ATLAS

THE TRADITIONAL MILK SECTOR AROUND GREATER CAIRO IN EGYPT

Université Ain Shams

Cairo University

ICARDA
Science for Better Livelihoods in Dry Areas

Agricultural Research Center

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APRI Animal Production Research Institute

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POUR LE DEVELOPPEMENT

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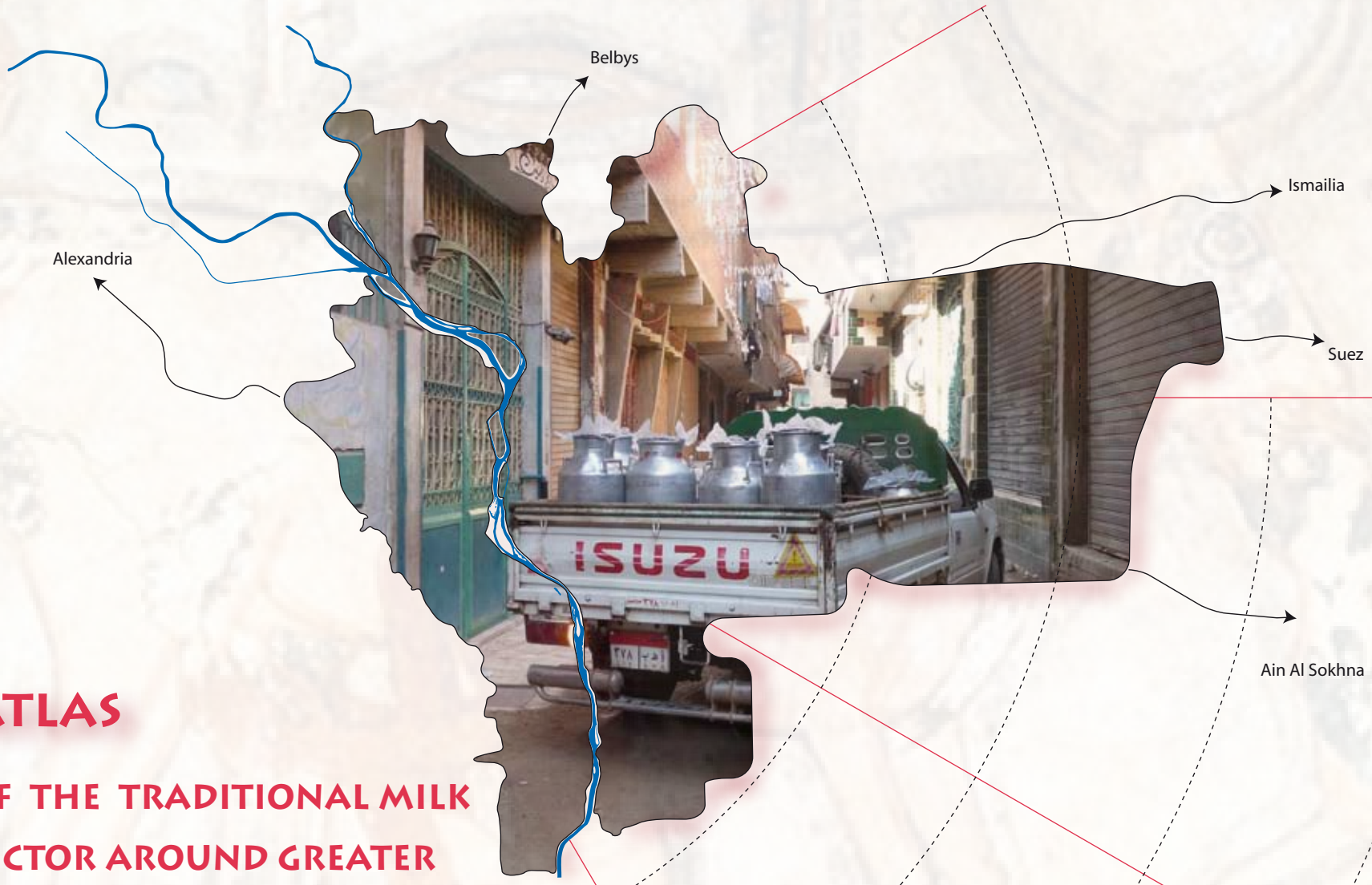

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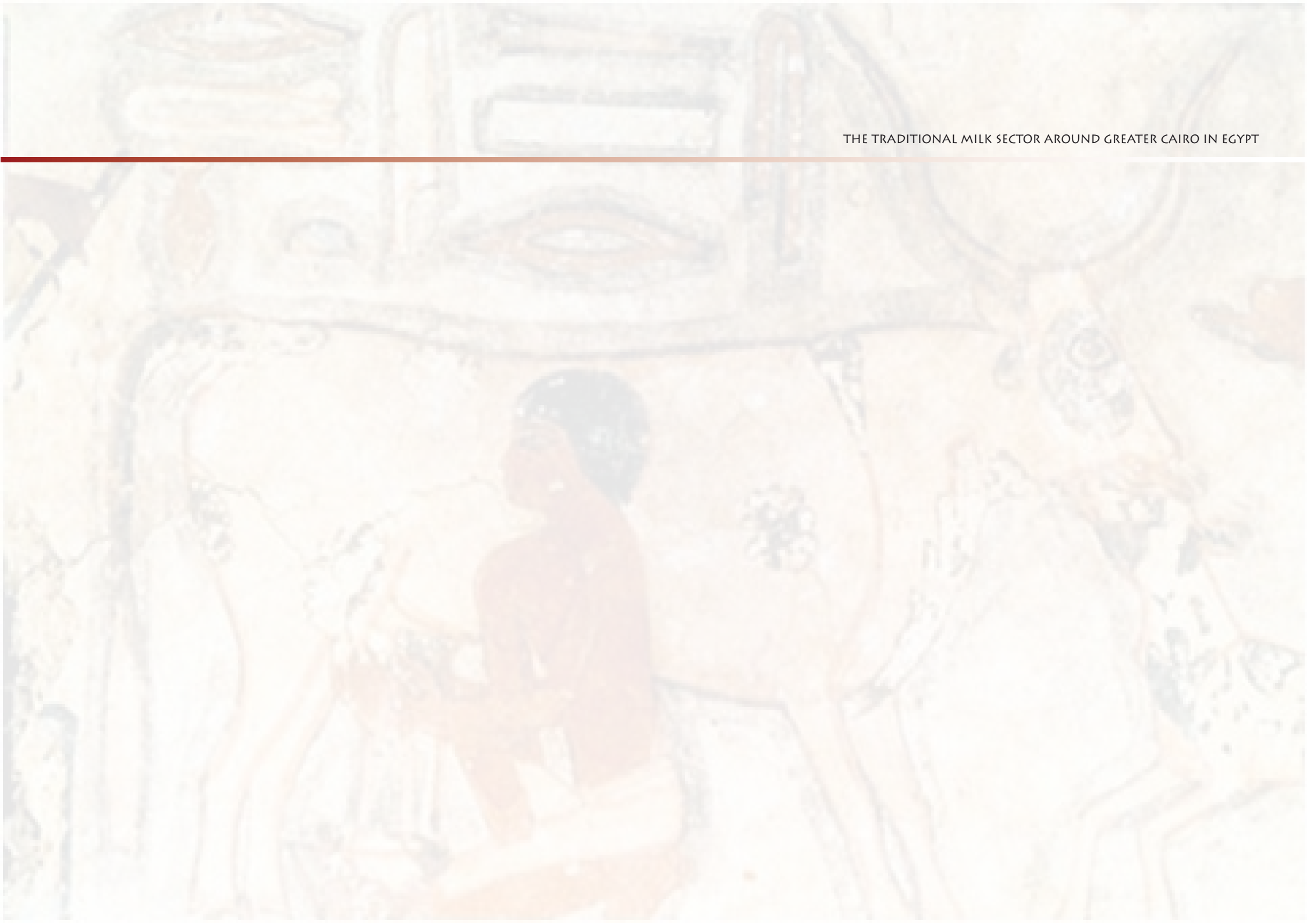

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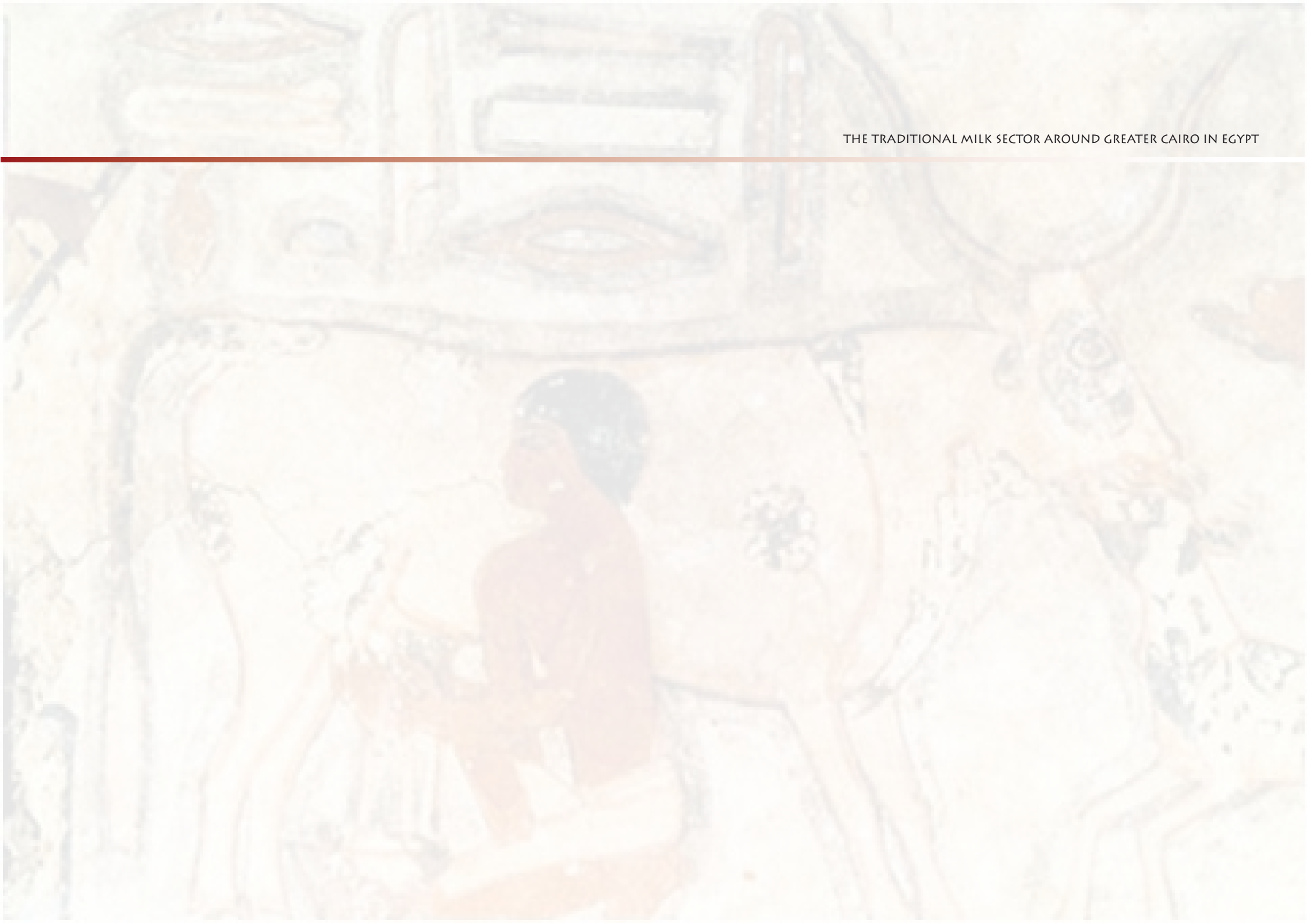

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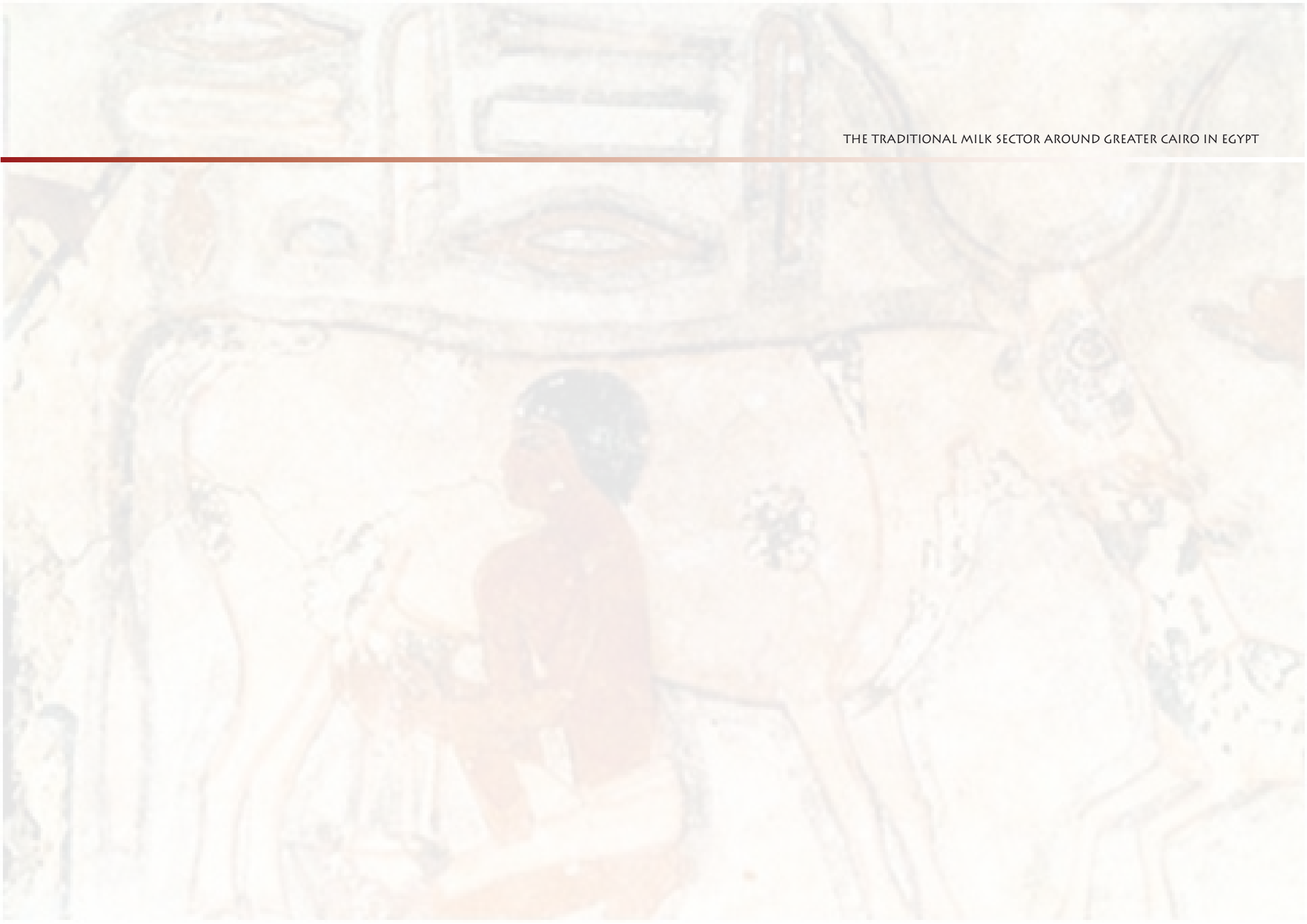

Editors:

Christian CORNIAUX[a] (second from left)

Christian Corniaux is an agronomist and holder of a PhD in livestock sciences. Over the course of the past 15 years, he has carried out research on dairy value chains in Africa. He is especially involved in West Africa (Senegal, Mali, Mauritania, Burkina Faso, Niger, Benin). The first studies were on dairy production systems. He worked also on dairy processors strategies in their production and consumption areas. Now, he is working on the dynamics of dairy value chains in different countries all over the world. Based in Dakar, he coordinates research projects on those topics.

Veronique ALARY[ab] (second from left)

Veronique Alary is an agronomist and holder of a PhD in economics. She has carried out research on household viability, risk management and vulnerability in rural areas over the last twenty years in several developing countries (Cameroon, India, Mali, Tunisia and Egypt). During the last 10 years, she has co-coordinated different projects in the Maghreb region on innovation adoption and impact in dry areas in the framework of the CIRAD/ICARDA collaboration. Based at ICARDA Cairo between 2009 and 2015, she has coordinated the ELVULMED project (2011-2015) on the roles of livestock in reducing vulnerability and the project DAIRY (2012-2015) on dairy value chains. She is now involved in two main research areas: firstly the adaptive capacity of families and the efficiency of their crop-livestock integrated systems in the new reclaimed lands of western Delta (CLIMED Project) and secondly the socio-economic impact of the development of milk collection centers in the new and old lands of Egypt (Danone Ecosystem Project). Her work mobilizes different approaches and tools (empirical data collection, typology, programming model).

Adel ABOULNAGA[c] (fourth from left)

Adel Aboul-Naga is an animal scientist holder of a PhD in Agriculture Science. He has occupied different functions in Egypt and abroad over the last 50 years: head of the sheep and goat production division at APRI (Animal Production Research Institute), APRI acting director for research and development, director of technology transfer at Agricultural Research Centre, undersecretary for the animal production sector at the Ministry of Agriculture in Egypt, Deputy permanent and representative of Egypt to FAO, WFP and IFAD in Rome over 5 years, senior advisor to ICARDA' director general. Since 2006, he is supervisor at APRI and chairman of different councils in animal breeding and genetic. He was the co-coordinator for Egypt of the research activities undertaken by the ElVulmed project on the role of livestock in reducing vulnerability and more recently by the Climed project on the future of livestock systems in Mediterranean context.

Salah GALAL[d] (Second from left)

Salah Galal obtained his PhD in Animal Breeding from Iowa State University, USA in 1965. His focus has been on Animal Genetics and Breeding, Animal Production Systems and Biometrics. He and his students and associates have taught and carried out research in these fields in Egypt and abroad. He spent twelve years as part of loan to Food and Agriculture Organization of the United Nations where his assignments consisted of involvement in regional and national programs and in Rome with the Animal Genetic Resources Group. Dr. Galal was involved in collaborative projects with France and Spain. Until July 2015, Dr. Galal was an Emeritus Professor at the Animal Production Department of Ain Shams University as well as the coordinator of the Dairy Project (Egypt).

a: Centre de Coopération International en Recherche Agronomique pour le Développement (CIRAD)
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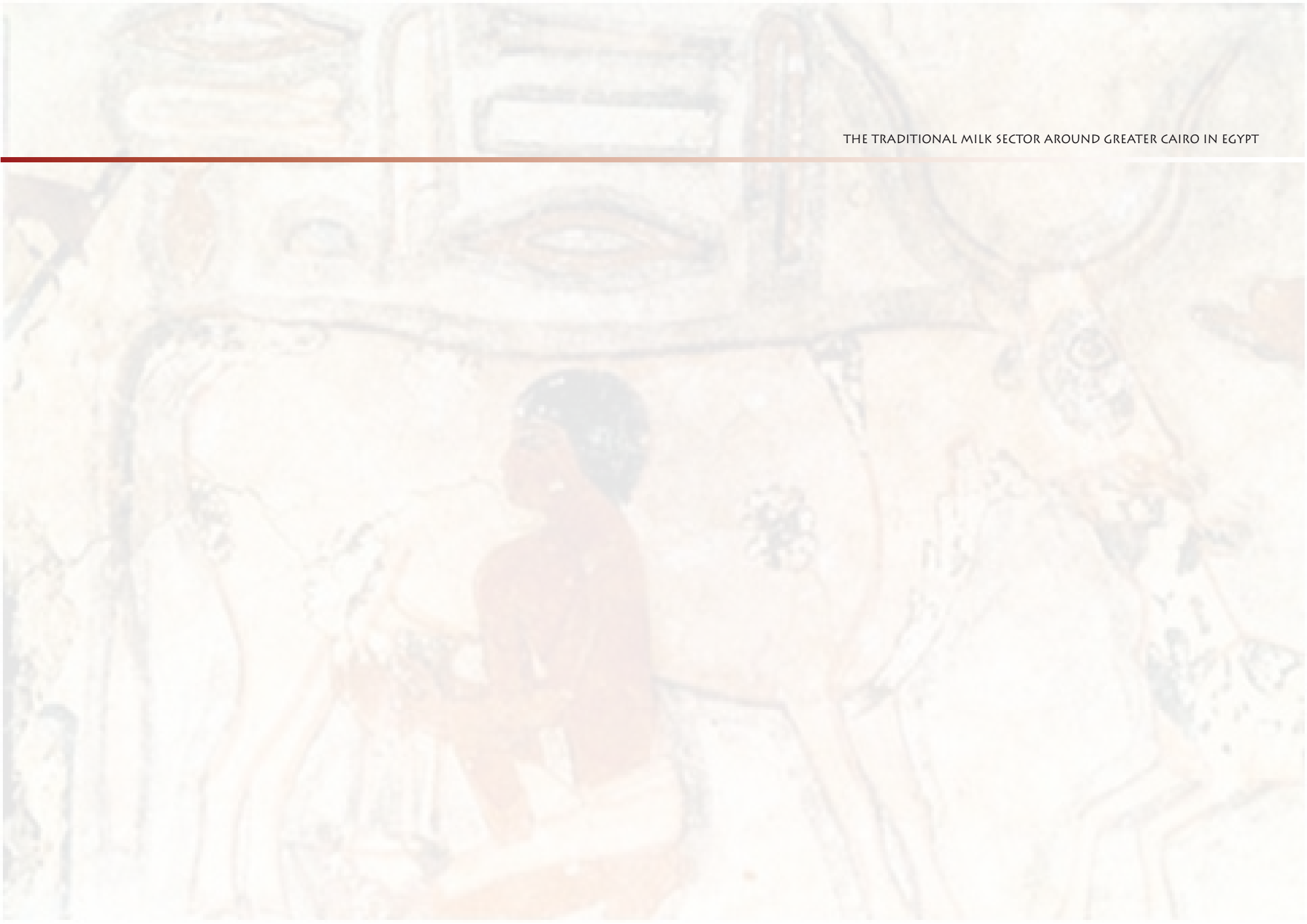


Agriculture has been the main pillar of national economy in Egypt, in absorbing population labor, and as source of livelihood for more than half the Egyptian population. Investment in agriculture has the highest socioeconomic dimension in the country, as 90% of the agriculture land are in the hands of the small-scale farmers, including livestock holders.

The main objective of livestock development in Sustainable Agriculture Development Strategy (SADS) 2030, issued in 2009, is to increase per capita share of animal protein by approximately 4 gm/day by the year 2030, as well as reconstructing the animal protein basket from different sources in favor of the local less costly sources. Consequently, prioritizing the development efforts of animal protein resources on the basis of their economic efficiency, while concentrating on the development of small and medium breeders.

SADS, recognized the imbalance between the efforts in development of agricultural production and that for market development, which lead to weakness in the marketing chain of different agriculture products, including fresh milk and its products. Such linkages become more complex in small farming operations, include small livestock holders.

Linking farmers, particularly small farmers with markets, including development of marketing systems and channels and the provision of marketing information, is essential especially for the perishable products like milk. There is a need to enacting laws and regulations to streamline markets, and commit dealers to apply quality standards, and inform consumers of these standards and their implications on price levels, as well as different products offered on the market, including dairy products.

The present Atlas book is the output of studies, shared by Egyptian and French scientists, is recognizable effort to update available information on the value chain of fresh milk and local dairy products, in Great Cairo (and the surrounding pre-urban areas), as the major consumer for fresh milk and dairy products.

Prof. Adel Elbeltagy
Former Minister of Agriculture and Land Reclamation , Egypt,
Former Director of ICARDA , President of CIHEAM and Chairman of GIVAR.

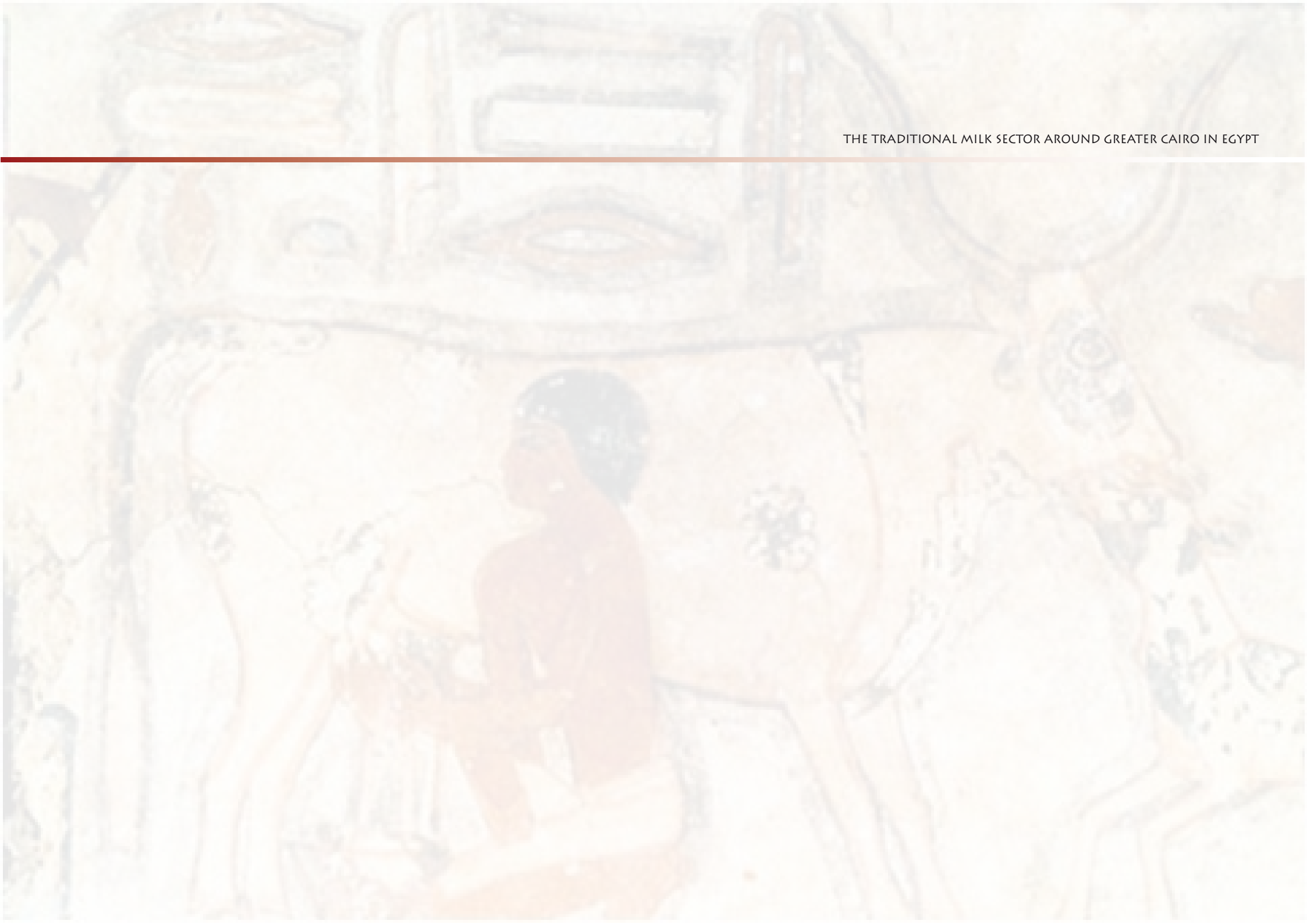
The atlas of the traditional milk sector around greater Cairo in Egypt is the confrontation of two main scientific concepts: (i) territory and space organization, and (ii) farming system. How the dairy producers in a traditional way are able to contribute significantly to the milk supply of a megapole like the great Cairo? How it is possible, to undertake the functioning of dairy farms (animal feeding, milk production and processing, marketing) in the interstices of this dense urban network? How, the different stakeholders of the dairy sector are combining their activities for satisfying the milk consumers? The answers needed to mobilize different disciplines (geography, economy, sociology, animal husbandry, food sciences,…) and methodologies (field survey, value chain analyses, historical investigation,…). And the result is a useful tool for understanding the ins and outs of this throbbing challenge: supply millions of people in animal proteins while maintaining a sustainable “rurban” network. Only a multidisciplinary approach is able to enlighten such complexity: indeed, the milk supply in the great Cairo is in a specific historical context plunging into the depths of the millennia of Pharaonic Egypt, in an anthropogenic network market by a strong human and animal density in a limited space (the Nile delta is among the most dense territories in the world), and a fantastic sociological diversity where the pluri-activity is an important fact of most stakeholders in the traditional dairy sector. The milk supply is not only a matter of produced quantities. It is also a question of sociological and spatial organization. Thus, the description of the production systems as well as their distribution in the urban and suburban territory relying on a complex set of maps, are among the high interests of the present Atlas. A city is not limited to a network of houses and streets, but includes also an important flow of goods and activities. The contribution of the cartography to illustrate the milk flow (importance and trajectories) is also an essential added-value of this Atlas. Of course, it is essentially valuable for the great Cairo, but the scientific approach developed to achieve this Atlas, is an interesting model valuable for all other megapoles in the world.

