td>
</tr>
<tr>
<td>MFA</td>
<td>Multifactorial analysis</td>
</tr>
<tr>
<td>MPU's</td>
<td>Milk processing units</td>
</tr>
<tr>
<td>MUN</td>
<td>Milk urea nitrogen</td>
</tr>
<tr>
<td>NGOs</td>
<td>Non-governmental organization</td>
</tr>
<tr>
<td>NRL</td>
<td>Newly reclaimed land</td>
</tr>
<tr>
<td>OLs</td>
<td>Old land</td>
</tr>
<tr>
<td>SCC</td>
<td>Somatic cell count</td>
</tr>
<tr>
<td>SCS</td>
<td>Somatic cell score</td>
</tr>
<tr>
<td>SNF</td>
<td>Solids not fat</td>
</tr>
<tr>
<td>TBC</td>
<td>Total bacterial count</td>
</tr>
<tr>
<td>TS</td>
<td>Total solids</td>
</tr>
<tr>
<td>TVBC</td>
<td>Total Viable bacterial count</td>
</tr>
<tr>
<td>WHC</td>
<td>Water holding capacity</td>
</tr>
</tbody>
</table>
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>PART I. Characterization of buffalo milk value chains in three different villages</td>
<td>5</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>5</td>
</tr>
<tr>
<td>REVIEW OF LITERATURE</td>
<td>7</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>14</td>
</tr>
<tr>
<td>RESULTS</td>
<td>16</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>26</td>
</tr>
<tr>
<td>PART II. Characterization of the diversity of dairy farming systems and milk marketing strategies</td>
<td>29</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>29</td>
</tr>
<tr>
<td>REVIEW OF LITERATURE</td>
<td>31</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>38</td>
</tr>
<tr>
<td>RESULTS</td>
<td>43</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>58</td>
</tr>
<tr>
<td>PART III. SWOT analysis of traditional skimmed milk chain around greater Cairo</td>
<td>62</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>62</td>
</tr>
<tr>
<td>REVIEW OF LITERATURE</td>
<td>64</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>73</td>
</tr>
<tr>
<td>RESULTS</td>
<td>76</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>95</td>
</tr>
<tr>
<td>PART IV. Veal supply chain at village level in Egypt</td>
<td>99</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>99</td>
</tr>
<tr>
<td>REVIEW OF LITERATURE</td>
<td>101</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>106</td>
</tr>
<tr>
<td>RESULTS</td>
<td>111</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>120</td>
</tr>
<tr>
<td>CONTENTS (continued)</td>
<td>Page</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------</td>
</tr>
<tr>
<td>CONCLUSION</td>
<td>124</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>126</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>130</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>147</td>
</tr>
<tr>
<td>ARABIC SUMMARY</td>
<td></td>
</tr>
</tbody>
</table>
GENERAL INTRODUCTION

Agriculture is a key sector in the Egyptian economy, providing livelihoods for 55% of the population and provides about 30% of employing (FAO WFP "IFAD", 2012). Cultivated areas are limited and represent about 3.5% of total land areas in Egypt (8.9 million feddan=3.74 million hectares).

According to FAO statistics (FAO, 2015) in 2013 Egypt produced about 5.9 million liters/year fresh milk, about 2.6 million liters produced by buffalo (represents 44.1% of milk production) and about 3.17 million liters produced by cattle (represents 53.73%). The total numbers of buffalo were 4.2 million heads and the cattle number was 4.95 million heads.

The present study were done in three villages located in Giza (ElAtf and Reka villages) and El-Beheira (ElEmam Malik village) governorates. Traditional sector is considered the main dairy sector in Egypt. This traditional sector is characterized by the absence of recording system, no quality control, unprocessed, unpackaged products, no contract and no statistics was available. Moreover, the traditional sector offers a lot of jobs for people. Also the majority of demands depend on traditional milk and milk products. Furthermore, approximately 85% of milk sold as loose milk\(^1\) (Oxford report 2012) which was higher than the quantity of loose milk in India, represents 19% of milk production (Banerjee, 2007). There is a big difference between

\(^1\) Note: Loose milk= fresh unpacked, unpasteurized milk
the price of raw milk and the price of milk products, good pricing system provide sustainability of the whole dairy chain including small dairy farming system.

Dairy industry in Egypt occupies an important place in food supply and represent about 47 % of food and agriculture enterprises (RAC/CP, 2002). The dairy industry involves the production of raw milk and it is products such as drinking milk, butter, cheese and yogurt (LACTIMED, 2014). Dairy marketing channels for smallholders are blocked with mediators and lack transparency (ACDI/VOCA Egypt, 2007). Furthermore, the dairy sector in Egypt has historically suffered from inefficient marketing channels, a lack of reliable market information, and weak agribusiness management skills.

Regarding the current situation of milk sector in Egypt, most of the buffalo milk produced were collected through unsafety ways and Egyptian consumers are preferred raw milk and its products (cheese, butter and yoghurt) because of its favorable characterization, buffalo milk is white color, high fat content around 7 % and flavor (Abdel Aziz and Sadek, 1999). Big dairy companies use cow milk which produced by large and medium farms under quality control and also use the powder milk (20-50 % of volume) which imported from outside country. The average milk consumption in Egypt was 61.8 kg per capita per (FAO, 2015), but still lower than the average world consumption (100 kg/capita/year).

In Egypt, the veal refer to buffalo calves that are slaughtered at early age with low weight. Slaughtering veal at early age and small weight was
led to a decrease in the contribution of buffalo in the national meat production.

The problem statement is there is a shortage of information about traditional milk sector and its contribution to milk supply were observed. Huge amount of milk is produced by smallholders through informal milk chain. There is no estimation about the daily milk circulated on greater Cairo pathways. Around 80% of the milk demand is provided by the traditional and informal sector. Traditional milk chain in greater Cairo is based on raw milk and processing the traditional cheese. The cheese consumption in Egypt is estimated by 10.4 kg/capita/year (CDIC, 2015). There is a lack of knowledge about this traditional sector which could help in better planning for this sector. There is a scarcity of data available about the veal chain that is often considered as a secondary product of milk production while there is a high demand.

The main hypothesis of the four parts of the present thesis were: the traditional milk chain characteristics were non-similar in different villages in Egypt, also the properties of different crop/livestock production system were not equal, while skimmed milk chain was not similar as traditional whole milk chain and veal selling decision was not due to similar reasons and veal demand was not related to meat quality.

The objectives of this study were

1. The main objective of this part was to characterize buffalo milk chains in three different villages.

2. To characterize the diversity of dairy farming systems in the selected villages and to understand milk marketing strategies of
farmers regarding livestock products according to internal (family size, herd size and land size) and external factor (seasonality and pricing system), which could help in making proposals for policy makers, NGOs working in dairy sector and developers accounting for livestock farming systems diversity in Egypt and in other tropical and subtropical countries that have similar integrated crop/livestock farming system.

3. To monitor the dynamic of traditional skimmed milk chains and applying SWOT analysis of this sector to propose recommendations for policy makers and even researchers to improve the whole dairy production system. This analysis was based on the supply chain approach that gives us the framework for identification and characterization of the actors involved in this value chain.

4. To identify the stakeholders along the veal chain, main characteristics of the whole chain and to characterize different interpret the huge demand of veal meat through quality analysis traits related to preference of buffalo meat consumer, and finally to identify the interaction between veal and dairy chains at farm level and the effect of veal on availability of buffalo milk in the market.
Part I: Characterization of buffalo milk value chain in three different villages

INTRODUCTION

The value chain could be defined as the full range of activities which are required to bring products or services from conception, through different phases of production, delivery to final consumers, and final disposal after use (Kaplinsky and Morris, 2001). In rural areas, farmers are considering livestock as a living bank that helps as a financial backup to cope with emergency status (Perera and Jayasuriya, 2008).

Milk production is a livestock enterprise in which small scale farmers can successfully involve to improve their livelihoods. Regular milk sales also allow them to move from subsistence to a market based income. Smallholder’s dairy farming are producing milk for family consumption and for daily income through selling milk and milk products, moreover manure is used as nutrient fertilizer to produce crops. Dairy animal had an important role in social insurance and financing emergency cash needs (Chinogaramombe et al., 2008).

Value chain approach is a favorable approach to understand the function of milk supply chain due to its nature that takes into account all actors along the chain. All relations between actors and different internal and external factors affecting the whole chain system.

Mastitis disease causes a huge economic loss in dairy cattle farms because of dropping milk production, increasing culling rate and
increasing veterinary cost, mastitis led to increase somatic cell counts (Němcová et al., 2007 and Sharif et al., 2007). Somatic cell count (SCC) is a parameter that used to judge the management programs farm level and a good indicator of udder health and milk quality produced in different production systems.

Roy et al. (2003) mentioned that high level of milk urea nitrogen (MUN) is a reflection of unbalance energy and protein in animal's diet, which regularly followed by low fertility, high feeding cost and low production efficiency. The MUN is considered as a tool for monitoring the dietary efficiency in terms of protein energy ration (Hof et al., 1997). Characterization of the dominant value chains and milk quality analysis of different locations could help to propose more realistic strategies that improve the sustainability of the whole dairy sector.

The main objective of this part was to characterize buffalo milk chains in three different villages.
1. Buffalo

Buffalo is considered as backbone of the farmers economics of in 40 countries all over the world, especially in India, South-Asia, Egypt, also for animals raised in European and American countries (Singh et al., 2015). Buffalo providing farmers with milk, meat, manure and draft power (Mourad, 1997 and Ahmed and Hassan, 2007). Buffalo is the main dairy animal to the majority of smallholder farmers in many developing countries (Perera, 2008). Buffalo plays a vital role through contribution in social and cultural aspects (Desta, 2012). Borghese (2010) reported that in India, the majority of the buffalo milk is produced by smallholder farmers where the herd size consists of 1-5 heads of buffalo/farmer.

In Egypt, water buffaloes are the main source for milk and contribute more than 70% of the annual milk production (Borghese, 2010 and Arefaine and Kashwa, 2015). The buffalo population was around 4 million head in year 2013 (FAOSTAT, 2015). Around 42% of the buffalo population is dairy cows, 32% heifers, 6% bulls and 20% male calves (Ibrahim and Abdelrazek, 2012). Eltawil et al. (1976) found that milk yield of first and second buffalo lactations were around 1004 and 1553 kg/305 day, respectively. Borghese (2010) reported that Egypt have about 1,650,000 buffalo cows, with an average milk yield per lactation around 1850 kg/180 day in traditional system, while in commercial farms the average milk yield was around 2250 kg/250 day. Fahim (2009) found that the buffalo milk yield was around 1849 kg/213
day. CISE (2012) reported that the average milk production of buffalo under commercial farming system was about 1960 kg/lactation period (7.1 kg/day), while in small herds the average milk production was around 1850 kg/lactation period (6.3 kg/day).

2. Value chain "filiere" approach

Khoi and Dung (2014) reported that value chain study should involve key actors in different chain points who provide the economic activity with inputs, participate in production, processing, distribution, and marketing.

Beyene (2015) reported that the value chain is an innovation that enhances or improves an existing product or introducing new products or new product uses. Also, value chain analysis could play a vital role in recognizing the distribution of benefits to different actors along the chain. In this value chain, the processing firms hold the decision and become the main actor, which receives most of the profit. The farmers who spend a lot of effort, time and investment receive a small proportion of the profit which considered one of the threats for the whole production system sustainability.

Traditional milk chain in terms of small scale milk production, trading fresh milk and traditionally dairy processing products is important in most of the developing countries. Moreover, 80 % of milk marketing in India supplied by traditional chain (Kumar and Staal, 2010).
In Ethiopia, Beyene (2015) observed that the dairy products reach to consumers through informal and formal marketing systems. The main market is informal (traditional system) which represent 98% and the rest comes through the formal chain which represent 2% of fresh milk supply.

Traditional or informal milk marketing chains often provide the main outlet for smallholder dairy producers and major source of fresh milk supply for consumers. They have been playing a vital role between growing demands among consumers and increasing production by producers.

Hemme and Otte (2010) concluded that milk production in small-scale farms not only improves the food security of households, but also helps to create several employment opportunities along the dairy chain.

3. Milk quality

Milk quality is very important aspect of dairy production (Dekkers et al., 1996). Sraïri et al. (2009) reported that the quality of fresh milk is an important factor for judging the performance of dairy chains. Quality is normally defined by milk chemical components such as fat, lactose and protein content which are affected by feeding practices, breeds and stage of lactation. The authors found also that fat and protein substances are key components affecting milk possible uses through industrial sector.
a. Milk composition

Milk composition of mammalian species varies widely with reference to genetic, physiological status, nutritional factors and environmental conditions (Sabahelkhier et al., 2012 and Claeys et al., 2014). Claeys et al. (2014) explained that milk of all mammals has the same basic components, such as moisture, protein, fat, carbohydrate, vitamins and minerals, but milk component percentages widely varies especially between ruminant and non-ruminant animals.

Many factors are affecting milk composition such as animal genotype, stage of lactation, diseases especially that related to udder health (mastitis), and seasonality (Lujerdean et al., 2007)

Hashmi and Saleem (2015) reported that milk composition can be affected by region, climate circumstances and lactation period. There is an inverse relationship between ambient temperature and protein-fat contents of milk. Thus, with seasonal changes most of milk components (Fat, protein, casein and all fractions of nitrogen) are affected. Also, they found that high environmental temperature led to a decrease in fat %.

Milk composition (Fat, protein and lactose) could be used as a diagnostic tools for the herd management in particular the health of lactating animals (Forsbäck et al., 2010)

Buffalo milk is one of the highest mammalian milk in the level of constituents. Mainly, fat content is the main fraction of buffalo milk and it is responsible for high nutritive value (Ménard et al., 2010).
Park and Haenlein (2006) reported that season affects buffalo milk composition. Fat and lactose were increased in summer by (8.4% and 5.2 %, respectively) than in spring (7.3% and 5.1 %, respectively) and winter (6.7% and 3.6 %, respectively). Most of milk components (fat, protein, lactose, SNF and TS) increased by advancing lactation period.

Han et al. (2007) found that the average milk composition of fat, protein, lactose, total solids and ash of River Nile buffalo in China was 6.53, 4.16, 4.56, 17.14 and 0.81 %, respectively.

b. Somatic cell count (SCC)

Somatic cell count is defined as the number of milk-secreting epithelial cells that have been shed from the lining of the gland and white blood cells (leukocytes) that have entered the mammary gland in response to injury or infection (Sharma et al., 2011). Mastitis causes changes in milk composition, which leads to decrease coagulation and produce lower cheese quality (Tripaldi et al., 2010).

Determination of SCC could be useful to predict the mastitis which causes a great economic loss due to decreasing milk yield and quality (Cerón-Muñoz et al., 2002 and Patil et al., 2015).

Fagiolo and Lai (2007) observed that mastitis commonly led to inflammation of one or more quarters of the mammary gland and it is frequently affecting not only the individual animal, but also the whole herd or some animals within the herd. The authors reported also that SCC can be changed due to animal age, stage of lactation, season and milking frequency. Bansal et al. (2007) reported that mastitis affects milk
composition which led to decrease in fat, protein, lactose and solids not fat content; however, there is an increase in some other components such as somatic cells, salt, whey proteins and bacterial count. The frequency of infection by mastitis is higher in bovine cows compared to buffalo cows (Mohamed et al., 2013).

The SCC was transformed to somatic cell score (SCS), where the lactation period started with high SCS then decreased to minimum at third month of lactation and increased again with the advancement in lactation period (Němcová et al., 2007).

Bytyqi et al. (2010) recorded that SCC in normal cases is lower than $1 \times 10^5 \text{ cells/ml}$, but in the case of infection with mastitis, the SCC is higher than $1 \times 10^6 \text{ cells/ml}$. So, an elevated SCC had negative impact on milk quantity, quality and the manufacturing properties of milk.

Patil et al. (2015) found that SCC in buffalo milk lower than $2 \times 10^5 \text{ cells/ml}$ is normal cases, ranged from $3.2 \times 10^5 \text{ cells/ml}$ to $1 \times 10^6 \text{ cells/ml}$ is subclinical mastitis and the count higher than $1 \times 10^6 \text{ cells/ml}$ is clinical mastitis. So, Somatic cells are used as indicator of both resistance and susceptibility of buffalo cows to mastitis and can be used to monitor the occurrence of subclinical mastitis in herds or individual cows.

The studies on buffaloes (Dhakal, 2006 and Syed et al., 2009) indicated that SCC in normal milk produced from healthy udder is less than $200,000 \text{ cells/ml}$, but quarters that tested and gave higher than $200,000 \text{ cells/ml}$ is considered as subclinical mastitis (infected quarters).
c. Milk urea nitrogen (MUN)

MUN is used for monitoring the protein/energy status of lactating cows and consequently is useful for reducing loss and maximizing efficiency of nitrogen utilization as reported by Roy et al. (2011).

In Indian traditional farms, buffalo diets didn't estimated according nutritional requirements which were led to negative effects on milk production, reproduction and health status as reported by Roy et al. (2003). High levels of milk urea nitrogen (MUN) reflect unbalance between energy and protein in animal's diet that followed by low fertility, high feed cost and low production efficiency. So, MUN is considered as a tool for monitoring the dietary efficiency in terms of protein energy ration (Hof et al., 1997). Many authors found that there was a negative correlation between MUN and milk protein production especially casein which affecting cheese yield (Godden et al., 2001 and Johnson and Young, 2003).

Yoon et al. (2004) found that MUN increased during the first two months of lactation and decreased after fifth months of lactation until the end of the lactation, also reported that there was 3 categories of MUN where low MUN less than 12 mg/L, normal MUN ranged 12-18 mg/L and high MUN more than 18 mg/L.

Martin et al. (1997) reported that MUN could have an effect on cheese production and suggested that the cheesemaker should measure the MUN before processing.
MATERIALS AND METHODS

Three different villages have been selected; ElEmam Malik is located 120 km north of Cairo El-Beheira governorate, represents the newly reclaimed land and the two other villages are; ElAtf and Reka located at 50 and 80 km south of greater Cairo Giza governorate, respectively, represent the traditional system in the Nile Valley. Milk pathways were followed by each chain in the three villages. The starting points were traders, milk collection centers and dairy key persons. Field visits and personal interview with semi-open questionnaires (Appendices) were used to collect data from farmers and mediators. The questionnaire covered farmers activity towards dairy production and marketing also, mediator's activists.

Milk samples were collected from farms in winter, spring and summer in the three studied villages through the year 2013-2014. Milk composition and milk urea nitrogen were analyzed by Bentley 150, USA and somatic cell count was measured by Nucleo Counter® SCC-100™ where applied in department of Mastitis and Neonatal Diseases, Animal Reproduction Research Institute (ARRI), Agricultural Research Center, Giza, Egypt. The somatic cell count (SCC) was log-transformed into somatic cell score (SCS) as: SCS= log10 SCC (Mrode and Swanson, 1996). The differences among villages were tested using Proc Glm SAS (SAS, 2016) to identify the effect of the village on milk quality traits in terms of moisture, fat, protein, total solids (TS), solids not fat (SNF), lactose, ash, milk urea nitrogen (MUN) and somatic cell score (SCS). The statistical analysis of data was performed using the following model:
\[ Y_{ijk} = V_i + S_j + e_{ijk} \]

where

\[ Y_{ijk} \text{ = the measured trait} \]

\[ V_i = \text{effect of village (i= 1, 2 and 3 where 1= ElAtf, 2=ElEmam Malik and 3=Reka)} \]

\[ S_j = \text{effect of season (j= 1, 2 and 3; where 1= winter, 2=spring and 3=summer).} \]

\[ e_{ijk} = \text{Random error} \]
RESULTS

1. Chain maps of buffalo milk

ElEmam Malik village is located in the west of delta, where the zone of the newly reclaimed lands which reclaimed at 1980's. The buffalo cows are reared basically for home consumption and the extra milk and dairy products (cheese and butter) were sold to neighbors or/and in village market as shown in Figure 1. No buffalo milk collection centers were found in this area, so farmers tended to keep the buffalo milk due to the low price offered by traders.

Fig. 1. The Buffalo milk chain in ElEmam Malik village (newly reclaimed land).
ElAtf village is located at the middle of Giza governorate, where milk production is mainly comes from buffalo.

Fig. 2. The Buffalo milk chain in ElAtf village (Nile Valley).

Reka village is located in the south, it’s the last village of Giza governorate and at the border of Beni Sweif governorate. Most of producers reared buffalo and few numbers of cattle. So, in this village the majority of milk produced was buffalo milk. Moreover, the farmers skimmed milk for getting butter and using skimmed milk for producing Qarish cheese.
Fig. 3. The Buffalo milk chain in Reka village (Nile Valley).

2. Comparison among the three studied villages
   a. At farmer level

   The average number of dairy buffalo was affected by village. The high number was observed in ElAtf village (3.1 head/ farmer) compared to ElEmam Malik (1.5 head/ farmer) and Reka (1.4 head/ farmer). The same trend was found in the average quantity of milk production per farmer and average daily quantity of milk sold. High differences in all studied variables were found in ElAtf village compared to the other two villages (Table 1). The percentage of sold milk was lower in ElEmam Malik than ElAtf and Reka villages, while the percentage of drinking milk was higher in ElEmam Malik than Reka and ElAtf villages.
Table 1. Mean (± SE) and coefficient of variability for number of dairy buffalo, average quantity of milk production per farmer, daily quantity of milk sold, average price of milk per liter, daily drinking of milk (liter) and % of drinking milk per production for the three different villages (ElAtf, EIEmam Malik and Reka).

<table>
<thead>
<tr>
<th>Village</th>
<th>ElAtf</th>
<th>EIEmam Malik</th>
<th>Reka</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of farmers</td>
<td>20</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Variable</td>
<td>Mean</td>
<td>SE</td>
<td>C.V %</td>
</tr>
<tr>
<td>No. of dairy buffalo</td>
<td>3.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.52</td>
<td>103.9</td>
</tr>
<tr>
<td>Daily milk yield/farmer (kg)</td>
<td>26.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.14</td>
<td>124.1</td>
</tr>
<tr>
<td>Daily milk yield sold/farmer (kg)</td>
<td>22.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.09</td>
<td>144.2</td>
</tr>
<tr>
<td>Price per liter (EGP)</td>
<td>4.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.06</td>
<td>7.8</td>
</tr>
<tr>
<td>Daily drink milk (kg)</td>
<td>0.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.08</td>
<td>54.3</td>
</tr>
</tbody>
</table>

SE: Standard Error and C.V.: Coefficient of Variability.
As shown in Figure (4) ElAtf village farmers sold more milk than the quantity of milk processed (66 vs. 27 %) and the same trend was found in Reka village (54 vs. 37%).

On the other hand, in ElEmam Malik village, the quantity of processed milk was the highest (72 %), 24 %, consumed as fresh milk and the rest (4%) was sold.

b. At trader's level

In ElEmam Malik village there was no traders to collect buffalo milk, however farmers have ability to rear buffalo in terms of technical and economical possibilities. More than one trader in ElAtf and Reka villages collect buffalo milk from farmers and deliver it to milk shops and milk processing units. The price of buffalo milk was higher in ElEmam Malik compared to ElAtf and Reka village (Table 1).