Bernard FAYE / Chercheur INRA - CIRAD France

Built on a joint partnerships between international institutes (CIRAD, ICARDA) and national research institutes (APRI, University of Cairo), the Atlas on the traditional milk sector around greater Cairo in Egypt is an original case study that provides an innovative approach in understanding the dynamics and challenges of a peri-urban agriculture sector in one of the global mega-poles.

The authors have used a pluridisciplinary approach along the dairy value chain, from the family farm to the consumer that highlights the embeddedness of socio-economic and technical challenges faced by the different stakeholders along the value chain. The integrative approach adopted in the study has allowed the identification and quantification of the critical role that the sector plays in terms of employment and economic viability for thousands of families. Through these diverse value chains the sector provides fresh and processed dairy products to millions of citizens within Cairo. Furthermore, the sector maintains strong social and economic links along a gradient of urbanization from the rural, peri-urban to urban zones that merit great attention from public decision makers in terms of the challenges associated with urbanization and development. Disrupters associated with the modernization of the sector that include aggregation of smallholder family farms to larger commercial units, the rise in imports and rapid urbanization will have significant implications for the sector and its associated value chains with social impacts. The atlas highlights new research areas within the context of what are seen as traditional agricultural in developing countries. The emergence of mega-poles such as Cairo will require new approaches that builds on these traditional systems that imparts resilience to these food systems. The functionality of urban food supply systems constitutes a major challenge for Egypt where the majority of the 165 million inhabitants will be living in mega-poles by 2050.

Andrew Noble
Deputy Director General - Research
ICARDA - International Center for Agricultural Research in the Dry Areas



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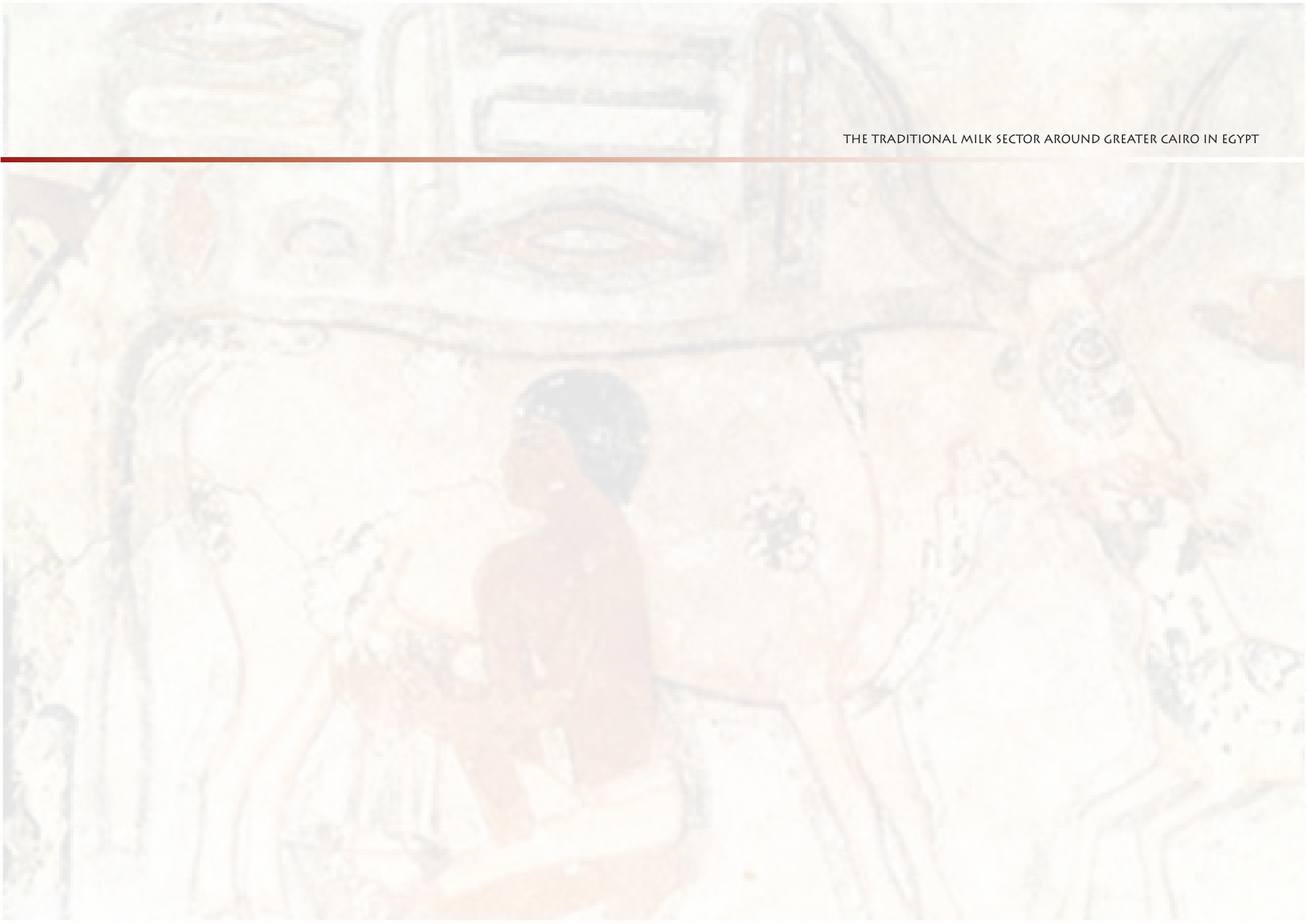


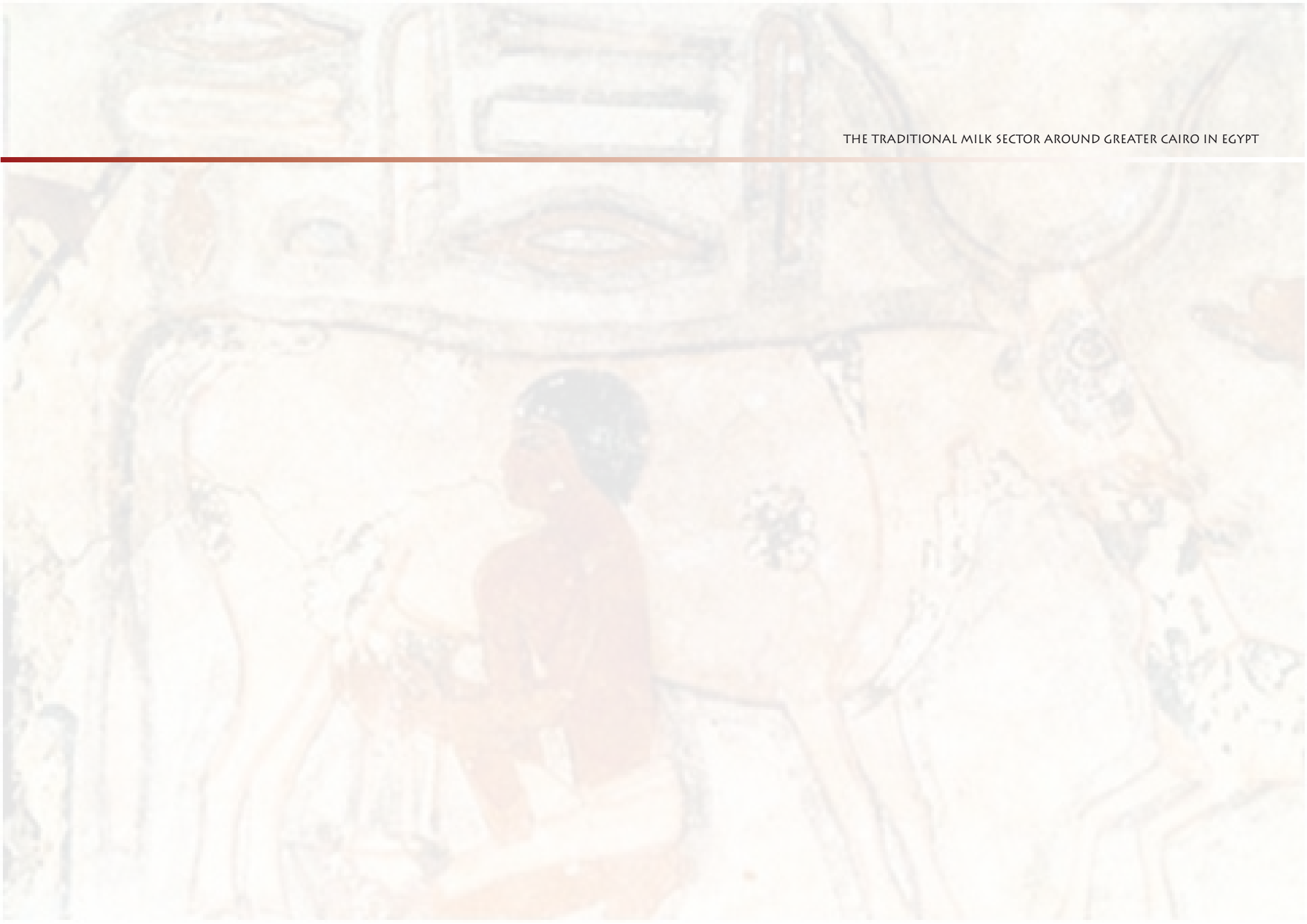
Acknowledgements

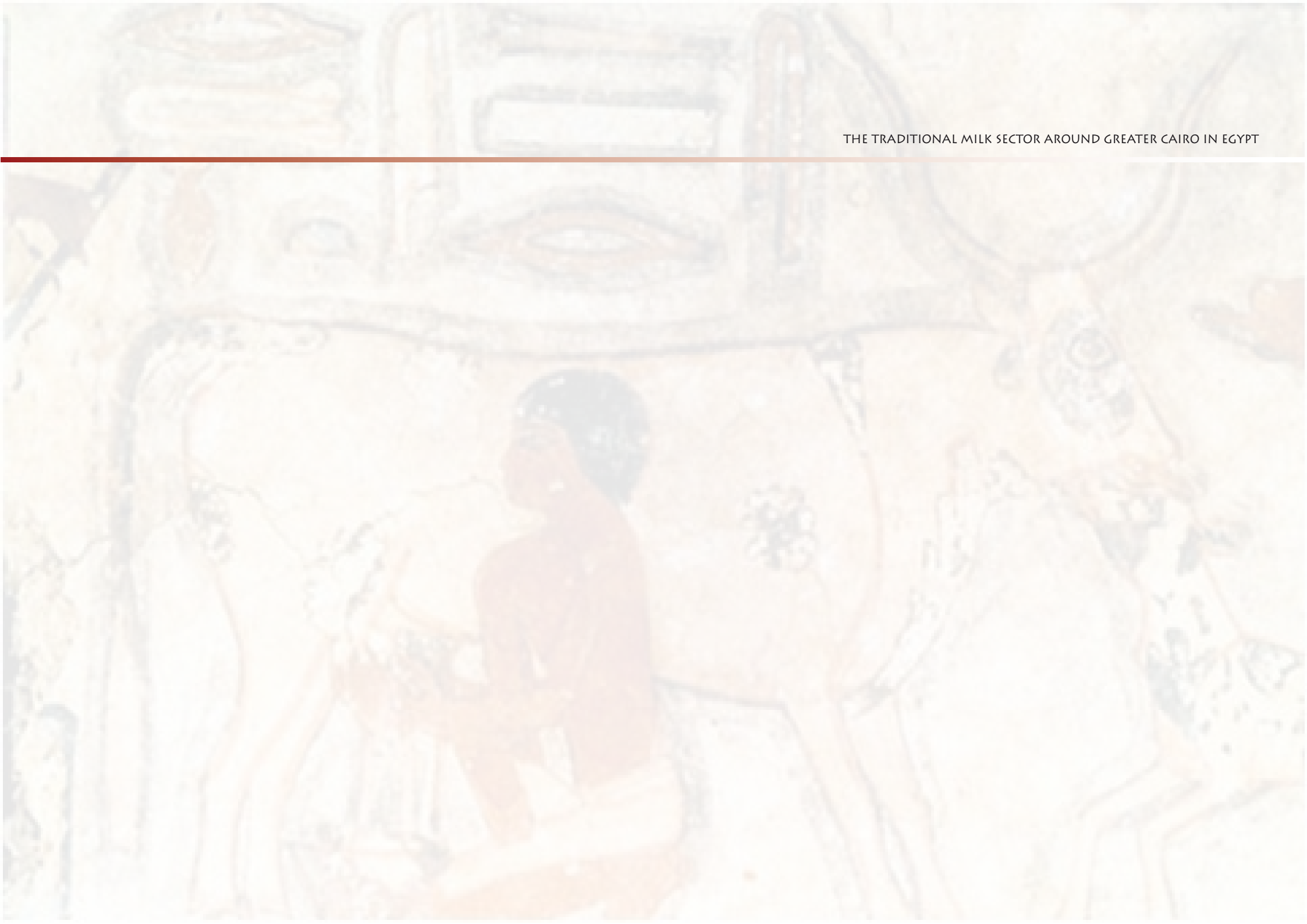
The dairy sector was identified as a research priority for the national livestock research and a priority for agricultural development and food security policy in the Strategic Plan of Agriculture Development in Egypt for 2030. This first exploratory and empirical research conducted in the DAIRY project on "Understanding the Traditional Milk Supply Chain functioning in El Cairo City, Egypt" aimed at providing a testimony on the dynamics, strengths and weaknesses of the traditional milk sector for decision makers and researchers in Egypt.

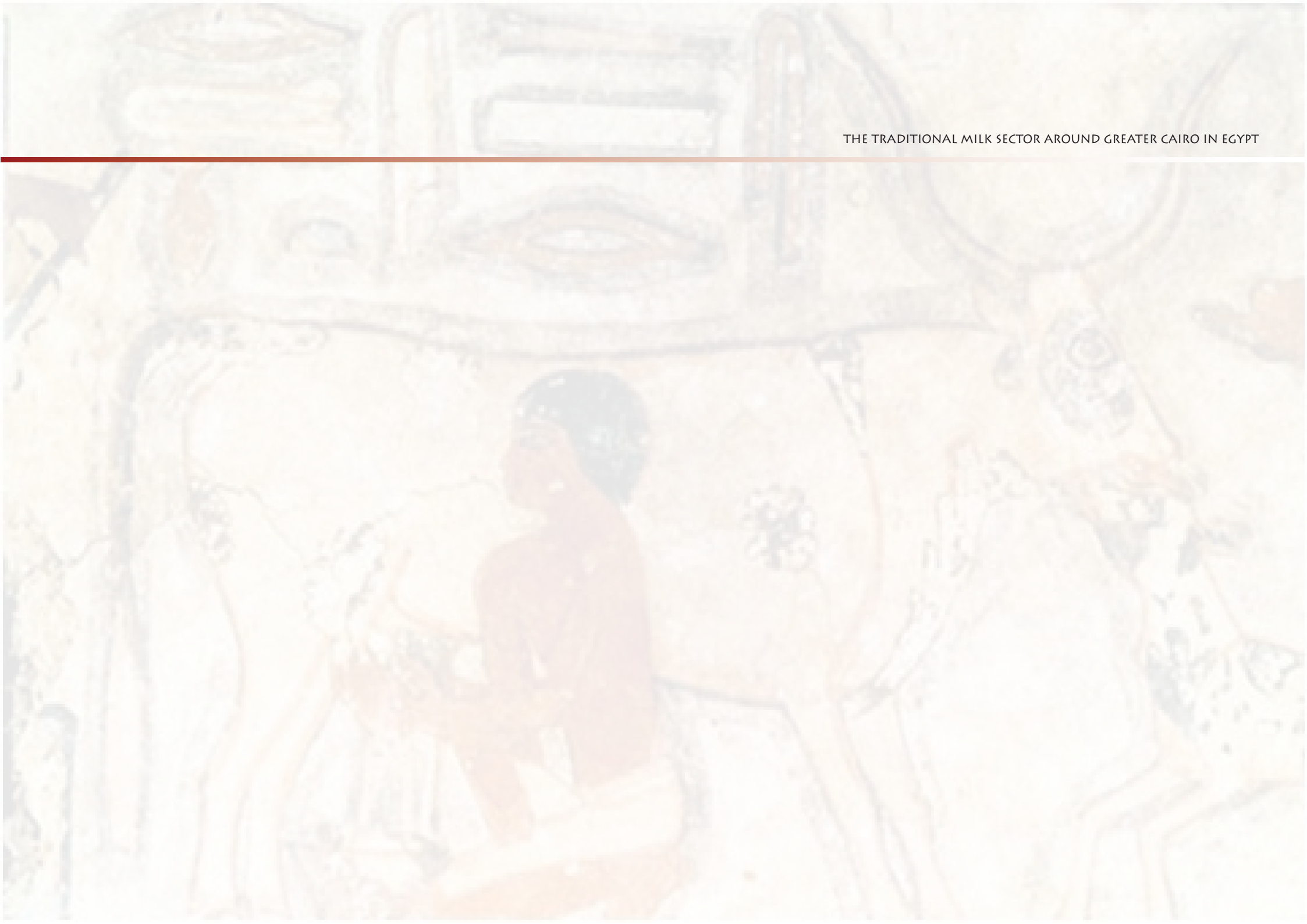
The idea of this project has been raised by Professor Salah Galal who has followed all the steps, accompanied all students and young and also senior researchers along the project. Pr. S. Galal passed away last July 2015 and this Atlas is a testimony of gratitude for the lessons and expertise he has contributed to the team. This project has been funded by a French fund AIRD. We express our special thanks to the IRD team in Cairo and Marseilles for helping us in the logistic and financial aspects. Over the course of the project, the main strength of the team has been its common will to invest in this exciting and challenging subtopic in Egypt. The second strength has been the flexibility of the team to accomplish many activities in a very troubled context. Two main interinstitutional trainings have been organized in June and November 2012 on the approach of dairy farming systems and one in January 2015 on statistical analysis, plus other individual trainings in CIRAD Montpellier with young researchers.

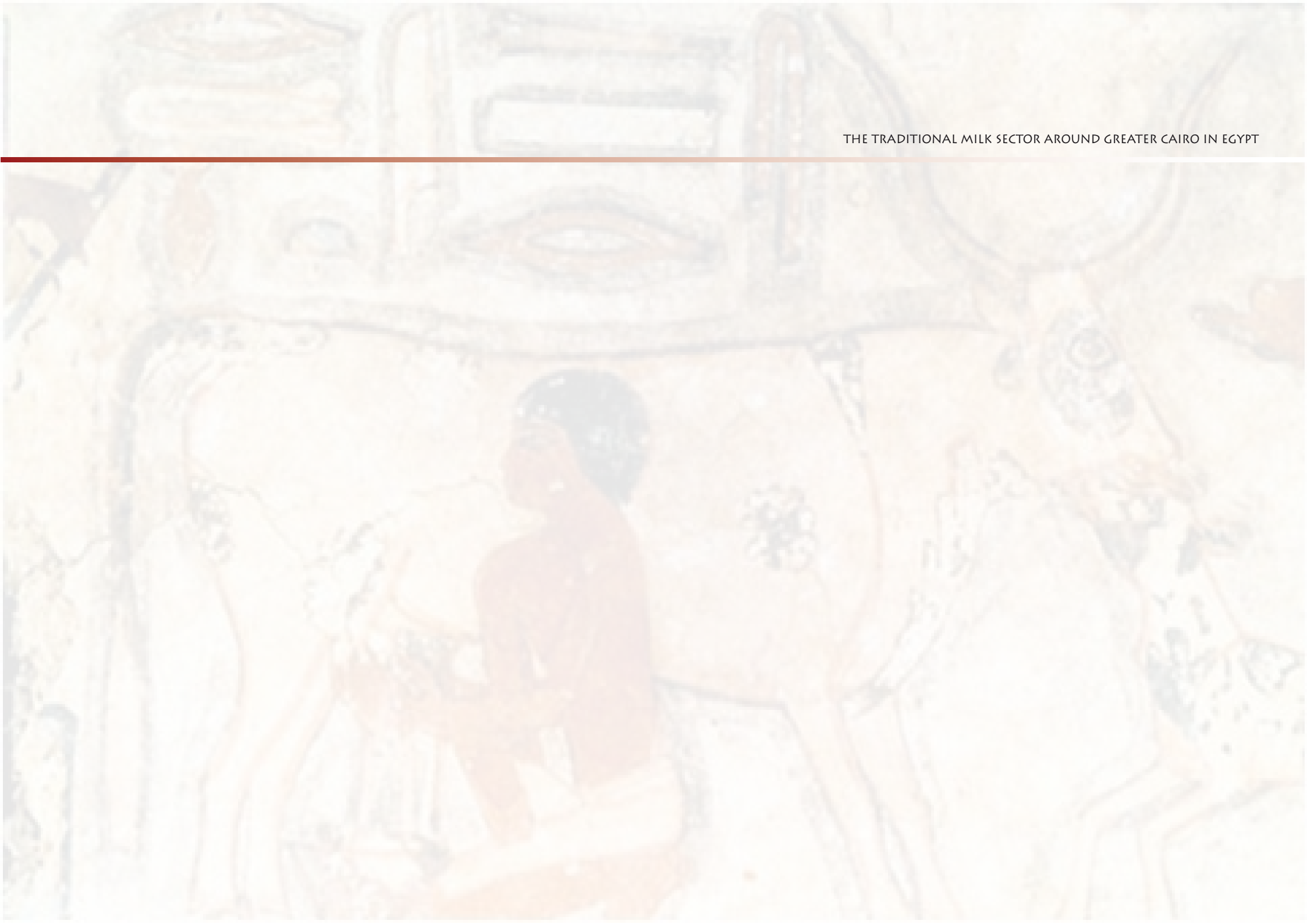
For that, this project has associated many researchers and experts at different levels of the process that we will like to sincerely thank for their contribution to this project. More specifically, all of thanks to Khidr, Raafat and Moslhy, Naiim (DRC), Elsayed, Manal (Ain Shams University), Bernard Faye, Philippe Lecomte, René Poccard, Guillaume Duteurtre (CIRAD-SELMET), Martine Antona (INRA, France), Virginia Porcile (consultant, Uruguay), S. Ranade (Indian Society of Agribusiness Professionals), Hussein Mansour (Ain Shams University), Taher Srairi (IAV, Morocco), Delgado, Juan (Cordoba University, Spain), and Gaukhar Konuspayeva (Université Al Farabi, Kazakhstan).

These first analyses have been extended in the rural zones of both the new reclaimed lands in the west part of the Nile Delta through the CLIMED Project (ARIMnet project funded by the National Research Agency in France) and the old lands of the Nile valley through the SIADEEP project (funded by the foundation Danone Ecosystem). Thus we would like to thanks these two organisms giving us the chance to reinforce our analyses. We would like to thank all our research institutes, APRI/ARC, Cairo University, Ain Shams University, Desert Research Centre in Egypt, CIRAD and INRA in France and ICARDA, that have given us all the support and encouragement to conduct this work over the period 2012-2015.









1. Context and objective

1.1. Background: Systemic approaches

a) Approach of the diversity of dairy farming systems and their sustainability

In dairy farming systems, dairy activity is usually one component or sub-system of the farming activities or the main economic orientation of the farm. However, for all these farms, this activity is at the intersection of the social, agronomic and economic dimensions of the family farm unit. A first draft attempt of modelling the farm factors elaborated during the first workshop of the DAIRY project, 2012, is presented in figure 1.

In this approach, the sustainability assessment of dairy farming systems is mainly based on the viability of the social group dependent on this activity and the secure access to the internal and external resources of the farm. According to Lhoste (1984) or Landais (1992), we can represent the livestock farming system (FS) as figure 2.

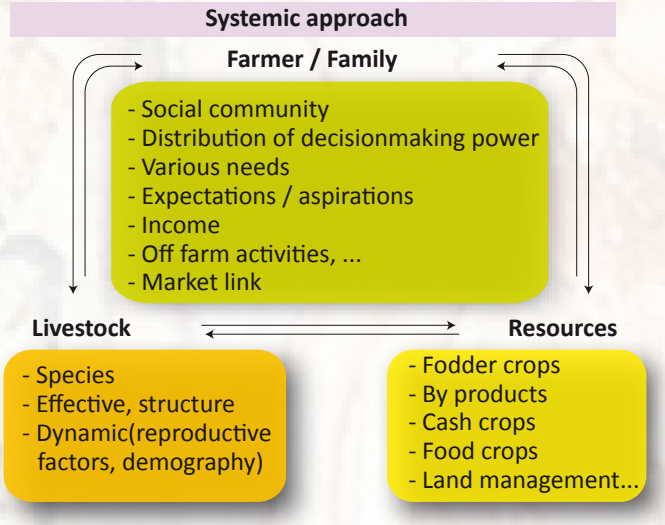


Figure 2: Representation of the livestock farming system

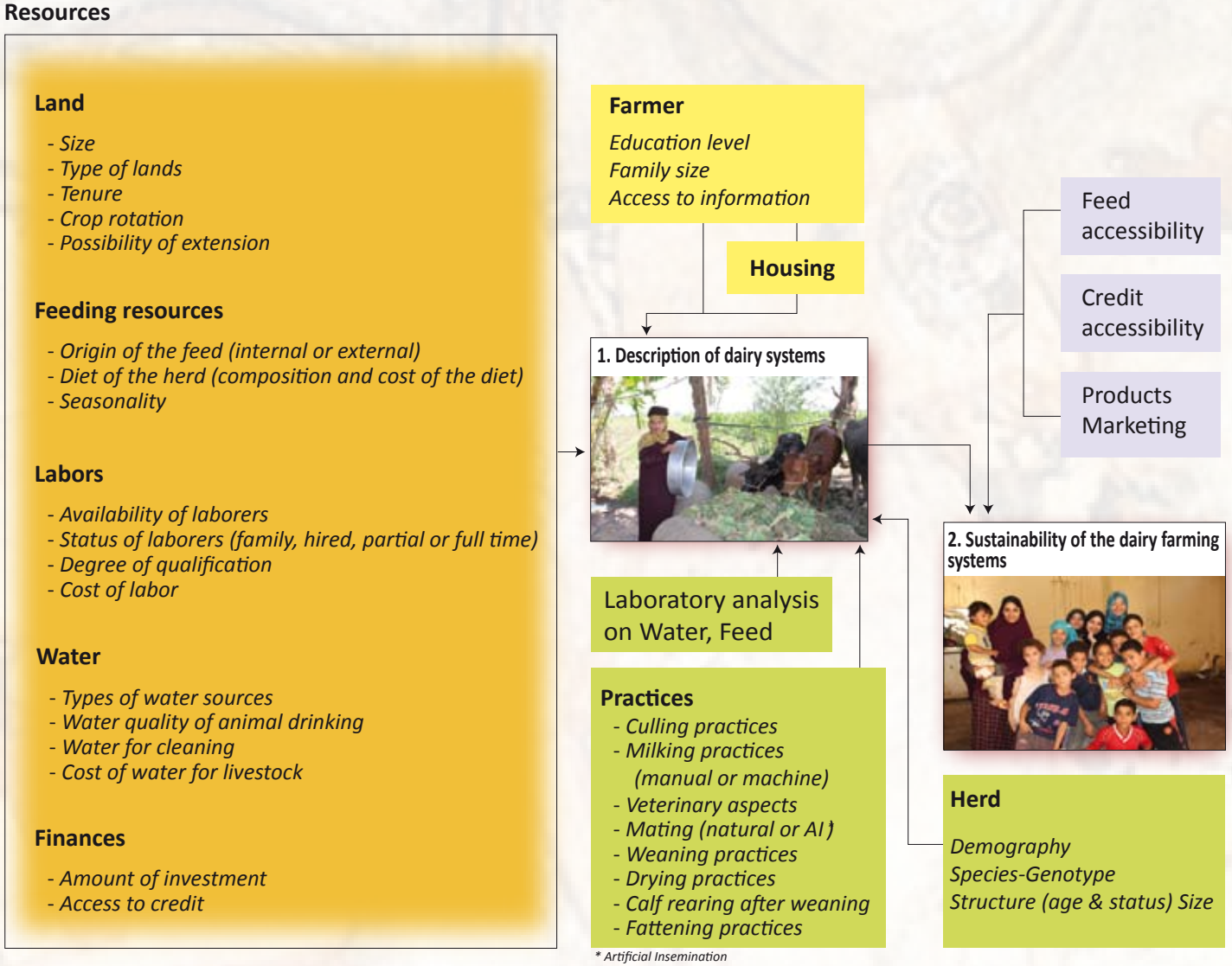


Figure 1: Identification of the indicators for the assessment of the sustainability of small dairy production systems (Workshop of the DAIRY project, June 2012, WP2 presentation)

At the farm level, typology is often used to identify homogeneous groups of individuals (farms) that are similar in terms of their structure or function. We generally speak about:

Structural typology:

- Meets objectives for identifying types based on farm structure: farm size, herd composition or plot distribution as a function of their use;
- Generally reflects the economic "weight" of farms (typically, the "large", "medium" and "small") or their main livestock systems ("nomadic pastoralists", "sedentary producers", "agro-pastoralists", etc.).
- Structural typologies are rather static. However, when developed over several years, they can be used to identify structural trajectories (changes).