3. Milk composition

Most of milk quality traits were affected by location as shown in Table 2. Moisture % of milk was higher in Reka village compared to ElAtf village (83.9 vs. 82.2 %). Also, protein and SNF were affected by village with higher levels in Elatf. Fat %, lactose % and SCS were insignificantly differed among villages. The milk urea /nitrogen was higher in Reka as presented in Figure 5, the normal range of MUN (12-18) with higher proportion was found in ElEmam Malik village (52%) than in Reka and ElAtf villages (31 and 23 %, respectively).
Fig. 4. The proportion of consumed, processed and sold buffalo milk at farmer's level in the three studied villages (ElAtf, ElEmam Malik and Reka).
ElAtf village had lower level of MUN (less than 12) (65 %) compared to ELEmam Malik (38 %) and Reka (30%). The high level of MUN was observed in Reka (39%) followed by ElAtf and ELEmam Malik village (12 and 10 %, respectively).

The percentage of normal animals (free from mastitis) was less than 50 % of buffaloes in the three studied villages (Figure 6). Estimating SCC in milk samples reflect possibility of infection with subclinical mastitis.
Table 2. Mean (± SE) of milk composition traits among the studied villages.

<table>
<thead>
<tr>
<th>Village</th>
<th>ElAtf</th>
<th>ElEmam Malik</th>
<th>Reka</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of samples</td>
<td>34</td>
<td>29</td>
<td>72</td>
</tr>
<tr>
<td>Variable</td>
<td>Mean</td>
<td>SE</td>
<td>C.V%</td>
</tr>
<tr>
<td>Moisture</td>
<td>82.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.38</td>
<td>2.7</td>
</tr>
<tr>
<td>Fat</td>
<td>7.1</td>
<td>0.22</td>
<td>17.8</td>
</tr>
<tr>
<td>Protein</td>
<td>4.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.15</td>
<td>20.8</td>
</tr>
<tr>
<td>TS&lt;sup&gt;A&lt;/sup&gt;</td>
<td>17.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.39</td>
<td>13.1</td>
</tr>
<tr>
<td>SNF&lt;sup&gt;B&lt;/sup&gt;</td>
<td>10.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.33</td>
<td>18.0</td>
</tr>
<tr>
<td>Lactose</td>
<td>4.9</td>
<td>0.15</td>
<td>17.7</td>
</tr>
<tr>
<td>Ash</td>
<td>1.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.12</td>
<td>41.8</td>
</tr>
<tr>
<td>MUN&lt;sup&gt;C&lt;/sup&gt;</td>
<td>11.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.63</td>
<td>32.2</td>
</tr>
<tr>
<td>SCS&lt;sup&gt;D&lt;/sup&gt;</td>
<td>5.4</td>
<td>0.07</td>
<td>7.8</td>
</tr>
</tbody>
</table>

<sup>A</sup> TS: Total Solids, <sup>B</sup> SNF: Solids not fat, <sup>C</sup>MUN: Milk Urea Nitrogen and <sup>D</sup>SCS: Somatic cell score.

SE: Standard Error and C.V.: Coefficient of Variability.
Fig. 5. The level of milk urea nitrogen (less than 12, 12-18 and more than 18 mg/dl) in the three studied villages.
Fig. 6. The proportion of normal, subclinical and clinical mastitis of buffalo in the three studied villages (ElAtf, ElEmam Malik and Reka).
DISCUSSION

In the three studied villages, buffalo milk provides farmers with food security and considered as a source of cash income, which matched with the results obtained by (Hemme and Otte, 2010). In ElEmam Malik village there were no traders for buffalo milk which may be responsible for a few numbers of buffalo reared to cover only family consumption and the rest was sold to neighbors and consumers in village market. This kind of chain, which called (short chain) was shown in Figure 1 without mediators between producers and consumers.

In short chain producers receive a relatively good price (Table 1), and less job opportunities. On the other hand, the two chains that showed in Figure 2 and 3 for ElAtf and Reka villages were (long chain) included producers, traders, milk shops, milk processing units and consumers. In this kind of chain, farmers were gotten lower prices in a regular payment (weekly payment). Moreover, more jobs opportunities offered along the chain. Also, the price of milk is increased regarding to the distance between production area and milk marketing area. The price of buffalo milk was higher in ElAtf village compared to Reka village.

Large quantities of milk collected in ElAtf from few farmers help traders to control milk quality and collect milk in short time. The average buffalo milk production was based on the average number of lactating animals. Fresh milk consumption was higher in new lands compared to old lands that might be due to high level of life style in new lands compared to old lands. So, if marketing of fresh milk is weak, the milk
processing was increased as an alternative solution to extend shelf life of milk as a reason to explain the situation in three villages (Figure 4).

Buffalo milk fat was not affected by location, which was around 7% (6.5-7%, Ibrahim and Abdelrazek, 2012). The protein % of buffalo milk was higher in ElAtf village compared to the other two villages. This may be due to MUN level which agree with Godden et al. (2001) and Johnson and Young (2003) who found negative correlation between MUN and protein %. High level of MUN was negatively associated with cheese yield as a reason for poor protein coagulation (Martin et al., 1997). Also, MUN level reflects the level of nutrition where the good nutrition ratio was found in ElEmam Malik because the normal level of MUN was the highest followed by Reka and ElAtf village (Figure 5).

Somatic cell count is considered as an indicator to management practices in terms of health (Dhakal, 2006, Syed et al., 2009 and Bytyqi et al., 2010). In the present study, the SCS was not differed among villages ranged from 5.1 to 5.5 which indicated that most animals were infected (subclinical mastitis). Thus, normal buffalo milk was less than 50% (Figure 6) which reflects the bad management condition practices towards buffalo in rural areas. Generally, MUN, SCC and milk composition could be used as a routine analysis for sampling small dairy farms in different regions to identify the most priority extension services needs in the area that should be introduced in different villages and regions.

Results of the present part could help in building up more realistic traceability and food security plans along dairy chains through
controlling management practices at different production points or at starting point in the chain by setting a new milk pricing standards based on quality. Controlling programs could be used to prevent some diseases like mastitis.
PART II: Characterization of the diversity of dairy farming systems and milk marketing strategies in three villages

INTRODUCTION

Crop/livestock system is the main system at the international scale, provides around 75% of dairy, 60% of meat and up to 50% of cereals production (Herrero et al., 2010). Hahlani and Garwi (2014) reported that, milk production in small scale provides rural employment and cash income while at the same time helping in diversifying, intensifying and stabilizing agricultural production system.

Multi factorial analysis (MFA) was applied to characterize the diversity of farming systems (Alary et al., 2002). Cluster analysis is allowed to identify different farming systems in terms of structure (family size, herd and land size) and function (the practices and strategies). This analysis helps in developing target interventions through policies or advices for different types according to their assets and their functioning (Perrot and Landais, 1993 and Faye and Lhoste, 1999).

In Egypt, crop-livestock production system is considered as the main farming system including about 95% of bovine population (cattle and buffaloes); in this system, 84% of farmers had <3 feddans (1.3 ha) with 2-3 heads of animals; buffaloes, native and crossbred cattle (Census, 2010). Crop-livestock production system provides about 75% of milk production at the national scale, while 25% produced by commercial farms (Abdel Aziz and Sadek, 1999).
In Egypt, most of the studies focused on the differentiation between intensive production system which linked with modern dairy industry and small scale production systems (crop/livestock production system) which connected with traditional dairy sector. There is no available studies about the diversity of crop-livestock production systems and milk marketing strategies of small and medium dairy enterprises.

The main goals of the present part were to characterize the diversity of dairy farming systems in the selected villages and to understand milk marketing strategies of farmers regarding livestock products according to internal (family size, herd size and land size) and external factors (seasonality and pricing system). This work will help to make proposals for policy makers, NGOs working in dairy sector and developers to fit livestock farming systems diversity in Egypt and in other tropical and subtropical countries that have similar properties.
REVIEW OF LITERATURE

The term system comes from the Latin word *systēma*, which means “to aggregate” (Sorenson, 1998). System is defined as a number of related components that interact and cooperate for achieving a certain goal and respond to both internal and external stimuli (Ghosh, 2005 and Gammack *et al*., 2006).

Zwald *et al*. (2001) reported that production systems changed from one country to another, among herds within the same country and over time.

Farming system is considered as encompassing the totality of production and consumption decisions occupied by a farm-household, including the choice of crop, livestock and off-farm enterprises, and food consumed by the family (Byerlee and Collinson, 1980). Also, Mahapatra (1994) reported that farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labor, capital and management to which they have access.

Kaine *et al*. (2004) reported that the diversity in farming led to creates pressure to classify farms into typologies which can be used to help set priorities and directions for research. The authors also reported that the farms diversity into farming systems led to assisted to recognize constrains that faced farms.
Kremen *et al.* (2012) defined a diversified farming system as a system of agricultural production that, included a range of practices, incorporates agro biodiversity across multiple spatial and/or temporal scales. Diversified farming system is important to sustain and to secure the global food system.

Morton (2007) reported that smallholders term usually used to describe rural producers, predominantly in developing countries, characterized by family labor and for whom the farm provides the principal source of income.

Ngongoni *et al.* (2006) recorded that smallholder in developing countries have numerous aims for their cattle enterprise. Under this system, cattle play many roles, these roles such as, essential part of meat and milk production, livestock are narrowly linked to the social and cultural lives. Moreover, livestock is considered as security assets influencing access to informal credits and loans to aid smallholders in crises and events (like bride price payments). In many smallholder systems in developing countries, manure is considered as important as milk, meat or draught power.

Phiri *et al.* (2010) found that smallholder dairy farms in eastern and southern Africa produce more than 80% of the milk production. Subsequently considering them a significant part of the dairy enterprise.

Salami *et al.* (2010) showed that smallholder farmers is defined based on land and livestock holding, where the cultivated lands were less than 2 hectares and own only a few heads of livestock. More than 75% of the total agricultural income in the four countries (Uganda, Ethiopia,
Kenya and Tanzania) comes from smallholder farmers. Munthali et al. (1992) reported that the average land size that cultivated by smallholder farmers ranges from less than 0.5 to 2.5 hectares.

In Vietnam, Suzuki et al. (2006) found that the popular farmers were owned small cultivated land with average 0.51 hectare (range 0.03-2.76 hectares) and small numbers of buffalo with average 1.4 head (range 1–5 heads) and non-dairy cattle with average 1.4 head (range 1-4 heads).

In India, Kumar et al. (2011) reported that the majority of milk producers are smallholders and contribute about 70% to the total milk production. Also, they found that smallholders hold a few heads of buffalo or cattle, within a system integrated with crop production where used crop residues such as straw of rice and wheat. Moreover, cattle and buffalo are very significant for smallholders to provide milk and milk products for family food security not only for selling to get cash money.

Mhone et al. (2011) reported that in Zimbabwe the dairy farming system was generally classified into commercial and smallholder sectors. Smallholders characterized by low input and low output. Chatikobo et al. (2013) informed that in Zimbabwe, the smallholders holding about 80-90% of total population of livestock and count around 75% of the food security.

In Pakistan, dairy animals were kept under different production systems including: 1) grazing systems, 2) mixed farming system and 3) pre-urban dairy clusters (Devendra et al., 1997; Devendra, 2001 and Sarwar et al., 2002).
In Egypt, Abdel Aziz and Sadek (1999) reported that there are two major systems of dairy production; 1) traditional crop/livestock system and 2) industrial system (commercial farms). Also, there are another system established to cover demands in big cities, this is called flying herds.

Most milk produced by smallholders in the developing countries comes from one of the following production systems:

1. **Crop/livestock production system**

   Dairying is often part of a mixed farming system in which manure is used for fertilizing cash crop production. Dairy animals are fed on grass, crop residues and cultivated fodder. Supplementary feeding is practiced only when feasible.

   This system was dominant in Pakistan characterized by herd size ranged 2-15 animals, milk production is the main component of farm income and feeding system included fodders, crop residues, agro-industrial by-products, weeds in cropland after harvesting are used as animal feed and with additional input like mixed concentrate feeding. Some of the milk produced was used for home consumption, but most of it is sold directly by the farmer or to middlemen. This production system holds about 59.3% of total cattle and 45.5% of the total buffalo population.

   In Egypt, the traditional system is considered the main system containing about 95 % of bovine population (cattle and buffalo). The system is characterized by small-herd size less than 50 head of animal,
less than 5 feddans and keep native and crossbred animals. The feeding system depends on Egyptian clover in winter and maize and sorghum in summer, supplemented with limited amount of ingredients (corn, wheat bran, cotton seed cake, etc.) or concentrate feed mixture. This system provides about 75% of milk production on the national scale as reported by Abdel Aziz and Sadek (1999).

2. Pastoral/agro-pastoral dairying (Grazing system)

These systems are based on land and milk which are often the most significant maintenance items. Dairy production is normally linked with cropping, but nomadic pastoralists practice slight or no agriculture and roam the land in search of grazing grounds and water.

In Ethiopia, this system represents 30% of livestock population, also represent 50-60% of total area in Ethiopia. The system was characterized by poor land depends on rainfall pattern and have shortage of feed availability; so the milk production is low and highly seasonality dependent. Also, both the pastoralist and Agro-pastoral systems represent 98% of the national milk production and 75% of the commercial milk production (Tegegne et al., 2013). In both systems, the production is based totally on low input, with little milk yield, and lack of market orientation. The main sources of milk in these systems are native cattle, camels and goats, while the contribution of sheep is small.

In Pakistan, this system is especially important for small ruminant (goat and sheep) and less significant to the dairy animals (buffalo). In this system, animals depend on grazing in open grasslands or lands not
suitable for cropping. Only 8.7% of cattle and 6.3% of buffaloes in Pakistan completely raised on grazing and around 40.8% of grazing cattle and 49.3% of grazing buffaloes were kept in less than 10 animals/ herd.

3. Urban and peri-urban milk production system

This is a purely market-oriented production system placed within and closed to the borders of cities. Dairy producers in peri-urban areas get advantage from their closeness to markets, but their production is depend on bought inputs and may meet problems of feed supply and waste disposal. In last decades, a peri-urban dairy sector has developed very fast around the bigger cities of many developing countries, in response to enlarging market demand (Bernet et al., 2000). One of the disadvantages of urban farms threaten human health.

Abdel Aziz and Sadek (1999) found that in Egypt, the flying herds are concentrated around the big cities. In this system buffaloes are keeping and feeding intensively to produce high fat milk which sold directly to consumers. The buffaloes are purchased as a dairy and sold to slaughter after finishing lactation period. The stakeholders under this system selected the high yielders and subsequently loss these animals. Fahim (2009) found that landless buffalo production system was dominate in flying herds in Giza governorate. The author stated that in flying herds system most of producers sold milk to middlemen and some of herdsmen sold milk directly to consumers which achieved high profit.
4. Intensive dairy farming (Commercial farming system)

Abdel Aziz and Sadek (1999) recorded that commercial farms system provide about 25% of milk production in Egypt, which keep the pure dairy animals (mainly Holsteins). Using high technology for milking animal and feeding is practiced. The feeding system depends on good ingredients (maize, soybean, cotton seed cake, etc...) and mixed with green fodder or silage as TMR. The farms provide a good atmosphere for animals to achieve the target production.

Duncan et al. (2013) reported that dairy production systems in developing countries continue to intensify due to increasing inhabitant's density, scattering land and increasing demands for animal source foods.
MATERIALS AND METHODS

1. Area of study and sampling

Three different villages have been selected; ElEmam Malik is located 120 km north of Cairo (El-Beheira governorate), represents the newly reclaimed land and the other two villages are ElAtf and Reka villages that are located, respectively, at 50 and 80 km south of Cairo (Giza governorate), represents the old system in the Nile Valley (Figure 7). The objective of this part was to differentiate farmer categories according to their farming systems, their livestock orientations (meat or milk), their animal marketing systems and their localization regarding Cairo markets. In each village, around 21 farmers were selected according to their milk strategies; farmers who sell milk to private traders, milk collection units or keep milk for home consumption.

Fig. 7. Villages location in the Egypt map (ElEmam Malik, ElAtf and Reka). Source: GoogleEarth scale 189.77 km.
2. Data collection

A total number of 65 farmers in the three villages have been followed each season from winter 2013 to summer 2014. A small semi-structure questionnaire (Appendices) was developed to approach the farm structure (land and crop allocation, herd structure and composition, milk and veal marketing strategies). This questionnaire was applied during the three consecutive seasons (winter, spring and summer) to record the changes in crop allocation, herd composition and animal products marketing pathways.

3. Data analysis

A multiple factorial analysis (MFA) has been done using the 65 farmers that have been followed over the 3 consecutive seasons. Based on a multiple factorial analysis, a cluster analysis was applied using an ascendant hierarchical classification (Manly 1994). All calculations were performed using R software (R core team 2012) and the additional package ade4 (Thioulouse et al. 1997).

In order to understand the link between the functioning system of the family farms including the family, the crop land system, the livestock system and the integration of crop-livestock system and the animal marketing system (related to milk and meat products and the reasons), data were classified into 7 themes (Table 3). The functioning of the mixed crop-livestock system was approached by 3 themes of variables: 1) ‘family’: included the main structural variables related to family size, external labor, land size and cropping system; 2) ‘Herd’: included all variables related to the herd structure and composition by species for the
three seasons; and 3) ‘feed’: included all variables related to the feeding supplementation by season with corn, concentrates feed mixture, wheat bran and cotton seed cake that are the four main feedstuffs. Also, four other themes of variables were related to animal marketing orientation: 4) ‘Milkcons’: including all variables related to family consumption of milk and milk products like cheese, butter, and yogurt; 5) ‘Milksale’: including all variables related to marketing quantity of all milk and milk products like cheese, butter and yogurt; 6) “veal”: included all variables related to veal management practices like, suckling practice, age at weaning, veal slaughtering age and selling price; and 7) ‘reasons”: contain 3 variables related to the choice of operators in the markets and the preferences of milk or meat marketing. The percentage of milk consumed by calf was estimated by the number of udder quarters available for feeding calves; 4 quarters meaning that calf consumed 100% of milk, while one quarter means that calf consumed 25% of the dam's milk.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family size</strong></td>
<td></td>
</tr>
<tr>
<td>‘family’</td>
<td></td>
</tr>
<tr>
<td>Family size</td>
<td>No. of hectares rented by farmer</td>
</tr>
<tr>
<td>Occasional labor</td>
<td>Total cultivated area by farmer</td>
</tr>
<tr>
<td>Permanent labor</td>
<td>No. of hectares cultivated by forage crop</td>
</tr>
<tr>
<td>No. of hectares owned by</td>
<td></td>
</tr>
<tr>
<td>farmer</td>
<td></td>
</tr>
<tr>
<td><strong>Herd size</strong></td>
<td></td>
</tr>
<tr>
<td>‘herd’</td>
<td></td>
</tr>
<tr>
<td>No. of dairy animals in</td>
<td>No. of buffalo in winter, spring and summer</td>
</tr>
<tr>
<td>winter, spring and summer</td>
<td></td>
</tr>
<tr>
<td>per farmer</td>
<td></td>
</tr>
<tr>
<td>No. of dry animal in</td>
<td>No. of bovine in winter, spring and summer</td>
</tr>
<tr>
<td>winter, spring and summer</td>
<td></td>
</tr>
<tr>
<td>per farmer</td>
<td></td>
</tr>
<tr>
<td><strong>Feeding ‘feed’</strong></td>
<td></td>
</tr>
<tr>
<td>Quantity of CFM* in winter,</td>
<td>Quantity of wheat bran in winter, spring and summer</td>
</tr>
<tr>
<td>spring and summer kg/day</td>
<td></td>
</tr>
<tr>
<td>Quantity of corn in winter,</td>
<td>Quantity of cotton seed cake in winter, spring and summer</td>
</tr>
<tr>
<td>spring and summer kg/day</td>
<td></td>
</tr>
<tr>
<td>**Milk consumption ‘milkcons’</td>
<td></td>
</tr>
<tr>
<td>Buffalo milk production /</td>
<td>Bovine milk consumption / farmer family in winter, spring and summer</td>
</tr>
<tr>
<td>farmer in winter, spring</td>
<td></td>
</tr>
<tr>
<td>and summer kg/day</td>
<td></td>
</tr>
<tr>
<td>Cattle milk production /</td>
<td>Buffalo milk consumed by drinking / farmer family in winter, spring and</td>
</tr>
<tr>
<td>farmer in winter, spring</td>
<td></td>
</tr>
<tr>
<td>and summer kg/day</td>
<td></td>
</tr>
<tr>
<td>Buffalo milk consumption /</td>
<td></td>
</tr>
<tr>
<td>farmer family in winter,</td>
<td></td>
</tr>
<tr>
<td>spring and summer kg/day</td>
<td></td>
</tr>
<tr>
<td>**Milk sale ‘milksale’</td>
<td></td>
</tr>
<tr>
<td>Quantity of buffalo milk</td>
<td>Quantity of buffalo milk sold to trader kg/day</td>
</tr>
<tr>
<td>sold / farmer in winter,</td>
<td></td>
</tr>
<tr>
<td>spring and summer kg/day</td>
<td></td>
</tr>
<tr>
<td>Quantity of cattle milk sold</td>
<td>Quantity of cattle milk sold to collection point kg/day</td>
</tr>
<tr>
<td>/ farmer in winter, spring</td>
<td></td>
</tr>
<tr>
<td>and summer kg/day</td>
<td></td>
</tr>
<tr>
<td>Quantity of buffalo milk</td>
<td>Quantity of cattle milk sold to milk collection center kg/day</td>
</tr>
<tr>
<td>sold to collection point</td>
<td></td>
</tr>
<tr>
<td>kg/day</td>
<td></td>
</tr>
<tr>
<td>Quantity of buffalo milk</td>
<td>Quantity of cattle milk sold to neighbor kg/day</td>
</tr>
<tr>
<td>sold to milk collection</td>
<td></td>
</tr>
<tr>
<td>center kg/day</td>
<td></td>
</tr>
<tr>
<td>Quantity of buffalo milk</td>
<td>Quantity of cattle milk sold to trader kg/day</td>
</tr>
<tr>
<td>sold to neighbor kg/day</td>
<td></td>
</tr>
</tbody>
</table>

Cont.


Table 3. Continued

<table>
<thead>
<tr>
<th>Theme</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veal ‘veal’</td>
<td>Veal age through winter, spring and summer season</td>
</tr>
<tr>
<td></td>
<td>Proportion of veal through winter, spring and summer (first 10 day after birth)</td>
</tr>
<tr>
<td></td>
<td>Veal price through winter, spring and summer seasons</td>
</tr>
<tr>
<td></td>
<td>Proportion of milk consumed veal through winter, spring and summer (after first 10 day after birth)</td>
</tr>
<tr>
<td>Reason</td>
<td>The reason to deal with trader</td>
</tr>
<tr>
<td>‘reasons’</td>
<td>The reason to sell milk or keep it</td>
</tr>
<tr>
<td></td>
<td>The reason to keep veal or sold</td>
</tr>
</tbody>
</table>

*CFM= concentrate feed mixture.

The main interest of the MFA is to observe and analyze the links between the characteristics of the functioning and both of milk & veal marketing strategies.
RESULTS

1. Diversity of crop-livestock systems

a. Multiple factorial analyses

The first factorial plan shows that milk marketing strategies were mainly linked to herd size and family milk consumption and this explained the first axis of differentiation (23.2%) in Figure 8A. The second axis differentiates farmers according to veal management practices in link with marketing opinions of farmers (16.1%). Feed and family appear significant only on third axis of the factorial plan (Figure 8B).