Functional typology:

- Meets objectives for identifying types based on the diversity of practices, herd management, mobility or feeding management, health care or culling practices.
- Generally reflects systems of practices (typically "traditional livestock production", "modern systems" or "systems undergoing intensification") or the farmers' socio-economic goals ("savers", "opportunists" or "diversified").
- Functional typologies are rather dynamic and they highlight changes in practices over several years.

b) Dairy Value chain

The value chain approaches were extended over the last decades. Reduced to a linear and technical systems in the fifties, they are now considered as socio-technical and complex systems:

- "Agribusiness" (1957): "... the sum total of all operations related to the production and distribution of farm inputs, to the farm production, to storing, to the transformation and distribution of field products and derived products". *J. H. Davis y R. A. J. H. Davis y R. A.Goldberg, A Concept of Agribusiness. Boston, Harvard Business School, Division of Research, 1957.*

- "Agrifood systems" (1979): "... the set of activities that contribute to the production and distribution of production of agrifood products, and therefore to the achievement of the human food supply function in a determined society".
L. Malassis, Economie agro – alimentaire I. Economie de la consommation et de la production agro-alimentaire.1979, Paris, Ed. Cujas.

- "Agrifood systems" (1994): "... the set of socioeconomic relations that influence directly on the processes of primary production, agroindustrial transformation, collection, trade and consumption of agrifood products". *FAO, Economie politique des systèmes agroalimentaires en Amérique Latine, Bureau régional de la FAO pour l'Amérique Latine et les Caraïbes, Chili, 1994.*

Afterwards, researchers and developers paid more attention to the development of alternative food chains in rural areas or developing countries. "*A common characteristic (of this recent development) is the emphasis upon the type of relationship between the producer and the consumer in these supply chains, and the role of this relationship in constructing value and meaning, rather than solely the type of product itself.*" (Marsden et al, 2000, p 425).
Over the last decades, institutional theories including theories of regulation and convention, theory of organizations, game theories (focusing on asymmetry of information) have been developed to address the complexity and key-point factors of relations between the intermediaries of the value chains (Griffon et al., 1999). More recently, geographical and historical or sociological approaches have been developed (Vatin, 1996, 2008; Poccard-Chapuis et al, 2011) that integrate the spatial and temporal links of actors along the chain. The dairy value chains become part of the social territory.

The classic steps followed in the value chain approach are presented in table 1. In this approach, analysis of the traditional milk chains is based on:
- Assessment of the flows (milk and milk products) according to the collection situation;
- Assessment of the weight and the localization of different circuits (dairy products and buffalo or cow milk);
- Assessment of the milk potential at the territorial level (villages or regions);
- First estimation of milk demand in consumption centers (neighborhoods, city, etc.).

The analysis is mainly composed of:

- Diagram of dairy value chain (Figure 3);
- Main factors affecting milk production and milk sale (Photo 1);
- Mapping (milk flows, density of suppliers and consumers).

Table 1: Main stages to conduct value chain analysis

N°	Step	Objectives
1st Step	Delimitation of the Commodity Chain	1. Identification of the actors and functions 2. Estimation of prices and quantities by product 3. Chain graph, flow
2nd Step	Typology of actors	1. Strategies analysis
3rd Step	Accounting analysis	1. Revenue and margins 2. Added value distribution 3. Capital accumulation
4th Step	Social Organizational analysis	1. Relations between actors 2. Rules that regulate the relations
5th Step	Historical approach	1. Past and present trends 2. Draw future scenarios

Photo 1: Mobility as a key-factor or a way of adaptation to urban contexts (Workshop of the Dairy project, 2012)

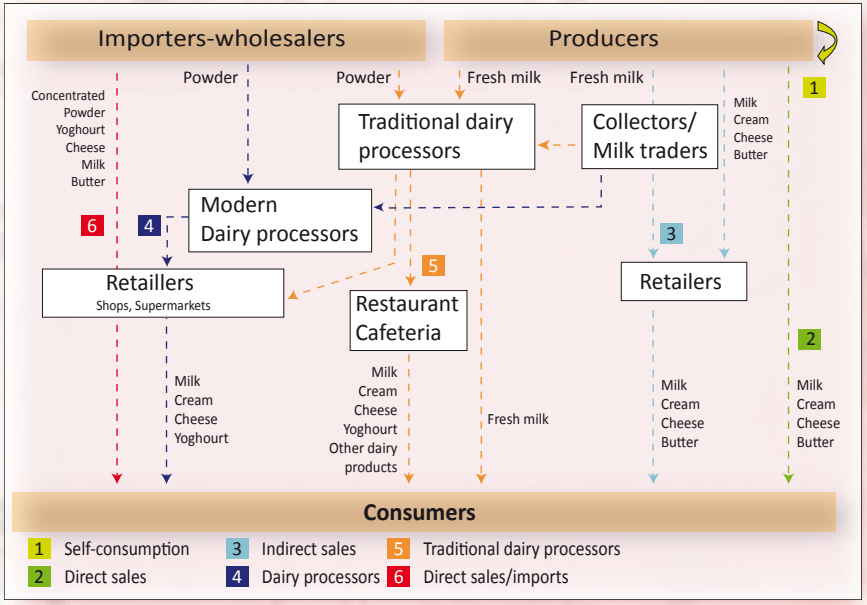


Figure 3: Diagram of dairy value chain in Cairo

In this Atlas, in link with the multidisciplinary team, the chosen approach has been based on a combination of qualitative and quantitative methods (narrative approach, semi-structure interviews, farm surveys, factorial analysis, cartography of value chain, literature, etc.) at the farm/household and value chain/territory levels . These approaches have been mobilized at different stages of the analysis in order to allow for a global view of these traditional dairy value chains in Egypt.

1.2. Research projects: context and objectives

a) Dairy project

Agriculture is a key sector in the Egyptian economy, providing livelihoods for 55% of the population and directly employing about 30% of the workforce. Dairy is considered the main livestock sector with a production of about 5.6 billion liters of whole fresh milk (FAO, 2010). Egypt's milk sector is still largely traditional with a majority of the population consuming unpasteurized milk often delivered straight to the home in aluminum bottles. This traditional sector was estimated to represent nearly 80% of Egyptian milk consumers (around 50 liter/hab./year) in 2010-11. This figure indicated a large potential for growth and a quality gap that producers will have to fill. Moreover it was difficult to find research or development studies on the technical-economic performances of the small dairy producers and the traditional dairy chains. The objective of the Dairy project was to understand the functioning of these small dairy units and intermediaries and the key-factors of their viability based on technical knowledge, social and economic context in link with traditional dairy chains and their interactions. The scientific objective was to develop an interdisciplinary team and to build expertise on the diagnostic of the traditional milk supply chain in the periurban area of Cairo using a systemic approach at both farm and family levels as well as a dairy chain analysis.

The understanding of the complexity of the dairy systems (including their social network in value chain organizations) needs holistic, interdisciplinary and systemic approaches along the milk value chains, from producers to consumers. So to assess the sustainability of these small dairy units, we have proposed to adopt a systemic approach at the farm level (crop-livestock interaction), family level (social network and family objective) and chain level (market dependence, social network, economic efficiency, political context…). Additional interviews based on interactive interview method have been organized (see list of activities in table 2).

The main achievements have been the completion of a survey of nearly 73 dairy farms in urban and peri-urban areas of Greater Cairo and a seasonal follow-up of 65 farmers in rural areas (45 farmers in two villages of South Giza and 21 farmers at 90 km on the road Cairo-Alexandra). A first cluster analysis (called also typology) based on multivariate statistical analysis (PCA, HCA) has allowed to identify 5 main urban and peri-urban dairy types according to land pressure and land access in urban areas and herd size in peri urban areas. These systems have been analyzed in terms of efficiency and viability.

In parallel, monitoring of milk flow over one year has started near 2 milk collection centers (MCC) and 2 private traders in South Giza. Different rapid surveys have been conducted of nearly all the stakeholders in downstream (producers, collectors, and collection points) and upstream (cheese processing units, milk shops in Cairo, etc.) in order to obtain a full picture of the different traditional milk chains that ensure the milk supply of Cairo. All these materials have been used to understand this traditional sector all around Cairo (Figure 4).

All of this research has been conducted in partnerships between research institutes, universities in Egypt and in coordination with CIRAD (France) and Ain Shams University (Egypt). In terms of partnerships and scientific collaboration, one of the main achievements has been the organization of a research school (training workshop) that has gathered 21 researchers in

June 2012, which included: (i) 8 researchers from 3 Egyptian universities (Ain Shams University, Sohag University and Cairo University) and 2 research institutes (Animal Production Research Institute of Agricultural Research Center and Desert Research Center) ; (ii) 9 researchers from CIRAD and INRA (France); and 5 researchers from 5 countries : India, Uruguay, Morocco, Kazakhstan, and Spain.

A total of 21 researchers or students from different Egyptian institutes and universities have participated in the presentations and debates over the course of the two days allotted to the workshop. Different professional partners (as some representatives from the Chamber of Food and Industries) have attended some sessions. This workshop has raised many issues and challenges of the dairy sector in Egypt (Photos 2 & 3).

Photo 2: Farm-researcher group discussion in Giza - Workshop of the Dairy project in November 2012

Photo 3: Farm-researcher group discussion in Giza - Workshop of the Dairy project in June 2012

Table 2: list of activities and methods in the Dairy project

Activities	Objectives	Methods	Sample
Historical and social context of the traditional dairy chains	To characterize the historical context of the traditional chains in the Greater Cairo Area with a focus on their past and more recent developments... .	-Survey based on an interactive interview method (Wood el al, 2001). -Review of literature and synthesis of national statistics and reports on livestock policies.	16 interviews with key local stakeholders from technical and research institutes, breeders, collectors and traders, cooperatives and milk collection centers, consultants and professionals.
Assessment of small dairy production systems	To establish and integrate the socioeconomic and technical parameters in order to asses the performance of dairy farms as well as their viability.	-Farm and family survey; -Cluster analysis (typology) using multivariate analysis (PCA; HCA). -Economic and environmental efficiency analysis. -Follow-up of animal performances and dairy production and marketing.	- 73 dairy farms surveyed in greater Cairo. - 65 farmers followed from winter 2013 to summer 2014.
The traditional dairy market in Egypt	To provide an overview of the traditional dairy chain in the Greater Cairo Area in terms of present day dynamics (supply, demand) and future dynamics by offering a prospective analysis and exploring potentialities.	- Monitoring the milk flow in dairy intermediaries, over the course of a one year period. - Rapid appraisal of milk sales by an exhaustive survey of milk shops in three sectors of Cairo (with the participation of 16 students from Cairo University).	- Monitoring of 2 MCC and 2 private traders in South Giza; - Monitoring of 1 MCC and 1 trader in Nuberia. - 17 stakeholders interviewed in upstream (cheese processing unit, milk shops in Cairo, etc.). - 74 dairy shops identified and surveyed in 3 sectors: Shubra, Sayeda Zeinab and Talbia (Cairo).
Interdisciplinary, research, School and capacity building	- To develop skills on the methods of approaching the functioning of the traditional milk chain. - To produce scientific knowledge and expertise of this traditional sector.	- Training workshops; - Training on data analysis (ACCESS, GIS, R). - Supervision of students. - Visit of dairy farms and dairy intermediaries out of Egypt.	- 2 training workshops in June and November 2012. - 2 PhD students supervised. - 16 trained undergraduate students at Cairo University.

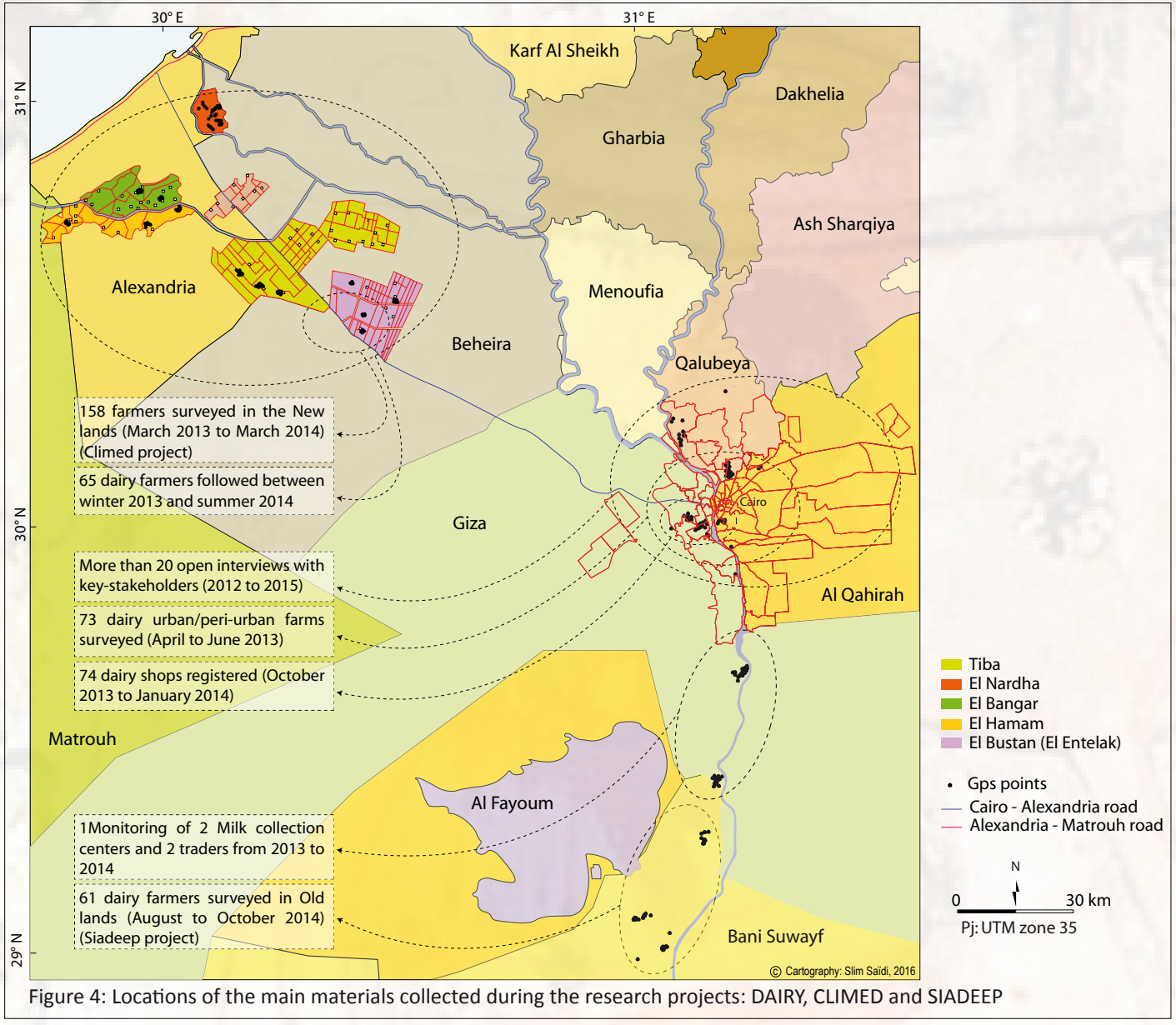


Figure 4: Locations of the main materials collected during the research projects: DAIRY, CLIMED and SIADEEP

b) Other projects on milk and milk products in Egypt

In 2013, the research team was involved in a new research project CLIMED on the "Future of Mediterranean Livestock Farming Systems: Opportunity and efficiency of Crop–Livestock Integration" (within the consortium of Agricultural Research in the Mediterranean Network). This project aimed to assess the technical, economic and socio-ecological viability of crop-livestock systems in the Mediterranean context to help farmers, local communities, researchers and decision makers in their decision making regarding future plans for Mediterranean livestock and in establishing priorities, rules and policies that could better deal with the socio-environmental issues linked with demographic and land pressure, increasing demand and strong international competition. A household survey has been conducted in the new reclaimed lands in the west part of the Nile Delta (Egypt). This household survey of nearly 175 farms allowed for the evaluation of the new rural farm development in this zone.

In 2014, the research team became involved in a new project, the SIADEEP project, on the "Assessment and Monitoring of the socio-economic Impacts of the Danone-Egypt Ecosystem Project and Perspectives for Milk Collection Centers (MCC)-Analysis at Farm & Community Level Related to Local Development", funded by Danone –Ecosystem. The SIADEEP Project aimed at assessing the socioeconomic impacts of the milk collection centres implemented by Danone-Ecosystem at a farm and community level using a set of relevant indicators shared at local scale over a period of 3 years (2014 to 2016). The farm and family surveys conducted in the governorate of Beni Suef has allowed us to capture the diversity of farming systems in the closest governorate of south Cairo in the Old lands in the present Atlas.

All these materials and knowledge accumulated in the research projects CLIMED and SIADEEP (Figure 4) have helped us to have a type of landscape of the different farming systems in rural areas and to complete the view of dairy farming systems (FS) around Cairo. Furthermore, in the two projects, some dairy chain analyses have been developed; thus allowing us to cover a variety of dairy circuits around Greater Cairo.

1.3. Objective of the Atlas

Among the expected results of the project DAIRY, two were focused on accumulating knowledge and expertise in order to:

(i) To provide relevant expertise and to reinforce the scientific competences in terms of systemic and interdisciplinary approaches;
(ii) To accumulate knowledge on the traditional dairy farm systems in this Mediterranean country that will favor the development of new collaborative research programs on the dairy sector.

By virtue of the present Atlas, the researchers involved wanted to restitute their accumulated knowledge on the traditional value chains called “loose milk” in Egypt. It is not exactly a traditional sector but a diversity of traditional value chains that, most of the time, intersect at one level of the chain. This entire sector is often in contact with the so-called modern dairy sector at one or several stages of the milk production cycle (Box 1).

The originality of the data used in this Atlas makes a good tool of testimony to the dynamics, strengths and weaknesses of this unique and diversified sector in Egypt.

The form of the Atlas based on a visual approach is also considered as a tool to communicate with decision makers from national institutions as well as from the private sector.

Box 1 - Terminology of traditional versus modern value chain

Traditional value chain refers to the definition of traditional economy where traditions, customs or beliefs shape the studied systems including the production and distribution of goods and services. This model has been mainly described in rural and subsistence economies. Its main characteristics are that the activities along the chains are often intertwined and managed by a social group. The technical operations are based on local knowledge with few external technical supports, and the activities are not always registered (informal activity).
At the opposite, in a modern value chain, all the stages of the chain are well differentiated in terms of logistics, competences; the transformation from the inputs to the final outputs are based on advanced technology with systematic quality control. And, all the processes and used-resources are planned.

1.4. Main challenges for the research investigation

Cairo is situated on the Nile at a point where the flat flood plain, delineated by desert hills on the two sides (west and east) sets about to open out into the Nile Delta (Figure 5).
So upon examining any map of Cairo, this city appears very well structured with the axis of the Nile. However, this first feeling is quickly forgotten when we start to circulate within the city and see the density of the network (Photo 4, 5, 6, 7 & 8).

Photo 4: Entanglement of building – downtown Cairo

Looking at a map, it is, it was difficult to define the border of the city itself (Figure 6). Moreover despite the fact that Cairo is administratively limited to the Cairo governorate, the Greater Cairo area extends southwest to include part of the governorate of Giza and to the north to Qalubeya. To date there does not exist a geographical and administrative delimitation of Greater Cairo.

This has made the work of delimitation of the study area very disconcerting. Where to start?

Photo 5: Cairo-density of the network

Photo 6: Mix of social classes in most of the neighborhood

Photo 7: Informality characterized by street vendors in Mounira

Photo 8: Narrowness of the streets inside the neighborhood-Mokkatan

a) Overview on the historical development of Cairo

The spatial development of the city has known different periods in link with the historical evolution of the country. This city has been preceded by two main settlements (Babylon and Memphis) until Cairo (Al Qahira, "the Victorious") was founded in 969 AD during the Islamic expansion conquests. Under the Mamluk' period by the 14th century, Cairo had known a radiant development, dominating regional trade and exhibiting a vast concentration of wealth and architectural splendor (Sims, 2001). This period has been followed by a period of decline during the Ottoman rule. Only in the mid-19th century, under Mohamed Ali Pasha and his successors, did Cairo begin to enter into a process of economic growth and modernization. However the actual socio-geographical configuration of the city with the phenomenon of informal urban development in all directions is largely due to recent developments, mainly after the World War II and the July 1952 Revolution.
Over the course of the last century (XXth), Cairo's expansion has been done both on rich agricultural land in the West and in the North as well as on desert lands, mainly in the eastern districts like Medinet Nasr (28) Nozha (12) and more recently to the South west with the new city of 6th October (9, 10) (Figure 7).

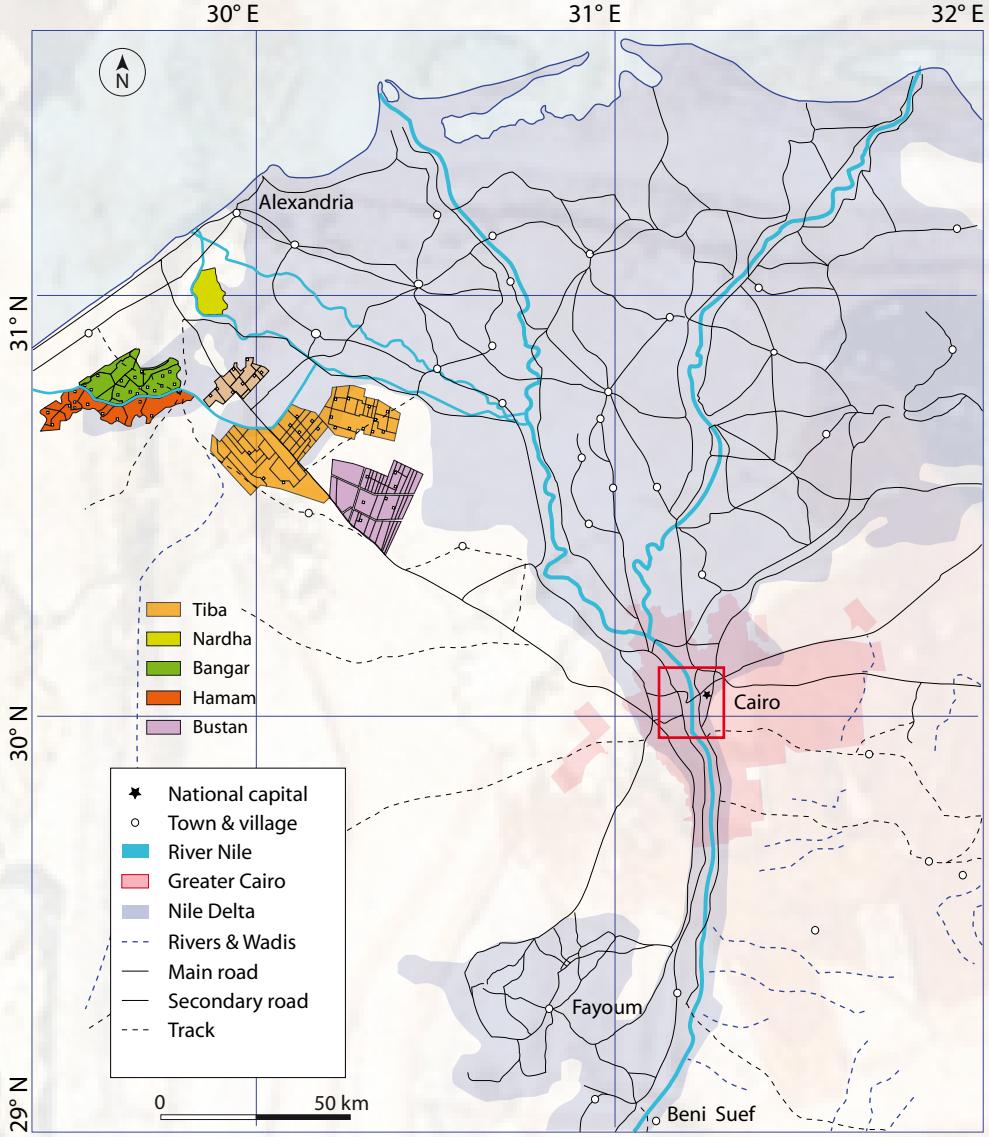


Figure 5: Geographical localization of Cairo

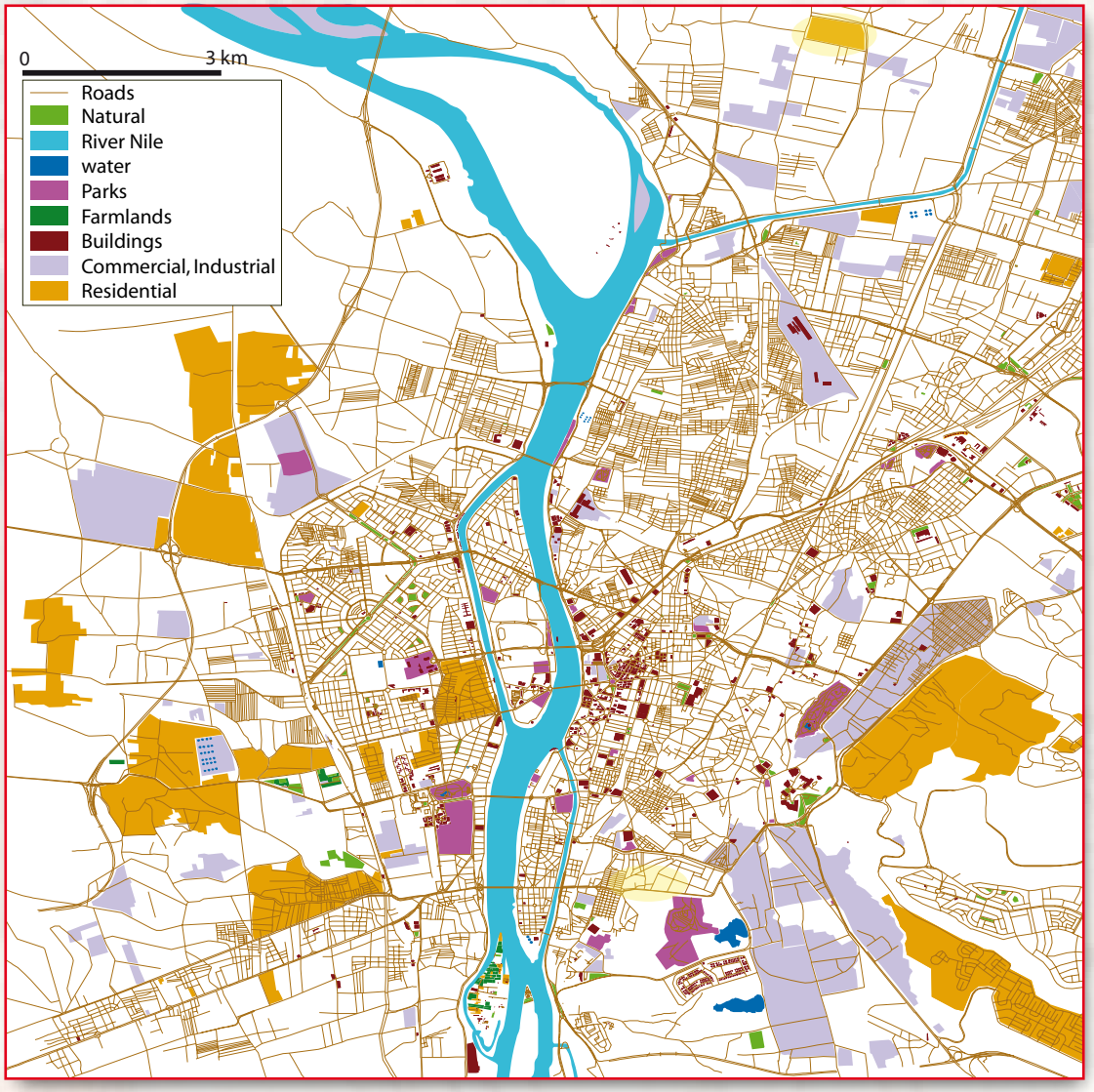


Figure 6: Road map of Cairo (Source: cadmapper)

Nowadays, all public institutions are concentrated in Cairo. Moreover, the city is experiencing a huge development of modern manufacturing, notably with the institution of new industrial zones in the Sixth of October city and the Tenth of Ramadan district (located respectively 30 and 50km away from the city center). In parallel to the development of this formal economy, Cairo also has an immense informal economy, composed of hundreds of thousands of small and micro-entreprises that absorb half of the city's workforce (Sims, 2001).

b) Geographical approach of Greater Cairo

Governorates are the main divisions of local administration in Egypt, and there is no macro-administrative structure which covers Greater Cairo as a well-defined entity. However it is recognized that Greater Cairo is composed of the whole of Cairo Governorate and the urban parts of Giza Governorate (west of the Nile) and Qaliubia Governorate (north of Cairo Governorate). In fact, for day to day administration, governance in Greater Cairo is organized through the three governorates and their administrative districts (Sims, 2001). For the governorate of Giza and Qaliubia, only some districts and outlying village administrative are considered.

Based on this approach and the data on the City Population (http://www.citypopulation.de/php/egypt-admin.php), we have calculated the trend of population in Greater Cairo (Table 3) by considering:

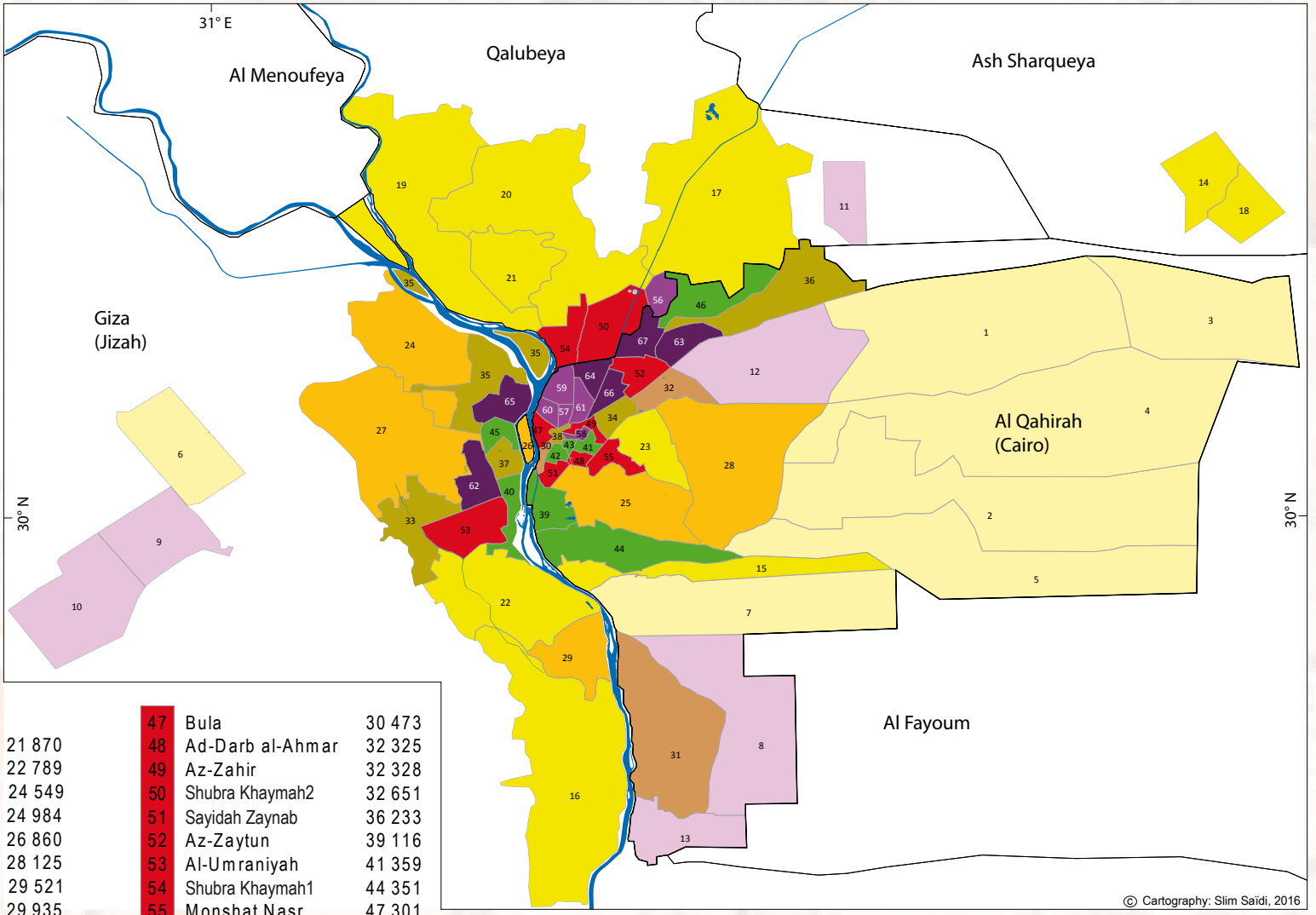
1) Cairo (classified as an "urban" governorate) with its 41 districts (*ahiya*);
2) Giza with 6 urban districts;
3) Qalubeya with 4 urban districts.

In 2006, Greater Cairo registered a population between 12.4 and 18.4 million considering urban densified districts or the two neighboring governorates respectively. These estimations fits with Sims's estimation of a population around 16.3 million in 2006. In 2009, Sims (2011) registers a population of 17.3 million with an annual growth rate of 2.1%.

Table 3. Estimation of the population growth and density in Greater Cairo between 1996 and 2006 (source: City Population, http://www.citypopulation.de/php/egypt-admin.php)

	Governorate	1996	2006	inh./km²
Cairo	Governorate	6 800 991	7 902 085	2 561.5
Giza (Jizah)	Governorate	4 784 095	6 294 319	477.4
	Only urban Districts	2 221 817	2 886 363	
Qalubeya	Governorate	3 281 135	4 251 672	3 782.6
	Only urban districts	1 083 747	1 625 415	

	Urban districts	1996	2006	inh./km²
Giza	Imbabah	...	391 363	69 467.8
	Bulaq al-Dakrur	453 884	569 227	61 564.7
	Al-Umrāniyah	537 905	726 384	41 358.8
	Al-Ajūzah	174 460	160 003	29 526.3
	Al-Jizah	238 567	251 596	22 787.4
	Ad-Duqi	93 660	93 834	17 979.3
Qalubeya	Al-Khusus	...	291 242	53 341
	Shubra al-Khaymah1	416 812	461 689	44 359.1
	Shubra al-Khaymah2	453 963	563 880	32 660.3
	Qalyub	77 081	107 303	3 873.8



District code		inh./km²
1	Ash-Shruq	140
2	Al-Qahirah Jadidah 1	164
3	Badr	212
4	Al-Qahirah Jadidah 2	220
5	Al-Qahirah Jadidah 3	454
6	Sheikh Zayed	747
7	Turah	998
8	15 Mayu	1 121
9	Sixth of October 1	1 176
10	Sixth of October 2	2 156
11	Al-Ubur	2 565
12	An-Nuzhah	2 704
13	At-Tebin	2 723
14	10 Ramadan 2	3 048
15	Al-Maadi	3 100
16	Al-Badrashayn	3 226
17	Al-Khankah	3 563
18	10 Ramadan 1	3 564
19	Al-Qanatir	3 730
20	Qalubeya	3 868
21	Qalubeya	3 874
22	Giza	4 290
23	Nasr City 2	4 378
24	Awsim	5 546
25	Al-Khalifa	6 145
26	Zamalik	6 269
27	Kirdasah	6 696
28	Nasr City 1	6 792
29	Al-Hawamidiyah	6 927
30	Qasr an-Nil	9 206
31	Helwan	9 998
32	Heliopolis	12 389
33	Al-Ahram	15 045
34	Al-Waili	15 592
35	Al-Warraq	17 206
36	As-Salam	17 467
37	Ad-Duqi	17 976
38	Al-Azbakiyah	19 070
39	Ancient Cairo	21 870
40	Giza	22 789
41	Al-Jamaliyah	24 549
42	Abdin	24 984
43	Al-Muski	26 860
44	Al-Basatin	28 125
45	Al-Ajuzah	29 521
46	Al-Marj	29 935
47	Bula	30 473
48	Ad-Darb al-Ahmar	32 325
49	Az-Zahir	32 328
50	Shubra Khaymah 2	32 651
51	Sayidah Zaynab	36 233
52	Az-Zaytun	39 116
53	Al-Umraniyah	41 359
54	Shubra Khaymah 1	44 351
55	Monshat Nasr	47 301
56	Al-Khusus	53341
57	Shubra	53877
58	Bab Ashariyah	55188
59	As-Sajil	57499
60	Rud al-Faraj	57574
61	Ash-Sharabiyah	59393
62	Bulaq al-Dakrur	61 538
63	Ain Schams	63 029
64	Zawiyya Al-Hamra	63 859
65	Imbabah	69 476
66	Hadaiq al-Qubbah	73 171
67	Al-Matariyah	80 000

Figure 7: Population density map of Greater Cairo (City Population, 2016)

Based on the estimations of Sims and Séjourné (2008), around 63.6% of settlements of the city are considered as informal. In 2006, they were estimated to contain more than 65% of the population of the metropolis area, that is 10.5 out of 16.2 million inhabitants, and the rate of population growth in these areas is higher than other city averages, increasing by 2% between 1996 and 2006.

These indicators highlight the major challenge of starting field work in this urban jungle of buildings with some locations registering a density of more than 70 thousand inhabitants per km².

c) Key entries to Cairo

In our project, a first step has been to investigate people's everyday experiences through the research team living in different parts of Cairo city (Photo 9 & 10). This first investigation allowed us to address more fully the diversity of productive systems in and around Cairo and the diversity of milk demand.

Based on this first share of knowledge, we have first developed a dairy farm survey that allowed to realize the importance of this milk productive sector in Cairo.

This first investigation helped us to identify some milk shops or markets (Photos 11 & 12), and progressively discover other milk supply around Cairo or milk processing units that transform the milk to produce a variety of white cheese or other milk products that are sold on the markets or milk shops or even groceries. So the sample of our survey and interviews have been based on a snowball effect generated by a sampling approach (Goodman, 1960) that allowed us to encounter hard to reach populations.

We are conscious that by using this method we may not be representative of the entire diversity of milk value chains in the Greater Cairo Area. However, this method allowed us to reach our targeted population and to draw a first representation of this sector in the Greater Cairo Area.

Photo 9: A father and his two sons in a green enclave surrounded by apartment blocks built over the course of the last 10 years in Al Umraniyah (district 53, fig. 7, p.10), 2012

Photo 11: Dairy shop in Talbia (Cairo, district 53, fig. 7, p.10), 2013

Photo 10: Dairy farm in Shubra (North cairo, district 27, fig. 7, p.10), 2012

Photo 12: A woman who sells milk products in street markets in Giza (District 40, fig.7, p10) in 2012

2. Glance at the dairy sector in Egypt

2.1. Place and specificity of Egypt in the world dairy sector

2.1.1 National dairy sector

a) Two main sources of milk: Buffalo and cow

One of the main characteristics of the milk sector in Egypt is the origin of the milk. Milk in Egypt originates from both buffalo and cow herds belonging in majority to landless farmers (representing 16% of the population of large ruminants) and small farmers owning less than 3 Feddans (representing 61% of the large ruminants population).

Until the last decade, buffalo milk production was the main source of fresh milk in rural and urban areas. In figure 8, we can observe a change of trend between cow and buffalo milk production occurring the last decade (since 2005-2006) that can be correlated with the emergence of a modern sector of pasteurized milk in Egypt. The figure shows also that the consumption demand linked to population growth is an important driver of the milk production.

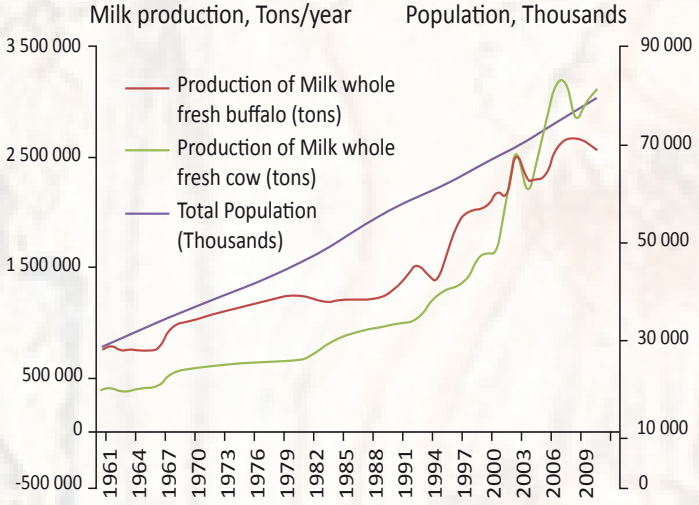


Figure 8: Buffalo and cow milk production and population growth over the period 1961-2011 (source: FAOSTAT)

b) Main milk breeds in Egypt

Buffalo (*Bubalus bubalis*, Photos 13 & 14) national herd represents approximately 5.3 million heads (Ibrahim, 2012). The Egyptian buffalo belongs to the river buffalo sub-species (larger and heavier than the swamp buffalo) (Borghese, 2005).

Photo 13. Buffalo (*Bubalus bubalis*, Halabeya, April 2014)

Photo 14. Buffalo (*Bubalus bubalis,* Qalubeya, North Cairo, February 2013)

This animal is the traditional breed in all Egyptian agricultural areas. It is particularly well adapted to the prevailing natural conditions. In the past, it was used as a draft animal for cropping. Now, it is mainly used for milk production with a high fat ratio (around 7.5% and total solid 17%) and calves are used to produce veal meat (called 'vitello' like in Italy) that is appreciated throughout the whole Delta.

One of the more advantageous qualities of the buffalo in comparison to the cow is its abilities to better use roughages and its higher intake capacity. The Egyptian buffalo weight range is around 350 to 600kg for females and 700 to 800 kg for males. The milk production capacity is around 1600kg/lactation in average in 305 days.

Baladi cattle (*Bos Taurus*, Photo 15) refers to all native cattle population making no distinction among different populations (breeds). However, there has been no serious effort to characterize the Baladi into different breeds (Galal, 2007) as has been with other species of livestock. The body weight for Baladi is around 450 kg for the female and 600 kg for the male.

Photo 15. Baladi (Beheira, June 2013)

This cow is mostly used for the meat production due to the low fat percentage of the meat (and its taste) as well as for potato cultivation in the west Delta. However, milk productivity remains low and dairy farmers prefer invest in crossbreds for milk production. This breed is also appreciated by its resistance to disease, in particular foot and mouth disease during the last outbreaks in 2013 and 2014 (Osman *et al*., 2017).

Like everywhere in the world, Holstein genetic is arriving massively in the country, mostly as crossbred with the Baladi cow in the small scale farms but also as a pure breed in large scale farms (Photo 16). Holstein constitutes the main exotic breed. However other national and international development projects have favored the introduction of other exotic breeds like Montbelliard, Abondance or Tarentaise in Beni Suef and Brown Swiss.

Photo 16: Crossbred (Hostein*Baladi)

c) National lactating herd

The number of lactating buffaloes and cows increased from 670,000 and 580,000, respectively in 1961 to 1,893,500 and 1,735,600, respectively in 2010 (FAO, 2012). Figure 9 shows the development of the number of females over time and figure 10 shows the percentage of each species /genotype to the national herd (> 2 years of age) based on sources of Ministry of Agriculture and Agrarian Reform (MoALR) statistics. The potentially lactating females (> 2 years of age) of buffalo, Baladi, exotic and crossbred changed by 10%, -6%, 40% and 210%, respectively. The increase in the exotics and crossbreds is understandable as they contribute to the increase of milk production at least in the short and medium term. However, the decrease in number of the Baladi females and their proportional contribution to the national herd could be alarming from the point of view of maintaining biodiversity and sustaining a valuable genetic resource. The change in numbers of bulls (1993-2010) was of 61% for buffalo, 35% for Baladi, 29% for exotic and 180% for crossbreds. Figures for the exotic and crossbred bulls may not be accurate due to the use of Artificial Insemination (Galal, 2012).

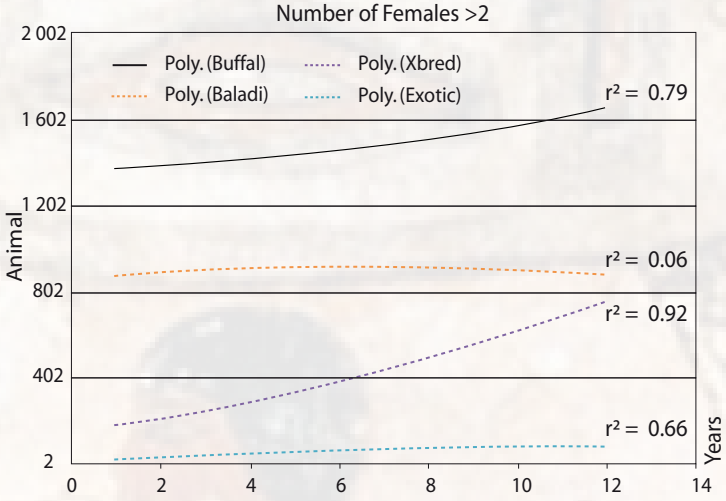


Figure 9: Number of females of different species/genotype (Source: Ministry of Agriculture and Agrarian Reform 1991 -2010; extracted from S. Galal, 2012).

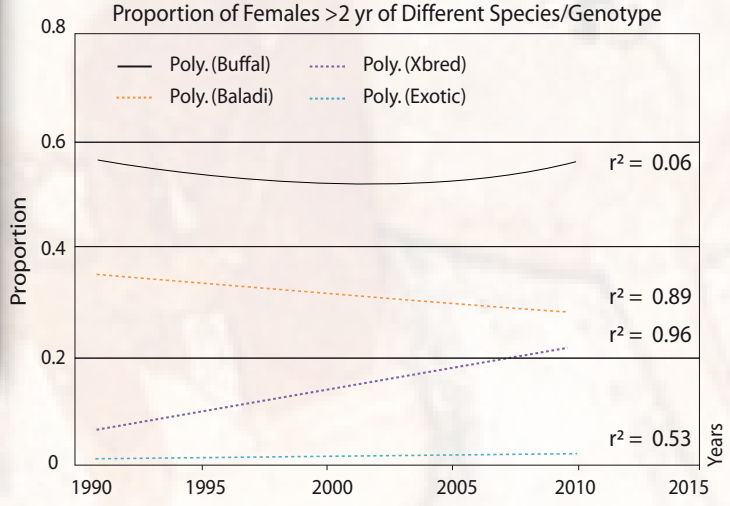


Figure 10: Proportion of Females of more than 2 years of age to the different Species/Genotype (Source: Ministry of Agriculture and Agrarian Reform 1991 -2010; extracted from S. Galal, 2012).

The following table 4 shows that main contribution of buffalos to the total buffalo-plus-cow milk reduced from 56% in 1995-2000 to 51% in 2000-2006 periods.

Another significant change is the doubling of the contribution of exotics from the first to second period.

Table 4: Percentage of buffalo and cow milk contribution between 1995/00 and 2000/06

Period	Buffalo	Baladi	Exotic	Crossbred
1995-2000	0.56	0.18	0.06	0.19
2000-2006	0.51	0.17	0.12	0.21

d) Milk productivity

FAO data shows that milk productivity has been increasing during the period 1961-2010 in both species (Figure 11). Average annual production per female buffalo cow increased from 1136 kg to 1439 kg during that period, i.e. 27%. Corresponding figures for bovine cows are 674 kg and 1672 kg for the same period, i.e. an increase of 148%.

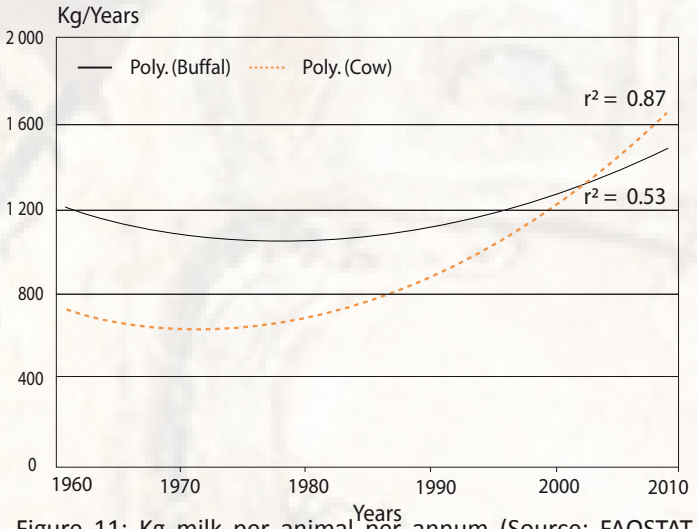


Figure 11: Kg milk per animal per annum (Source: FAOSTAT, 2012)

The dramatic increase in bovine cows is due to the wider use of exotics and crossbreds along with improvements in the environment including vet care. The change for buffaloes is mainly due to the latter. There is almost a total lack of performance recording in the two species except in institutional herds; and the pilot work carried out by the Egyptian Dairy Herd Improvement Unit (EDHIU) concerned a very limited number of animals (3681 buffaloes in 2010-2011).

2.1.2. Egyptian milk production in the world

Egypt was the 37th cow milk producer in the world with 3.1 million tons and the 4th buffalo milk producer with 2.6 million tons in 2011/12 after Asian countries (India, Pakistan and China) (FAOSTAT, 2011 & 2012) (Figure 12).

However, Egypt was the first producer of cheese in the world and the second of butter made from buffalo milk in 2011 (Table 5). In the Mediterranean region, Egypt was the third producer of cheese after France and Italy with 310,000 tons in 2001 (RAC/CP, 2002).

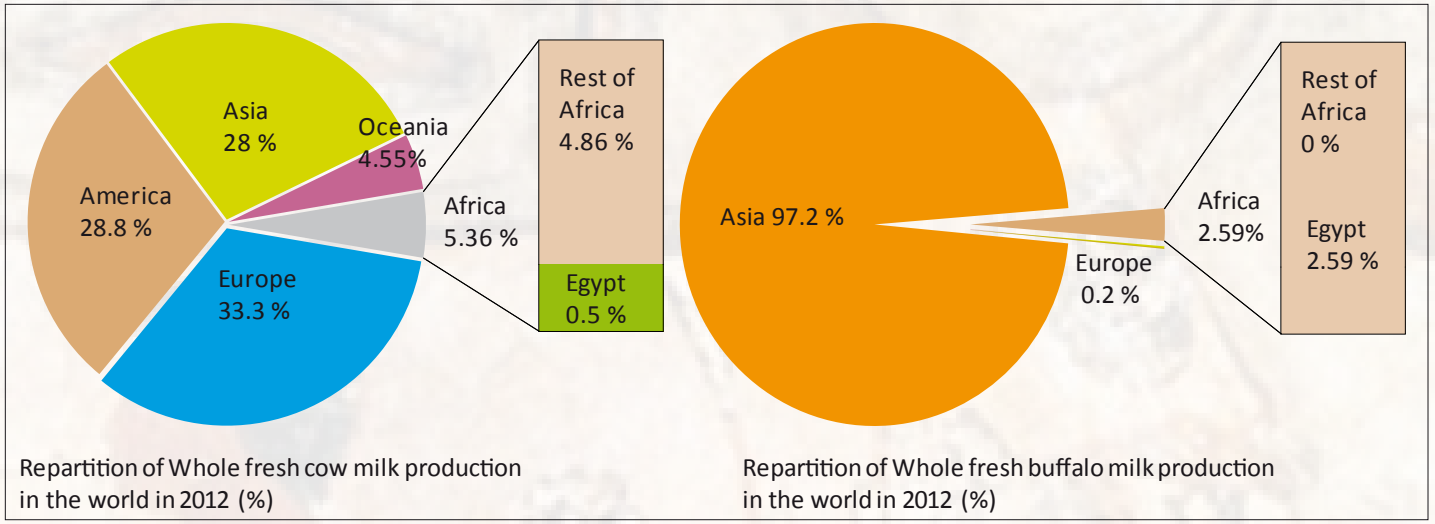


Figure 12: Whole fresh milk production by continent, respectevely for buffalo and cow in 2012 (FAOSTAT)

Table 5: Production of milk products in Egypt in 2011 (FAOSTAT)

Processed products	Production (tons)	Egyptian production in % of world production	Ranking in the world	Egyptian production in % of African production
Cheese, buffalo milk	258 750	90.26	1	100
Butter, buffalo milk	90 050	10.87	2	100
Cheese, skimmed cow milk	88 500	3.74	6	69.86
Cheese, whole cow milk	286 250	1.69	11	72.39
Butter, cow milk	33 500	0.67	28	19
Milk, skimmed cow	636 500	0.52	36	12.71
Cream fresh	5 000	0.15	42	9.39

In Figure 13, we observe a spectacular increase of cheese production of about 170 000 tons between 1990 and 2002 which was mainly due to milk production increase and the large substitution of importation by local cheese products.