![Factorial Analysis Output](image)

Fig. 8. Factorial analysis output, A: the relation between Dim 1 and Dim 2; B: the relation between Dim 1 and Dim 3.
The links among the themes illustrated the main characteristics of traditional farming systems in the irrigated zones. Supplemental feed system was mainly explained by the land and crop system; and there were some fluctuations for the small farmers due to the strong land constraints. The orientations of animal products marketing between self-consumption or selling milk products were linked to the herd size. At opposite, the strategies of veal marketing were more related to economic status.

b. Cluster analysis

Based on a hierarchical cluster analysis, four main groups and two very little groups were identified. Figure 9 shows the cluster projections on the first factorial plan (1*2) and table 4 presents the classification of farms in each cluster according to their location.

![Cluster Analysis Diagram](image)

Fig. 9. Clusters projection on the first factorial plan (1*2).
Table 4. Cluster group and number of farmers in each group.

<table>
<thead>
<tr>
<th>Cluster Groups</th>
<th>Large croppers</th>
<th>Large breeder</th>
<th>Micro CLS(^a) in old land</th>
<th>Small CLS in old land</th>
<th>Medium CLS in NRL(^b)</th>
<th>Small-medium CLS oriented cash crops</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group No.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Village:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elatf</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Reka</td>
<td>16</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>25</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>EIEmam Malik</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>6</td>
<td>21</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>1</td>
<td>25</td>
<td>8</td>
<td>18</td>
<td>11</td>
<td>65</td>
</tr>
</tbody>
</table>

\(^a\)CLS: crop/livestock system; \(^b\)NRL: Newly reclaimed land.

The three farmers belonging to the group 1 and 2 represent the profile of the largest scale with more than 2.5 hectares and 5-6 dairy animals. In order to reflect the diversity of farming systems and to understand milk/veal marketing strategies according to farm size, we have preferred to keep these 2 groups that contain only 3 farmers.

Groups 3 and 5 that gather more than 66% of farmers in our sample represent the contrasting situation in the two villages, Reka and ElAft, in the old lands (group 3) and the village of EIEmam Malik that reflected the situation in newly reclaimed lands (group 5). The main difference between these two types was the land access and crop cultivation that influenced the herd size. Group 4 could be considered as a variant of the type 3 with milk oriented strategies based on buffalo. The herd size around 4 buffaloes and more than 65% of the land was allocated to forage crops. Finally, group 6 (16.9%) is a farm type that oriented mainly on cash crops production instead of animal products. The main characteristics of these groups are presented in Table 5.
Table 5. Mean (±SE) of the main variables characterizing each cluster group (average of three seasons).

<table>
<thead>
<tr>
<th>Item</th>
<th>Large croppers</th>
<th>Large breeder</th>
<th>Micro CLS&lt;sup&gt;a&lt;/sup&gt; in old land</th>
<th>Small CLS in old land</th>
<th>Medium CLS in NRL&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Small-medium CLS oriented cash crops</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Family size (person)</td>
<td>10.5 (4.5)</td>
<td>7.0 (0.9)</td>
<td>7.9 (1.2)</td>
<td>10.4 (1.2)</td>
<td>9.8 (1.2)</td>
<td>7.5 (0.2)</td>
</tr>
<tr>
<td>Cultivated land (hectare)</td>
<td>3.6 (1.1)</td>
<td>2.9 (0.2)</td>
<td>0.6 (0.2)</td>
<td>0.9 (0.2)</td>
<td>2.3 (0.4)</td>
<td>1.0 (0.3)</td>
</tr>
<tr>
<td>Fodder area (% cultivated land)</td>
<td>38.4 (17.5)</td>
<td>60.4 (4.1)</td>
<td>46.9 (6.4)</td>
<td>64.3 (7.2)</td>
<td>29.7 (7.9)</td>
<td>35.4 (8.3)</td>
</tr>
<tr>
<td>Cereals area (% cultivated land)</td>
<td>33.0 (21.8)</td>
<td>30.1 (4.1)</td>
<td>28.7 (5.4)</td>
<td>23.7 (4.6)</td>
<td>20.8 (8.3)</td>
<td>24.9 (3.3)</td>
</tr>
<tr>
<td>Vegatables area (% cultivated land)</td>
<td>14.4 (13.5)</td>
<td>9.5 (5.0)</td>
<td>23.7 (3.2)</td>
<td>11.9 (7.2)</td>
<td>37.5 (7.3)</td>
<td>29.5 (7.3)</td>
</tr>
<tr>
<td>Owned land (% cultivated land)</td>
<td>100 (0)</td>
<td>100 (7.7)</td>
<td>26.1 (7.2)</td>
<td>40.6 (9.9)</td>
<td>54.0 (14.3)</td>
<td>42.6 (14.3)</td>
</tr>
<tr>
<td>Rented land (% cultivated land)</td>
<td>0 (0)</td>
<td>0 (38.5)</td>
<td>73.9 (30.7)</td>
<td>59.4 (42.0)</td>
<td>40.1 (47.3)</td>
<td>57.4 (47.3)</td>
</tr>
<tr>
<td>Landless (% in the sample)</td>
<td>0 (0)</td>
<td>0 (7.7)</td>
<td>73.9 (7.2)</td>
<td>59.4 (9.9)</td>
<td>40.1 (14.3)</td>
<td>57.4 (14.3)</td>
</tr>
<tr>
<td>Herd size (No. of heads)</td>
<td>17.0 (3.0)</td>
<td>32.0 (0.5)</td>
<td>2.2 (0.8)</td>
<td>5.7 (0.8)</td>
<td>5.4 (0.8)</td>
<td>2.8 (0.6)</td>
</tr>
<tr>
<td>Buffalo&lt;sup&gt;c&lt;/sup&gt; (No. of heads)</td>
<td>10.0 (1.7)</td>
<td>22.3 (0.4)</td>
<td>1.4 (0.4)</td>
<td>4.2 (0.4)</td>
<td>2.4 (0.4)</td>
<td>1.2 (0.2)</td>
</tr>
<tr>
<td>Cattle&lt;sup&gt;c&lt;/sup&gt; (No. of heads)</td>
<td>7.0 (3.8)</td>
<td>9.7 (0.4)</td>
<td>0.8 (0.6)</td>
<td>1.5 (0.9)</td>
<td>3.0 (0.9)</td>
<td>1.6 (0.6)</td>
</tr>
<tr>
<td>Lactating animals (No. of heads)</td>
<td>6.5 (0.8)</td>
<td>8.3 (0.2)</td>
<td>1.5 (0.4)</td>
<td>3.4 (0.4)</td>
<td>2.4 (0.4)</td>
<td>1.5 (0.3)</td>
</tr>
<tr>
<td>Dry animals (No. of heads)</td>
<td>3.0 (1.2)</td>
<td>3.5 (0.1)</td>
<td>1.4 (0.4)</td>
<td>2.0 (0.2)</td>
<td>1.3 (0.2)</td>
<td>1.3 (0.2) Conti.</td>
</tr>
<tr>
<td>Item</td>
<td>Cluster Group</td>
<td>Large croppers</td>
<td>Large breeder</td>
<td>Micro CLS&lt;sup&gt;a&lt;/sup&gt; in old land</td>
<td>Small CLS in old land</td>
<td>Medium CLS in NRL&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------</td>
<td>----------------</td>
<td>---------------</td>
<td>-----------------------------------</td>
<td>----------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Total feeding animal (kg/head/day)</td>
<td></td>
<td>4.3</td>
<td>5.2</td>
<td>4.9</td>
<td>4.8</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9</td>
<td>-</td>
<td>0.4</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>CFM&lt;sup&gt;d&lt;/sup&gt; (kg/head/day)</td>
<td></td>
<td>4.0</td>
<td>5.2</td>
<td>2.8</td>
<td>2.7</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1</td>
<td>0</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Corn (kg/head/day)</td>
<td></td>
<td>0</td>
<td>0</td>
<td>1.7</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2</td>
<td>0</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Wheat bran (kg/head/day)</td>
<td></td>
<td>0.5</td>
<td>0</td>
<td>2.1</td>
<td>1.8</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3</td>
<td>0</td>
<td>0.1</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Buffalo milk production (kg/day)</td>
<td></td>
<td>27.9</td>
<td>46.0</td>
<td>8.9</td>
<td>21.3</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.6</td>
<td>(1.4)</td>
<td>(2.3)</td>
<td>(1.2)</td>
<td>(0.8)</td>
</tr>
<tr>
<td>Buffalo milk production (kg/head)</td>
<td></td>
<td>6.2</td>
<td>9.2</td>
<td>6.7</td>
<td>7.4</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3</td>
<td>(0.3)</td>
<td>(0.2)</td>
<td>(0.4)</td>
<td>(0.6)</td>
</tr>
<tr>
<td>cattle milk production (kg/head)</td>
<td></td>
<td>12.3</td>
<td>30.7</td>
<td>5.2</td>
<td>6.9</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3</td>
<td>(0.5)</td>
<td>(0.8)</td>
<td>(0.6)</td>
<td>(0.4)</td>
</tr>
<tr>
<td>cattle milk production (kg/head)</td>
<td></td>
<td>5.0</td>
<td>6.3</td>
<td>4.2</td>
<td>5.9</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.6</td>
<td>(0.4)</td>
<td>(0.8)</td>
<td>(0.3)</td>
<td>(0.3)</td>
</tr>
<tr>
<td>% of buffalo milk sold</td>
<td></td>
<td>56.8</td>
<td>97.3</td>
<td>48.6</td>
<td>83.8</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40.2</td>
<td>(8.2)</td>
<td>(3.7)</td>
<td>(7.5)</td>
<td>(10.0)</td>
</tr>
<tr>
<td>% of cattle milk sold</td>
<td></td>
<td>71.3</td>
<td>98.4</td>
<td>88.0</td>
<td>53.1</td>
<td>44.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28.8</td>
<td>(8.6)</td>
<td>(11.9)</td>
<td>(10.2)</td>
<td>(5.8)</td>
</tr>
<tr>
<td>Veal marketing age (day)</td>
<td></td>
<td>0</td>
<td>0</td>
<td>41.2</td>
<td>37.0</td>
<td>41.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.3)</td>
<td>(1.6)</td>
<td>(0.7)</td>
</tr>
<tr>
<td>Proportion of milk consumption by calf (%)</td>
<td></td>
<td>75.0</td>
<td>50.0</td>
<td>94.0</td>
<td>86.2</td>
<td>82.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0</td>
<td>(2.7)</td>
<td>(3.4)</td>
<td>(4.1)</td>
<td>(2.5)</td>
</tr>
</tbody>
</table>

<sup>a</sup> CLS: Crop/Livestock System; <sup>b</sup> NRL: Newly Reclaimed Land; <sup>c</sup> Including all categories (dairy, dry, heifer, calf, fattening animals); <sup>d</sup> CFM: Concentrate Feed Mixture. Values between brackets = the standard error (SE).
Group 1 and 2 differed by their structural characteristics, notably the land ownerships (more than 2.5 hectares) and the herd size with 5-7 dairy animals. The cultivated forage area is used to cover part of the animal nutritional requirements. The green fodder was berseem (Egyptian clover) in winter and horse grass and/or corn fodder in summer for all farmers.

(1) Group 1: Large croppers (3%)

This group gathered the large family size (10.5 persons in average). Farmers owned the largest cultivated lands (3.6 hectares). The herd composed of around 10 buffalo heads and 7 cows on average. The forage crops were represented 38.4% of cultivated lands over the year. Farmers depend on CFM by 93% of total feeding.

Herds included 6-7 lactating animals and 3 dry animals through studied seasons. Around 50% of buffalo milk and 70% of cow's milk production were sold. The farmers kept calves for breeding or fattening and consumed or sold about 25% of milk production, while the rest milk consumed by calf.

(2) Group 2: Large breeder (1.5%)

This group included only one farmer, which characterized by a family size of 7 persons. This farmer cultivated around 2.9 hectare of his own land. Forage crops represent 60.4% of cultivated lands over the year. The areas cultivated with cereals and vegetables represent 30.1% and 9.5% of total lands. CFM account 100% of total animal feedstuffs.
The herd size was the largest (up to 32 heads) composed of 22 heads of buffalo and 10 heads of cows. Dairy herd contained 8-9 heads while dry animals were around 3-4 heads. More than 97% of produced milk are sold. Veal calves were raised and consumed 50% of dam milk production through suckling period.

(3) Group 3: Micro CLS in OLs (38%)

This group was characterized by medium family size (7-8 persons). The cultivated area was the smallest (0.6 hectare), where owned land represented only 26.1% of the cultivated lands and the rest was rented. Forage crops represented near half of cultivated lands, while the areas cultivated with cereals and vegetable accounted for 28.7% and 23.7% of total lands. Farmers used CFM <50% of total feed.

Herd size didn’t exceed 3 heads per farm, composed of 1-2 heads of buffaloes and one cow. Half of animals were lactating animals, where <50% of buffalo milk and 88% of cow's milk production were sold. Also, Farmers tended to sell veal calves at early stage of lactation (on average 41 days), and calf consumed about 94% of dam milk production through suckling period.

(4) Group 4: Small CLS in OLs (12%)

This group was characterized by large family size (10-11 persons) and considered as a subgroup of group 3 due to similarity of land size, proportion of rented land and feeding system. They had small cultivated lands (0.9 hectares) and the rented land accounted 59.4% of total lands. Forage crops area represented two third of the cultivated lands, contrary
to only 46.9% in group 3 and the other crops like cereals and vegetables accounted for 23.7% and 11.9% of total cultivated lands.

Herd size was about 5-6 heads with 4-5 buffalo heads and 1-2 cattle heads with a dairy herd counting 3-4 lactating animals and 2 dry animals. Farmers in this group tended to sell buffalo milk compared to cow milk (83.8% vs. 53.1% of total milk production). Veal are sold at 36-37 days old and at which the calf consumed around 85% of dam milk.

(5) Group 5: Medium CLS in NRL (28%)

This group was characterized by a large family size (9-10 persons). Cultivated around 2.3 ha owned land while some farmers extended cultivated lands through renting more lands (<50% of total lands). Forage crops represented around 30% of cultivated lands while the cereals and vegetables represented 20.8% and 37.5% of total lands. Farmers feeding animals with corn and wheat bran while CFM represent lower quantity (< 30% of total feeding).

Herd size was about 5-6 heads composed of 2-3 buffaloes and 3 cows, with 2-3 lactating and 1-2 dry animals. Farmers consumed the big quantity of the milk produced and sold only 12% and 44% of buffalo and cow milk, respectively. Farmers are sold veal with an average age of 41 days and the average milk consumption was 82% of dam milk.

(6) Group 6: Small-medium CLS oriented to cash crops (17%)

This group was characterized by a medium family size (7-8 persons). This group gathered farmers from North and South villages. In the North, they cultivated around 1.0 ha and in the south they rented
around 57.4% of total cultivated lands. Forage crops were about one third of total lands, cereals and vegetables represent around 25% and 30% of total lands.

Group 6 had a small herd size around 2-3 heads composed of 1-2 buffaloes and 1-2 cows, with 1.5 lactating animals. 23.6% and 59.7% of milk production from buffalo and cattle were sold. Farmers sold veal with an average age of 44-45 days which consumed 95% of dam milk.

This first description of dairy farming systems showed a large diversity of dairy orientation according to the location, the herd composition (buffalo or cattle) and the land constraint. These factors could be contributed to explain the diversity of milk production and valorization.

2. Milk seasonality and milk marketing

a. Milk production as affected by seasonality and species

The rate of buffalo calving increased in winter season and decreased in spring and increased again by the end of summer season (Figure 10). There was a similarity between cows and buffaloes in calving frequency pattern. Milk production was affected by season where the peak milk yield was registered in cold season and a fall in hot season (Lambertz et al., 2014).

Buffalo produced more milk in winter 7.3 kg/day/head compared to in spring that 6.5 kg/day/head and in summer that 5.2 kg/day/head. The same trend was found in most cluster groups, except in group 2 (large breeders, Table 6). Table 7 represent the cow milk production
which record the highest level in winter (7.7 kg/day/head), followed by summer (5.2 kg/day/head) and spring season (4.7 kg/day/head).

This trend was matched with results in Figure 10 where the high calving occurred in winter and summer season. Cluster groups represent the same trend except for small CLS in OLs (group 4) and small CLS oriented cash crops group (group 6) where cattle milk production decreased in summer.

**Fig. 10.** The proportion (%) of buffalo and cattle calving per each month.
Table 6. Daily milk production (kg) per lactating buffalo (Mean ± SE) for different cluster groups through winter, spring and summer seasons.

<table>
<thead>
<tr>
<th>Cluster groups</th>
<th>Group No.</th>
<th>Milk production (kg/head/day)</th>
<th>Winter ±</th>
<th>Spring ±</th>
<th>Summer ±</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large croppers</td>
<td>1</td>
<td>7.6</td>
<td>1.6</td>
<td>6.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Large breeder</td>
<td>2</td>
<td>9.5</td>
<td>--</td>
<td>11.4</td>
<td>--</td>
</tr>
<tr>
<td>Micro CLS(^a) in old land</td>
<td>3</td>
<td>7.7</td>
<td>0.4</td>
<td>6.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Small CLS in old land</td>
<td>4</td>
<td>7.4</td>
<td>0.4</td>
<td>7.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Medium CLS in NRL(^b)</td>
<td>5</td>
<td>6.4</td>
<td>0.5</td>
<td>5.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Small CLS oriented cash crops</td>
<td>6</td>
<td>6.7</td>
<td>0.6</td>
<td>6.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Over all mean</td>
<td></td>
<td>7.3</td>
<td>0.2</td>
<td>6.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

\(^a\) CLS: crop/livestock system; \(^b\) NRL: Newly reclaimed land.

Table 7. Daily milk production (kg) per lactating cow (Mean ± SE) for different cluster groups through winter, spring and summer seasons.

<table>
<thead>
<tr>
<th>Cluster groups</th>
<th>Group No.</th>
<th>Milk production (kg/head/day)</th>
<th>Winter ±</th>
<th>Spring ±</th>
<th>Summer ±</th>
</tr>
</thead>
<tbody>
<tr>
<td>large croppers</td>
<td>1</td>
<td>5.0</td>
<td>--</td>
<td>3.2</td>
<td>--</td>
</tr>
<tr>
<td>Large breeder</td>
<td>2</td>
<td>-- 2</td>
<td>--</td>
<td>3.0</td>
<td>--</td>
</tr>
<tr>
<td>Micro CLS(^a) in old land</td>
<td>3</td>
<td>5.0</td>
<td>--</td>
<td>3.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Small CLS in old land</td>
<td>4</td>
<td>6.5</td>
<td>1.7</td>
<td>6.5</td>
<td>--</td>
</tr>
<tr>
<td>Medium CLS in NRL(^a)</td>
<td>5</td>
<td>8.3</td>
<td>0.3</td>
<td>3.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Small CLS oriented cash crops</td>
<td>6</td>
<td>8.0</td>
<td>--</td>
<td>5.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Over all mean</td>
<td></td>
<td>7.7</td>
<td>0.4</td>
<td>4.7</td>
<td>0.4</td>
</tr>
</tbody>
</table>

\(^a\) CLS: crop/livestock system; \(^b\) NRL: Newly reclaimed land.

b. Milk marketing seasonality

Quantity of milk collected and sold in summer was lower than those in spring and winter. Table 8 shows that this trend is confirmed for all groups and the peak of selling buffalo milk was in spring after calving and suckling, and before the hot climate at summer (Figure 11). Amount of selling milk was decreased to <50% in summer for all cluster groups except small CLS in OLs group and large breeders group.

Figure 11 showed the different places of milk in the farming system between the OLs in the south and the new lands in the north.
Table 8. The quantity of buffalo milk sold (kg) per day in each cluster groups through winter, spring and summer seasons.

<table>
<thead>
<tr>
<th>Season</th>
<th>Large croppers</th>
<th>Large breeder</th>
<th>Micro CLS(^a) in old land</th>
<th>Small CLS in old land</th>
<th>Medium CLS in NRL(^a)</th>
<th>Small-medium CLS oriented cash crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>36</td>
<td>37</td>
<td>67.5</td>
<td>142</td>
<td>--</td>
<td>7</td>
</tr>
<tr>
<td>Spring</td>
<td>59.5</td>
<td>79.5</td>
<td>63</td>
<td>167.8</td>
<td>46.5</td>
<td>12</td>
</tr>
<tr>
<td>Summer</td>
<td>17.5</td>
<td>19</td>
<td>15</td>
<td>65.3</td>
<td>18.5</td>
<td>--</td>
</tr>
</tbody>
</table>

\(^a\)CLS: crop/livestock system; \(^b\)NRL: Newly reclaimed land.

Fig. 11. The percentage of buffalo milk sold per production for each cluster groups (1: large croppers, 2: large breeder, 3: micro CLS in OLs, 4: small CLS in OLs, 5: medium CLS in NRL, and 6: Small CLS oriented cash crops) per season (winter, spring and summer).
3. Different marketing strategies of milk according to different farming systems

a. Internal and external factors of milk marketing strategies

Quantity of fresh milk available in the markets varies in function of farmers’ tradition and endogenous knowledge. Data collected confirmed that during cold temperature, milk is usually processed in cheese and butter during winter and stored for the whole year especially in small scale farms. (Figure 12).

In NRLs, milk traders deal frequently with cheese processing units didn't valorize well the buffalo milk compared to cow milk with lower fat %; so farmers prefer to sell cow's milk and keep buffalo milk for family consumption and/or for consumers in the village (short chain). This explains partially the decrease of the buffalo population in these NRLs. In Reka village, the activity of one milk collection center changed the milk valorization at the family level; now skimmed milk is collected with reasonable price and women keep the cream to produce butter and cheese for the family or village market. Milk traders are the common buyers of fresh milk for both in ElAtf and ElEmam Malik villages, while in Reka, MCPs and MCC are common. However, local market and neighborhood are considered as a good outlet with a good valorization.

b. Veal and milk marketing strategies

Figure 13 show that farmer's behavior tend to sell more veal in summer (87%) than in winter and spring (73%) as a strategy to save milk for human demand. Moreover, the selling percentage increased in summer season because the shortage of buffalo milk.
Fig. 12. Percentage of buffalo and cattle milk sold per cluster groups (1: large croppers, 2: large breeder, 3: micro CLS in OLs, 4: small CLS in OLs, 5: medium CLS in NRL, and 6: Small CLS oriented cash crops).

Raising veal could be viewed as a competitor with milk marketing due to the milk consumption by calves during the more productive seasons like winter and at the beginning of spring. This clearly appeared in the traditional mixed crop-livestock systems representing in the groups 3 to 6 where the milk consumed by the veal represented around 80 to 95% of milk production. In the medium dairy farms representing in groups 1 and 2, farmers keep the veal.
Fig. 13. The proportion of farmers sold veal vs. who keep veal in three seasons.