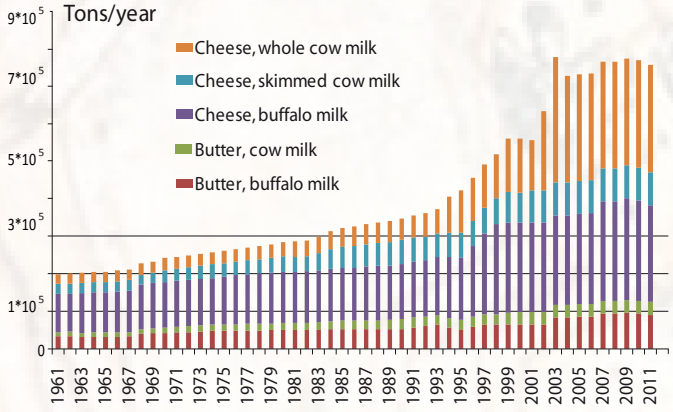


Figure 13: Butter and cheese production in Egypt over the period 1961-2011 (Tons/year, FAOSTAT)

Moreover, over the last decade, Egypt has become an important exporter of cheese, mainly in the sub-region (Middle East and North Africa) (Table 6). In 2011, Egypt was the 12th exporter of cheese and curd in the world with 180 thousand tons (Table 7). During the same period, Egypt records a high increase of the importation of skimmed dried and whole dried milk powder that corresponds to the recent emergence of a modern milk sector in the country.

2.1.3. Milk consumption in Egypt.. "Egyptians eat milk"

North African countries have a long tradition of production and consumption of milk and milk products.

Due to the highly perishable nature of fresh milk, mainly in the very hot summer seasons of these countries, inhabitants have developed different methods of conservation based on fermentation. The white soft cheese (with a short shelf life 3-15 days) called literally *Gibna Bida* is the most expended cheese over the region. Other cheeses that can be preserved for several months like Kariesh in Egypt are also very popular food items in the region (Abd El-Salam et BenKerroum, 2006).

In Egypt, consumption of cheese and butter represents almost half of milk consumption and this proportion has remained stable over the last 60 years (Figure 14).

In the beginning of the 2000s, the cheese processing units that manufactured pickled cheeses (like the Feta, Domiati or Tallaga, etc.) absorbed up to 36% of the total milk production (Anonymous, 2002, cited by Tamime, 2008). FAOSTAT data shows a doubling of the cheese production between 1982 and 2002, to reach more 500,000 tons (Figure 15).

Table 6: Import and export of milk products between 1994 and 2011 in Egypt (source: FAOSTAT)

	Import			Export		
Milk products	Variation (%) 1994-2011	Quantity (tons) (1994)	(2011)	Variation (%) 1994-2011	Quantity (tons) (1994)	(2011)
Butter, cow milk	3.84	40 131	79 014	20.76	11	328
Buttermilk, curdled, acidified milk		65	66		6	14
Cheese, processed			6 848		0	62 282
Cheese, whole cow milk	4.82	21 877	51 008	22.41	3091	11 7662
Milk, skimmed cow		125	6		14	2 477
Milk, skimmed dried	10.46	12 993	77 843	31.55	11	1 531
Milk, whole condensed		586	1 615		0	1 507
Milk, whole dried	11.71	7 690	56 421	33.56	3	549
Milk, whole evaporated		0	169	23.94	13	619
Milk, whole fresh cow		58	97	33.25	29	5 086

Table 7: Import and export of milk products in 2011 in Egypt (FAOSTAT)

	Import		Export	
Milk products	Quantity (tons) 2011	Ranking in the world dairy sector	Quantity (tons) 2011	Ranking in the world dairy sector
Butter	106 760	4	3 367	28
Cheese and Curd	57 856	24	179 944	12
Milk dry	134 264	11		
Milk equivalent	2 111 834	14	643 091	25

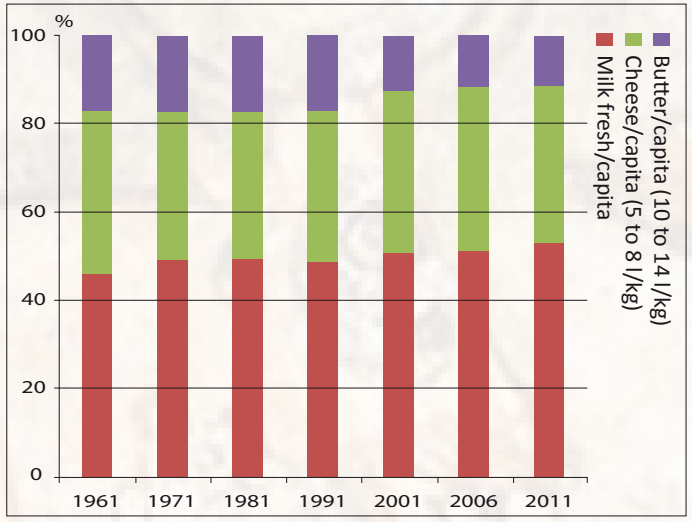


Figure 14: Milk and milk products consumption (% milk liter equivalent, FAOSTAT)

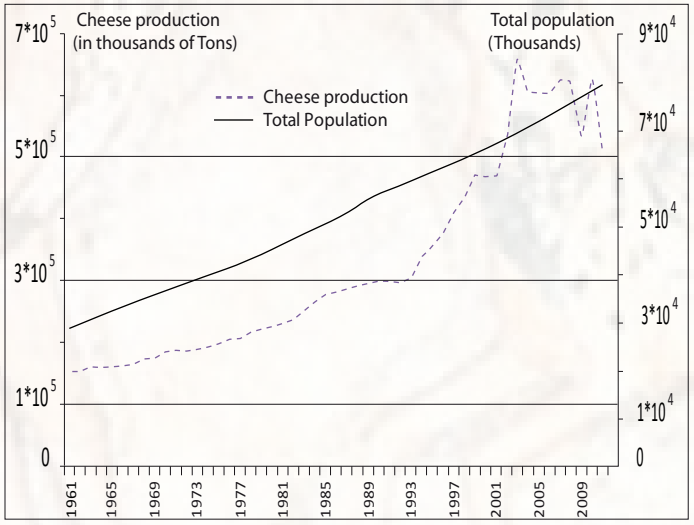


Figure 15: Cheese production in Tons/year between 1961 and 2012 (Source: Faostat)

The per capita consumption per year increased from 4.2 kg/capita/year in 1981 to 4.4 kg in 2000 (Abd El-Salam et BenKerroum, 2006). The milk consumption (excluding butter) with 64-65 kg/capita/year covered near 40% of the protein need from animal source in 2011 (Figures 16 & 17).

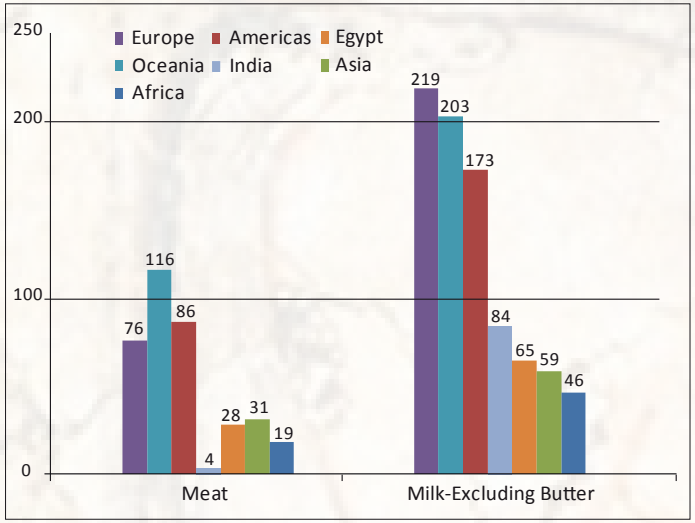


Figure 16: Average consumption of animal products over the world in 2011 (kg/capita/year)

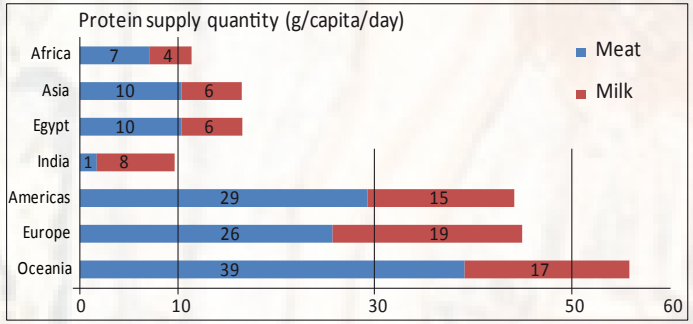


Figure 17: Protein supply quantity (g/capita/day) in 2011 (Faostat)

2.2. Milk: a long tradition (historical and social knowledge)

2.2.1. Historical glympse

a) Ancient Egypt

Dairy animals are fully embedded in the ancestral culture of Egypt (Photo 17). The cow was firstly the symbol of fertility and maternity in Ancient Egypt through the divinity Hathor (photo 18). The earliest evidence for the use of cattle as providers of milk from Egypt dates to the 4th millennium BC. Cows being milked and nursing calves are frequently depicted throughout the Dynastic Period.

Photo 17: Milking cow, Mastaba of Kagemni at Sakkara reign of King Teti (2345–2333 BC)

Egyptian cheese has also been depicted in murals in Egyptian tombs from 2000 BC. The main representation is men carrying pots or jars of milk and cream (Photo 19). Milk was usually preserved in earthen jars, plugged with grass as a protection against insects.

Photo 18: Hathor representation-Denderah Temple, Upper Egypt (323-30 BC)

Photo 19: Men carrying jars of milk or cream

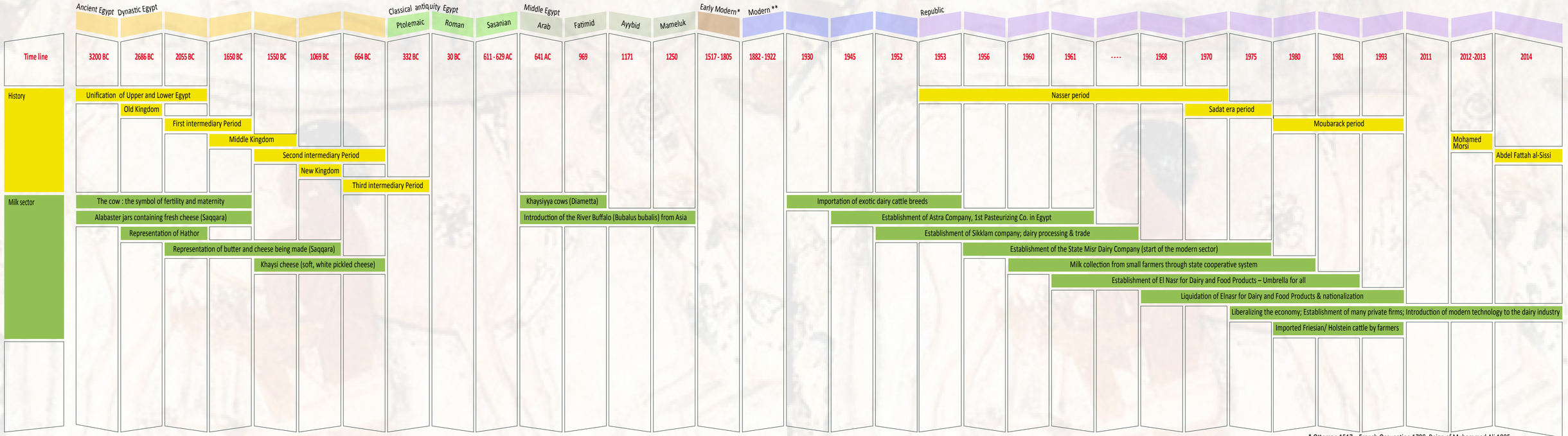


Figure 18 : Transition of dairy farming system and emergence of the modern era

* Ottoman 1517 French Occupation 1798 Reign of Muhammed Ali 1805
** British Occupation Sultanate Kingdom

Cottage cheese was made in ancient Egypt by churning milk in a goatskin and then straining the residue using a reed mat. The process would be similar to that used today when preparing butter (Photo 20).

Photo 20: Ancient and recent practice of churning milk in a goatskin (Giza)

b) Middle ages

This period saw the introduction of buffalo into Egypt coming from India, Iran and Iraq, dating approximately in the middle of the 7th Century. Presently, it is the most important and popular native livestock for milk production in Egypt.

Damietta on the Mediterranean coast is considered as the first area where cheese was made from Buffalo milk. Damietta was also well known for its Khaysiyya cow, from which Khaysi cheese was derived. Khaysi cheese is mentioned as early as the fifth century A.D. In the fifteenth century, another author describes the cheese being washed, which may mean that it was salted in brine. It may therefore have been an ancestor of modern Dumyati cheese (Lewicka, 2011, p.235).

Lewicka (2011) cites a writer of the 17th century who described mish as the "*blue qarish cheese which was kept for so long that it cut off the mouse's tail with its burning sharpness and the power of its saltiness*".

The Egyptian peasants ate this cheese with bread, leeks, or green onions as a staple part of their diet. It seems that the mish made and eaten by rural people today is essentially the same cheese (Lewicka, 2011). At that period, especially during summer time, Egyptians usually needed to import cheese from Sicily, Greece and Syria to satisfy their demand.

c) Recent years

Cheese is always an important part of the modern Egyptian diet (see part 2.1). Although many rural people still make their own cheese, notably the fermented mish, we can observe a rapid development of traditional and modern processing plants over the last 2 decades.

Cheese is often served with breakfast, it is also included in several traditional main course dishes, and it is an ingredient in some popular deserts. There is a range of different varieties of Egyptian cheese.

2.2.2. Diversity of milk products: a social knowledge

The Egyptian cheeses have thus a long history, and cheese plus yogourt with rice remain an important part of the modern Egyptian diet. While the majority of rural families still make their own cheese, notably the fermented mish (fermenting salty cheese), today an increasing amount is produced in family businesses or private cheese factories. Recently we can observe an increase of the proportion of cow milk or a substitution of milk with vegetable oils or filled milk powder (mixture of vegetable oil and skimmed milk).

And cheese is included in several traditional main course dishes, mainly breakfast dishes.

Cheeses are usually classified in 4 categories:

1) Hard cheese (from the family of Parmesan): the most popular is Ras (or Romy), Goda, Cheddar...

2) White cheese made from fresh milk of cows or buffalo or a mixture of these: there are different names depending on the original region or salt content e.g. Damietta (belongs to Damietta governorate), Talaga, Baramilli, Istanboly.

3) Feta cheese, that is manufactured in different ways, but often depends on the replacement of milk fat by vegetable oils.

4) Karish cheese, made from skimmed milk using the acid coagulation method and can be manufactured in more than one way.

The main processes differentiating these cheeses is represented in figure 19.

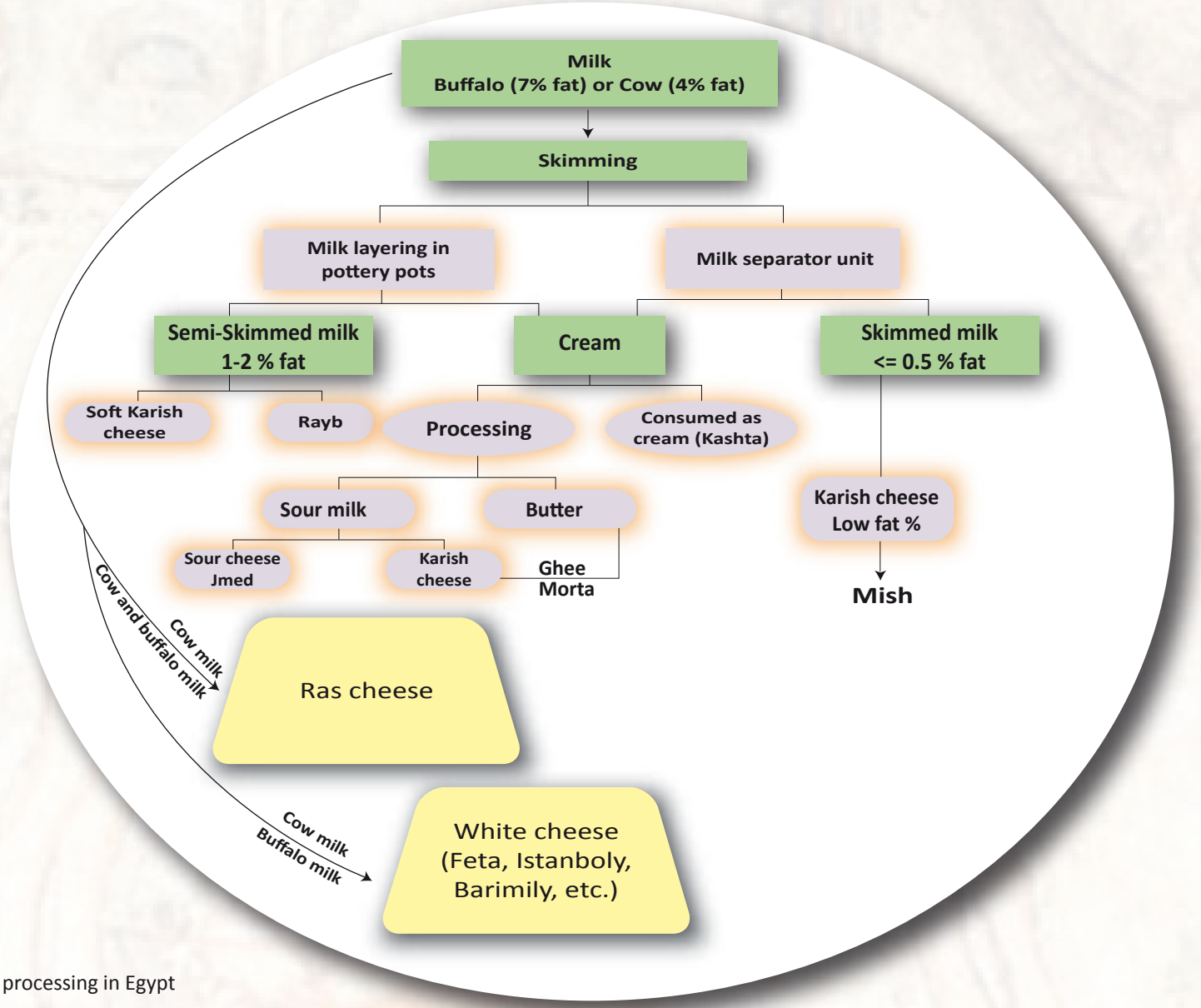


Figure 19: Traditional milk processing in Egypt

Hard cheese

Ras cheese (Gebna romy or also called Roman cheese)

Process

It is made from cow milk but can be manufactured by mixing cow milk with a maximum of 20% buffalo milk.
The milk is first heated, coagulated using rennet, scalded, salted and then placed in cylindrical molds and kept pressed 30 hours; the filled cheese molds are then stored on wooden shelves, turned over every day during the first week and then treated applying the dry salting method by scattering rough salt on the cheese surface in 4-5 turns during 4 weeks.
The cheese is then stored until maturity for around 3-4 months (in the winter period) before consumption.

Consumption

It has a salty taste, crumbly texture and may be purchased at different stages of aging, according to taste and mode of consumption. It is used in pizza. It can be used in both hot or cold dishes.

White soft cheese

Domiati (Gebna bida)

Process

Made from a blend of milk obtained from cattle and buffaloes. It is salted, heated, coagulated using rennet and then ladled into wooden molds where whey is drained away over the next three days. The cheese may be eaten at once, or first stored in salted whey for up to eight months, then matured in rine. It becomes firm when stored in brine (High salty: 12-13% in winter and 13-14% during summer)

Consumption

It is appreciated in summer because salt makes a physiological balance with the hot weather's inducing high rates of sweating.

White soft cheese

Tallaga cheese (closely related to Domiati)

Process

It is a type of traditional Egyptian cheese that is processed from pasteurized whole buffalo or cow milk or a mix of the two; it is processed as Domiati cheese but with less salt (moderate salty: 8-9 % salt during winter and 10-11% during summer).

Consumption

It is consumed by people who want to consume less salt or during Ramadan where salty cheese increases thirst.

Ripening cheese

Mish

Process

Mish is usually made at home from Qarish cheese. It is a sharp and salty product made by fermenting cheese in salted whey for several months. It may be flavored with red chillies.
It can be always stored in earthenware pots like in the ancient Egypt.

Consumption

It is a mainstay in the diet of the Egyptian peasant and often eaten as an appetizer in cities.
Products similar to Mish are made commercially from different types of Egyptian cheese such as Domiati.

White soft cheese

Feta cheese

Process

Feta cheese is different from the feta made in Greece and is mainly based on vegetable oils.
In the traditional way: it is made from skimmed powder milk and vegetable oils that are homogenized, salted, unripened with rennet; the mixture is then poured immediately into padded trays, left to clot and then moved to a refrigerated environment.
By Ultra-filtration technology: This method uses an Ultra-Filtration unit to concentrate the skim milk by drawing part of its water content, until 20% total solids is reached; at this stage vegetable oils are added using an imported homogenizer; it is then pasteurized and cooled.

Consumption

Feta cheese knows a specular growth in the Egyptian consumption.

White soft cheese

Karish or Qarish or Arish (the Egyptian slang pronunciation)

Process

It is an ancient type of white, soft and lactic cheese made from Laban Rayeb curd. It is salted and eaten fresh.
Nowadays, it is made from skim milk using the acid coagulation method and can be manufactured by more than one way.

Consumption

Soft fat-free cheese. It is highly requested nowadays for local and export markets.

White soft cheese

Baramily cheese

Process

Pasteurized milk is firstly stored in salty whey milk for a few weeks in a cooling room, and then it is put at ambient temperature for a few days to raise the acidity level and to expel some serum, and finally re-placed in a cooling room. It is traditionally stored in barrel.

Consumption

Usually consumed as an appetizer or as an ingredient in salads.

White soft cheese

Istanboly cheese

Process

A white cheese to which pepper is added and has a very hot taste.

Consumption

This cheese is usually spread on bread or crackers.

Recipes of rice with milk

Rice with milk

Process

There are different recipes of rice with milk. Rice and milk can be mixed in a pot. Butter is then grated over the surface and it is seasoned with freshly ground pepper. The dish is baked for an hour until a golden brown crust forms.

Another recipe is the Egyptian milk pudding (Mihallabiya) which consists of combining ground rice with milk, adding and dissolving sugar to the milk over heat all the while stirring occasionally until the mixture thickens to reach a custard like consistency. Once removed from the heat, the top of the pudding can be sprinkled with nuts.

Consumption

This is a very traditional Egyptian rice dish that's easy to make. It has a slightly creamy texture and can accompany any dish.

One main product of cream processing is butter than can be stored in the shape of Ghee or Morta. The "ghee" (butter oil) comes from melting the fat left over from cream extracted from milk by churning. Then Morta is extracted as the solid matter (coagulated protein-rich precipitate) after the manufacture of butter oil by the boiling-off method. Morta can be used to make Mish.

Milk and butter are regularly used to prepare baked goods such as biscuits, cookies or pies (photo 21).

Photo 21: Buffalo butter (June 2012, Shanshour, North Cairo)

2.3. Main challenges of the dairy sector

2.3.1. Increasing demand

The Egyptian dairy sector faced two main challenges: a tripling of its population over the last 5 decades (from around 28 million in the early 1960's to around 80 million in 2011 and almost 87 million in 2015) and a dramatic increase of its urban population from 7 million in the 1950's to more than 36 million in 2015 (Figure 20) that has led to important changes in the consumption pattern, notably with an increase in the consumption of milk and milk products (Figure 21).

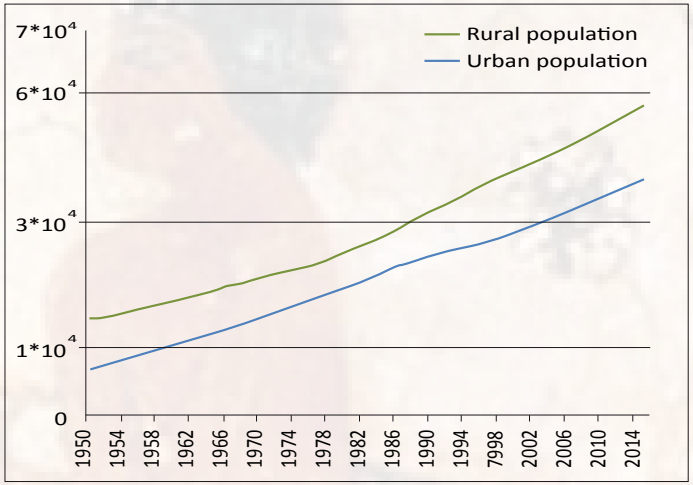


Figure 20: Trend of rural and urban population over the period 1950-2015 (FAOSTAT)

2.3.2. Emergency of modern sector

Moreover, over the course of the last 2 decades, Egypt has seen its modern dairy sector develop significantly. This has been facilitated by the liberalization of the economy which started during the second presidential term of Anwar El Sadat (towards the late 1970's). This change has been accelerated by the Structural Adjustment policies of the 1990's during the Hosni Moubarak presidency.

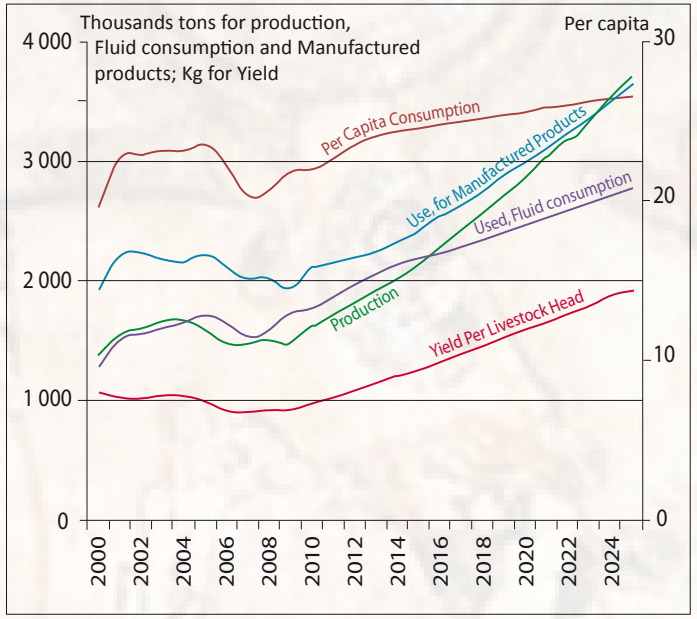


Figure 21: Trend of milk consumption and milk trade with population growth in Egypt over the period (1961-2011) (FAPRI)

This modern sector is composed of the privatization of state companies, the installation of multinationals, and also the development of private dairy enterprises. In 2011, the Egyptian dairy sector counted more than 3300 dairy enterprises, representing 47% of all food and agricultural enterprises in Egypt (RAC/CP, 2012). This emergence of a modern sector explains the rapid growth of importation, mainly in the case of milk powder (Figure 22).

The recent emergence of the modern sector is rapidly presented in the table 8. In 2013, two firms, Juhayna (Egyptian enterprise) and El-Marai (Saudi enterprise), held more than 80% of the market of pasteurized and packages milk; and four firms, mainly multinationals such as Danone, Lactel and Nestlé, plus Juhayna, shared the yoghurt market.