So, we can see clearly that farmers' practices regarding suckling calves and/or storing cheese and butter affect directly the availability of milk in the markets through the year.
DISCUSSION

The factorial analysis shows clearly the dominance of the mixed crop-livestock systems in the old lands (Nile Valley) and in the new reclaimed lands in the west Delta. This system is based on the allocation of lands between fodder and food crops; green fodder (Clover, horse grass and corn) and grain (corn) are the main components of the feed ration of the herd, plus crop residues from food and cash crops. Wheat bran as industrial byproduct is intensively used in new and old lands because it's reasonable price and its larger volume of the same unit weight of other alternatives like grains.

Manure is directly applied to the land; and veal value used to finance annual expenses like rent land or animal investment.

However, it is clearly observed a regional diversity between old land and new reclaimed land due to the land access. The traditional CLs in the old lands don’t exceed 1 ha, while the majority of graduates who have benefited of land in the NRL get around 2.28 ha. So the animal charge per ha is between 3 and 11 animal by ha in old lands, compared to 2-3 animals/ha in the NRL. These variations will affect the needs of each group and each region for services and development projects. Newly reclaimed land may need a balance services for both livestock and other agriculture activities. Old land needs more low cost services to be sustained and very tight vaccination and bio security programs to protect the main source of income and the main protein source for families.
More studies are needed to identify the optimum animal units load per hectare in both new and old lands to sustain different production systems that surrounded with different circumstances. The second criterion of differentiation is the herd composition between buffalo and crossbred cattle. In old land, farmers tended to rear more buffaloes for milk that is well valorized on the market, compared to farmers in new reclaimed land that they prefer raising crossbred cattle because buffalo milk is not well valorized on the local market. Also, the significant forage production of old land encouraged farmers to supply buffalo with sufficient nutrients to produce milk with high fat and protein percent that has high value and less quantity compared to crossbred cow. For the two villages of old lands, this can be explained by the proximity of Cairo where buffalo milk can be sold by 7-8 EGP/liter in 2014, while milk traders acting in the village of the NRL sold traditionally cow milk to a cheese processing units with lower price. Another criterion of differentiation is the crop allocation between fodder crops, cereal crops, vegetables and trees that depends on the size of cultivated area and cash crop orientation.

Many farmers in new land tended to increase the number of livestock especially cattle to deal with the high fluctuation of vegetables and fruits price in the local market, also to provide daily income and high quality organic fertilizer for land which will decrease the need for buying more chemical fertilizers.

Most of buffalo breeders sold young calves (veal) to save milk and to get a quick source of money. Cattle breeders, mainly breeders of
Baladi (native) cattle, prefer to valorize the veal. Sometimes, certain use the crossbred or Baladi cows is to suckle buffalo veal, which will decrease the cost of rearing buffalo calves and increasing the revenues of selling more buffalo milk. The marketing decision between veal and milk can vary from one year to another according to family needs. For land renters they usually rear and sell their calves to cover the cost of renting land. More generally, most of them were depending on milk as family food and as a daily cash income (Ngongoni et al., 2006).

One common characteristic for milk selling strategy is marketing seasonality, where the peak of milk marketing was spring for all groups and this in link with the calving and suckling periods in winter and the reduction of milk production in summer due to hot temperatures; where less availability of forage quality and quantity and most lactating animals at the end of lactation or started to be dried. Moreover, winter season corresponds to the period of transformation of milk in butter and cheese to cover the family needs along the year.

Two types of dairy chains could be identified: the first one is the very short chain where farmers sold directly to consumers; the second one is medium chain where farmers sold milk to middle men who will sell to cheese processing units, retailers like dairy shops or consumers. In 13/2014, the highest milk price was observed when farmer sold directly to consumer in a very short dairy chain.

There are many financial and institutional constraints that affect the sustainability of these crop-livestock systems. Financial constraints like no loans especially for farmers as an aid to rent the lands. Selling
veal is one strategy to deal with financial constraint; farmers tended to sell veal to earn money to cover part of land rent cost. Instead of selling veal that could be kept as a capital source to cope with financial crisis. Moreover, this study showed that most farmers in Nile Valley cultivated land mainly with forage to feed livestock, so high quality forage seeds should be introduced by cooperatives to cover both quality and quantity nutritional gap of dairy cattle.

There is a gap of energy in winter, where the main forage is Egyptian clover, while protein supplement or legume forage is needed to cover the protein gap in summer. Also, most farmers are not adding minerals and vitamins for cattle. Fertility management and AI programs should be conducted in winter and spring seasons, where most dairy cattle are inseminated at these seasons. Vaccination programs for dry cows and buffaloes should be introduced in summer where most cattle are dry. Feeding extension services for transition cattle should be introduced by the beginning of winter, where most cattle calved at this time. Women training for milk processing should be introduced in winter where most of milk processed. It is very vital for dairy farming sustainability to introduce new economic activities such as poultry raising, traditional food processing or some simple home made goods especially in summer, where no or low income of dairy enterprise available.
Part III: SWOT analysis of traditional skimmed milk chain

INTRODUCTION

A supply chain is a network of retailers, distributors, transporters, storage facilities and suppliers involved in the production, transportation and marketing of a specific product (Bacarin et al., 2004). Webber and Labaste (2010) reported that value chain approach is used to guide and to enhance impacts of sustainable initiatives focused on improving productivity, competitiveness, entrepreneurship, and the growth of small and medium enterprises. In the dairy chain, milk collection center (MCC) is a “logistic” link between farmers and processing industrials (Demirbas et al., 2009). Also, MCCs play intermediary roles for smallholder farmers to enable them to enter the commercial selling of milk through the processors and to get market access. Also, MCCs were very important intermediaries to control milk quality and to guarantee food safety (Sayin et al., 2011).

Skimmed is a term that describes the milk after remove most of fat, which less than 0.5 % (Black, 2009).

A SWOT analysis is a term that used to describe a tool that is effective in identify Strengths and Weaknesses, and for examining the Opportunities and Threats that face. SWOT Analysis (one of many possible strategic planning tools) is used to assess the Strengths, Weakness, Opportunities and Threats involved in a project, or any other situation requiring a decision (Hay and Castilla, 2006).
In Egypt, cheese is an important component of the daily Egyptian meals (Todaro et al., 2013), which mainly made from skimmed milk. Karish cheese (is a popular Egyptian cheese (white cheese) made from buffalo or mixed buffalo and cattle skimmed milk). Cheese yield is around 20-30 %, also, it is the most popular cheese in Egypt, especially in rural zones, and it is produced from buffalo or cattle or mixed skimmed milk (Awad et al., 2014). Egypt is the largest cheese producer in the Middle East and it is ranked the sixth on the world with a production of 720,000 tons in 2012. This production is expected to reach 980,000 tons in 2020 (Mikkelsen, 2014). The cheese consumption in Egypt was about 7 kg/capita/year (Rome, 2006).

However, there is a shortage in the data about skimmed milk chain in Egypt. The objectives of this part were: monitoring the dynamic of traditional skimmed milk chains around greater Cairo and applying SWOT analysis of this unique sector to propose recommendations for policy makers and even researchers to improve the whole dairy production system. This analysis was based on the supply chain approach that gives us the framework for identification and characterization of the actors involved in this value supply chain.
REVIEW OF LITERATURE

In Egypt dairy industry plays important role in Egyptian agriculture. Milk production has provided approximately one third of the total agricultural gross income (Hofi, 2011). Also, dairy sector is considered as a cornerstone of Egyptian industry and take a worthy place in food supply. Dairy is the only product that provides a daily income for farmers (OECD-FAO, 2014).

1. Traditional dairy sector

In Ethiopia, milk and dairy products to consumers are through both formal and informal dairy marketing systems. Bandara (2001) found that in Sri Lanka milk collecting organizations and private milk collectors play an important role in the formal milk collection network; while small scale processors, restaurants, hotels, cafeterias, neighboring consumers etc. were dominated in the informal milk market. Also, the increased domestic milk production has not been reflected in the formal milk market and most of the growth in the domestic production has gone to the informal milk market.

In terms of marketing, 71 % of the producers sell milk directly to consumers (Redda, 2001). Ahmed et al. (2004) found that about 73 % of the total urban milk production was sold, 10 % was left for household consumption, 9.4 % for calves feeding and 7.6 % was processed into butter and cheese.

The traditional system is mainly depends on smallholders in Egypt, that main part of milk goes directly to family consumption and
the surplus was sold in market. Milk consumed as fresh milk and big part processed into cheese and butter for home consumption and the rest was sold. Local or village markets was common under the traditional system, while the consumers or /and mediators bought from farmers directly. On the other hand, the commercial system sold milk directly to dairy plans (Abdel Aziz and Sadek, 1999).

Cheese is an important component of the daily Egyptian meals (Todaro et al., 2013). Karish cheese is one of the most popular traditional cheese and the oldest type is consumed in Egypt (Abou Donia, 2008). Karish cheese is produced from skimmed milk of buffalo or cow milk or both of them especially in rural zones (Todaro et al., 2013 and Awad et al., 2014). Karish cheese yield around 20-30 % of the milk amount used (Awad et al., 2014). Egypt is the largest cheese producer in the Middle East and it is ranked the sixth in the world with a production of 720 thousand tons in 2012. This production is expected to reach 980 thousand tons in 2020 (Mikkelsen, 2014). The cheese consumption in Egypt was about 7 kg/capita/year (Rome, 2006). Growing of Karish demand by Egyptian consumers is due to its high protein content and low price (Osman et al., 2010). Furthermore, Karish cheese is a promising food in the prevention of health problems linked to fat, recommended for elder people (Todaro et al., 2013).

2. The main challenges faced traditional dairy chain

In Ethiopia, Tassew and Seifu (2009) and Seifu and Doluschitz (2014) reported that dairy smallholders meet numerous limitations such as shortage of milk quality control, low milk production, insufficient
skilled/trained staff, difficulty to land access, high feed cost, poor genetic merits of native animals, shortage of farm labors, animal diseases, lack of artificial insemination services, scarcity of milk processing plants, insufficiency of cooling & storage facilities, absence of dairy cooperatives, lack of milk collection centers and lack of authoritative information, up-to-date and regular information.

Mhone et al. (2011) reported that in Zimbabwe the dairy farms were faced several challenges that include lack of resources for improving management and milking hygiene, and for controlling livestock diseases. Also, due to the low profitability each farmer has limited investment for enhancement of milking hygiene, proper storage and processing of milk. Furthermore, in Zimbabwe, Chatikobo et al. (2013) mentioned that the common constraints included lack of feeding and water, high diseases prevalence and lack of veterinary extension and services.

Al-Atiyat (2014) investigated that in Jordan, the small dairy sector have some constraints that lead to delayed improving this sector such as, no logistic support of disease control and sustainable veterinary services, no regulations for animal health, lack of recording system, low milk quality, shortage of technical knowledge (Know-How), no pricing policy but more monopolization, no support of marketing or trading products, poor hygienic measures and high cost of technology (including cost of training, implementation & sustainability).

at first calving, and high production cost due to low milk to concentrate ratio. In Bangladesh, the main constraints faced dairy cattle production were poor feed quality, poor management practices, lack of veterinary care and disorganized marketing systems. In addition, there is a lack of institutional support, research and training (Rangnekar and Thorpe, 2001).

Markelova et al. (2009) reported that in developing countries, it is difficult for smallholders in rural area to access and compete in the market. Also, cooperatives were inefficient enough to help smallholders.

In Egypt, Abdel Aziz and Sadek (1999) found that the milk production through smallholders faced many constrains such as; lack of veterinary service, AI services, extension services and animal insurance. Also, the local breeds suffering from poor genetic improvement (low productivity and low reproductive efficiency). Moreover, no direct connections through milk chain. Daburon et al. (2014) found that the small dairy farming system in Egypt, especially buffalo were facing many constraints such as high cost of agricultural inputs, land pressure and low availability of agricultural land. Also, Hofi (2001) reported that bad milking practices at farm level is one of the challenges that faced traditional dairy chain in Egypt, where farmers did not care about washing the udder before milking, avoid milk from animals that take treatment (antibiotic) and atmosphere of milking that adversely influence milk quality and safety consequently human health hazard.

Food quality and safety have become an important topic in the Agri-food sector (Grunert, 2005 and Curzi et al., 2015). Food safety can
be defined as the opposite of food risk, i.e. as the probability of not contracting a disease as a consequence of consuming a certain food (Grunert, 2005).

**Total viable bacterial count (TVBC)**

World's loss is about 25% of food along the chain was due to microbial activities that led to a global economic problem as reported by Losito *et al.* (2014) and Kuma *et al.* (2015). Milk is a good media for microorganisms multiplication especially buffalo milk due to its high nutritional value (Fagiolo and Lai, 2007; Han *et al.*, 2007 and Hashmi and Saleem 2015).

Count of microorganisms is used as indicator of milk handling from production till consumption and the quality of milk (Deepika *et al.*, 2015). Milk can be easily contaminated and spoiled when it is produced under non-hygienic environment (Hashmi and Saleem 2015). Clinical or sub-clinical mastitis and/or environmental contaminations taking into account at different steps of the milk chain are considered as the main sources of milk contaminations (Cortesi and Murru, 2007). Also, the authors reported that the total bacterial count of buffalo milk at 30°C should not exceed 500,000 cell/ml.

Park and Haenlein (2006) reported that the total bacterial count is one of the important indicators for microbial status and safety in the milk. Also, they found, that the bacterial count was increased in warm months. Moreover, the total viable bacterial count (TVBC) in raw buffalo milk in Cairo was ranged from $10^3$ to $10^8$/ml in summer season.
Doyle et al. (2015) found that TBC in raw milk was higher in milk shops than that in MCCs than that in milk transporters (0.98 * 10^7, 0.15 * 10^7 and 0.93 * 10^6 CFU/ml, respectively). The authors also concluded that the increases in TBC which observed along the value chain may be due to several factors, such as contamination on the farm, storage and transport in unclean milk utensils, and lack of controlling temperature along transportation.

3. The main opportunities of traditional dairy chain

In Ethiopia, Seifu and Doluschitz (2014) found that the opportunities of dairy sector were attractive milk price and cheap farm labor, high demand for traditional milk with low competitors in the dairy chain.

Hemme and Otte (2010) reported that the strengths of smallholder dairy systems are low input costs; high outputs; low liabilities; low risk; and flexibility to increasing feed prices strengths that enable smallholders to attend as a competitive source of milk supply. The major opportunities for smallholder dairy production sector are growing demand for dairy products in developing countries; probable milk price increase; potential to increase milk yields through relatively few supplementary inputs; potential to increase dairy labor productivity; and employment generation in the dairy value chain.

In India, the main strengths of dairy farm sector were directly increasing crop production by making available draught power, manure and cash income on day-today basis. Also, provide employment to rural population mainly women, Regular income to the farmer, usage of crop
residues and by-products to feed animals, appropriate to the mixed farming system, (Gupta, 2007).

4. Recommendations for improving dairy sector in developing countries

Hahlani and Garwi (2014) observed that the Zimbabwean government has been of the view that developing smallholder dairy farming system will not only improve the availability of milk and its products to the country, but will also improve the standards of living for the rural communities. Moreover, recognized that dairy development is not only important for nutrition, but can also lead to the social and economic improvement of smallholder families.

Belli et al. (2013) recommended that introducing training programs for farmers becomes necessary to improve hygienic level of traditional milking. A specific effort should be made to increase the awareness of farmers about the significant effects of microbial contamination of milk on dairy yield and on safety and durability of dairy products. These training programs need some good practices such as, identifying a clean milking area, avoiding calf suckling during milking operations, tying the tail, cleaning the udder (washing and drying) and washing of hand's of milker, removing the first milk outflows (stripping), cleaning the containers and decreasing the time between milk collection and delivery. The use of hygienic milking procedures and hygienic storage are of utmost importance in reducing the levels of contamination of milk by microorganisms.
Improving productivity of dairy animals is crucial for increased output and family welfare, this achieved through improving management in terms of feeding, breeding and disease control as reported by Urassa and Raphael (2004). Also, the authors suggested that establish co-operative unions to collect milk with reasonable price (establish milk collection centers), provide feed supplementation, drugs, extension services, loans or credits to support smallholders, establish processing plants and cold rooms in milk collection centers towards modernization of production and marketing, and provide a good heifers with a good husbandry training.

Rathod et al. (2011) reported that establishment of co-operatives will help the smallholders through improving or facilitating access to market information, reduce costs of marketing and can increase producers’ access to technology, extension and related services, and thereby enhance efficiency in the process of production and marketing of dairy. Also, dairy marketing co-operatives can help to decrease transaction costs and price risks, and enhance negotiating power of dairy producers.

Training programs for farmers on good milk practices will lead to improve the milk quantity and quality, for instance; Ng et al. (2010) in Nepal found that the dairy animal of small farmers suffering from mastitis disease that led to high loss, but when training programs were applied for farmers, the rate of mastitis disease was decreased.

Bebe et al. (2003) reported that smallholders production system in developing countries recommended to use small dairy breed frame
size (Guernsey and Jersey); because the large breed frame size (Holstein and Ayrshire) need high nutritional demand, poor adaptation, low productive efficiency under this system.

In Egypt, Abdel Aziz and Sadek (1999) recommend that to improve milk production through stimulate private sector investment, strengthen existing service systems, set well-defined breeding policy, improve supervision and control on private dairy processing units and establish the Egyptian dairy federation.
MATERIALS AND METHODS

Our case study focused on the dynamic of one MCC specialized in skimmed milk collection. This study was carried out in Reka village located at the south of Giza governorate, the border of Beni Suef governorate. The MCC in Reka village is one of the main hubs of skimmed milk in Greater Cairo with a capacity of around 20 ton/day. This study started in March 2013 till August 2015. A total number of 21 farmers, 8 milk collection points (MCPs) owners, one milk collection center (MCC) owner and 4 milk processing units (MPUs) owners were visited regularly and the interviews were based on semi-structure questionnaires (Appendices). Also, MCC skimmed milk records from 2013 to 2015 were collected and registered. The GPS check points for each point of the value chain were collected and used to draw maps by Arc GIS software (Arc Map 10.2.2). The data of the international prices of skimmed powder from 2010 to 2015 were collected through Global Dairy Trade Holdings Limited (2015).

The analysis of milk marketing strategies (selling buffalo milk, selling skimmed milk plus butter and selling Karich cheese plus butter) were based on the primary data collected from a farm follow up from winter 2013 till summer 2014. This follow-up included data regarding quantity of daily milk, milk marketing quantity and prices of fresh milk and dairy products (like skimmed milk, Karish cheese and butter). The technical coefficient that used to estimate the receipt from each milk marketing strategies were the average percentage of skimmed milk that produced from whole milk around 74.5%, the average percentage of
karish cheese produce from skimmed milk around 24% and average of butter produce from buffalo milk around 12 %. Return percentage of price for buffalo milk, cattle milk and skimmed milk was calculated on data records that collected from 1994 to 2015 at MCC level using this formula:

\[
\text{Return} \% = \frac{\text{selling price} - \text{purchasing price}}{\text{purchasing price}} \times 100.
\]

Complementary milk quality tests in terms of total bacterial count analysis were applied for milk samples (50 ml) that have been collected from 15 farmers per village in 16 villages which supplied the MCC and from 3 tanks (stored skimmed) located at the MCC, to count the total bacterial count at months of January, May and August, 2015. These three periods represent the three main seasons: winter, spring and summer. This analysis was applied to judge the hygienic conditions at farm level, at village level and through transportation to the MCC. The test was carried out in Microbiology Research Lab at Cairo University Research Park (CURP) Faculty of Agriculture, Cairo University, Giza, Egypt. Simple descriptive statistics analysis were conducted at farm level, village level and processing level. The employment created by skimmed milk value chain has been estimated on the quantity of skimmed milk collected divided by the total number of labors and owners per each MCPs and MCC through three seasons (winter, spring and summer).

All the qualitative and quantitative data collected during the follow up and interviews along the chain have been used to apply SWOT analysis. SWOT analysis principles starts with defining current situations (pro SWOT) followed by analysis of external environment to
define the opportunities and threats, then analysis of internal environment to define the strengths and weaknesses (Bernroider, 2002). The results of SWOT analysis is usually used to elaborate the recommendations. The diagnostic of the current situation and the identification of the variables of the external and internal environment were based on the value chain approach.
RESULTS

1. Main actors along the skimmed milk value chain

The identification of the main actors along the chain and the links among them are considered as the basic step for the value chain approach. The main actors along the chain are shown in Figure 14. This approach allows representing the links between the different actors and the role of milk collection points in scattered villages and the central milk collection as a main hub for milk collection. In this value chain, the MCC is like a transition point for all milk collected to cool milk and to reload it again for milk processing units.

Fig. 14. Map of skimmed milk chain.
a. Farmers

The smallholders’ type dominated in this area is based on crop-livestock system with local buffaloes and crossbred cattle. All characteristics of this system are presented in (Table 9).

Table 9. Mean (±SE) and Coefficient of Variability (%) of the studied characteristics of crop/ livestock farming system.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>SE</th>
<th>C.V</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family size</td>
<td>7.2</td>
<td>0.6</td>
<td>35.8</td>
<td>4.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Total farm size (hectare)</td>
<td>0.6</td>
<td>0.2</td>
<td>135.3</td>
<td>0.1</td>
<td>4.0</td>
</tr>
<tr>
<td>Cultivated area by forage (hectare)</td>
<td>0.3</td>
<td>0.04</td>
<td>79.3</td>
<td>0.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Owned land (%)</td>
<td>23.9</td>
<td>7.8</td>
<td>149.7</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Rented land (%)</td>
<td>76.1</td>
<td>7.8</td>
<td>46.6</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Forage land (%)</td>
<td>57.0</td>
<td>5.6</td>
<td>44.8</td>
<td>17.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Cereal land (%)</td>
<td>19.2</td>
<td>4.9</td>
<td>114.9</td>
<td>0.0</td>
<td>54.5</td>
</tr>
<tr>
<td>Vegetables land (%)</td>
<td>23.8</td>
<td>5.6</td>
<td>108.0</td>
<td>0.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Herd size (heads)</td>
<td>3.1</td>
<td>0.6</td>
<td>92.6</td>
<td>1.0</td>
<td>13</td>
</tr>
<tr>
<td>Lactating animal (heads)</td>
<td>2.0</td>
<td>0.3</td>
<td>67.3</td>
<td>1.0</td>
<td>5.7</td>
</tr>
<tr>
<td>Milk production (kg/farmer/day)</td>
<td>8.9</td>
<td>1.2</td>
<td>63.4</td>
<td>4.0</td>
<td>25.5</td>
</tr>
<tr>
<td>Proportion of milk consumed as fresh from production %</td>
<td>9.1</td>
<td>0.9</td>
<td>47.0</td>
<td>0.0</td>
<td>15.4</td>
</tr>
<tr>
<td>Veal age at selling (day)</td>
<td>38.0</td>
<td>1.9</td>
<td>22.7</td>
<td>25</td>
<td>80</td>
</tr>
</tbody>
</table>

SE: Standard Error, C.V: Coefficient of Variability.

Farmers had different strategies for milk marketing as presented in Figure 15. They have a possibility for selling the whole buffalo milk by 4.5 EGP/liter or skim Milk process to get skimmed milk and cream. Cream is used to produce butter that can be sold by around 45 EGP/kg. Skimmed milk can be used to produce karish cheese that will be sold by 6 EGP/kg. Skimmed milk could be sold to MCC by 1.25 EGP/liter.
In Figure 16, we have estimated the milk receipt for the different strategies per day per farmer (based on average 8.9 liter/day/farmer). Selling whole milk generates lower income compared to selling skimmed milk plus butter or selling Karish cheese and butter (149 and 153 % of income relative to sale whole milk, respectively). The third scenario needs a lot of efforts to process cheese and the marketing is highly risky due to technical and economic reasons like high fluctuation of cheese price and demand that lead to irregular income.
b. Milk collection points

MCPs basically belong to MCC. The MCPs have milk separators to produce milk fat and skimmed milk. The majority of owners of the MCPs are women. After milking animals, women goes to MCPs to get the cream and skimmed milk which is used to produce butterfat and Karish cheese. The cost of separation is 2-3 EGP/ head/week.

The first MCP has started dealing with the MCC since 15 years ago. Now, 239 MCPs distributed in 16 villages deal with the MCC of Reka village. Table 10 shows the number of MCPs and number of farmers and Table 11 showed the quantity of skimmed milk collected per each village through the three seasons in 2015. The highest number of MCPs was registered in Qmn Elaros village with 46 MCPs that collected 22,461 liter/week from 633 farmers. At the opposite, Ezbet Shiha village had only 1 MCP which collected about 709 liter/week from 24 farmers.
The peak of milk collection was done in spring (38% of annual collection); followed by summer season (33%). The lowest amount of skimmed milk was registered in winter season (29%) as shown in Table 11.

c. Milk collection center (MCC)

The Reka MCC dealt with around 3381 farmers through MCPs in 2015. The MCPs sent weekly records that were checked by the MCC. In return the MCC paid directly to farmers through MCPs. The price of one liter skimmed milk was ranged 1.10 - 1.40 EGP for the farmers through the studying period.

The MCC sent its laborers (permanent workers without contract) twice a day to collect the skimmed milk by vehicles. The collectors measured the specific gravity for each MCP by Lactometer, and then the MCC sold the skimmed milk by 1.60-2.20 EGP/liter according to the outlets distance and quantity. Sometimes, the MCC got extra quantity of skimmed milk from other traders, especially when the demand increased and this in order to keep strong relationships with all available outlets. Social network plays an important role in this chain.
<table>
<thead>
<tr>
<th>Village</th>
<th>Winter</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. MCPs</td>
<td>No. farmers</td>
<td>No. MCPs</td>
<td>No. farmers</td>
<td>No. MCPs</td>
<td>No. farmers</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Abu-Ghazaleh</td>
<td>8</td>
<td>87</td>
<td>9</td>
<td>87</td>
<td>7</td>
<td>74</td>
<td>8</td>
<td>0.6</td>
<td>83</td>
<td>4.3</td>
</tr>
<tr>
<td>Atwab</td>
<td>14</td>
<td>206</td>
<td>15</td>
<td>244</td>
<td>16</td>
<td>248</td>
<td>15</td>
<td>0.6</td>
<td>233</td>
<td>13.4</td>
</tr>
<tr>
<td>Al Jazeera</td>
<td>14</td>
<td>131</td>
<td>15</td>
<td>146</td>
<td>15</td>
<td>177</td>
<td>15</td>
<td>0.3</td>
<td>151</td>
<td>13.6</td>
</tr>
<tr>
<td>El-Atf</td>
<td>2</td>
<td>16</td>
<td>2</td>
<td>25</td>
<td>2</td>
<td>43</td>
<td>2</td>
<td>0.0</td>
<td>28</td>
<td>7.9</td>
</tr>
<tr>
<td>El-Nagha</td>
<td>7</td>
<td>84</td>
<td>3</td>
<td>46</td>
<td>5</td>
<td>77</td>
<td>5</td>
<td>1.0</td>
<td>69</td>
<td>11.7</td>
</tr>
<tr>
<td>Bane Haded</td>
<td>8</td>
<td>149</td>
<td>9</td>
<td>195</td>
<td>8</td>
<td>204</td>
<td>8</td>
<td>0.3</td>
<td>183</td>
<td>17.0</td>
</tr>
<tr>
<td>Deraga</td>
<td>6</td>
<td>54</td>
<td>7</td>
<td>86</td>
<td>10</td>
<td>206</td>
<td>8</td>
<td>1.2</td>
<td>115</td>
<td>46.2</td>
</tr>
<tr>
<td>Saad El-Den</td>
<td>11</td>
<td>263</td>
<td>14</td>
<td>275</td>
<td>15</td>
<td>230</td>
<td>13</td>
<td>1.2</td>
<td>256</td>
<td>13.5</td>
</tr>
<tr>
<td>Saft MIDOM</td>
<td>17</td>
<td>182</td>
<td>19</td>
<td>189</td>
<td>18</td>
<td>178</td>
<td>18</td>
<td>0.6</td>
<td>183</td>
<td>3.2</td>
</tr>
<tr>
<td>Midom</td>
<td>31</td>
<td>273</td>
<td>35</td>
<td>310</td>
<td>33</td>
<td>298</td>
<td>33</td>
<td>1.2</td>
<td>294</td>
<td>10.9</td>
</tr>
<tr>
<td>Ezbet Shiha</td>
<td>1</td>
<td>18</td>
<td>1</td>
<td>32</td>
<td>1</td>
<td>23</td>
<td>1</td>
<td>0.0</td>
<td>24</td>
<td>4.1</td>
</tr>
<tr>
<td>Qmn Aros</td>
<td>42</td>
<td>509</td>
<td>48</td>
<td>621</td>
<td>47</td>
<td>769</td>
<td>46</td>
<td>1.8</td>
<td>633</td>
<td>75.3</td>
</tr>
<tr>
<td>Azab</td>
<td>10</td>
<td>144</td>
<td>13</td>
<td>202</td>
<td>13</td>
<td>190</td>
<td>12</td>
<td>1.0</td>
<td>179</td>
<td>17.7</td>
</tr>
<tr>
<td>Kafr Atwab</td>
<td>20</td>
<td>319</td>
<td>21</td>
<td>306</td>
<td>23</td>
<td>331</td>
<td>21</td>
<td>0.9</td>
<td>319</td>
<td>7.2</td>
</tr>
<tr>
<td>Buwayt</td>
<td>6</td>
<td>58</td>
<td>12</td>
<td>89</td>
<td>15</td>
<td>188</td>
<td>11</td>
<td>2.7</td>
<td>112</td>
<td>39.2</td>
</tr>
<tr>
<td>Kom Idrijah</td>
<td>9</td>
<td>62</td>
<td>11</td>
<td>107</td>
<td>11</td>
<td>145</td>
<td>10</td>
<td>0.7</td>
<td>105</td>
<td>24.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>206</strong></td>
<td><strong>2555</strong></td>
<td><strong>234</strong></td>
<td><strong>2960</strong></td>
<td><strong>239</strong></td>
<td><strong>3381</strong></td>
<td><strong>226</strong></td>
<td><strong>2965</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
</tbody>
</table>

SE: Standard Error
Table 11. The quantity of skimmed milk (liters/week) per each village through winter, spring and summer seasons of 2015 and mean (± SE) through the year.

<table>
<thead>
<tr>
<th>Village</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abu-Ghazaleh</td>
<td>4510</td>
<td>4425</td>
<td>2888</td>
<td>3941</td>
<td>527</td>
</tr>
<tr>
<td>Atwab</td>
<td>5364</td>
<td>6522</td>
<td>6282</td>
<td>6056</td>
<td>353</td>
</tr>
<tr>
<td>Al Jazeera</td>
<td>3504</td>
<td>3872</td>
<td>3575</td>
<td>3650</td>
<td>113</td>
</tr>
<tr>
<td>El-Atf</td>
<td>397</td>
<td>582</td>
<td>1148</td>
<td>709</td>
<td>226</td>
</tr>
<tr>
<td>El-Nagh</td>
<td>3542</td>
<td>3378</td>
<td>3778</td>
<td>3566</td>
<td>116</td>
</tr>
<tr>
<td>Bane Haded</td>
<td>3807</td>
<td>7085</td>
<td>5894</td>
<td>5595</td>
<td>958</td>
</tr>
<tr>
<td>Deraga</td>
<td>1482</td>
<td>2590</td>
<td>4697</td>
<td>2923</td>
<td>943</td>
</tr>
<tr>
<td>Saad El-Den</td>
<td>8834</td>
<td>12316</td>
<td>7809</td>
<td>9653</td>
<td>1364</td>
</tr>
<tr>
<td>Saft MIDOM</td>
<td>6727</td>
<td>5152</td>
<td>5295</td>
<td>5725</td>
<td>503</td>
</tr>
<tr>
<td>Midom</td>
<td>11426</td>
<td>14874</td>
<td>11072</td>
<td>12458</td>
<td>1213</td>
</tr>
<tr>
<td>Ezbet Shiha</td>
<td>638</td>
<td>1032</td>
<td>503</td>
<td>724</td>
<td>159</td>
</tr>
<tr>
<td>Qmn Aros</td>
<td>17336</td>
<td>26169</td>
<td>23877</td>
<td>22461</td>
<td>2646</td>
</tr>
<tr>
<td>Azab</td>
<td>4849</td>
<td>7430</td>
<td>4714</td>
<td>5664</td>
<td>884</td>
</tr>
<tr>
<td>Kafr Atwab</td>
<td>10420</td>
<td>11487</td>
<td>9077</td>
<td>10328</td>
<td>697</td>
</tr>
<tr>
<td>Buwayt</td>
<td>1630</td>
<td>2948</td>
<td>4821</td>
<td>3133</td>
<td>926</td>
</tr>
<tr>
<td>Kom Idrijah</td>
<td>2042</td>
<td>2924</td>
<td>4657</td>
<td>3208</td>
<td>768</td>
</tr>
<tr>
<td>Total</td>
<td>86,508</td>
<td>112,786</td>
<td>100,087</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SE: Standard Error
MCC uses many practices to keep the relations with farmers and MCPs and to protect their enterprise, notably through participation in social events and through introducing loans in financial crisis. Also, the MCC owner provided separators with equipment's, scales and money for maintenance and regular visits especially in occasions to strength the social network with MCPs owners. When the demand increases, the MCC may find other sources of skimmed milk like private traders to secure the milk sourcing and engagement regarding the outlets. Moreover, one of the pillars of the MCC is the use of family labors: the MCC depends on a large social network and relatives to sustain the enterprise.

C. Dairy processing units (DPUs)

According to the volume of skimmed milk obtained through the studied MCC, two types of dairy processing units have been identified: 1) the small processing units (n= 12) that received 75.4 tons/week (45.4 % of total milk collected by the MCC) with an average of 6.3 tons/week for each DPUs; and 2) the large processing units (n=3) that received 90.8 tons/week (54.6 % of total milk collected by the MCC) with an average of 30.3 tons/week, as shown in Table 12. Dairy processing units prefer to use skimmed milk because of its lower price compared to whole milk. Most of small processing units produce Karish cheese and white cheese (Feta, Istanboly, Baramily and Talaga). The main season of producing

---

1 Feta, Istanboly, Baramily and Talaga are considered traditional white cheese produced in Egypt from whole or skimmed milk.
white cheese is between November and May and it may be extended to July according to market needs.

Small DPUs are characterized by limiting technologies, few numbers of labors (1-4 labors), with no specific background about dairy technology, a limited equipment and production. Also, according to the cheese makers, each 100 liters of skimmed milk produces around 26-30 kg Karish cheese (26-30%). The price of 10 kg Karish cheese is sold to shops or distributors with around 100 EGP. Consumers (majority from Greater Cairo) purchase Karish cheese from shops (dairy or glossary shops) with around 12-18 EGP/kg.

Table 12. Quantity of skimmed milk (tons/week), no. of Dairy processing units (DPUs), percentage of total skimmed milk that MCC collected, (Mean ± SE) and C.V for small and large DPUs.

<table>
<thead>
<tr>
<th>DPU</th>
<th>No. DPUs</th>
<th>Skimmed milk (tons/week)</th>
<th>% of total</th>
<th>Mean /unit (tons/week)</th>
<th>SE</th>
<th>C.V (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>12</td>
<td>75.4</td>
<td>45.4</td>
<td>6.3</td>
<td>0.7</td>
<td>38.2</td>
</tr>
<tr>
<td>Large</td>
<td>3</td>
<td>90.8</td>
<td>54.6</td>
<td>30.3</td>
<td>2.1</td>
<td>12.2</td>
</tr>
</tbody>
</table>

SE: Standard Error; C.V: Coefficient of Variability

Most of skimmed milk collected from villages of Beni Suef governorate and cooled through the Reka MCC, before being transported to different outlets (small and large DPUs) in Greater Cairo as shown in Figure 17.
Fig. 17. Map of the milk collection points (MCPs) in 16 villages, milk collection center (MCC) in Reka village and small and large dairy processing units (DPUs). Source Google Earth scale 183.9 km.
2. Dynamics of skimmed milk at MCC level

The MCC owner in Reka village had started to collect buffalo milk in 1994 with few amount of milk (20 liters/day from family relatives). Quantity of buffalo milk increased slowly till year 2000; the amount reached to 300 liters/day and, in the same year, the MCC had started to collect skimmed milk (around 500 liters/day). In 2008, the collection of skimmed milk has dramatically increased to reach 5.5 tons/day. In 2015, the quantity of milk collected reached around 20 tons/day. Buffalo milk collected did not increase and still fix with an average quantity of 500-600 liters/day. Cattle milk collected was increased and it was estimated by 3 tons in 2013 collecting from three big farms (Figure 18).

![Graph](image)

**Fig. 18. Development of collecting milk (buffalo, cattle and skimmed milk) by the milk collection center (MCC) in Reka village from 1994 to 2015.**
There was also a dynamic trend for price. Figure 19 shows the relation between the purchasing and selling price per buffalo, cattle fresh milk and skinned milk. Buffalo milk recorded the highest price for selling and purchasing comparing to cattle or skinned milk.

![Figure 19. Development of MCC price of purchasing and selling (EGP) of buffalo, cattle fresh milk and skinned milk during the period from 1994 to 2015.](image)

The high return % was achieved through skinned milk enterprise. Cattle and buffalo milk enterprise achieved low return % (Figure 20). Moreover, the overall return trend of skinned milk was going up while the trend of buffalo and cattle fresh milk was going down (Figure 20).
Fig. 20. The percentage of return of MCC per invested currency unit (return %) for buffalo, cattle and skimmed milk during the period from 1994 to 2015.

We can note that the rapid change in skimmed milk collected by MCC was due to increase the number of farmers, number of MCPs and quantity of skimmed milk collected per each milk collection point (Table 13).

Table 13. Trend of increasing number of farmers, number of collected points, quantity of skimmed collected milk and number of villages between 2013 and 2015 for the Reka MCC.

<table>
<thead>
<tr>
<th>Item</th>
<th>2013</th>
<th>2015</th>
<th>Percent of increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of farmers</td>
<td>1729</td>
<td>2965</td>
<td>171.5</td>
</tr>
<tr>
<td>No. of CPs*</td>
<td>129</td>
<td>226</td>
<td>175.2</td>
</tr>
<tr>
<td>Quantity of skimmed milk</td>
<td>47110</td>
<td>99794</td>
<td>211.8</td>
</tr>
<tr>
<td>No. of villages</td>
<td>9</td>
<td>16</td>
<td>177.8</td>
</tr>
</tbody>
</table>

*CPs: Collection points
In Figure 21, it can be observed that many villages were added in the year 2015 to south of MCC compared to year 2013. Also, the cycle size reflects the increase of milk collection capacity in many villages during the studying period. Moreover, in 2013 there was only one village collected more than 10,000 liters/week but in 2015 there were 3 villages collected more than 10,000 liters/week (as overall mean of three seasons).
Fig. 21. The location of villages of milk collection points (MCPs) dealing with milk collection center (MCC) and the quantity of milk collected through three seasons in year 2013 and 2015.
The trend of price changes of local skimmed milk and imported international powder milk are shown in Figure 22.

![Graph showing price changes of local skimmed milk and imported international powder milk from 2010 to 2015.]

**Fig. 22.** The changes of the international price of skimmed powder milk (equivalent to liquid) and skimmed milk price for outlets linked with milk collection center (MCC) from year 2010 to 2015.

### 3. SWOT analysis

The main strengths of this MCC was the development of the skimmed milk chain and its capacity to increase and diversify the actors at the sourcing (farmers and villages) and at the top (small, medium and large outlays). Social network has playing an important role in this chain. Also, this enterprise has created one new job for each 45-55 liters. This means that this enterprise employs around 400 persons (MCC owners, labors, transporters and MCP owners).
The main weakness: milk profitability at farm level, due to the high cost of feedstuffs (concentrate feed mixture, corn and wheat bran) and the increasing cost of renting lands with limiting access. Also, poor genetic merit of animals, bad veterinary service and shortage of extension service were also observed during this study. Furthermore, the seasonality of milk production, as in many places over the world, remains a major constraint for the market. The percentage of sold milk over the production was higher in spring (95.3 %) comparing to summer (89.0 %) and winter (78.9 %) (Radwan et al., 2016).

Another challenge is the total bacterial counts (TBC). Buffalo milk at farmer level recorded the lowest TBC through the three seasons compared to skimmed milk. Also, winter season recorded the lowest TBC compared to spring and summer seasons (Figure 23). Moreover, absence of written contracts among actors along chain could cause unbalanced revenues or unfair pricing system, where no contracts among the chain of farmers and MCC, MCPs and MCC and outlets (in most cases they respect this kind of oral contracts). Also, the big manufactures had the upper hand on this chain. Also, there is no fair pricing system along the chain.
Fig. 23. Total bacterial count (TBC, log10) at farmer (buffalo milk), villages milk collection points (MCPs) (skimmed milk), and milk collection center (MCC) (skimmed milk tanks) through winter, spring and summer seasons.

SWOT analysis summarized the strengths, weaknesses, opportunities and threats of skimmed milk chain as following:

**Strengths**
- Milk is the main source of income for farmers in studied area.
- Very dynamic chain in terms of quantity of milk, milk price and no. of suppliers and outlets
- High demand of skimmed milk
- Most links among actors in this chain based on social network.
- Skimmed milk offered with cheaper price
- Created too many jobs (46-55 liters created one job)
- MCC can link buffalo smallholders with big plants.
- Regular quality check by MCC.

**Weakness**
- Increased the price of feedstuffs and concentrate feed mixture.
- Lack of public veterinary services.
- No livestock extension servicers.
- Limited cultivated lands.
- High cost of land rent.
- Low price of skimmed powder milk affecting the revenues along the chain.
- Increased TBC of skimmed milk especially in warm seasons.
- No contracts along the chain among actors.
- No fair pricing system.
- Provided regular income for all actors.
- Increased the demand of traditional cheese.
- Most cheese production in cold season

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Establish cooperatives that help farmers and provide them with reasonable price inputs and services (Ortmann, and King, 2007).</td>
<td></td>
</tr>
<tr>
<td>• There is a room for quality control (Figure 23).</td>
<td></td>
</tr>
<tr>
<td>• Ability of different actors along the chain to update chain standards (Chain Flexibility to set new standards).</td>
<td></td>
</tr>
<tr>
<td>• Many services can be introduced through the strong social network.</td>
<td></td>
</tr>
<tr>
<td>• Unexpected feedstuffs prices fluctuation</td>
<td></td>
</tr>
<tr>
<td>• Uncertainty of urbanization level at rural areas led to decrease cultivated land limited access of land</td>
<td></td>
</tr>
<tr>
<td>• Increase cost of rented land</td>
<td></td>
</tr>
<tr>
<td>• Allow the importation of dairy products without protection for national products</td>
<td></td>
</tr>
<tr>
<td>• Increasing costs of services introduced to farmers in term of veterinary and extension services.</td>
<td></td>
</tr>
<tr>
<td>• Continuing decline in the international price of skimmed milk powder.</td>
<td></td>
</tr>
<tr>
<td>• Increase the level of quality standards of consumers for milk and milk products.</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

Skimmed milk value chain

There is a question why farmers prefer to sell skimmed milk than to sell whole milk or to process milk. Figure 16 showed clearly the economic interest compared to selling of cheese and butter that required more women efforts in processing with high risk for processing and marketing cheese. Indeed there is no regular demand in the local market for the milk products with an unexplained technological failing in traditional milk processing especially in summer. Moreover, the skimmed milk grown faster than buffalo or cattle milk for many reasons: 1) high return % of skimmed milk compared to cattle and buffalo milk as shown in Figure 20, which mean that skimmed milk gain more profits for traders; 2) DPUs considered skimmed milk cheaper than cattle and buffalo milk (Figure 19); and 3) Karish cheese with low fat and Feta cheese with added vegetable oils were cheaper for the local and city markets, where most consumers are more interested in low prices than high quality.

Moreover, the analysis of maps in Figure 16 and 20 indicated that villages south of greater Cairo became an important source of skimmed milk to feed the DPUs concentrated in greater Cairo with the highest demand of dairy products in Egypt. There are two reasons to explain this dynamic: 1) the villages in south Giza (or north Beni Suef) are far from the main fresh milk markets; so, farmers prefer skim milk to produce butter and cheese with more shelf life compared to fresh milk and 2)
some rural farmers have always a custom that prevent selling milk as fresh.

However, the price of skimmed milk is also affected by the demand, especially from big manufactories which received more than 50% of MCC milk. This demand varies with the international skimmed milk powder price that influences the national price of skimmed milk (Figure 21). The quantity of skimmed milk sold by MCC increased when the international price increased. Therefore, skimmed milk price sold by MCC in 2015 compared to in 2013 was decreased which might be due to lower international price (Figure 18). However, the demand of cheese is also linked with the population growth. Consequently, the price depends on three main factors: the price of Karish cheese (as an internal factor), the price of international powder milk (as an external factor) and the processing units demand which is directly related to the availability of milk in the market and its alternatives, mainly powder skimmed milk.

The price of skimmed milk could affect the price of Karish cheese in village market due to the demand of skimmed milk. So, the external factors like skimmed milk alternatives price for cheese processing units affect indirectly the revenues of farmers and other related activities through its effect on the skimmed milk purchasing price of CPUs. Farmers are searching for the best price and the lower risk. So the price offered by the MCC is a major factor affecting milk marketing. The owner of the MCC adjusts the price of skimmed milk according to the price of Karish cheese in the local market.
Milk quality and safety

Total bacterial count (TBC) is an indicator for milk handling (Deepika et al., 2015). The TBC increases in the hot season compared to cold season. These results agreed with the findings of Hashmi and Saleem, (2015) (Figure 23). Whole milk contains lower TBC compared to skimmed milk collected from MCPs for each village due mainly to the absence of cooling system, the time of skimming which takes up to three hours (which lead to high multiplication of microorganisms in skimmed milk) and the time of milk collection from all MCPs of each village. Most processors consider cold season as the best period for producing high quality cheese which match with the bacterial count in winter as shown in Figure 23. Establish a proper method to identify microbial contents in food chain is necessary in Egypt (Montet et al., 2015).