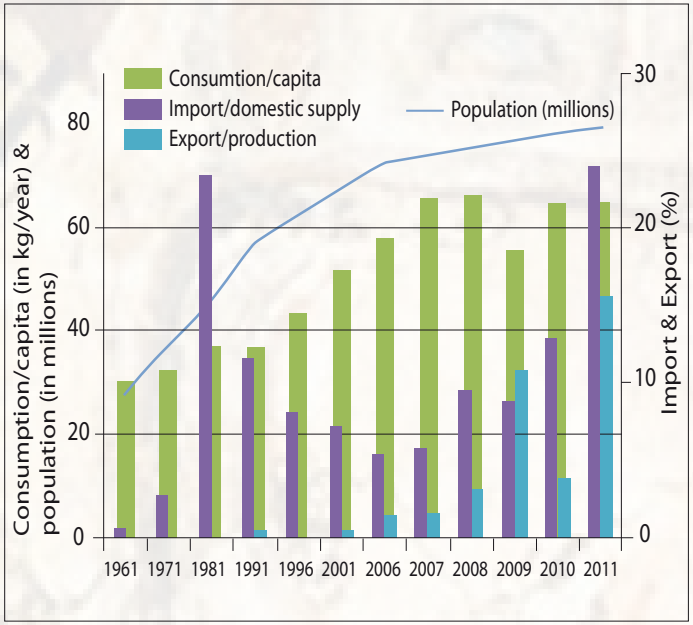


Figure 22. Trend for the milk sector over the period 2000-2011 (Faostat)

This sector has benefited from national policies in terms of facilities for trade but also in terms of publicity by financing large awareness campaigns to milk quality and packaged UHT (ultra-heat treated) milk.

However of the 3300 dairy firms, 85% are considered traditional ones, 11% industrial and 4% with high level of technology (RAC/CP, 2012). Packaged products represent only around 15% of Egypt's milk consumption (HC, 2011).

According to official data, loose milk accounted for 90% of Egypt's milk market in 1998, 82% in 2010 and 65% in 2013. Out of the loose milk volume, around one quarter is for farm consumption, one quarter is for the market of fresh milk and the rest is transformed in cheese and other products.

Table: 8. Agro-industrial sector of milk and milk products in 2013 and market share (source: rebuilt from Juhayna, Annual report, 2013)

Agro-ind Sector	Date of installation	Liquid milk	Yogourt	Drink yogourt
Juhayna	1987	68%	34%	53%
El marai	2009	15%	4%	11%
El Sabah	2010-2013	5%		
Enjoy		3%	2%	
Belhana		2%		
Labanita		2%		3%
lamar		2%		
Faragelo	1973	1%		
Bashayer		1%		
Danone	2005		30%	2%
Lactel	2007		13%	23%
Nestlé	1988		12%	7%
Beyti	2005		1%	
Dina farm				2%
Other		3%	4%	

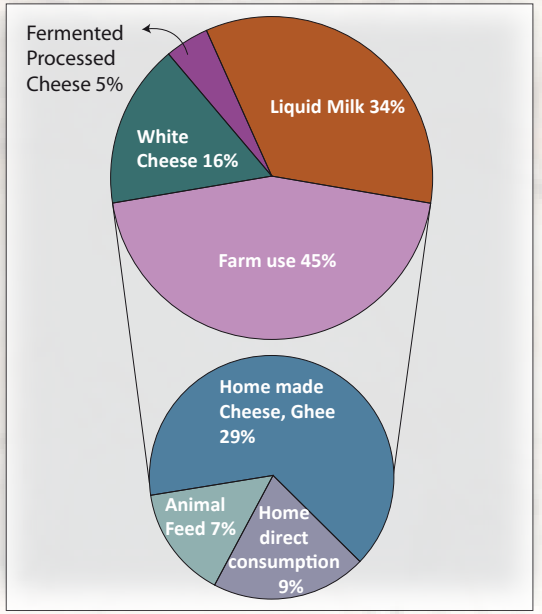


Figure 23: 2011 Total milk market % 4.4 mnLt (Tetrapack, cited by Galal, 2012)

Loose yoghourt represented 46% in 2010 and 26% in 2013. Around 45% of the loose milk was self-consumed by rural families; and around two thirds were transformed in cheese in 2011 (Figure 23).

In conclusion…

- Thanks to the Nile, Egypt is an important milk producer in the African continent. The main characteristics of this country compared to rest of Africa is the important part played by buffalo milk in the whole milk production sector.
- The production of milk from both buffaloes and cows is increasing at a higher rate than the growth of the Egyptian population, leading to an increased per capita share of milk.
- However, as expressed by researchers and experts, "Egyptian people eat milk", namely the majority of milk production is transformed into cheese and butter or ghee for home-consumption. Among all milk products including liquid milk, soft white cheese is the most prominent milk product Egyptians consume; cheese consumption is around 6 kg/year/inhabitant.
- Egypt has become the world's first producer of Feta.

3. Dairy farming systems in Egypt

3.1. Urban and peri-Urban dairy farming systems

3.1.1 Approach of the diversity

Seventy three dairy farmers located from urban to peri-urban areas of Greater Cairo have been visited and surveyed (Photo 22) in the spring of 2013 (Table 9).

Table 9. Distribution of the farm sample by area (2013)

Area	Locality	Density*	Sample
Urban	Al Omrania (district 53)	41359	12
	Dar es salam (district 44)	28125	12
	Al Marj (district 46)	29935	12
Peri urban	Mashiat El bakery (district 33)	15045	13
	Saft El Leben (district 27)	6696	12
	Shalakan (district 19)	3730	12

* (inhab./km²) in 2006 (see figure 7)

The farm survey was based on a semi-structure questionnaire composed of 4 parts:

1) General data on the life-story of the farm;
2) Main land and cropping system;
3) Livestock system including different sub-parts related to herd composition, animal products and transactions for live animals and milk products, feeding system, and sanitary management;
4) Family activities and perspectives. All the materials have been collected and stored in ACCESS database.

The variables issued and calculated from the primary data (Table 10) have been classified in three themes that illustrate the 3 main assets at the dairy farm level: family, land and livestock. The theme of family gathers variables related to family size, family farm workforce and the salaried workforce in the farm. The theme of land gathers variables related to total land, cultivated land and the crop land allocation between cereal, fodder and cash crops.

The theme of livestock gathers variables related to herd size (expressed in Total Livestock Unit: TLU), the percentage of dairy animals, and the percentage of each species (buffalo, Baladi and crossbred cattle).

Photo 22: Urban and peri urban dairy farming systems

Table 10: Variables used in the clustering analysis

	Variable	Variable content	Units
Family	fsz	family size	Nb
	acml	number of potential male workers in the family	Nb
	acfm	number of potential female workers in the family	Nb
	acfarm	number of farm family workers	Nb
	noag	number of family members working outside the farm	Nb
	WAWU	Percentage of salaried workforce in the total farm workforce	% AWU
	AWU	Family and salaried workforce in the farm	Nb
	FWU	Number of family workforces	Nb
Land & Crops	atot	total area owned by the family	feddan
	acult	total seasonal cultivated area by the family	feddan
	prent	percentage of rent area / seasonal cultivated area	%
	pfodder	total area cultivated with fodder crops per year	%
	pcereal	total area cultivated with cereal crops per year	%
	pcashcrop	total area cultivated with truck (vegetable) crops per year	%
Livestock	TLU_ex	number of Total Livestock Unit (TLU) per farm	TLU
	FAT_ex	number of fattening large ruminants in the farm	heads
	DAIRY_ex	number of dairy large ruminants per farm	heads
	perbuf	percentage of dairy buffalo per farm	% / dairy heads
	perbaladi	percentage of dairy Baladi cow per farm	% / dairy heads
	percross	percentage of dairy crossbred per farm	% / dairy heads
	SR_head	number of small ruminants per farm	heads
	AniProd	Total animal product (milk; meat; manure)	EGP
	Dairyprod	Percentage of dairy products/ total animal product	%
	Daiprod_head	Total dairy production per dairy animal per year	liter/head
	Daiprod_fed	Total dairy production per feddan of fodder crops	liter/feddan
	Stocking	Stocking rate	TLU/feddan forage crops

1 TLU=250 kg liveweight (FAO) & 1 feddan=0.42 ha

In the second step we have used a method of multi-factorial analysis to obtain a description of the main 'livelihood' profiles (Alary et al., 2015) and a hierarchical clustering approach (Ward method) that allows us to identify main groups of dairy farmers according to the degree of specialization in the dairy activity and the degree of crop-livestock integration.

The cluster analysis allows us to divide our population (sample) into 5 groups that are described in figure 24 and table 11. Firstly the axis 1 opposes the groups of herders (groups 4 and 5) in the urban areas from the mixed crop-livestock systems in the peri-urban areas (groups 1, 2 and 3) and this mainly according to the constraint of land availability and land access. And the axis 2 differentiates farmers according to a gradient of capital assets, mainly based on the family size and the contribution of family workers in the farm.

In summary, the analysis allows to identify:

- Two specialized systems oriented towards dairy activities: medium herders with around 21 dairy animals and small herders with 5-6 dairy animals on average. These two groups are mainly located in urban areas (Photo 23).

- Three mixed Crop-Livestock (C&L) systems according to land tenure and livestock orientation. We can identify a gradient according to land access that determines the livestock capital from the medium farmers with 27 dairy animals and around 12 feddans of cultivated land, small farms with 3 dairy animals and 2.5 feddans and very small farmers with 1-2 dairy animals and 1-2 feddans (Photo 24).

Photo 23: Small and Medium dairy farms in urban area

Table 11: Descriptive analysis of dairy farming systems around Greater Cairo

		1	2	3	4	5	
	Variables	Medium mixed C&L system	Small mixed C&L system	Very small mixed C&L system	Medium herders	Small herders	Average
	Sample	7	20	11	21	14	73
Family	Family size (number of members)	39.4	14.7	6.1	13.4	4.6	13.5
Family	Number of family workforces	22.6	8.1	3.3	8.5	3.4	8
Family	Familial and salaried workforce in the farm	28.4	8.5	3.6	9.6	3.5	9
Family	Salaried workforce in the total farm (%)	13	6	9	7	7	8
Land & crops	Total area owned by the family (fed.)	17.4	2.9	1.8	0.2	0.8	2.9
Land & crops	Total seasonal cultivated area (fed.)	12.7	2.5	1.7	0.1	0.7	2.3
Land & crops	Rent area per seasonal cultivated area (%)	21	61	49	10	39	37
Land & crops	Cultivated area with fodder per year (%)	67	70	45	5	36	41
Land & crops	Cultivated area with cereal per year (%)	12	17	22	0	0	9
Land & crops	Cultivated area with vegetable crop per year (%)	15	17	12	0	13	10
Livestock	Number of TLU per farm	93	1	6	56	16	32
Livestock	Number of fattening large ruminants in the farm (heads)	25-26	1-2	0-1	9-10	3-4	6-4
Livestock	Number of dairy large ruminants per farm (heads)	27	3	2	21	6	11
Livestock	Dairy buffalo per farm (%)	62	52	64	85	99	73
Livestock	Dairy Baladi cow per farm (%)	24	38	32	1	0	18
Livestock	Dairy crossbred per farm (%)	14	10	5	13	1	9
Livestock	Number of small ruminants per farm (heads)	18	3	1-2	9-10	2-3	5-6

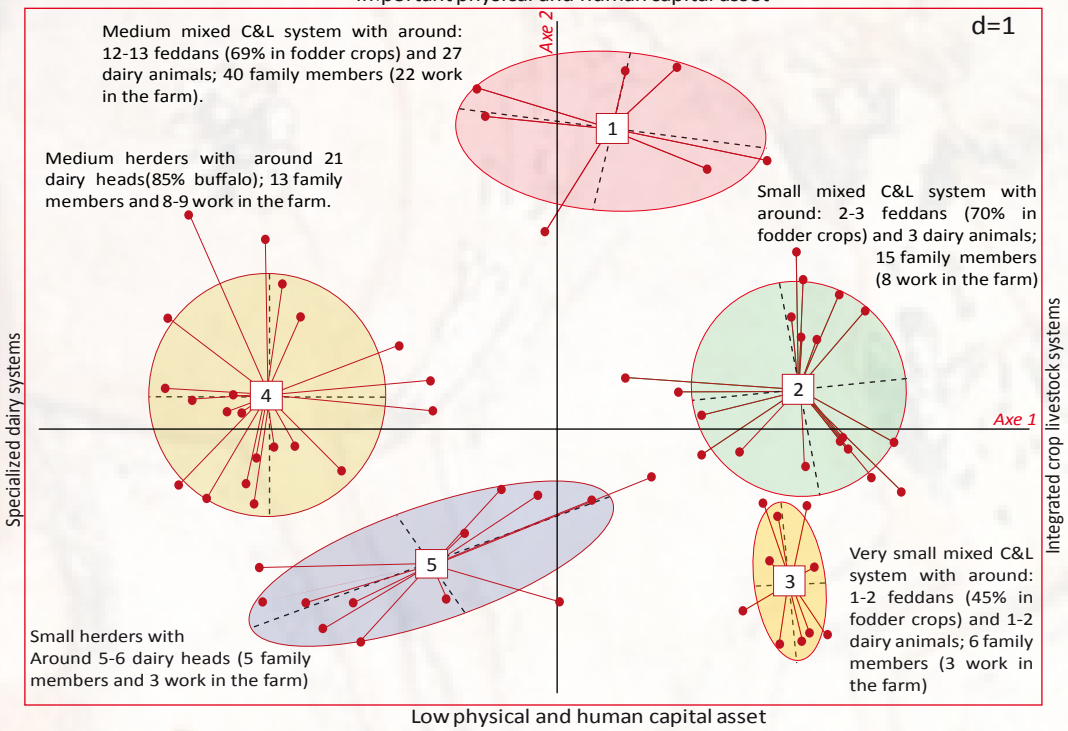
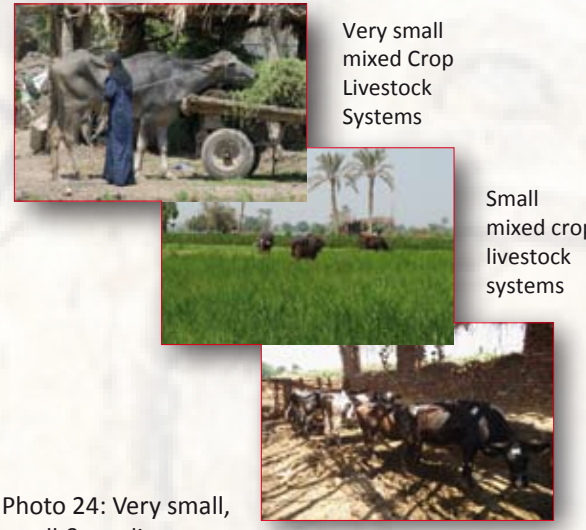


Figure 24: Identification of five urban and peri-urban dairy farm systems around Greater Cairo



Very small mixed Crop Livestock Systems

Small mixed crop livestock systems

Medium mixed Crop Livestock Systems

Photo 24: Very small, small & medium mixed Crop-Livestock systems in peri-urban areas

3.1.2. Some elements of efficiency

The technical efficiency of dairy systems is generally assessed according to two main groups of indicators: one group related to dairy performance by unit of land and livestock assets and a second group related to feeding systems keeping in mind that feed cost and feed availability are the major constraints in milk profitability.

a) Dairy performance according to land and livestock assets

Firstly we propose to evaluate the technical performance according to milk production per fodder areas (in feddan) and milk production per head.

Table 12 shows different links between the milk performance and the crop-livestock systems. We can observe the largest gap according to physical assets, with an average annual milk production between 3300 and 4000 liters/heads for medium systems, compared to around 1900-2200 liters/head for all the others groups. According to FAOSTAT, milk yield production was estimated at around 2000 liters/head for dairy cows and 1500 for buffaloes in Egypt in 2012.

Table 12: Dairy production per dairy animal (litre/head) and per fodder area (litre/feddan) (71 farmers)

	Medium mixed C&L system	Small mixed C&L system	Very Small mixed C&L system	Medium herders	Small herders	On average
Total dairy production per dairy animal per year	3359	2159	1945	4098	1979	2720
Total dairy production per feddan of fodder crops*	9201	2636	2747	--	--	2430

** area of maize and berseem*

The dairy production per feddan is around 2400-2700 liters/feddan for the traditional small mixed crop-livestock system in Egypt, compared to around 9200 liter for medium mixed crop-livestock systems.

b) Dairy performance according to feeding systems

Here we propose to assess the feed costs based on the sources and the quantity of fodder and complements (including concentrates) used in the feed rations.

Firstly, we note that the total feed dairy cost per liter is the highest for small and very small crop-livestock systems (group 2 and 3) with a maximum of 4 EGP/liter for small crop-livestock systems (Figure 25a). The lowest feed cost per liter is achieved for the medium farmers: medium mixed crop-livestock systems (group 1) and medium herders' group in urban zone (group 4) with, respectively, 2.4 and 1.7 EGP/liter.

Secondly, the market dependence for complements and for the green and dry fodders is high for all groups. The economic dependence exceeds 80 % for herders' groups. More surprisingly this market dependence represents around 40-50% for feed and 50-60% for fodder for mixed crop-livestock around Cairo (Figure 25b).

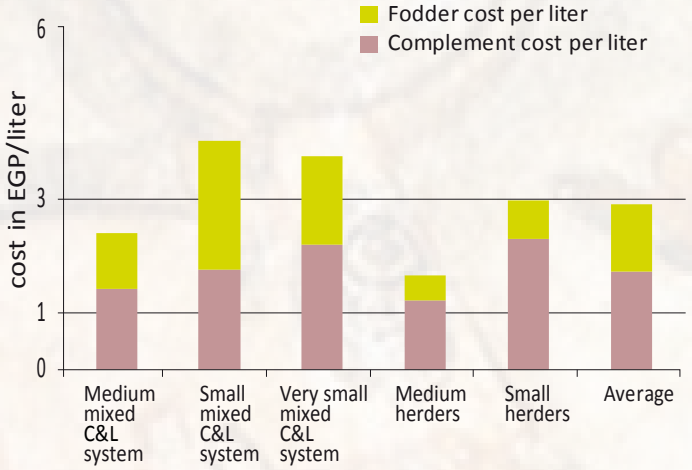


Figure 25a: Fodder and complement cost per liter (EGP/liter) (71 farmers)

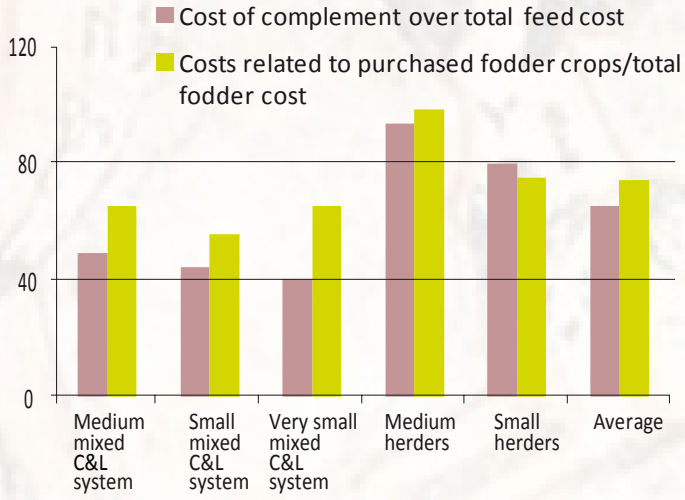


Figure 25b: Market dependence for complement and fodder crops (in %) (71 farmers)

The feed efficiency per specie is approached by the total cost of produced and purchased feed par liter for each species (Figure 26).

Firstly the herders' groups with no land record the lowest feed efficiency for buffalo compared to other groups. In fact, for these farmers (group 4 and 5), more than 85% of the herd are dairy buffaloes and the milk is mainly oriented to the Cairo market with a high milk valorization. This compensates the high feed cost par liter.

Among the mixed crop-livestock systems, the best efficiency is achieved for the small and very small mixed crop-Livestock systems with a feed cost efficiency around 2.4-2.7 EGP/liter for buffaloes and around 1-2 EGP/liter for crossbreds. The feed cost efficiency is the lowest for Baladi species and this in link with the low milk performance and the main meat-oriented system of this breed.

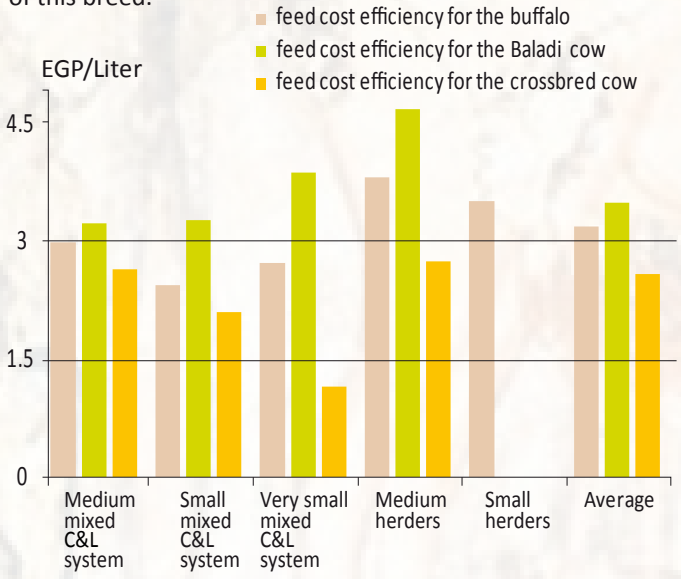


Figure 26: Feed cost efficiency (in EGP/liter) (71 dairy farms)

c) Evaluation of the nutrient ration

To assess the technical feed efficiency per specie, we have compared the Total Digestible Nutrient (TDN), Crude Protein (CP) and Dry Matter (DM) intake of each ration compared to the daily standard requirements of a 550 kg buffalo producing 7 kg of milk per day with a fat ratio 7.2% (Thomas, 2008, cited by Daburon, 2013).

The DM voluntary intake is estimated around 3% of the live weight of the animal; thus, for a 550 kg buffalo, average DM intake requirement can be estimated around 16.5 kg per day (Table 13).

Table 13: Requirement of a dairy buffalo weighting 550 kg and producing 7kg of milk per day with a fat ratio of 7.2% (Daburon, 2013)

Total Digestible Nutrient (TDN) kg	Crude Protein CP kg	Dry Matter DM kg
7.32	1.32	16.5

The DM intake was reported on the daily average milk production of a buffalo in each farm. By comparing this index between farms, we can have an idea of the more efficient feeding systems that better valorize the feed intake.

When comparing the quantity of TDN, CP and DM ingested by a lactating animal on the basis of their daily ration with standard requirement of a dairy buffalo, we can see that average feeding is too rich in energy and protein compared to the norm, except for dry matter for small C&L groups (Figure 27). This is easily explained by the feed composition in this urban environment that privileges supplements.

Therefore some adjustments of the supplementation can be done with regards to the average expected dairy production in this environment.

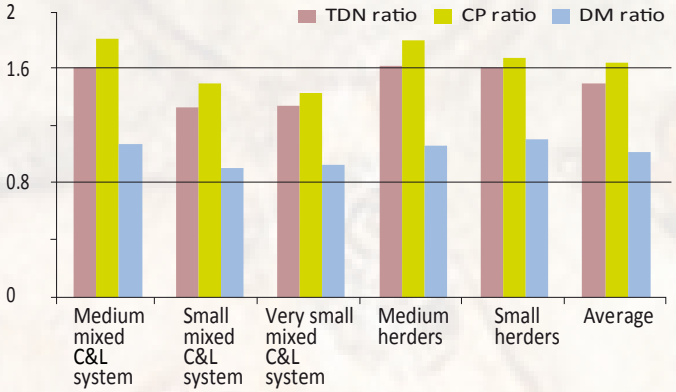


Figure 27: Technical feed efficiency parameters (71 farmers)

d) Environmental efficiency

In the dairy sector, the most expanded indicator of environmental efficiency is nitrogen efficiency (Stilmant et al. 2000; Steinshamn et al. 2004).

Here, based on previous work in the DAIRY project (Daburon, 2013), we have chosen the apparent nitrogen balance that measures the ratio between the global N-outputs and the global N-inputs at the farm scale level over one year (Table 14). In this farm approach, we don't consider the atmospheric and soil flow (fixation by leguminous and especially *Trifolium alexandrium* (called berseem), neither the precipitations of N, nor the leaching of the soil or the atmospheric volatilization). The standard values for each component come from the literature.

The results (Figure 28) highlight low nitrogen efficiency, especially for mixed crop-livestock systems with the lowest environmental efficiency for the very small mixed systems due to the high importance of family consumption, important livestock investment following to the Foot and mouth disease outbreak and the quantity of fertilizer used per feddan.

Table 14: Components of the nitrogenous flow (N= nitrogen quantity in kg)

	Nitrogen variable	Name of the variables
N input	N feed	N in purchased fodders per farm and per year N in purchased concentrates per farm and per year
	N animal	N in purchased animals per farm and per year
	N total fertilizers	N in quantity of chemical and organic fertilizers purchased per year
N output	N milk	N in total milk production per farm and per year
	N manure	N in quantity of manure exported (sold or donated) not used on the land
	N sold animal	N in sold animals per year and per farm
	N dead animal	N in dead animals per year and per farm
	N crop export	N in the sale of fodder crops (not used for animal feed in the farm) N in the sale or consumption of food crops or cash crops (sold or used for home consumption)

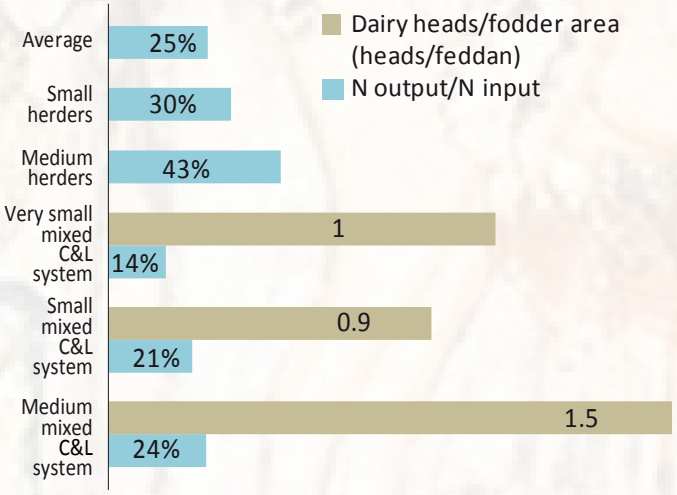


Figure 28: Environmental indicators of efficiency.

3.1.3. Socio-economic approach

a) Economic contribution of animal products

If the contributive part of dairy products over total animal products follows the same trend over all the systems (between 45-60%), significant gaps are observed for the contribution of dairy gross income in the total family net income. In particular, we can observe lower contribution for small and very small crop-livestock systems. This can be explained by the self-sufficiency orientation of these farms and also the dual-purpose (meat and milk) of livestock in the farm (Figure 29).

b) Net income and economic efficiency at the farm level

The family net income is almost double for medium mixed crop-livestock systems compared to small and very small livestock systems. The family net income is the highest for the medium herders. So feed cost efficiency doesn't reflect the farm economic efficiency due to high valorization of milk, mainly buffalo milk, in the urban market.

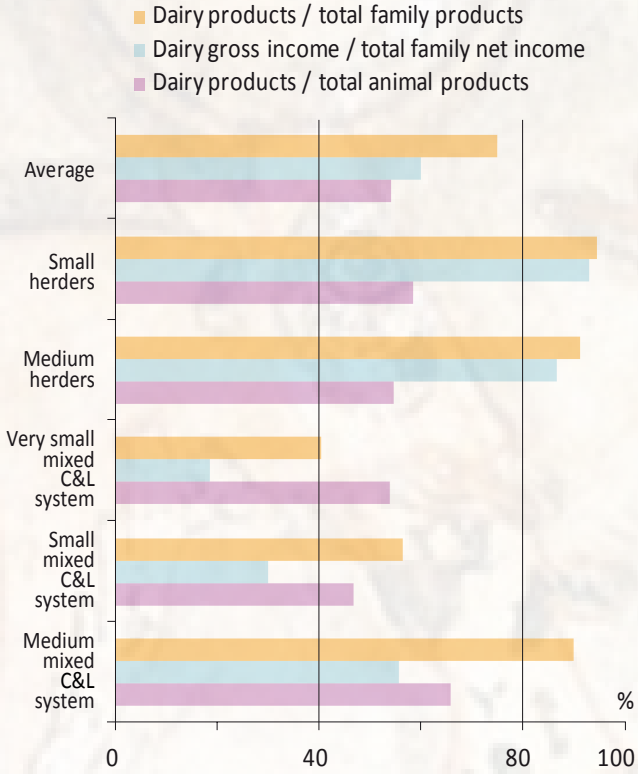


Figure 29: Part of dairy activity in family and livestock gross products and net income for each urban and peri-urban dairy systems in 2013.

The largest herders in our sample registered a monthly net income around 6400 EGP per month, equivalent to a job in the private sector, and around 2600 EGP for medium mixed crop-livestock system (double than legal minimum income) in 2013. Conversely, the very small and small mixed crop-livestock received a monthly income per workforce of around 1200 EGP and 1100 EGP, respectively; so similar to the minimum salary in the public sector.

Of course we observe a similar trend between the economic efficiency (called also profit) ranging between 45-60% and the family net income (Figure 30) .

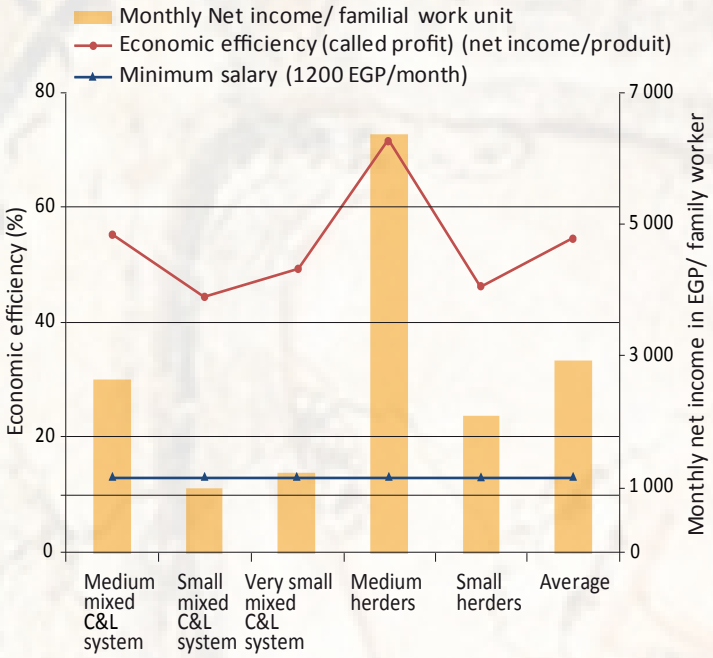


Figure 30: Economic indicators at the family farm level

In summary…

- Dairy products represent between 40% and 90% of total family products at farm level but the dairy gross products are the highest for landless breeders in urban areas; the urban demand of buffalo fresh milk constitutes an opportunity for milk breeders in urban zones;
- Land access is the main constraining factor in the mixed crop-livestock system, mainly in peri-urban zones where these systems are essentially based on the same assets and management as we can find in the mixed farm systems of the Nile valley.

3.2. Rural dairy farming systems

3.2.1 Presentation of the two case studies

a) Case study in the new lands of the west part of Nile Delta

The materials used in this study have been collected within the CLIMED project in the new reclaimed lands of the west part of Nile delta (from March 2013 to march 2014).

Five zones have been chosen (Figure 31) according to the date of land reclamation: from the Old Reclaimed Lands (ORL) in the sixties located in the South west of Alexandra (El-Nardha) to the New Reclaimed Lands (NRL) at the end of the nineties represented by the regions of Tiba and the Bustan extension in our sample. In-between, two zones have been considered: Sukhar-el-Bangar reclaimed mainly in the eighties and El-Hamam in the nineties.

In the five zones, three villages have been chosen in order to represent the diversity of land access in each zone. In each village, 10 farmers have been selected using the method of snowball sampling (Goodman, 1960) and respecting a certain proportion of very small, small and medium farms considering livestock size.

This technique of sampling is mostly used for exploratory investigation. It's based on a social network contact of persons that guide the researcher to his next interviewee. In our case, the main contact persons have been some farmers in the community and some resource persons like cooperative personals, technical officers, or other intermediaries like traders or cheikhs in the community.

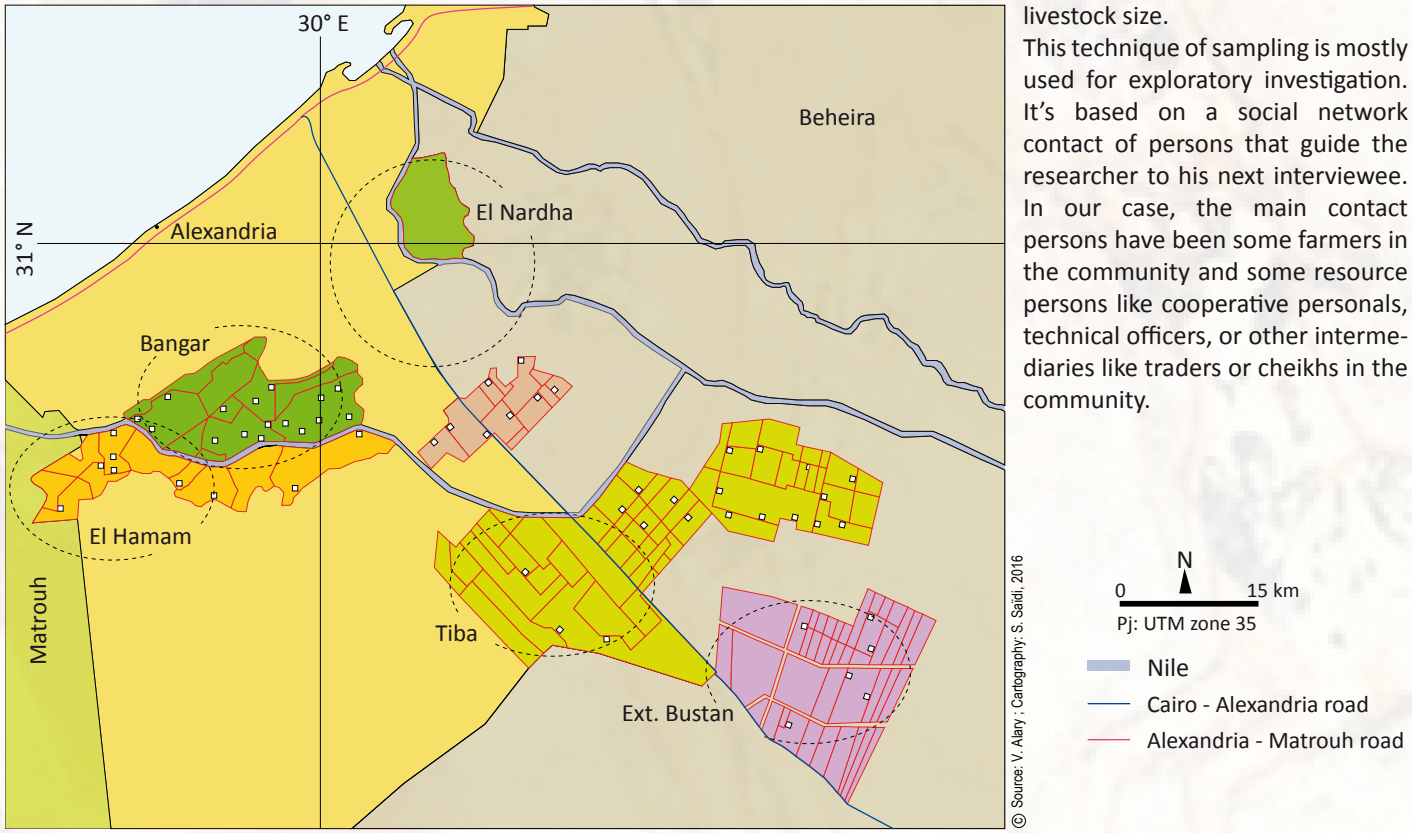


Figure 31: Geographical localization of the 5 selected zones for the farm survey in the west part of Nile delta (CLIMED project).

This multiplicity of resource-persons in each community can be considered as pledge of diversity and therefore representativeness. In total, 158 farmers surveyed have been considered in this analysis. The farm survey has been based on a semi-opened questionaire including 6 parts:

* Part 1: Family and house description;
* Part 2: Land and crop system. This part consists of a detailed description of the land access and crop management;
* Part 3: Livestock structure and management including the feeding system, animal movements, animal performance and health care;
* Part 4: Mode of funding;
* Part 5: The main changes during the last 10 years;
* Part 6: Social capital.

b) Case study in the old lands of Nile Valley: BeniSuef

A baseline farm survey has been conducted within the SIADEEP project from August 2014 to November 2014. This family farm survey was based on a semi directed questionnaire structured in four main parts:

- Part 1: Description of the farm family based on the life story of the farm and the family composition and education,employment in and out of agriculture;
- Part 2: Land and crop production systems including land tenure and cultivated lands, cropping systems, crop management;
- Part 3: Livestock system approach including herd composition and management;
- Part 4: Information related to farm and family expenses, access to loans and financing, training and social network, perception of changes.

In total, 87 families have been interviewed in three villages of the governorate of BeniSuef (Figure 32).

As in the previous survey, we have used the snowball sampling technique by respecting certain criteria related to asset basis (land size and livestock) and milk marketing strategies.
In fine, the sample consists of 57% of small herders with less than 2 dairy animals in the herd and 28% of medium herders between 3 and 5 dairy animals. In the 2010 census, 48.3% of farms were categorized as very small farms (< 1 feddan) with around 1-2 heads of large ruminants in average and 36% were small farms with 1- 3 feddans and around 2-3 large ruminants. Therefore the sample well represents the very small and small farms that are dominant in the old lands of Nile valley (representing around 84% of Egyptian farms) with 1- 3 feddans.

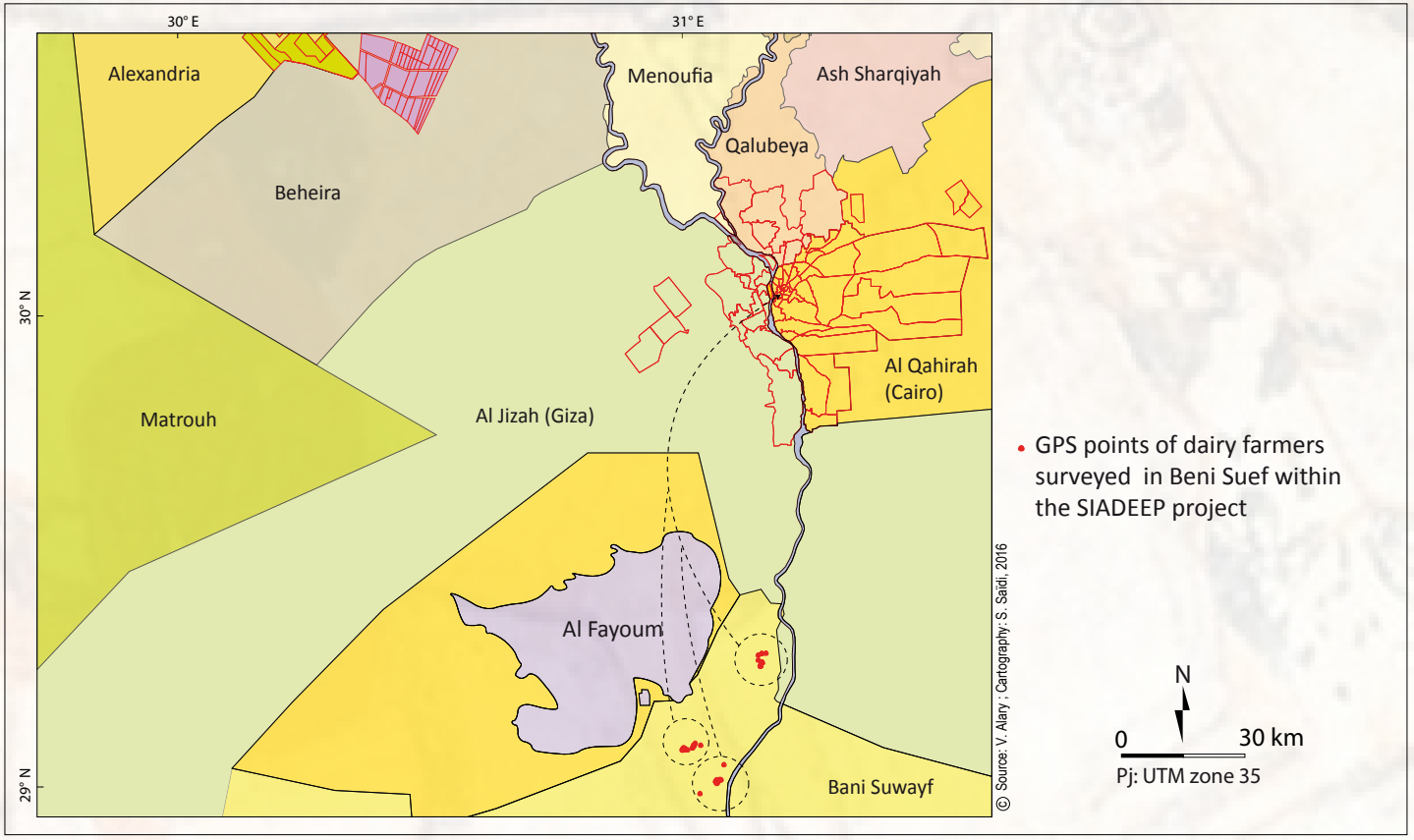


Figure 32: Geographical localization of the 3 selected zones for the farm survey in old lands of Nile valley (Beni Suef) (SIADEEP project)

3.2.2. Contrasting roles of livestock between new lands and old lands

a) Socio-geographical approach of the villages in the two zones

The first difference (Figure 33a & 33b) is the geographical rural organization between Old and New lands:

* In old lands: we have densely populated villages; generally the cultivated plots are located along the canals; the contours of plots are not rectilinear; dairy cows are usually brought daily to the plots in order to see the sun and to eat green fodder crops and they come back at the end of the afternoon to be milked at home;
* In new lands: we have low dense populated villages; the cultivated lands are located outside of the village. Plots are geometrical lots attributed by the administration belonging to an"irrigated entity". The low density in the village allows for keeping the animals in the village, therefore few animals move to the plots.

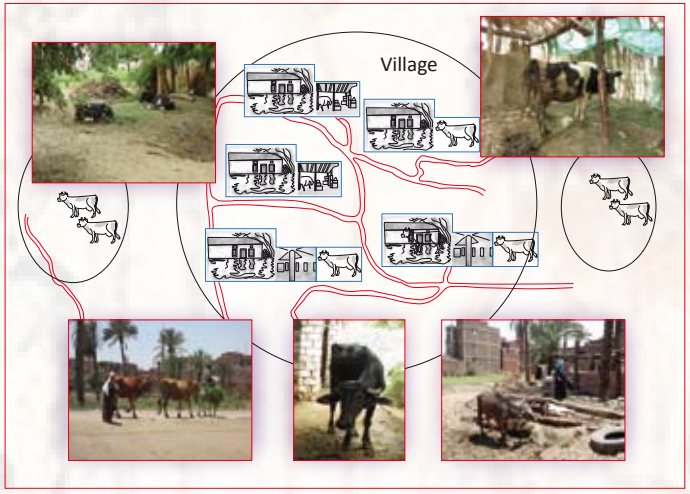


Figure 33a: Spatial organization of the village in the old lands (Beni Suef)

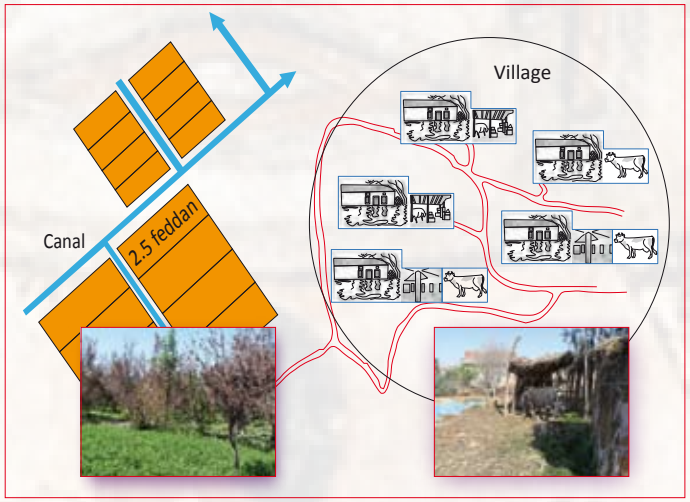


Figure 33b: Spatial organization of the village in the new reclaimed lands (Bustan, Tiba).

The second main difference is the sociological context. In Old lands, communities are constituted since many decades or even centuries with strong family or community links within them through the marriages or other arrangements such as informal loans and services. To the contrary, in the new reclaimed lands, the majority of farmers come from all over the country with no special links to their neighborhood. The community in the NRL is composed of three majors social categories:

1) University graduates who were the targeted beneficiaries of these lands during the first settlement waives;

2) Tenants of the Old Lands who have benefited from these lands over the course of the last two decades, following land policies that have put an end to the inheritance of land leases;

3) New buyers who have purchased these lands from official beneficiaries.

b) Description of the farm systems in the new lands

The description of the diversity of farming systems in each zone has been done by using a multi factorial analysis (MFA) and clustering analysis.
37 variables have been chosen and classified in six thematic groups: family, labor, land, crop allocation, livestock and dairy system, in order to understand the diversity of structure and functioning of the farm systems (Table 15).

Table 15: Presentation of the six themes in new reclaimed lands' systems

	Variables
Family	Education and age of the family head; family size; schooling; ...
labor	Family and external agricultural workers in the farm
Land	Land access and tenure; part of cultivated land
Crop allocation	Annual and perennial crops
Livestock	Herd composition by species and physiological stages
Dairy system	Milk income contribution; milk productivity; rate of charge

The projection of the 6 themes on the two main factorial plans shows the strong structuration of the population between the land access and the farming systems (Figure 34). There is a clear differentiation between the traditional mixed crop-livestock systems on the first axis (mainly old renters or new buyers) and the tree oriented systems developed by graduates. The third axis differentiates the farmers according to family activities, mainly with the economic diversification out of agriculture.

Based on the hierarchical clustering method six groups of family farms have been identified (Figure 34).
A rapid description of the 6 groups is presented in table 16 and figure 35. We have 4 groups which characterize the traditional crop-livestock systems in the ORL (groups 5 and 6) and in the NRL (groups 1 and 3). The medium to medium-large farm systems (groups 5 and 6) have started their activities in the 70-80's; the majority of them are localized in the oldest reclaimed lands of our sample (in the last 50-60 years). With an average cultivated ranging between 6 and 10 feddans, they have around 8-11 dairy animals and around 22 TLU (including all animals).

Group 5 is composed of only 2 farms which have respectively 90 and 140 ewe. These two farms are particular and have been remove of the following analysis.
The small and small-medium farms (groups 1 and 3) are located in the recent reclaimed lands (El Hammam and Bustan). These groups include the more recent common beneficiaries who obtain 2.5 feddan with the extension of the National Resettlement Scheme in 1996 to different social strata (Adriansen, 2009).

Table 16: Descriptive variables of each farm groups in the NRL (158 families)

Classes	1 (59)	3 (42)	6 (7)	5 (2)	2 (34)	4 (14)
Description	Small mixed C&L system	Small-medium mixed C&L system	Medium mixed C&L system	Medium - large mixed C&L system	Graduates oriented fruit trees	FS oriented fruit-tree-livestock
localization	El hammam Bustan Bengar	Bengar El Hammam El Nahda	El Nahda	El Nahda Bustan	Tiba Bustan	Bustan Tiba
Family size	7	10	18	13	7	11
% casual workers	22%	29%	43%	18%	36%	42%
Total land (feddan)	2.5	4.5	6.1	9	4.7	5.7
Av. Year of land access	1996	1989	1975	1984	1996	1995
Main land access	New buyers Evicted tenants	New buyers Evicted tenants	New buyers Other beneficiaries	Illegal Evicted tenants	Graduates	Graduates Evicted tenants
Crop system	Seasonal crops	Seasonal crops	Seasonal crops	Seasonal crops	83% trees	44% trees
% fodder	21%	19%	23%	13%	8%	15%
Nb. Dairy heads	2	3-4	8	11	1-2	5-6
Milk yield/head	1066	1312	2682	1860	1252	1718

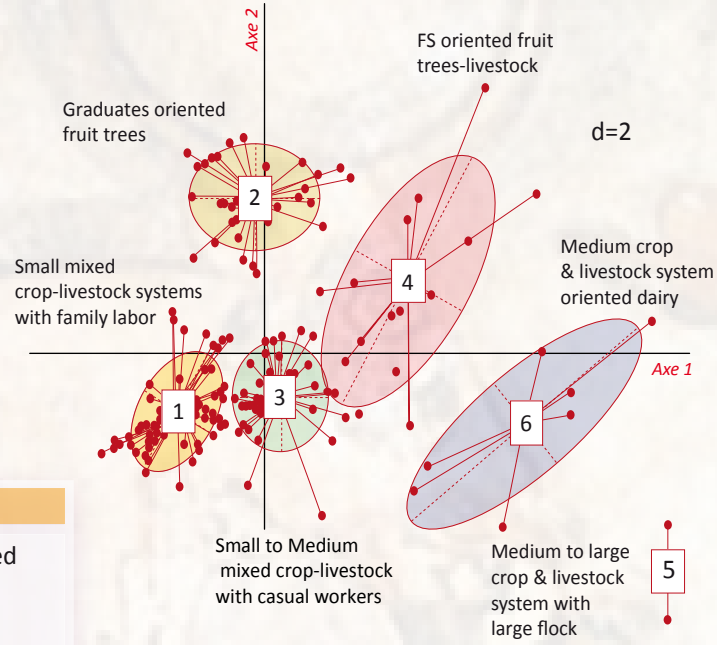


Figure 34: Projection of the 6 groups of family farms on the factorial plan (1*2) (Legend: FS for farming system)

These common beneficiaries are mainly evicted tenants, but also early retirees from the public sector and female heads of household. The group 3 is composed of new buyers who have bought supplementary land to their neighborhood or some beneficiaries of Bengar that got around 5 feddans.
The two last groups (groups 2 and 4) are tree-oriented farmers that obtained the land recently, mainly in the two zones of Tiba and Bustan. The majority of them are graduates. Generally they opt for tree crops and market orientation for all agricultural activities.

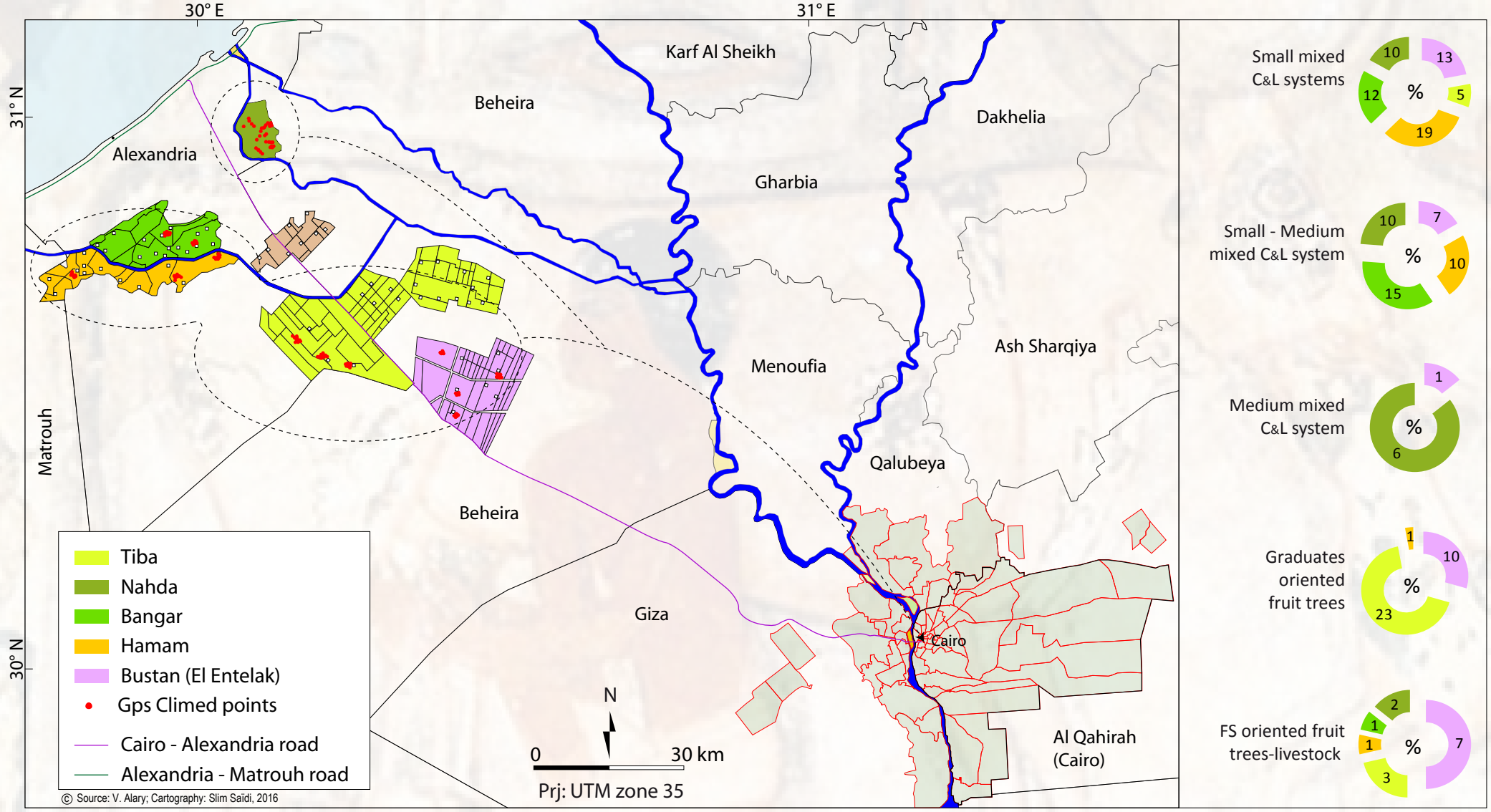


Figure 35: Repartition of farm groups by zone in the new reclaimed lands of the west part of Nile Delta (CLIMED survey)

c) Description of the farm systems in the old lands

Out of a total of 87 interviews conducted in three villages of Beni Suef governorate, we performed a multifactorial analysis on 83 farms. Four farms had to be removed due to some extreme data.

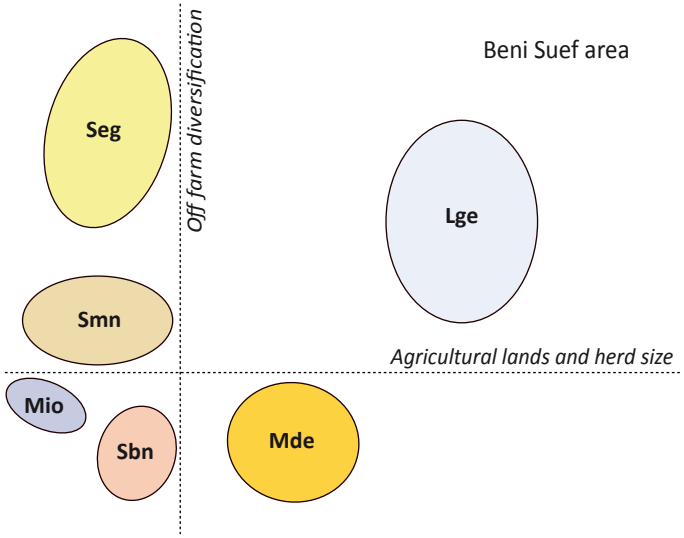
From the database, 56 variables have been chosen and classified in 9 thematic groups. Three themes includes the active variables related to the 'Family' ('social'), 'Herd' and 'land and cropping system' and the six following themes include 31 supplementary variables that allow for the understanding the diversity of structure and functioning of the farm systems according to milk practices and milk strategies (Table 17).