Finally, it is observed that MCC, MCPs, and DPUs depend mainly on relatives in running the enterprises. Also, dealing with neighbors and local community build trust to guarantee the daily milk supply and milk quality. In this chain, the MCC tried to check regularly the quality and it discusses with MCPs for improving the quality of collected milk. All farmers could produce at least two types of dairy products (cheese and butter) through accumulated knowledge from one generation to another. Also, DPUs produce many types of cheeses. The technical skills used to process the cheese was obtained from the work in large processing units or transmitted from family members.
Recommendations related to SWOT analysis

Many recommendations could be proposed for enhancing the skimmed milk chain. First, at the farm level, many improvements can be done regarding the supply of good quality feedstuffs and CFM with reasonable price, the access to highly producing buffaloes with high genetic merits and helping farmers through training programs to use milk replacer for calves and applying artificial feeding to save milk. Moreover, there are an increasing demand of training for farmers and MCP owners to produce clean milk and setting pricing system based on quality and a demand of loans for milk collection points to support cooling systems. Furthermore, Ministry of Agriculture, cooperatives and private sectors linked with Research Institutes and Universities and chain stakeholders could provide new skills, green technologies and knowledge about milk handling and processing. Moreover, this link can provide up to date information about the weakness and opportunities, this will help in developing more applicable research plans.

In other region or countries, MCC can play a crucial role to connect the smallholder's producers to processors and provide a lot of job opportunities (Demirbas et al., 2009). Moreover, MCC owner can build social relationships as a tool to extension, and a way to secure the enterprise. So, the Reka MCC as a private unit highlights a new model that can be used as a tool to improve the dairy sector, in particular in the whole traditional dairy sector. The social network in this chain needs to be deeply studied to understand the social mechanisms and how useful of these social networks at national level and in other countries that had similar production system and dairy sector.
Part IV: Veal supply chain at village level in Egypt

INTRODUCTION

In several developing countries, buffaloes (Bubalus bubalis) are considered as an important source of milk, meat, draft power and leather production (Sarwar et al., 2009). The world buffalo meat production was about 3.7 million tons in year 2013. India comes at the top of world buffalo meat producers (36%), Egypt ranked the fifth (390 thousand tons represent about 27.3% of the world buffalo production, FAOSTAT, 2015). El-Saadany (1998) reported that beef and veal meat production represent about 58% of total meat production in Egypt. Where the annual consumption of beef and veal was about 10.8 kg/capital represent about 46% of meat demand (OECD-FAO, 2014). Un-estimated huge number of veal animals are slaughtered outside the slaughterhouse, which means no inspection (anti and post mortem), no statistics about the real number of veal slaughtered and no control about slaughtering young females. The relationship between buffalo veal and milk chains where veal calves are sharing rural families in their milk that affect significantly the availability of milk to families' consumptions or to sell as a good daily source of income, especially in the first two months of lactation, where veal calves consume most of buffalo milk. Value chain has five main stakeholders: inputs, production activities, processing, distribution, and consumption (Khoi and Dung, 2014).

Many studies confirmed that the buffalo meat is rich in iron, high in protein content, low in fat content and low in cholesterol level; this
may led to increase the demand of buffalo meat because it is healthier than cattle meat (Cannarsi et al., 2008; Kandeepan et al., 2009; Abdolghafour and Saghir, 2014 and Giuffrida-Mendoza et al., 2015).

The problem statement focused on the shortage of data available about veal supply chain and meat quality analysis. The aims of this part were to identify the stakeholder along the veal chain, highlights the main characteristics of the whole chain and characterize different meat quality traits related to the consumer preferences of buffalo meat.
Ngapo and Gariépy (2006) defined veal ‘bob veal’ as the calf less than 4 weeks of age, male or female and it's live weight up to 70 kg. Furthermore, Specht et al. (1994) define ‘vealers’ as calves from 4–12 weeks of age with live body weight ranged from 57 to 140 kg. Buffaloes play a vital role in the whole social development in many countries in Asia through contributions for milk, meat, hides and draft power of agricultural sector as reported by Nanda and Nakao (2003) who mentioned that buffalo meat is very popular in most developing countries although it comes from culled animals or surplus males.

Singh et al. (2013) reported that buffalo meat value chain in India consists of a network of stakeholders, the roles and responsibilities of each actor along the chain. The value chain is included livestock producers, traders, butchers, wholesale meat dealers and retailers. The dairy farmers were the main predominantly of buffalo meat producers in India. Moreover, most farmers sell their animals to traders while traders don't own slaughter facilities but rather use the services of butchers at public slaughterhouses. The buffalo meat is then collected by wholesale meat suppliers or in some instances directly by retailers.

Regarding to rearing calves on different milk sources, Infascelli et al. (2004) found that feeding buffalo calves on cow milk or milk replacer recorded a lower cost compared with feeding on buffalo milk by 73.6 and 71 %, respectively.
Buffalo meat

The buffalo meat types that could be found in the market are veal, fattening calves and culled buffalo (most of them are females). Kandeepan et al. (2009) reported that buffalo meat is called by many terms in different countries according to the age of slaughter. Buffalo veal is the meat from male buffalo calves. Buffalo broilers are the buffalo calves reared exclusively on milk for meat purpose. In India, most of buffalo slaughtered after finishing their productive period that lead to reduce the tenderness and decline most of meat quality traits as reported by Naveena et al. (2011). Concerning the use of culled buffaloes, in India, meat that produced from culled water buffaloes > 10 years of age is regularly consumed (Neath et al., 2007). Culled cows were an important source of meat and income for farmers, but needed good regime to get correct weight and body condition (Lee et al., 2008).

Giordano et al. (2010) reported that water buffalo meat has a low energy yield, a high level of protein and low level of lipids that means healthier for human consumption than beef.

Meat quality

Meat quality is a common term used to define properties and perception of meat. The meat quality is affected by many variables such as breed or genetic, age, gender, feeding, type of suckling milk and management (Guerrero et al., 2013). Giordano et al. (2010) demonstrated that buffalo meat can confer significant benefits in terms of cardiovascular risk profile, including lower carotid atherosclerotic burden and susceptibility to oxidative stress.
Calabrò et al. (2014) found that the chemical composition of fattening Italian buffalo males contain around 75.5 % moisture, 2.1 % fat and 21.3 % protein. Infascelli et al. (2004) found that the veal (age 6 months) was low in dry mater, contain low fat and show more attractive color than young bull (age 16 months). Buffalo calves meat had high protein and fat % and lower moisture compared with buffalo broilers (24.1 vs. 22.46; 1.8 vs. 0.35 and 74 vs. 76.9%, respectively).

Kandeepan et al. (2009) in comparison between buffalo fattening males (18 months) and culled females (10 years), found that moisture was higher in fattening males (74.99 %) than culled females (72.63 %), the fat content was higher in culled females (3.98 %) than fattening males meat (2.67 %). Giuffrida-Mendoza et al. (2015) found that fat content and cholesterol level in buffalo meat were increased by increasing age from 19 to 24 months (1.5 vs. 1.8 gm/100 gm fresh meat and 53.1 vs. 62.7 mg/100 gm fresh meat, respectively).

Meat color including; Lightness (L*), Redness (a*) and Yellowness (b*) have been measured objectively by Minolta colorimeter (Liu et al., 2003 and Prieto et al., 2008). Meat color (L*, a* and b*) were higher in good meat quality (42.8, 24.7 and 12.6, respectively) than in low quality one (34.7, 19.4 and 9.1, respectively) reported by Kim et al. (2008). Age also affect meat color. Revilla and Vivar - Quintana (2006) found that young bulls had slightly higher values of L*, a* and b* (47.7, 16.5 and 16.2, respectively) than heifers (39.5, 12.6 and 9.9, respectively). Buffalo meat color appears dark because it had more
pigment and less fat content. Rodas-González et al. (2015) reported that buffaloes had lean meat and less fat compared to cattle.

Collagen content in meat is affected by sex (Seideman et al., 1982), type of feeding (Faueitano et al., 2008), type of muscle (JURIE et al., 2007), genotype (Chambaz et al., 2003 and Serra et al., 2008) and age (Berthiaume et al., 2006). Meat tenderness is an important trait in beef meat for its impact on consumer satisfaction (Schenkel et al., 2006). Consumers consider tenderness is the most important trait of meat quality (Miller et al., 1995), and determine to some extent the meat grade (Kim et al., 2008).

Naveena et al. (2011) mentioned that collagen in connective tissue becomes more complex and stronger with advancing age. So, a problem of using aged buffalo's meat is its toughness (Raj et al., 2004). Moreover, Kandeepan et al. (2009) indicated that collagen content was higher in culled female compared to fattening males (1.85 vs. 0.82 %, respectively), consequently, shear force values were higher in culled female's meat compared to fattening males 93.8 N (9.6 kgf) and 60.6 N (6.2 kgf), respectively. Veal meat had low shear force value 3.9-4.8 kgf/cm³ (González et al., 2014). Age affected tenderness, since meat of aged cows had less tenderness than younger ones (Webb et al., 1964).

The history of veal project in Egypt

El-Saadany (1998) reported that, in 1964 the policy makers in Egypt started to think to increase contribution of buffalo in meat production by established "The National Project for Fattening Buffalo Calves" this project provide support farmers to fattening the calves until
150-300 kg and after farmers sold the calves to organization that finishing in station until 450-500 kg. The project was pause in 1991 as a result to adopting free market policies in the agricultural sector and decreased the supported of feed concentrate gradually from 1986. After that the project worked again. Hamza (2015), mentioned that in early of 2012 the Ministry of agriculture was approved by the Social Fund for Development (SFD) and the Principal Bank for Development and Agricultural Credit (PBDAC) with 450 million EGP (58 million $) in funds. This project aimed to improve livestock rearing in Egypt’s governorates in an effort to increase the rate of self-sufficiency in meat production by providing micro-credit loans to small farmers at a low interest rate of 4-7 percent. In addition, in December 2013, the Ministry of Agriculture instituted a proscription of the slaughter of live cattle that are less than 250 kilograms in an effort to increase red meat production. According to the Ministry, the decision, which took effect on February 2014, aims to protect 300,000 to 500,000 calves. The decision will also prevent the slaughter of young female calves which at this age and weight are more capable of reproduction.
MATERIALS AND METHODS

Survey analysis was conducted using semi-open questionnaire to identify the main characteristics of veal chain through meeting 82 farmers at 5 villages (ElEmam Malik, Wardan, ElAtf, ElSaf and Reka villages) 4 traders and 4 butchers connected to ElEmam Malik, ElAtf and Reka villages based on French filière approach (Raikes et al., 2000). The quantity of milk that consumed by a calf at 40 and 90 days were (285 and 448 kg/ head, respectively) this quantity is within the range that Ahmed and El-Shazly (1978) mentioned that the calf consumed about 230-700 kg milk through suckling period. Due to the high costs of raising and the economic reasons that reported by farmers, three scenarios of buffalo calves suckling based on real data were suggested. The proposed scenarios were feeding calves with whole buffalo milk, feeding calves with whole cow milk and feeding calves with milk replacer. Cost per each scenario, based on the quantity of milk consumed multiplied by the price for each type of milk used, was calculated.

**Technical coefficient used for the calculation of feeding cost**

1. Amount of buffalo milk consumed through 40 day =285 kg.
2. Amount of buffalo milk consumed through 90 day =448 kg.
3. The price of one kg of buffalo milk= 5 EGP.
4. The price of one kg of cow milk= 3 EGP.
5. The price of one kg of milk replacer (equivalent liquid milk) =2.6 EGP.
To understand the intervention between dairy and veal chain the preference of consumers to veal meat, samples were collected from Egyptian meat markets (meat shops), from *Longissimus dorsi* muscle, 11 veal samples (meat plus bone); 8 boneless samples of fattening calves and 8 boneless of culled female samples were collected.

**Meat analysis**

Meat samples were analyzed at Cairo University Research Park (CURP)/ Faculty of Agriculture, Cairo University, for the following traits:

1. **Chemical analysis**

   Moisture, protein, fat and collagen at *Longissimus dorsi* muscle were determined using Food Scan Pro- meat analyzer (Foss Analytical A/S, Model 78810, Denmark). According to the manufacturer instructions, about 50 - 100 gm of fresh lean meat was minced after removing fats and connective tissues. Ground meat was put in meat analyzer cup, which inserted into the apparatus for scanning sample with infra-red to determine the above mentioned components.

2. **Cholesterol determination**

   Cholesterol was quantified spectrophoto-metrical using Stanbio Cholesterol LiquiColor® Kit, (Proc. No. 1010) produced by Stanbio Laboratory Inc., Boerne, Texas, USA. Total cholesterol determination was performed the method by Allain *et al.* (1974).
Sample preparation:

Saponification: About 2 gm of each meat sample were saponified according to the modified version of the method described by Stewart et al. (1992), with 4 ml of 50% potassium hydroxide and 6 ml of 95% absolute ethanol then heated for complete solubilization at 40 °C, and heated again for 10 min. at 60 °C. After this, 5 ml of water were added and the samples were cooled. The non-saponifiable fraction was extracted three times using 10 ml of hexane. Aliquots of hexane extracts (3 ml) were dried under a nitrogen flow.

3. Physical properties

Physical traits included color, water-holding capacity (WHC) percentage, cooking loss percentage and shear force values (Indicator for tenderness):

a. Meat color was measured by Chroma meter (Konica Minolta, model CR 410, Japan) calibrated with a white plate and light trap supplied by the manufacturer. Color was expressed using the CIE L, a, and b color system (CIE, 1976). A total of three spectral readings were taken for each sample on different locations of the LD muscle. Lightness (L*) (dark to light), the redness (a*) values (reddish to greenish). The yellowness (b*) values (yellowish to bluish) were estimated.

b. The WHC percentage was measured by weighing about (0.3 gm., W1) of meat in filter paper (Whatman No .1) and subjected to pressure of 1000 gm for 10 minutes (Sami et al., 2012) then it was
weighed again (W2). The WHC was estimated as the percentage according to the following formula:

\[ \text{WHC} \% = \frac{W_2}{W_1} \times 100. \]

c. Cooking loss % was calculated as a weight loss from steaks cooked individually in polythene bags to an internal temperature of 75 °C as measured by temperature probe, in a water bath at 90 ± 0.5 °C and cooled at the room temperature for 30 min. Cooking loss was calculated as outlined by Franco et al. (2009) and Sami et al. (2012) according to the following formula:

Cooking loss % =

\[ \frac{\text{initial fresh meat weight} - \text{final cooked meat weight}}{\text{initial fresh meat weight}} \times 100. \]

d. The cooked samples were used to determine the shear force (kgf/cm³). Samples were kept at 4-5°C for about 12 hours before estimating shear force using Instron Universal Testing Machine (Model 2519-105, USA). Six cores from each sample were taken where cores were removed parallel to the longitudinal orientation of muscle fibers. The shearing machine was adjusted at crosshead speed of 200 mm/min according to the procedure outlined by Shackelford et al. (2004).

4. Statistical analysis

Meat quality data were analyzed using the General Linear Model of SAS (2016) as a one way analysis of variance. Duncan’s multiple range test was applied to determine the significant differences among means (p<0.05). Data was analysed using the following model:-
\[ Y_{ij} = \mu + T_i + e_{ij} \]

where

\[ Y_{ij} = \text{the measured trait} \]

\[ \mu = \text{the overall mean} \]

\[ T_i = \text{effect of buffalo meat type (i= 1, 2, 3; where 1= veal meat, 2= fattening male and 3= culled female).} \]

\[ e_{ij} = \text{Random error} \]
RESULTS

Veal chain actors

1. Farmers

Through interview with farmers, 65% of the sample tended to sell veal for different reasons which classified into: economic and technical reasons as shown in Table 14. Economic reasons represent about 61% of total reasons, 14% of farmers sold veal for technical reasons and 25% for technical and economic reasons (Figure 24).

Fig. 24. A: proportion of farmers who sold their veal calves vs. who keep them; B: proportion of farmers who sold male and female calves vs. who sold male calves only.

According to survey analysis, 65% of farmers sold veal and 35% keeping them for fattening (Figure 24; A). 62% of Farmers who sold their calves tend to sell male and female calves, the rest (38%) were selling male calves only (Figure 24; B). Figure 25, shows the expected cost of suckling calves in each scenario depends on the market price at the year of study, 2013/2014. Milk replacer achieved the lowest cost compared to using cattle milk or buffalo milk, assuming the stability of vet costs and mortality rate for all scenarios.
Fig. 25. Cost of feeding veal calves on buffalo milk, cow milk and milk replacer as different scenarios that Egyptian farmers used.

Table 14. Technical and economic reasons responsible for selling veal.

<table>
<thead>
<tr>
<th>Economic</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Family needs</td>
<td>• Fattening calves needs long time till marketing weight.</td>
</tr>
<tr>
<td>• To save milk for selling &amp; family consumption.</td>
<td>• Risk of missing calves (death: diseases, weaning shock, low growth rate after weaning …etc.).</td>
</tr>
<tr>
<td>• High price at veal stage compared to weaned calf price.</td>
<td>• Low milk productivity of buffalo</td>
</tr>
<tr>
<td>• To cover feedstuffs and chemical fertilizers costs.</td>
<td>• Land limitation to cover animal's feed requirements.</td>
</tr>
<tr>
<td></td>
<td>• No enough space in the pen.</td>
</tr>
</tbody>
</table>
The average veal selling age was 40.6 days and the average selling price was 1934 EGP/head (Table 15).

Table 15. Mean (±SE) of veal calves age at selling (day) and price of veal (EGP/head) at farm level.

<table>
<thead>
<tr>
<th>Item</th>
<th>No.</th>
<th>Mean</th>
<th>SE</th>
<th>C.V %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling age (day)</td>
<td>54</td>
<td>40.6</td>
<td>1.6</td>
<td>29.0</td>
</tr>
<tr>
<td>Price of veal (EGP/head)</td>
<td>54</td>
<td>1934</td>
<td>72.9</td>
<td>27.7</td>
</tr>
</tbody>
</table>

SE: Standard Error, C.V: Coefficient of Variability.

2. Traders

Regarding to data collected during October 2014 to February 2015 in three areas (ElAtf, Reka and ElEmam Malik villages), the large numbers of veal calves in the market were recorded from October to April with lower price ranged from 1200-3500 EGP/head depends on body condition and suckling period compared with the other seasons.

During the period from May to August, lower numbers of veal were available in the market with higher price ranged from 2500 to 5000 EGP/head.

Farmers and livestock market are the main source of trader's supply. Sometimes, traders hire some collectors to arrange and deal with farmers. Also, traders use slaughterhouse as a market to select the best calves (healthy with good body conformation) to supply fattening farms. Regarding to survey analysis, the main criteria that used to estimate veal price was the estimated carcass weight, according to the trader's experience. One of trader's methodologies that identified through traders
interview was the unique grading and pricing system of veal, where traders can expect carcass weight depending on body conformation and multiply the estimated carcass weight by the price of 1 kg.

3. Breeders

Breeders in this chain were mostly the farmers who fattening calves or rearing females till reaching the milk production stage or selling pregnant heifers. This kind of breeders may be bought veal from livestock markets or traders. Farmers indicated that rearing the pre-weaning calves need a lot of experience due to calves' sensitivity to many health problems at this age, where the collected calves received different levels of caring and feeding at the original farm.

4. Butchers and meat shops owners

Butchers or meat shop owners have two ways to get veal carcasses. The first way is to purchase veal from farmers or traders or livestock markets and slaughter them inside /or outside slaughterhouses. The second way is to purchase veal from slaughterhouses or meat traders. The veal carcasses were sold to consumer and /or restaurants. Grading veal carcasses were done according to Egypt meat markets to: grade A: including hind quarters and fore ribs and grade B including fore-quarters. The price of meat cuts based on the traders unique grading system, was higher in the grade A by 21% than grade B. Restaurants prefer to get cuts of grade A which was acceptable by consumers and the demand was higher in summer compared to winter season.

Figure 26 showed the different stakeholders along the veal chain including producers (farmers), mediators, retailers and consumers.
Buffalo meat categories in Egyptian market

A complementary meat analysis approach was applied to justify the reasons of the high demand on veal meat in the Egyptian markets. Regarding to survey analysis, the buffalo meat categories common in Egyptian meat markets were veal meat, fattened buffalo calves and culled females. Regarding to this survey the veal (Figure 27a) is a baby calf’s slaughtered at around 40 days and sold to consumer as a carcass (meat + bone). Figure 27b showed that, fattening calves ranged in age from 1 to 3 years slaughtered at 400-500 kg and sold as boneless meat. Figure 27c, showed culled females that slaughtered after finishing the productive life or culled for any reason ranged from 1 and up to 20 years of lactations with a wide weight variation (Kandeepan et al., 2013) and sold as boneless meat.

Meat quality of different buffalo ages

1. Chemical composition and cholesterol level

As shown in Table 16, no significant difference was detected in moisture percentage between veal meat (74.8 %) and fattening calves (73.9 %) but the differences were significant regarding the culled females (71.7 %). Culled females recorded significant percentage of intra muscular fat (4.2 %) compared to fattening calves (2.2 %) and veal (1.8 %). The percentage of collagen appears to be higher in veal meat (1.6 %) than fattening calves (1.5 %) and culled females (1.3%).
Fig. 26. Map of the different stakeholders along the veal chain.

Fig. 27. Egyptian buffalo categories; Veal (a), fattening calves (b) and culled females (c).
Culled females had higher significant cholesterol level compared with fattening calves and veal (61.1, 56.4 and 51.1mg/100g meat). There were no significant differences among all buffalo meat categories in protein %.

**Table 16. Mean (± SE) chemical analysis of different buffalo meat categories.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Veal</th>
<th>Fattening male</th>
<th>Culled female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture%</td>
<td>74.8 ± 0.4</td>
<td>73.9 ± 0.4</td>
<td>71.7 ± 0.5</td>
</tr>
<tr>
<td>Protein%</td>
<td>21.4 (0.1)</td>
<td>21.5 (0.4)</td>
<td>21.8 (0.2)</td>
</tr>
<tr>
<td>Fat%</td>
<td>1.8 b (0.1)</td>
<td>2.2 b (0.3)</td>
<td>4.2 a (0.3)</td>
</tr>
<tr>
<td>Collagen%</td>
<td>1.6 a (0.03)</td>
<td>1.5 ab (0.1)</td>
<td>1.3 b (0.04)</td>
</tr>
<tr>
<td>Cholesterol (mg/100g meat)</td>
<td>51.1 c (0.5)</td>
<td>56.4 b (0.5)</td>
<td>61.1 a (0.4)</td>
</tr>
</tbody>
</table>

*Means having different superscripts in the same row differ at (P < 0.05).*

2. Physical traits

Most of meat physical traits were affected by buffalo categories as shown in Table 17.

Results indicated that culled females and fattening calves were darker in color (less L*) than veal meat (32.8, 36.1 and 46.9; respectively). Fattening calves and veal were more reddish (a*) than culled females meat (19.4, 18.6 and 14.0; respectively). No significant differences were identified among buffalo categories in yellowness.

WHC was higher in culled females (74.3 %) than veal (68 %) and fattening calves meat (66.2 %). Veal meat have lower cooking loss compared to fattening calves and culled females meat (34.4, 37.4 and 38.9 %; respectively). Veal meat scoring higher tenderness (4.4 kg/cm³, lower shear force values) than fattening calves (6.7 kg/cm³) and culled female (8.0 kg/cm³).
Table 17. Mean (± SE) of physical traits of different buffalo categories.

<table>
<thead>
<tr>
<th>Item</th>
<th>Veal</th>
<th>Fattening calves</th>
<th>Culled females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L*</td>
<td>46.9 a</td>
<td>36.1 b</td>
<td>32.8 b</td>
</tr>
<tr>
<td>a*</td>
<td>18.6 a</td>
<td>19.4 a</td>
<td>14.0 b</td>
</tr>
<tr>
<td>b*</td>
<td>7.5 (0.7)</td>
<td>5.6 (0.7)</td>
<td>5.7 (0.4)</td>
</tr>
<tr>
<td>WHC %</td>
<td>68.0 b</td>
<td>66.2 b</td>
<td>74.3 a</td>
</tr>
<tr>
<td>Cooking loss %</td>
<td>34.4 b</td>
<td>37.4 a</td>
<td>38.9 a</td>
</tr>
<tr>
<td>Shear force (kgf/cm³)</td>
<td>4.4 b</td>
<td>6.7 a</td>
<td>8.0 a</td>
</tr>
</tbody>
</table>

Means having different superscripts in the same row differ at (P < 0.05).

Strengths and weakness of buffalo veal chain

Buffalo veal chain has many strength points concerning the farmers such as: a) provides farmers with money to cover their needs, b) offers a lot of jobs along the chain and c) there a demand of veal meat along the year were observed.

The weakness points almost concerning the markets or at national level such as a) slaughtering veal led to decrease the contribution of buffaloes in Egyptian meat market, b) difficult of controlling veal slaughtering where the butchers can slaughter veal outside the slaughterhouse without any control or inspection and c) there was no training programs for producers to learn about raising buffalo calves and how to maximize the profits of raising and fattening calves.

In Figure 28 shows the suggested model on village to maximized the contribution of buffalo meat at national level.
Fig. 28. Suggested model for maximizing buffalo contribution at village level.
DISCUSSION

In Egypt, small scale farmers who rear buffaloes mainly raised buffaloes for milk production to provide daily cash money or to cover the family milk consumption. This type of production system represents the majority of farmers in Egypt which characterized by limited land access, where milk is the main source of cash income and limited income to purchase concentrate feed. So, the results of this part indicated that most of farmers (Table 14) tend to sell calves as early as possible to save milk and to provide money for covering family needs. The majority of farmers sold veal calves due to economic reasons (Figure 24). As shown in Figure 25, if farmers used milk replacer for suckling calves, the cost will be reduced by 48 % relative to buffalo milk and by 13 % compared to cow milk. In this scenario, the same mortality rate and vet cost were used for all scenarios. Also, farmers could need some training to apply artificial milk feeding for calves in an efficient way.

The veal price was affected by season and demand where it decreased in winter compared to summer season by 20-40%. Increasing the available veal in winter where most of buffaloes calved in winter season. In summer, beside the seasonal decrease in the number of veal calves, a higher demand at grilled meat restaurants in big cities was reported by some traders due to low fat content in veal meat compared to lamb's meat, which preferred by grilled meat consumers in hot summer days.

Nutritive value (Chemical composition) of meat is affected by age (Mojto et al., 2009 and Bureš and Bartoň, 2012). Differences of
moisture, fat, collagen percentages of three buffalo categories were significant (Table 16), which matched with the finding of Kandeepan et al. (2009). Moisture % and collagen % were decreased by age advancing, and fat % was increased, while the protein % didn't change significantly by advancing age, this result is in agreement with Infascelli et al. (2004) and Abdolghafour and Saghir (2014).

Red meat is an important source of cholesterol diet (Ma, 2004). Cholesterol level in buffalo meat was increased by the advance in age, this result was agreed with Giuffrida-Mendoza et al. (2015) where the highest level was found in culled females meat followed by fattening calves meat and the lowest level was recorded in veal meat. The recommended level of cholesterol for human healthy body is less than 200 mg/ day (USDHHS, 2005), if person was consumed 200g of buffalo meat his body will get 102-123 mg of cholesterol. So, the buffalo meat especially veal meat, was usually recommended for patients (who have cardiovascular diseases) and old persons. Meat color is an important indicator for meat acceptability, it is a first visual investigation of consumers (Węglarz, 2010). Buffalo meat color is darker than cattle at similar age. Also, meat color became darker by advancing age due to increasing pigment concentration (Kandeepan et al., 2009). So, veal meat had bright color than fattening calves (Infascelli et al., 2004) and culled females.

Water-holding capacity (WHC) is considered one of the main quality characteristics of raw meat, because it affects consumer acceptance and the final product weight (den Hertog-Meischke et al.,
Water holding capacity was not differed significantly between veal and fattening calves, however veal meat had a higher WHC than fattening calves and this result was matched with the findings of Infascelli et al. (2004). Cooking loss was increased by advancing age, where the veal meat recorded a lower cooking loss percentage than fattening calves and culled females. This may be due to high fat content in culled female's meat and low one in veal meat. Shear force values reflect the meat tenderness, these values increased linearly with advancing age (Rao et al., 2009). Veal meat (younger one) recorded the lowest shear force values (more tender) than fattening calves and culled female's meat. These results answer the question why there is a demand of veal in Egypt compared to other buffalo meat. Generally, buffalo meat is less tender compared to beef meat (Khan and Iqbal, 2009).

Referring to the meetings and interviews with farmers, traders and other stakeholders in the veal chain; results showed that veal chain may be enhanced in Egypt through: 1) set training programs for farmers to use cattle milk or milk replacer for raising veal; 2) Establishment of commercial fattening farms at village level in cooperation with NGO's and/or private sector to control the long distance trading; 3) collecting calves after suckling the colostrum and milk for one or two weeks to save milk for farmers and to provide meat at national scale; 4) make a link among the commercial farms with financial and technical institutions; 5) communicate and link modern farms with small farmers to improve the quality of calves produced and 6) establishment a grading system for calves to be selected for raising and slaughtering the rest through passing to slaughterhouse to meet consumer's needs (elders and patients). This
new kind of fattening farms will save buffalo milk for home consumption and selling purposes, if calves will be fattened for long time and heavy weights it provide a lot of jobs and increasing the contribution of buffalo meat at national scale. Figure 28 showed the suggested model at village level. Policy makers should be participated through facilitating and supporting the whole system through coordination and organizing the relationship among different actors by setting and following up regulations. Universities and research institutes should play an important rule to introduce technical support and to set breeding plans. Collecting data could be used to select the best animals and to propose updated technical support or to propose new agricultural policies. Traders could play a coordination role especially at the beginning of the suggested model and should involve them in a new proposed system. The stations will provide identification system, selected pregnant heifers, good feeding system, selected buffalo bulls, good veterinary services and advices and instructions to small and medium farmers. Fattening stations will select the good calves for fattening and data related to growth and feed efficiency should be used in breeding programs.
CONCLUSION

Under crop-livestock production system in Egypt, the majority of farmers consider dairy animals as the main source of daily regular income and offer a source of family food. Buffalo milk chain can be classified into long and short chain, and each one has advantages and disadvantages. The present thesis consists of four parts, the first three ones dealt with buffalo milk chain while the fourth one is concerned with veal production.

Estimating each of MUN, SCC and milk composition could be used as routine analysis diagnostic tool for sampling small dairy farms in different regions to identify the most priority services and extension needs at village and small scale farm levels (Part one).

Concerning the second part which deals with the diversity of farming system, single agricultural policy will not fit all farmers' categories. Governmental and non-governmental projects are needed to supply farmers with high quality forage seeds, high producing animals and veterinary services with reasonable costs. However, services should be adapted according to the region and the season. High demand of skimmed milk was observed by dairy processing units. Farmers are considered a weak point in the traditional dairy chain, due to their high sensitivity to internal and external factors than mediators. However, the price of skimmed milk is a major factor that affected the farmer's revenues and this price could depend on the price of powder skimmed milk in the international market and the cheese manufactories’ strategies.
The MCC could play a vital role in rural communities in terms of local development by allowing a good valorization of milk and in setting new quality standards. Governmental and non-governmental activities could propose new policies to protect the traditional actors along the chain. Specific dairy quality control programs should be developed along the chain. So, dairy sector instruction and rolls should be reviewed to make a balance along the chain and to set a fair pricing system and guarantee food safety for all consumers in local village and city markets.

The fourth part was conducted on veal supply chain in Egypt which involved with many beneficiaries along the chain that affecting the contribution of buffalo meat production at national level. It is important for policy maker to take into account when establishing new polices or new regulations toward reducing the negative effects on producers, mediators and consumer's needs. A contract veal raising model needs to be tested at village level as (a suggested model) for improving whole production system taken into account all actors, components and relationships in the whole village veal production system.
SUMMARY

The present study was carried out in three villages. ElEmam Malik village is located 120 km far from the north of greater Cairo, El-Beheira governorate represents the newly reclaimed land and the other two villages were ElAtf and Reka villages that located, respectively, at 50 and 80 km far from south of greater Cairo, Giza governorate, represent the old system in the Nile Valley. The thesis was divided into four parts; the first part is the characterization of buffalo milk value supply chains. The main objective of this part was characterize buffalo milk chains in three different villages. Milk pathways were followed for each chain in different villages. The starting point was traders, milk collection centers (MCC) and the key persons in the three studied areas. Field visits and interview with semi-open questionnaires where it used to collect the data from farmers and mediators. Milk samples were collected from farmers in winter, spring and summer in the three studied villages at the year 2013-2014. Milk composition, milk urea nitrogen (MUN) and somatic cell count (SCC) were determined. The results indicated that each village had its own chain that proper for each case. Also, there are two chains the first was called long chain which included farmers, mediators in terms of milk collection point, traders, milk collection centers, milk shops and consumers. The second chain called short chain which consists of farmers and consumers or have only one trader in between. Short chain achieved high profit for farmers and reasonable price for consumers compared to long chain. Long chain provided a lot of jobs along the chain. MUN level reflects the level of
nutrition where the best nutrition ratio was found in ElEmam Malik followed by Reka and ElAtf villages. The SCS was not affected by village site, SCS values were ranged from 5.1 to 5.5 which indicated that most animals were infected (subclinical mastitis). Also, normal buffalo milk contains less than 50% in rural areas, where no good management programs were applied and no mastitis control programs are followed. In General, MUN, SCC and milk composition could be used as a routine analysis for sampling small dairy farms in different regions to identify the most priority services and extension needs that should be introduced in different villages and rural regions.

The second part is focused on the characterization of the diversity of dairy farming systems and milk marketing strategies. The aim of this part was to suggest a methodology to characterize the diversity of dairy farming systems in Nile valley lands (NVLs) and newly reclaimed lands (NRLs) in Egypt to understand the traditional dairy sector. Data were collected from 65 farmers in three villages through three consecutive seasons. Interviews and field visits were done at the farm level. Based on multi-factorial and cluster analyses, six farmer groups were identified according to land and livestock assets, milk production and milk marketing. Milk marketing was influenced by season, farmers’ traditions, and market access. Structure highlights the dominance of small-scale crop-livestock system, farm family depends on milk as a source of protein and fat for family food and as a main source of income especially in old lands, while in NRLs, there was a higher crop-livestock integration and complementary to cover family and farm expenses, so paid services strategy could fit dairy sector in new lands. Milk
production constitutes a major activity in very small land farms, the sustainability of this sector facing the lack of technical support and lack of pricing system for milk and feedstuffs, where more governmental and non-governmental projects are needed to supply farmers with high quality forage seeds, high producing animals, and veterinary services. So, considering the diversity of farming systems, one agricultural policy will not fit all farmers’ categories.

The third part is the traditional skimmed milk chain. The aim of this part was to apply SWOT analysis on traditional milk chain, particularly buffalo skimmed milk chain around greater Cairo which one of the main dairy markets in Egypt. Consequently, SWOT analysis including food safety aspects and value chain analysis were combined to raise the major advantages and malfunctioning of traditional sector. This part was based on regular field visits, interviews, and milk sampling analysis. The main stakeholders of the chain were farmers, points of milk collection, milk collection center, and dairy processing units. The SWOT analysis show that milk chain had a major role of social network to explain the flexibility and adaptation of this sector to the major constraints in link with international competitiveness and national constraints, mainly on land access. Other weaknesses concerned higher price of feedstuffs, and lack of public services, in terms of quality and herd management at farm level. However, the social network opens interesting opportunities to develop efficient and flexible services. These elements could help decision makers and developers to select sustainable development activities in link with global agenda of the agricultural sector and increasing demand for dairy products in Egypt.
The fourth part is veal supply chain at village level in Egypt. The aims of this part were characterize the veal supply chain using survey analysis for different actors along veal chain and to estimate meat quality parameters of buffalo meat categories in Egyptian market to interpret the high demand for veal meat. About 27 meat samples from *Longissimus dorsi* muscle were collected from local markets: 11 samples of veal (meat plus bone); 8 boneless meat samples of fattening calves and 8 boneless meat samples of culled females. Meat chemical composition, cholesterol and physical traits were determined. Survey analysis indicated that 65% of Egyptian farmers sold veal as early as possible. 61% of those farmers sold their animals for economic reasons, 14% for technical reasons and 25% for both reasons. Veal price was affected by season, the veal price was lower in winter compared to summer season. Meat chemical composition, cholesterol content and physical traits were influenced by advancing age. Fat content and cholesterol levels were lower in veal meat compared to fattening calves or culled females; the same trend was observed for shear force values and cooking loss percentages. Concerning meat color culled females were darker than fattening calves and consequently veal meat. This result explain why the veal meat is regularly consumed by elders, sick peoples and employees (less physical work) due to it is high tenderness, attractive color, lower fat and cholesterol content. Modification of veal supply chain at village level through establishing fattening calves and heifers raising stations supported by policy makers, banks, NGOs, private sectors, universities and research institutes could improve the contribution of buffalo meat at national scale.
REFERENCES


El-Ramady, H.R.; El-Marsafawy, S.M. and Lewis, L.N. (2013). Sustainable agriculture and climate changes in Egypt. Sustainable agriculture reviews, Sustainable Agriculture Reviews 12. DOI 10.1007/978-94-

ESRI (2014). Environmental Systems Research Institute, Arc Map 10.2.2 Redlands, California.


FAO, WFP. "IFAD" (2012). The state of food insecurity in the world. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition." Food and Agriculture Organization of the United Nations, Rome, Italy (2015).


LACTIMED (2014). Developing the typical dairy products of Alexandria and Beheira: Diagnosis and local strategy. 54 p. www.lactimed.eu.


APPENDICES

APPENDIX I

Questionnaire at the farm level

T1_Identification

1. Code number: ____  5. Location: N
2. Location:  6. E
3. Farmer’s Name:  7. Way point:
4. Date of visit:  8. Mobile phone:

T2_Structure

9. How many persons in your family? (Persons who depend economically on you): /_____/
12. Number of occasional labor /_______/  13. cost (LE/day): /__________/  
14. Number of permanent labor /_______/  15. cost (LE/month):/__________/  

Crop production

## Animal production

**T3_Herd** composition for large ruminants (day of visit)

<table>
<thead>
<tr>
<th>Type</th>
<th>Buffalo</th>
<th>Holstein</th>
<th>Crossbred</th>
<th>Baladi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy animal</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Bulls</td>
<td></td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Heifers</td>
<td></td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Male calves</td>
<td></td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>(&lt; 3 months)</td>
<td></td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Fattening calves</td>
<td></td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>(&gt; 3 months)</td>
<td></td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
</tbody>
</table>

Other animals: number of

- 23. Goats :
- 24. Sheep :
- 25. Donkeys :

**Code number:** _____ **Date of visit:**
## Part 2: Variables to access

### 1. T4 Milk (The day of the visit):

<table>
<thead>
<tr>
<th>Number of milked female</th>
<th>Buffalo</th>
<th>Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (kg/day)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Main milk selling destination**

<table>
<thead>
<tr>
<th>Sale to collector or collection point (kg/day)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (EGP / liter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cream return (Yes / No)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**The use of raw milk via the family farm**

| Self-consumption of raw milk (kg/day) |         |     |
| Direct raw milk sale (kg/day)        |         |     |
| Transformation for cheese (kg/day)   |         |     |
| Transformation for cream (kg/day)     |         |     |
| Transformation for raïben (kg/day)    |         |     |

Do you sell raw milk (Yes / No)?

If “yes”, how many this day (kg / week)?

Price (EGP / kg)

Do you sell butter (Yes / No)?

If “yes”, how many (kg / week) this week

Price (EGP / kg)

Do you sell cheese (Yes / No)?

If “yes”, how many (kg / week) this week

Price (EGP / kg)

The main selling point for cheese and butter?
2. **T5_Veal**

26. Do you sell veal (Yes / No)?

If “Yes“

- 27. average price this season (EGP / head)
- 28. average age this season (months / head)
- 29. Where (trader, market)?
- 30. Age of weaning (in days)
- 31. source of milk ( ) Buffalo ( ) Cow ( ) milk powder
- 32. How much milk did you feed for veal first 10 day (total kg / head)?
- 33. How much milk did you feed for veal after first 10 day (total kg / head)?
- 34. Average concentrate feeds (kg )
- 35. Composition: wheat bran / mixed / other

3. **T6_Feedstuff**

- 36. Do you feeding Animal on concentrate (yes or no)?
- 37. If no give why?
- 38. Average concentrate feeding (kg/ day)
- 39. Composition of Concentrate
- 40. type of forage /____/ a. clover  b. green corn  c. sweet corn  
  d. other
- 41. Explain the other ……………………………
- 42. Average forage feeding kg/day
- 43. Average Silage feeding kg/day
- 44. type of Roughage /____/ a. Wheat straw  b. Rice straw  c. other
- 45. Average Roughage feeding kg/day
- 46. the price of silage (ton)
- 47. the price of concentrate (ton)
- 48. the price of Roughage (ton)

4. **T7 Question?**
   49. What is the reason for contact with trader or milk center other than another one?

   50. Why you don't sell milk?

   51. Why do you sell veal?

   **Code number: _____**

   **Date of visit:**
APPENDIX II

Questionnaire at the collection point level

Code number: _____        Date of visit: 

Location:

Head’s unit Name: Location: N
                  E

Way Point:

Part 1: Description (only for the first visit)

1. Story of the head of the Collection Point (Establishment date, experience before, key dates of change in the unit)
2. Organization around the Collection Point (Capacity, equipment, products, suppliers …) To draw a diagram with all stakeholders, types – volumes and prices of each milk products
3. Future for the Collection Point? (What do you like to change in the future? If you have a lot of money, what will you do / milk activity?)

Part 2: Milk flows at the Collection Point

Today:

- Number of collected farmers :
- Maximum distance between the farmer and collection point (km) :
- All raw Milk Collection (kg/day):
  Buffalo: Cow:
- Skimmed Milk Collection (kg/day) :
  Buffalo: Cow:

- Milk price to the farmer (EGP/kg) :
APPENDIX III

Questionnaire at the collection center level

Code number: _____                    Date of visit: 

Head’s collection center Name:        Location: N
                                        E

Way point:

Part 1: Description (only for the first visit)

1. Story of the head of the Collection Centre (Establishment date, experience before, key dates of change in the unit)
2. Organization around the Collection Centre (Capacity, equipment, products, suppliers, retailers, …) To draw a diagram with all stakeholders, types – volumes and prices of each milk products
3. Future for the Collection Centre? (What do you like to change in the future? If you have a lot of money, what will you do / milk activity?)

Part 2: Milk flows at the Collection Centre level

IF RECORDING BOOKS: monthly collected and selling milk per stakeholder (collection points or farmers / cheese collection units or airy

Today: IF NO RECORDING BOOKS: 3 visits if necessary (to confirm)

- Milk Collection (kg) : Buffalo :
  Cow :
- Sale (kg/day and price) : - Buffalo raw all milk :
APPENDIX VI

Questionnaire for veal selling decision at the farm level

1. Code number: ____  5. N
2. Location:  6. E
3. Farmer’s Name:  7. Way point:
4. Date of visit:  8. Mobile phone:

9. Level of Education:
   Labor:

10. Number of occasional labor /______/ 11. cost (LE/day): /________/  
12. Number of permanent labor /________/ 14. cost (LE/month):/__________/

Veal

13. The sex of calf
14. Date of birth  15. Period of suckling
16. Suckling method
17. Amount of milk until weaning or selling
18. Weight at selling or weaning
19. Selling price
20. Why did you selling veal? Ranking the season
   (Money need – shortage in milk - sex. - )
21. Why did not selling the veal?
APPENDIX IV

<table>
<thead>
<tr>
<th>Questionnaire for veal at the trader and butcher level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Code number: _____</td>
</tr>
<tr>
<td>2. Location:</td>
</tr>
<tr>
<td>3. Trader Name:</td>
</tr>
<tr>
<td>4. Date of visit:</td>
</tr>
<tr>
<td>9. Level of Education:</td>
</tr>
<tr>
<td>10. History of the enterprise</td>
</tr>
<tr>
<td>10.1 Data of starting</td>
</tr>
<tr>
<td>10.2 where</td>
</tr>
<tr>
<td>11. Type of live animals</td>
</tr>
<tr>
<td>............................................../............................................../............................................../..............</td>
</tr>
<tr>
<td>............................................../..............................................</td>
</tr>
<tr>
<td>12. Name of markets visited by traders/ week and day of this market the distance for each on</td>
</tr>
<tr>
<td>........................................................../........................................................../............................................../..............</td>
</tr>
<tr>
<td>........................................................../..........................................................</td>
</tr>
</tbody>
</table>
13. The highest veal price………………EGP, and the lowest veal price
…………………..EGP

14. Purchasing systems depend on:

Weight ( ), Body conformation ( ), age ( ), Other ( )
……………………………………………………………………

15. Keeping period before selling or slaughtering………………………………………………

16. The price of cuts

17. The time to selling all carcasses

18. The type of customers

19. The reason of work with Veal

20. Do you think the rearing veal better or slaughter?

21. How is slaughter?
If rear veal (farmers or traders have a veal enterprise)

22. No. of veal / cycle…………………………

23. For fattening ( ) or for breeding ( ) or Both ( )

24. Selling weight ( ) or age ( )

25. Period of cycle

26. Cost of head

27. Selling price

28. Type and quantity of feeding Restaurant
الملخص العربي

توصيف سلسلتي إنتاج اللبن والبلعوم من الجاموس تحت نظام الإنتاج النباتي-الحيواني في مصر

الهدف العام من الدراسة هو توصيف سلسلتي اللبن والبلعوم من الجاموس وتحديد أهم العناصر الفاعلة في كل سلسلة والعوامل المؤثرة على كل سلسلة.

تقع هذه الدراسة في أربعة فصول.

الفصل الأول: يختص بتصنيف سلسلة إنتاج اللبن الجاموسى في ثلاث قرى مصرية.

وتمثلت الأهداف الرئيسية لهذه الدراسة في تحديد العناصر الأساسية على طول سلسلة إنتاج اللبن، وكذلك إجراء تحليل اللبن لدراسة ما إذا كان موقع القرية تأثير على التركيب الكيميائي للبن وكذلك مستوي البوريا والخلايا الجسدية فيه.

والقرى التي تم اختيارها هي الإمام مالك وتقع على بعد 120 كم شرق القاهرة بمحافظة البجيرة (كمثال للأراضي حديثة الاستصلاح)، أما القرى الأخرى (العطف و الرقة) على بعد 50 و 80 كم، على التوالي جنوب الجيزة (كمثال للنظام القديم في وادي النيل). وقد تم تتبع مسارات اللبن في كل سلسلة من سلاسل إنتاج اللبن لكل قرية. وكانت نقطة البداية من التجار ومركزا تجميع اللبن الأطراف الفاعلة في قطاع الألبان في المناطق الثلاث. كانت الزيارات الميدانية والمقابلات الشخصية هما الوسائل الأساسية المستخدمة لجمع البيانات من الفلاحين والوسطاء.

تم جمع عينات اللبن في فصول الشتاء والربيع والصيف من القرى الثلاث خلال الفترة من 2013 إلى 2014. وتم تقدير التركيب الكيميائي ومستوى البوريا في اللبن (MUN) وعدد الخلايا الجسدية (SCC). وأشارت النتائج إلى أن كل قرية لها سلسلة خاصة بها تتناسب وظروفها الخاصة. وقد وجد أن هناك سلسلتين، الأولى طويلة وتتضمن ثلاثة وعشرين من حيث نقطة تجميع اللبن والتجار، وتركز تجميع اللبن والمحال التجارية والمحلات التجارية. وعندما تقنع أن السلسلة القصيرة تتكون من المنتجين والمستهلكين وقد تحتوي على وسيط واحد فقط.

1
فوائد السلسلة القصيرة أنها تحقق ربح مرتفع للفلاحين وسعر معقول للمستهلكين مقارنة بالسلسلة الطويلة. بينما توفر السلسلة الطويلة الكثير من فرص العمل على طول السلسلة. أشارت النتائج أن مستوى MUN يعكس مدى ملاءمة نظام التغذية المتبوع حيث حزفت أفضل النسب كمؤشرات للتغذية الجيدة في قرية الإمام مالك تلاها قرية الرقة ثم قرية العطف.

لم يظهر تقدير درجة الخلايا الجسدية اختلافاً بين القرى محل الدراسة وكانت القيم تتراوح بين 5.1-5.5 درجة والتي تشير إلى أن معظم الحيوانات كانت مصابة (بالتهاب الضرع - غير المرئي). حيث، وجد أن أقل من 50% من الجاموس خالي من الإصابة بالتهاب الضرع، حيث تعاني معظم القرى من غياب تطبيق برامج الرعاية الجيدة وبرامج البيطرة على مرض التهاب الضرع على مدار العام. ومن هنا كانت الحاجة لإجراء هذه التحليلات بصفة دورية وأخذ عينات بصفة مستمرة من مختلف القرى حتى يمكن توفير الدعم الفني للخدمات ذات الأولوية طبقاً لاحتياجات كل قرية.

الفصل الثاني: يختص بتوصيف تنوع النظم الزراعية واستراتيجيات تسويق الألبان في القرى الثلاثة بهدف اقتراح منهج بحثي لدراسة وتوصيف تنوع النظم الزراعية لإنتاج الألبان في أراضي وادي النيل والأراضي حديثة الاستصلاح لفهم قطاع إنتاج الألبان تحت النظام التقليدي في القرى المحليبة بالقاهرة الكبرى. وقد تم جمع البيانات من عدد 55 مزارع في القرى الثلاث خلال ثلاثة مواسم متتالية. وقد أجريت الزيارات الحقلية والمقابلات الشخصية على مستوى المزرعة وبناء على تحليل العوامل المتعددة والتحليل الفني تم تحديد ست مجموعات من الفلاحين وفقاً لأصول الأراضي والثروة الحيوانية وإنتاج اللبن وطبيعة تسويق اللبن. وقد تأثر تسويق اللبن بالموسم وتفاعلات الفلاحين، وطريقة تسويق اللبن في كل منطقة، ومن خلال تحليل ضوء على صغر الفلاحين الذين يهممون على نظام الإنتاج النباتي الحيواني التقليدي وخاصة في الأراضي القديمة، حيث أن الأسرة الريفية تعتمد على اللبن كمصدر للبروتين الحيواني والدهن في الطعام وكمصدر للكهرباء خاصة في الأراضي القديمة، بينما في الأراضي حديثة الاستصلاح كان هناك قدر كبير من التكامل بين الإنتاج النباتي والإنتاج الحيواني بهدف لتغطية نفقات الأسرة والمزارع، لذلك فإن استراتيجية الخدمات المفتوحة للأجر يمكن أن تسهم في إصلاح قطاع الألبان في الأراضي حديثة الاستصلاح. ويشكل إنتاج اللبن
النشاط الرئيسي لأصحاب الحيازات الصغيرة جداً، كما أن تحقيق الاستدامة في هذا القطاع يواجه عدم توفر الدعم الفني وغياب وجود نظام مناسب لتعزيز الألبان والأعلاف، وبالتالي يحتاج هذا القطاع للمزيد من المشاريع الحكومية وغير الحكومية لدعم الفلاحين من خلال توفير بدور الأعلاف المحسنة علايا الإنتاج، وتوفير حيوانات محسنة وراثياً ذات إنتاج عالي وتقديم الخدمات البيطرية. ونظراً لتتنوع النظم الزراعية، فإن سياسة زراعية واحدة لن تناسب كل فئات الفلاحين. كما يجب مراعاة أن تتسبب الخدمات الحكومية وغير الحكومية المقدمة طبقاً للمنطقة والموسم.

الفصل الثالث: وفيه تم تحليل نقاط القوة والضعف والفرص والمخاطر (SWOT) لسلسلة إنتاج اللبن الفرز التقليدية تحت النظام التقليدي بهدف تطبيق تحليل SWOT على سلسلة إنتاج الألبان تحت هذا النظام، وخاصة سلسلة إنتاج اللبن الجاموسي (الفرز) حول القاهرة الكبرى التي تعتبر واحدة من الأسواق الرئيسية في استيعاب منتجات الألبان في مصر. ونتيجة لذلك تم عمل تحليل SWOT لما في ذلك تناول بعض المقاييس الخاصة بسلامة الأغذية وتحليل سلسلة الإنتاج لتحديد أهم المزايا والمشاكل التي تواجه هذا القطاع. تم جمع البيانات و أخذ عينات اللبن من خلال الزيارات الحقلية المتكررة، والمقابلات الشخصية. حيث شملت العناصر الرئيسي اللفاصل وثامن: الفلاحين، ونقاط تجمعي اللبن، مركز تجميع اللبن، وحدات تصنيع البترول. وقد سمح تحليل SWOT بتسليط الضوء على الدور الرئيسي لشبكة العلاقات الاجتماعية، والتوكالات والتكيف التي يتمتع بها هذا القطاع مع المعايير الرئيسية والتي ترتبط بالسلسلة الإنتاجية، والقدرة على الحصول على الأراضي الصالحة للزراعة والتي تعتبر من المعايير المحلية. ومن نقاط الضعف الأخرى ارتفاع أسعار مكونات الألبان في الأسواق، وعدم توفر الخدمات العامة من حيث تحسين الجودة و رعاية القطعان على مستوى المزرعة.

ومع ذلك فإن شبكة العلاقات الاجتماعية يمكن الاستفادة منها في تطوير وتقديم خدمات فعالة ومرنة هذه العناصر يمكن أن تساعدها صناع القرار والتموين في تحديد أولويات أنشطة التنمية المستدامة وربطها برامج الزراعة العالمية وزيادة الطلب على منتجات الألبان في مصر.

الفصل الرابع: كان الهدف من هذا الفصل وضع سلسلة الببتل باستراتيجية تحقيق الاستدامة لمختلف العناصر الرئيسية على طول السلسلة وتقييم جودة اللحوم لفئات اللحوم الجاموسي.
المختلفة في السوق المصري لتفسير زيادة الطلب على لحوم البتلول. تم شراء 27 عينة لحوم من عضلة الظهر (بيت الكلاوي) من الأسواق المحلية على النحو التالي 11 عينة من لحم البتلول، 8 عينات من لحوم الكندوز و 8 عينات لحم من الإناث المستبعدة. وتم تحديد التركيب الكيميائي والكوليسترول والصفات الطبيعية للحوم. أشارت النتائج إلى أن 65% من الفلاحين المصريين يĉومن ببيع العجل البتلول في عمر صغير (40 يوم)، 31% من هؤلاء الفلاحين يبيعون حيواناتهم لأسباب اقتصادية، و 14% لأسباب فنية و 25% لكلا السببين معاً.

وقد لوحظ أن أسعار العجل البتلول تتأثر بالموسم، حيث سجلت أقل سعر في فصل الشتاء مقارنة مع فصل الصيف. ووجد أن التقدم في عمر الحيوان له تأثيرات على كل من التركيب الكيميائي للحوم ومستوى الكوليسترول والخصائص الطبيعية للحوم. حيث إنخفضت نسبة الدهن بين الألياف ومستوى الكوليسترول في لحوم "البتلول" مقارنة مع لحوم "الكندوز" ولحوم "الإناث المستبعدة". وقد لوحظ أن القوة اللازمة للمقطع (كمؤشر للطراوة) والنسبة المئوية للفقد بالطبخ قد أخذت نفس الاتجاه أيضاً. كان لون لحوم الإناث المستبعدة أكثر قتامة من حوم الذكور المسمنة ولحوم البتلول. هذه النتائج قد تفسر سبب تزايد الإقبال على إستهلاك لحم البتلول من قبل كبار السن والمرضى والموظفين (بذل مجهود بدني أقل) والراجع إلى ارتفاع درجة الطراوة، اللون الفاتح، وانخفاض محتوياً من الدهن والكوليسترول.

ويوصى الدراسة بزيادة مساهمة الجاموس من اللحوم الحمراء على المستوى القومي عن طريق تعديل سلسلة البتلول على مستوى القرية من خلال إنشاء محطات لتسمين العجل وأخرى لتربيته العجلات بدعم من قبل صانعي السياسات الزراعية والبنوك والمنظمات غير الحكومية والقطاع الخاص إضافته إلى المشاركة الفنية من الجامعات والمعاهد البحثية.
العنوان الرئيسي: توصيف سلسلة إنتاج اللبن والبقل السائل من الجاموس تحت نظام الإنتاج النباتي. الحيوانات في مصر

المشرفون:
- دكتور: آمال مالك العشيري
- دكتور: السيد صلاح الدين جلال
- دكتور: كريستيان كورني
- شريف عيدالغني طلبة

تاريخ منتخب: 6/2/2013

الاسم المحترم: محمد علي عبد الله رضوان

المستخلص العربى

استنادًا إلى أبحاث أجزاء لهذا التوصيف سلسلة إنتاج اللبن والبقل السائل من الجاموس في ثلاث قرى في ثلاث سنوات، وتم جمع البيانات عن النموذج الكيميائي والمستوى البخاري في اللبن. تم تجميع البيانات عن نظام الري والارتفاع الخلفي، وال nhắnات الفردية والمحاصيل الفردية. كما تم معالجة البيانات للфиالات على القدر من الفلاحين أظهرت النتائج أنه هناك سلسلة إنتاج للبن تكون متصلة وأخرى سلسلة إنتاج للبن، والموارد التجارية. وبناء عليه، تضمن الفلاحين أوجه اقتراحات عديدة لتحسين العمليات المحسنة، حيوانات عالية الإنتاج، وتوفير الخدمات الإقليميةplots. وبناء على تابين النظام المزرعي فإن سياسة زراعية واحدة تعتبر غير ملائمة لكل فلاحين مع الأقدام في الاتفاقية المختلفة للموضوع.

الهدف من الجملة الثالث هو تطبيق تحليل نقاط القوة والضعف والفرص والمخاطر لسلسلة إنتاج اللبن التقليدية والنصوصية السليسلة إنتاج اللبن المفروض حول القارة الكبرى والتي تعتبر من أكبر أسواق منتجات اللبن في مصر. وسعت هذه الدراسة أن يكون السلف والنشاط الذين وردت تعديلات الأسباب تشكل انضباط الإنتاج للسلة. وكما أظهرت النتائج أن 25% من النقلين يقومون ببيع البقولين البقل السائل في عم صغر. وبناء على تابين النظام المزرعي فإن سياسة زراعية واحدة تعتبر غير ملائمة لكل فلاحين مع الأقدام في الاتفاقية المختلفة للموضوع.

الهدف من الجملة الرابع هو توصيف سلسلة إنتاج البقل، باستخدام تحليل الاستجابة لمختلف العناصر على طول السلسلة. كما أن هناك تأثيرات على بعض العناصر، مثل التزايد النموذجي للحوم البقر في ثلاث سنوات، حيث أظهرت النتائج أن 25% من الفلاحين يقومون ببيع البقولين البقل السائل في عم صغر. وبناء على تابين النظام المزرعي فإن سياسة زراعية واحدة تعتبر غير ملائمة لكل فلاحين مع الأقدام في الاتفاقية المختلفة للموضوع.

التعليمات النهائية: الجاموس، سلسلة الإنتاج النباتي الحيواني، نقاط القوة والضعف، الفرص والمخاطر، بناء عليها، تابين النظام المزرعي فإن سياسة زراعية واحدة تعتبر غير ملائمة لكل فلاحين مع الأقدام في الاتفاقية المختلفة للموضوع.
توصيف سلسلتي إنتاج اللبن والبيتلو من الجاموس تحت نظام الإنتاج النباتي-الحيواني في مصر

رسالة مقدمة من

محمد علي عبدالله رضوان
بكالوريوس في العلوم الزراعية (الإنتاج الحيوي)، كلية الزراعة، جامعة القاهرة، مصر، 2004
ماجستير في العلوم الزراعية (الإنتاج الحيوي)، كلية الزراعة، جامعة القاهرة، مصر، 2009

للحصول على درجة

دكتوراه الفلسفة

في

العلوم الزراعية

(الإنتاج الحيوي)

قسم الإنتاج الحيوي
كلية الزراعة
جامعة القاهرة
مصر

2016
توصيف سلسلتي إنتاج اللبن والبئن من الجاموس تحت نظام الإنتاج النباتي-الحيواني في مصر

رسالة دكتوراه الفلسفة
في العلوم الزراعية
(الإنتاج الحيواني)

مقدمة من

محمد علي عبدالله رضوان
بكالوريوس في العلوم الزراعية (الإنتاج الحيواني)، كلية الزراعة، جامعة القاهرة، مصر، 2004
ماجستير في العلوم الزراعية (الإنتاج الحيواني)، كلية الزراعة، جامعة القاهرة، مصر، 2009

لجنة الإشراف

دكتور/ آمال كمال العشيرة
أستاذ رعاية الحيوان - كلية الزراعة - جامعة القاهرة

دكتور/ السيد صلاح الدين جلال
أستاذ تربية الحيوان - كلية الزراعة - جامعة عين شمس

دكتور/ كرستيان كورنييه
باحث - بمعهد سيراد - مونبلييه - فرنسا

دكتور/ شريف عبد الغني طلبة
مدرس تربية الحيوان - كلية الزراعة - جامعة القاهرة
توصيف سلسلتي إنتاج اللبن والبتهو من الجاموس تحت نظام الإنتاج النباتي-الحيواني في مصر

رسالة دكتوراه الفلسفة
في العلوم الزراعية
(الإنتاج الحيواني)

مقدمة من
محمد علي عبدالله رضوان
بكالوريوس في العلوم الزراعية (الإنتاج الحيواني)، كلية الزراعة، جامعة القاهرة، مصر، 2004
ماجستير في العلوم الزراعية (الإنتاج الحيواني)، كلية الزراعة، جامعة القاهرة، مصر، 2009

لجنة الحكم

دكتور/ سمير أحمد مختار
أستاذ تربية الحيوان المتفرغ - كلية الزراعة - جامعة قناة السويس بالإسماعيلية

دكتور/ ربيع رجب صادق
أستاذ رعاية الحيوان - كلية الزراعة - جامعة القاهرة

دكتور/ آمال كمال العشيري
أستاذ رعاية الحيوان - كلية الزراعة - جامعة القاهرة

التاريخ: 09/6/2016
استمارة معلومات الرسائل التي تمت مناقشتها

الكلية / المعهد :

القسم :

1 – الدرجة العلمية :
- ماجستير
- دكتوراه

2 – بيانات الرسالة :

عنوان الرسالة باللغة العربية :
توصيف سلسلتي إنتاج اللبن والبيتلو من الجاموس تحت نظام الإنتاج النيبائي-الحيواني في مصر

عنوان الرسالة باللغة الأجنبية :
Characterization of Milk and Veal Production Chains of Buffalo
Under Crop-Livestock Production System in Egypt

tخصص الدقيق : علوم إنتاج حيواني "رعاية الحيوان"

تاريخ المناقشة :
09/06/2016

3 – بيانات الطالب :

الاسم : محمد علي عبدالله رضوان
الجنسية : مصري
النوع : ذكر
العنوان : 18 شارع الحبشة الشرقية الحوامدية الجيزة تليفون 38118269
جهة العمل : قسم الإنتاج الحيواني- كلية الزراعة- جامعة القاهرة
رقم الفاكس :
m.radwan883@agr.cu.edu.eg

4 – المشرفون على الرسالة :

الاسم 

المشرف

أد/ آمال كمال العشيري
قسم الإنتاج الحيواني - كلية الزراعة - جامعة القاهرة

أد/ السيد صلاح الدين جلال
قسم الإنتاج الحيواني - كلية الزراعة - جامعة عين شمس

د/ كريستيان كورتيه
بمعهد سيراد - مونبلييه - فرنسا

د/ شريف عبد الفتى طلبة
قسم الإنتاج الحيواني - كلية الزراعة - جامعة القاهرة
مستخلص الرسالة

باللغة العربية: بشرط ألا يزيد عن 7 أسطر

5-1

امتدت هذه الرسالة على 4 أجزاء لتوصف سلسلتي إنتاج اللين الجاموني والبلتو. كان هدف الجزء الأول إيراز وتحديد أوجه الاختلاف في سلسلة الإنتاج وكذلك تحديد الأطراف الفاعلة في سلسلة إنتاج اللين في ثلاث قرى تقع في محافظة الجيزة والبحيرة. لم يتم كيفية عمل هذه السلاسل الإنتاجية. أظهرت النتائج أن هناك سلسلة قصيرة لإنتاج اللين وأخرى طويلة. أما الجزء الثاني فقد كان الهدف منه وضع مقترح مهني لتوصف الاختلافات في نظام إنتاج الألبان في مصر حتى يتسمى فهم قطاع الألبان التقليدي. كان الهدف من الجزء الثالث هو تطبيق تحليل نقاط القوة والضعف والفرص والمخاطر لسلسلة إنتاج اللين التقليدية والأ服务区 سلسلة إنتاج اللين الفرز حول القاهرة الكبرى. أوضحت هذه الدراسة أن المزارع الصغيرة ونقاط تجميع اللين ومركز تجميع اللين ووحدات تصنيع الألبان تشكل العناصر الأساسية للسلسلة. أما هدف الجزء الرابع فهو توصيف سلسلة إعداد البلتو باستخدام تحليل الاستبيان لمختلف العناصر على طول السلسلة وكذلك فهم أسباب تفضيل بعض المستهلكين لحوم البلتو من خلال مقارنتها مع لحوم فئات الجاموس الأخرى في السوق المصري. أشارت النتائج إلى أن 65% من الفلاحين يقومون ببيع العجلة البلتو في عمر صغير. وربما تفسر هذه النتائج سبب تزايد الإقبال على استهلاك لحم البلتو من قبل كبار السن والمرضى والموظفين.

الكلمات الدالة: الجاموس، سلسلة الإنتاج الحيواني، نقاط القوة والضعف والفرص والمخاطر، اللين الفرز، البلتو.
This thesis includes four parts to characterize Buffalo milk and veal chains at different chain levels, the objectives of the first part were to identify the diversity of different chains and more deeply to determine main actors along the milk value chains in three different villages to understand how these chains work. Results indicated that there were a short chain and a long chain. The aim of the 2nd part was to suggest a methodology to characterize the diversity of dairy farming systems in Egypt to understand the traditional dairy sector. So, considering the diversity of farming systems, one agricultural policy will not fit all farmers’ categories taking into account the region and the season. The objective of the 3rd part was to apply SWOT analysis on traditional milk chain, particularly buffalo skimmed milk chain. SWOT analysis highlights the major role of social network to explain the flexibility and adaptation of this sector to the major constraints in link with international competitiveness and national constraints. The aim of 4th part was to characterize the veal supply chain. Survey analysis results indicated that 65% of Egyptian farmers sold veal as early as possible. Meat quality analysis results explained why the veal meat is regularly consumed by elders, sick people and employees.

**Key words:** Buffalo, chain, crop/livestock production system, SWOT, skimmed milk, veal
6 - أهم النتائج التطبيقية التي تم التوصل إليها:

( لا تزيد عن سطرين لكل منها )

6 - 1 - تطبيق المنهج البحثي المناسب لدراسة إنتاج الألبان والبيتلو في مصر.
6 - 2 - تحديد نقاط القوة والضعف والفرص والتهديدات التي تواجه قطاع الألبان التقليدي في مصر.
6 - 3 - وضع نموذج مقترح لتطوير قرية لتحسين استفادة من الموارد الحيوانية المحلية المتاحة (البيتلو).
7 - ما هي الجهات التي يمكن أن تستفيد من هذا البحث :
( اذكر تلك الجهات مع شرح أهمية البحث لهذه الجهة بما لا يزيد عن أربعة سطور لكل جهة

- وزارة الزراعة :
  تساعد هذه الرسالة صانعي السياسات الزراعية لفهم سلسلة إنتاج اللبن التقليدية وأهم المعلومات وكيفية الابتكار بذلك القطاع. كذلك، فهم سلسلة الإمداد بالبنو...

- شركات تصنيع الألبان :
  يمكن استفادة بمعرفة المشاكل التي تواجه الفلاحين وبالتالي تأتي إلى
  تقليل جودة الألبان وبالتالي العمل على المساعدة في حل المشاكل للوصول لمنتج ذو معايير عالية
  الجودة.

7 - مراكز تجميع الألبان :
  حتى تتمكن من معرفة كيفية تحسين جودة الألبان التي يتم تجميعها من
  صغار المزارعين.

8 - هل توجد علاقة قائمة بإحدى هذه الجهات :

في حالة نعم اذكر هذه الجهة :

- وزارة الزراعة
- شركات تصنيع الألبان
- مراكز تجميع الألبان

ما هي طبيعة العلاقة :

- مشروع بحثي
- تعاون أكاديمي
- مشروع ممول من جهة ثالثة

( Institut de recherche pour le développement (IRD)

( تذكر )
9 - هل توافق على التعاون مع جهات مستفيدة من خلال الجامعة:

لا

نعم

( لماذا)

(أ) لتطبيق البحث:

لا

(ب) لاستكمال البحث:

لا

(ج) أخرى

(تذكر)

10 - هل تم نشر بحوث مستخرجة من الرسالة في مجلات أو مؤتمرات علمية:

لا

(تذكر مع جهة النشر والمكان والتاريخ)


11 - هل سبق التقدم لتسجيل براءات اختراع:

لا

(تذكر مع الجهة والمكان والتاريخ)

12 - هل توافق على إعطاء البيانات المذكورة في هذه الاستمارة لجهات أخرى:

لا

نعم

توقيع الطالب:

- 

- 

- 

توقيع المشرفين:

- 

- 

- 

وكيل الكلية (المعهد) للدراسات العليا والبحوث:

التاريخ