The two first axes (that explain approximately 25.6% of the variance of the sample) are presented in figure 36.
The first axis is constituted mainly with variables belonging to the "herd" and "crop" theme. Indeed, the three main contributive variables are the size of the utilized agricultural area (UAA), the size of the dairy herd and the total TLU per farm.

The second axis is mainly constituted of variables belonging to the family theme, mainly off-farm jobs and the level of education of the family head.

Table 17: Presentation of the 9 themes in old lands (SIADEEP project)

	Themes	Variables
Active variables	Family	Family size, education, family farm workers and non-farm jobs
	Herd	Herd structure and herd composition
	Land and cropping system	Land tenure; cultivated area; cropping pattern.
Explanatory variables	Animal costs	Including all animal costs (feeding costs, labor costs, veterinary costs)
	Milk marketing	Related to milk marketing channels
	Dairy production	Dairy production, maximum daily production, duration of lactating period
	Dairy-sales	Dairy sales: type of dairy product sold (cheese, butter, raw milk, skimmed milk)
	Opinion	Opinion and perception of the families about the Milk collection center (MCC), the role of women, the opportunities and difficulties, mainly in link with the milk activity.
	Sanitary	Sanitary practices: milking practices and medecine residues



Seg (Small farm & governmental jobs): UAA=1.5f, 50% in property. 5.5 TLU. 5-6 members/family, head finished secondary school, few governmental job;
Smn (Small farm with medium educational level): UAA=1.7f, 40% in property. 7.4 TLU, 6-7 members/family. The head finished primary to prep-school, no off-farms jobs;
Mio (Micro farm & illiterate head): UAA=0.9f, 15% in property. 4.53 TLU, 5-6 members/family, few occasional job.
Sbn (Small farm, renting & read and write level): UAA=1.5f, mainly rented, 6 TLU, mainly with dairy cows. 8 members/family, head illiterate or can read and write, no off-farms jobs;
Mde (Medium farm): UAA=3f, 50% in property. 11 TLU. 8-9 members/family. the head can only read and write; no off-farm job;
Lge (Large farm): UAA=6.8f, 60% in property. 28.8 TLU, head finished prep-school. secondary school. 9 members/family, few governmental or private off-farms jobs;

Figure 36: Typological group representation in the Old Lands (Beni Suef)

In summary, in Beni Suef (Table 18) a multi-crop pattern is the rule including:
- Fodder: mainly clover (*Trifolium alexandrinum*) in winter and maize fodder (*Zea mays*) in summer;
- Cereals: wheat (*Triticum aestivum*) in winter and corn (*Zea mays*) in summer;
- Cash crop, mainly vegetables with a large variety such as tomatoes, onions, cucumbers, eggplant.

The herd is mainly composed of cattle (crossbred or baladi) knowing that raw cattle milk is preferred to buffalo milk in this governorate, contrary to many governorates of the Nile valley and Delta. For all those families, animal or cereal crop production is used firstly to ensure the food security of the family.

In summary

- The degree of education is a common factor of differentiation in the old and new lands because it conditions the diversification in and out of agriculture;
- Land is the major constraining factor for livestock activity

- However, we observe more diversity of farming systems in the NRL compared to old lands where it is mainly a diversity of farm size due to land fragmentation and population density.

Table 18: Descriptive variables (mean) for each farm type in Beni Suef

	Small farm with medium educationnal level	Small farm & governmental job	Small farm tenant	Micro farm illiterate	Medium farm	Large farm	Average
Sample	24	8	16	13	17	5	83
Family size (number of members)	6.6	5.4	8.4	5.7	8.9	9.2	7.3
Education of the family head	Primary or prep-school	Secondary	Can read and write	Illiterate	Can read and write	Prep-school	
Number of family workforces	4.6	4.5	5.4	4.4	6.4	6.5	5.2
Total seasonal cultivated area (fed.)	1.7	1.5	1.5	0.9	2.9	6.8	2.1
Total area owned by the family (fed.)	0.7	0.8	0.3	0.1	1.5	4.2	0.9
Cultivated area with fodder per year (%)	52.9	52.5	39.8	62.6	44.9	59.1	50.6
Cultivated area with cash crop per year (%)	4.1	1.3	2.1	0	11.2	10.3	4.6
Cultivated area with vegetable crop per year (%)	3.3	2.1	13.5	0	18.7	8.3	8.1
Cultivated area with tree per year (%)	0.9	0	0	0	0	0	0.3
AV. Number of total TLU per farm	7.3	5.5	6.1	4.5	10.9	25,8	8.3
AV. Number of fattening TLU per farm	0.2	0.3	0.3	0	0.6	1.4	0.3
AV. Number of dairy aminals (herds)	2.7	2	1.7	1.7	4.1	10	3.1
Dairy buffaloes in the herd (%)	9	0	22	9	36	4	16
Dairy crossbreds in the herd (%)	65	94	30	57	33	82	54
Dairy baladi in the herd (%)	26	6	48	35	30	14	30

3.2.3. Socio-economic approach of the rural systems: constraints & opportunities

a) Some economic descriptive data in the new lands

Figures (37, 38 and 39) give an overview of the contribution of dairy activity in each farm type of the west part of Nile delta. Figure 37 shows the important gap of benefit between cattle and buffalo milk in the West delta region. Figure 38 highlights the significant importance of milk products for almost all groups (representing more than one third of animal products except for the medium large group).

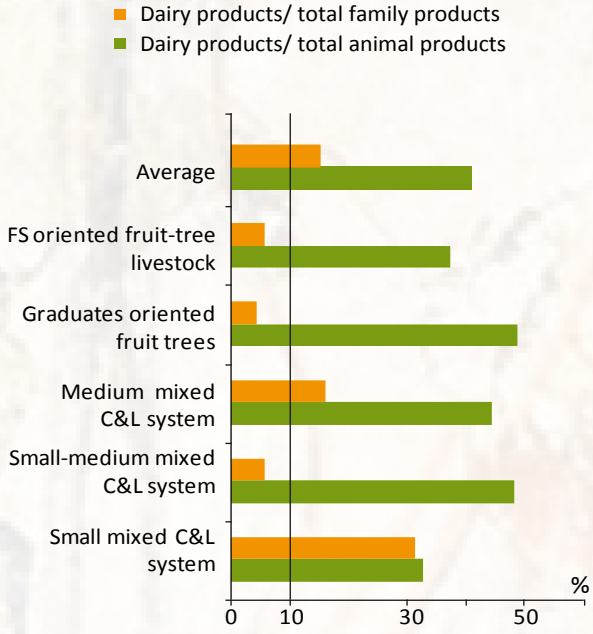


Figure 38: Part of dairy activity in family and animal gross products for each farm type in the new lands of West Delta (%)

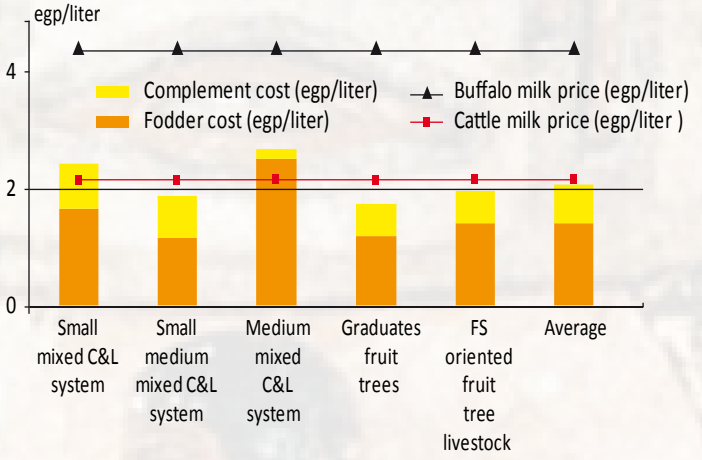


Figure 37 Comparison of feed cost and milk price for each dairy farm type in the new lands of West Delta

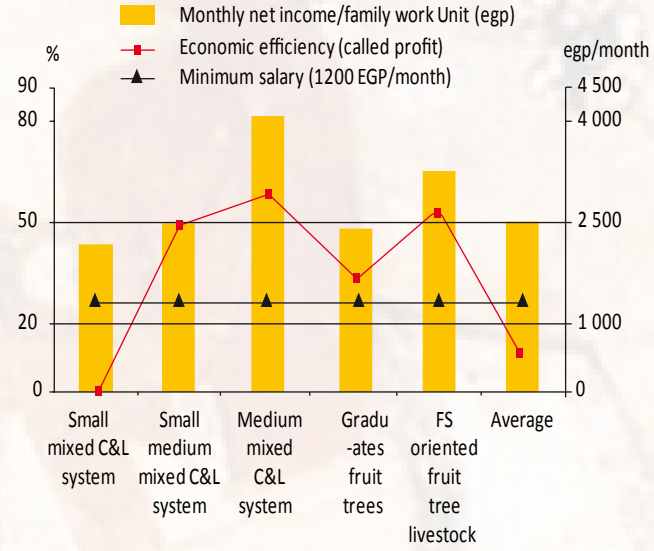


Figure 39: Economic indicators for each dairy farm type in the new lands of the West Delta

All family farms groups are above the poverty line (Figure 39). However we have a multiple factor of five between small and medium large ones. Moreover the economic profit is almost zero for small farm systems due to the low economic valorization on the market due partly to their distance to markets.

b) Some economic descriptive data in the old lands (Beni Suef)

Comparing to reclaimed lands in the west part of Nile Delta, all farm types in Beni Suef get a positive unit benefit per milk liter, mainly due to the lower use of concentrates and the limitation of the herd size to land availability (Figure 40).

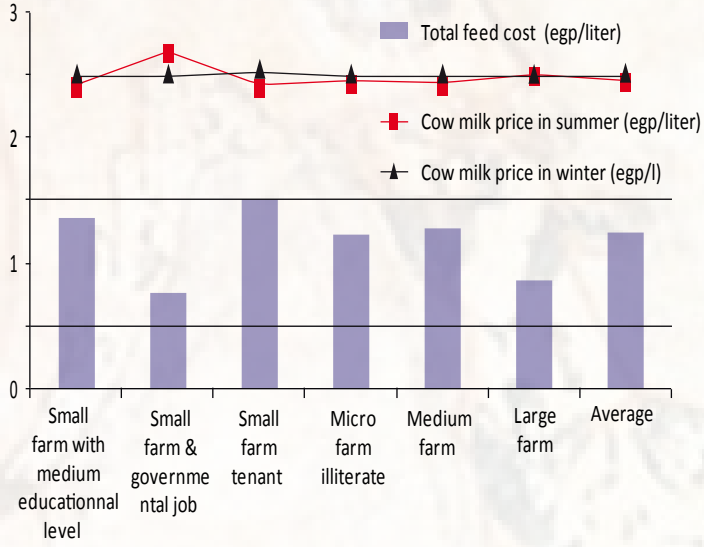


Figure 40: Comparison of feed cost and milk price for each dairy farm types in BeniSuef

However, we can observe a contrast in terms of dairy contribution to gross profit. Compared to new lands, there is an important homogeneity between the farm types regarding the milk contribution: around 30% of family gross products and 50% of total animal gross products. This reflects well the homogeneity of farm systems in the zone (Figure 41).

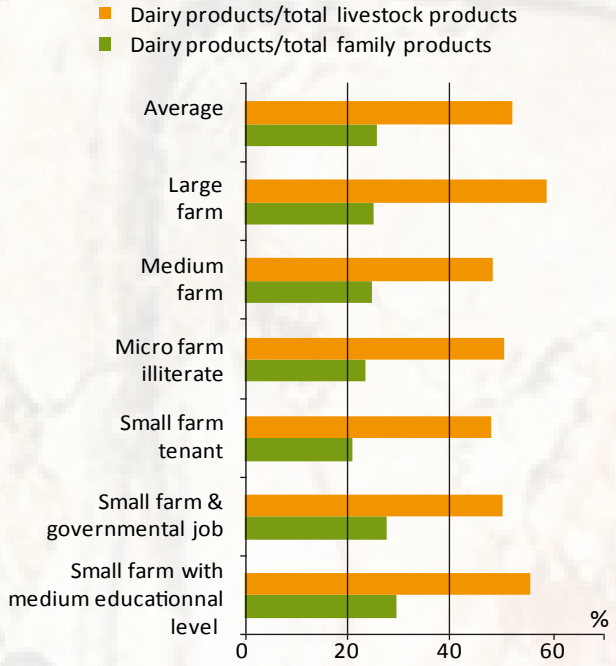


Figure 41: Part of dairy activities in family and animal gross products for each dairy farm type in BeniSuef (%)

Finally, only the farm type with secure jobs (like governmental jobs) or medium and large farms achieve a monthly net income superior to the minimum wage (fixed at 1200 egp/month in 2014) (Figure 42).

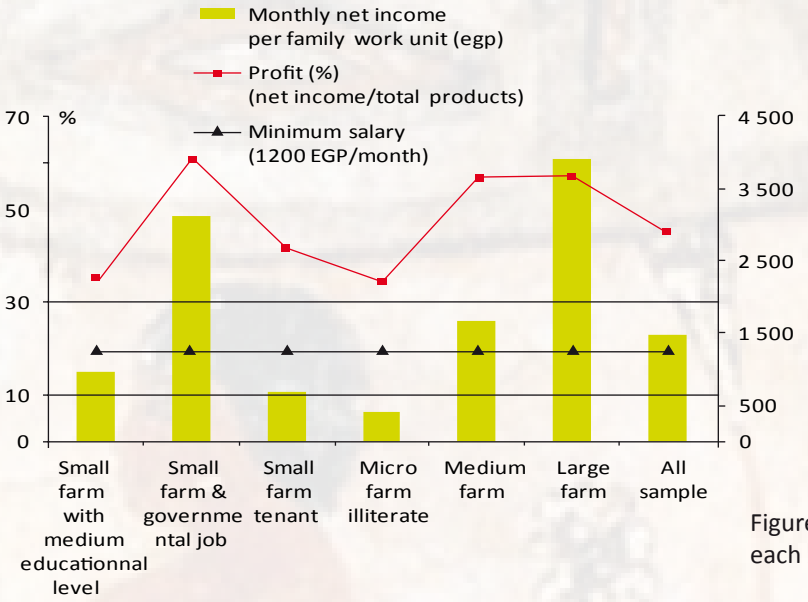


Figure 42: Economic indicators for each farm type in BeniSuef

In summary

If the experience accumulated in old lands allows generating a positive benefit from dairy activities, it is not enough to compensate for the land fragmentation that affects the viability of the vast majority of farms in the old lands.

In the new reclaimed lands of the west part of Nile delta, dairy activity is not considered as a viable economic activity at the farm level considering the feed cost and the low market access.

3.3. Compared analysis of indicators of milk profitability

Figure 43 and figure 44 show the contrasting position of urban and peri-urban dairy farming systems compared to rural dairy systems.

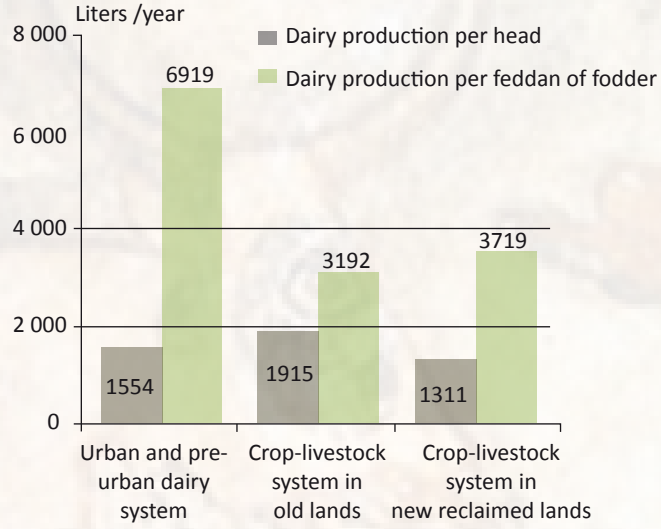


Figure 43: Milk performances per animal and per feddan for each zone

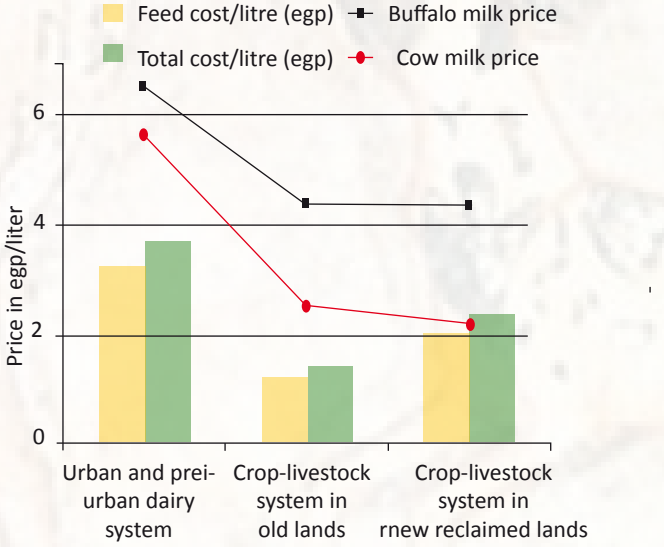


Figure 44: Unit benefit of cow and buffalo milk in the three zones (egp/liter)

In reality, through the traditional milk chains, urban farmers make a profit from their dairy products in the urban milk shops, especially buffalo fresh milk (with a selling price 50% higher than in rural areas (Table 19). Therefore the unit benefit can reach 2.5 egp/liter. In rural zones, we can observe a large gap for the unit benefit per liter between the buffalo and cow milk. In fact, the buffalo fresh milk is mainly kept for family consumption; and the surplus can be transformed into butter or cheese.

Table 19: Average producers' selling prices of dairy products per specie and per zone (egp/liter or egp/kg) (2013-2014)

	Buffalo			cattle		
	Old land	New land	Urban and Peri-urban	Old land	New land	Urban and Peri-urban
Fresh milk (winter)	4.5	4.4	6.6	2.6	2.2	5.68
Fresh milk (summer)	4.3	--	--	2.5	--	--
Butter (winter)	37.4	34.7	40	29.4	33.3	40
Butter (summer)	33.4	--	--	30.4	--	--
Cheese (Winter)	8.2	8.9	10.5	6.9	9.7	17
Cheese (summer)	9.3	--	--	8.2		--

The figure 45 shows clearly the economic profitability of dairy activity at the family level in urban and peri-urban farming systems compared to rural families.

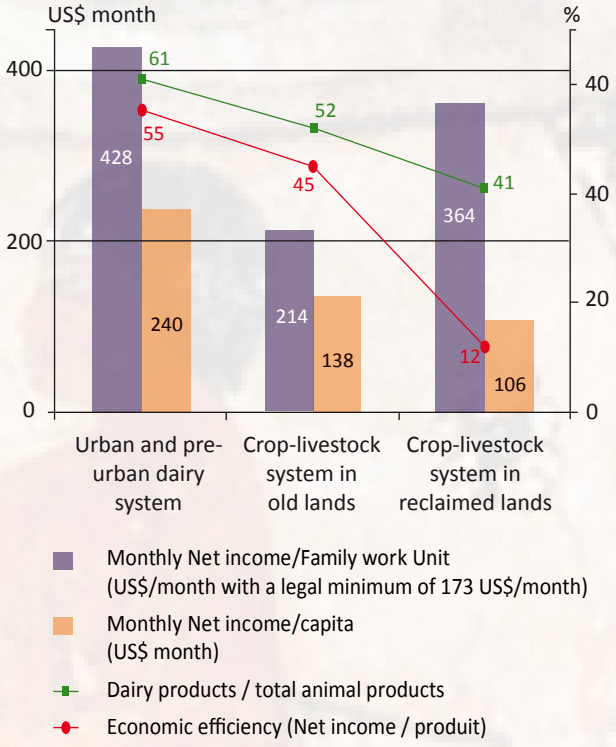


Figure 45: Economic contribution of dairy activity at the family level

The differences between the old and new lands can be explained by the two development paths of the farms in link with the agrarian reforms in the two zones. In the new reclaimed lands, the livestock plays an important role in terms of organic matter supply for the soil and investment is funded by calves. Conversely, in old lands, milk and calves are the two pillars of the systems.

In conclusion

This first description of the different dairy farming systems in the three studied zones (urban and peri-urban, the old lands of the Nile Valley and the newly reclaimed lands in the West Delta) highlights the different roles of livestock, and especially dairy animals, in the family farms. If the dairy farms in the urban and peri-urban are mainly oriented towards the milk market specialization, the family farms in the old and new lands are traditionally mixed crop-livestock systems where the livestock is fully integrated in the farm for the soil preservation (manure supply and valorization of the leguminous in the crop rotation), source of finance for important expenses like land rent thanks to the calves and sources of food through milk for the family. The dairy marketing orientation depends on the land and herd size and the milk market opportunities. However, as soon as the market is there, farmers are willing to sell the milk surplus in order to increase their cash flow. Over the course of the last 2 decades, we can observe an incredible development of the milk market in the surrounding governorates of greater Cairo.

4. Traditional milk chains around Greater Cairo

4.1. Case-studies

As mentioned in part 2, there is great potential for the milk sector in Egypt in link with the traditional mixed crop-livestock systems in rural areas, the long tradition and culture of milk processing and cheese consumption, and the high and increasing demand due to demographic growth and urbanization. However, over the last two decades, the dairy sector has been subject to important transformation with the rapid development of a modern sector that creates new consumer behavior, incertitude and suspiccion regarding milk quality in the traditional sector that is more and more discussed in the media with the risk of marginalization of the traditional sector. Nevertheless this traditional sector succeeds in connecting a multitude of very small and small-scale farms to the consumers and to satisfy part of the urban demand for fresh milk, mainly buffalo fresh milk.

Figure 46 is a representation of the main dairy value chains from the farms to the consumers: the traditional milk chains (in blue) and the modern milk chains (in orange). The traditional dairy value chains concern a multitude of actors who interact with different intermediaries along different chains. Each actor can contribute to different value chains according to the demand of the agro-industrial sector or the retailers (based on consumer demand), the season, and the market prices.

The main differences between the two dairy value chains (traditional and modern) concern:

- the legal registration of the unit: majority of small-scale units of dairy processing or private milk collection centers are not registered and therefore they are no subject to any financial scrutiny or sanitary controls;
- the scale of the units: the majority of cheese processing units in the traditional sector don't exceed a volume of 1000 liters/day;
- the standard quality is not a constraint in the traditional sector.

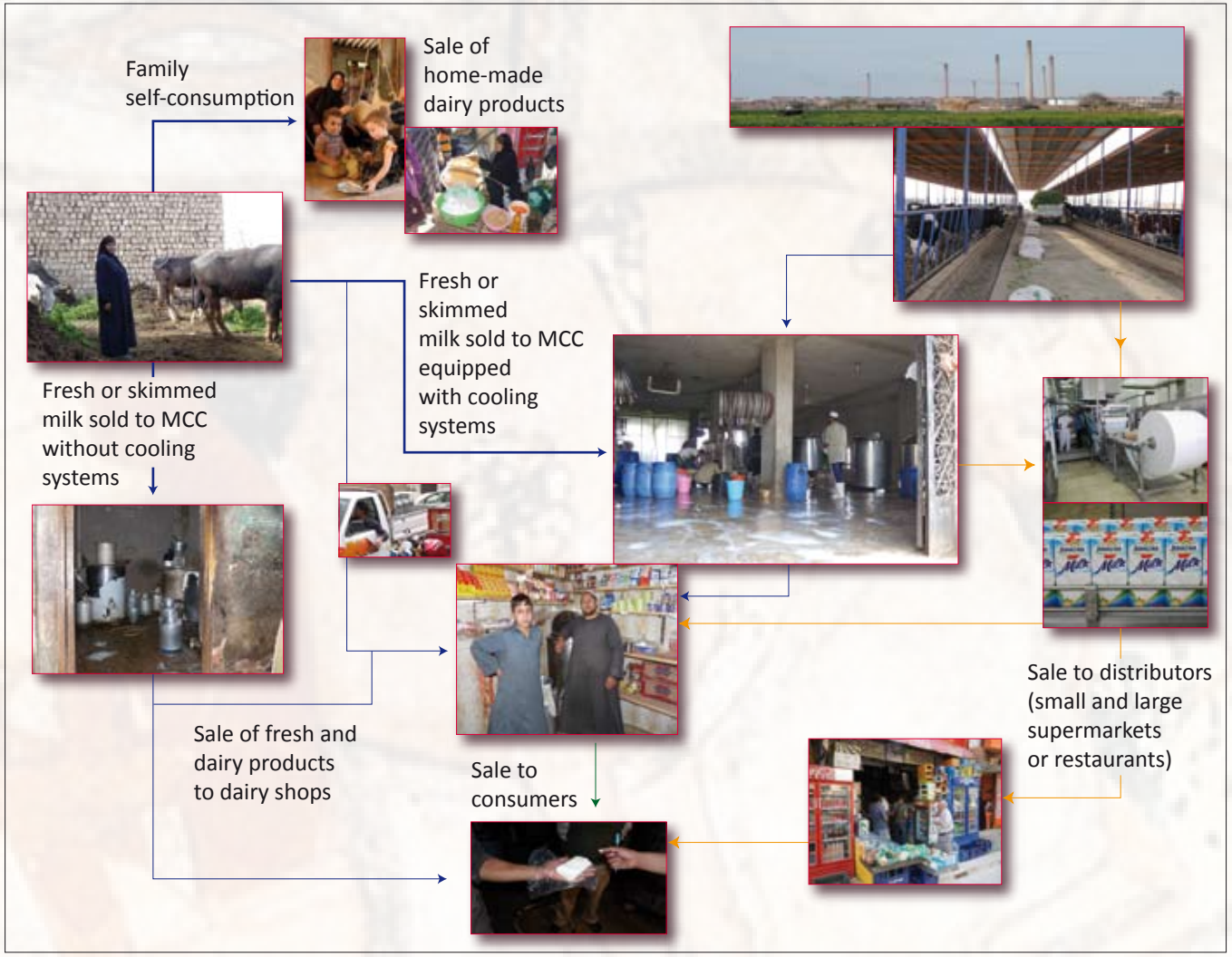


Figure 46: Representation of the flux of milk and dairy products from the farms to the consumers (in blue: the traditional value chains; in orange: the modern value chains)

However these two main value chains (traditional and modern) interact regularly in order to secure their milk supply and also to benefit from opportunities in link with national and international prices and the demand. However, few studies have been conducted on the intermediaries to understand the milk circuits. The following sections aim to provide a description of different milk collection centers or traders that supply the area of Greater Cairo in fresh milk and milk products.

The three case studies (described below) correspond to different milk intermediaries (Milk collection centers or private traders) that supply greater Cairo in milk and milk products (Figure 47).

The three case studies are:

1. Reka: a milk collection center (MCC) that collects three milk products: buffalo milk, cow's milk, and skimmed milk. The milk products are collected from milk collection points in villages surrounding Reka. This MCC is connected to a large network of intermediaries: milk shops in Greater Cairo through middlemen, cheese processing units, milk shops in the near localities, big cheese manufacturers, from both the traditional and modern sectors;

2. El-Atf: the milk circuit is mainly based on milk traders connected to milk shops in Greater Cairo and local consumers;

3. Sidik Youssef (located on the intercity Cairo-Alexandria road, around 90 km from Cairo in the Nubaria district): where the milk circuits are mainly based on traders that deal with one big trader or a small MCC connected to the modern sector.

The interviews have been conducted from April 2013 to October 2014 and they were based on an open-questionnaire comprising 4 parts: 1. Historical approach of the enterprise; 2. Main capital asset (mainly equipment); 3. Technical performances of the milk activity (volume of milk collected and sold, activity of transformation); and 4. Future of the activity.

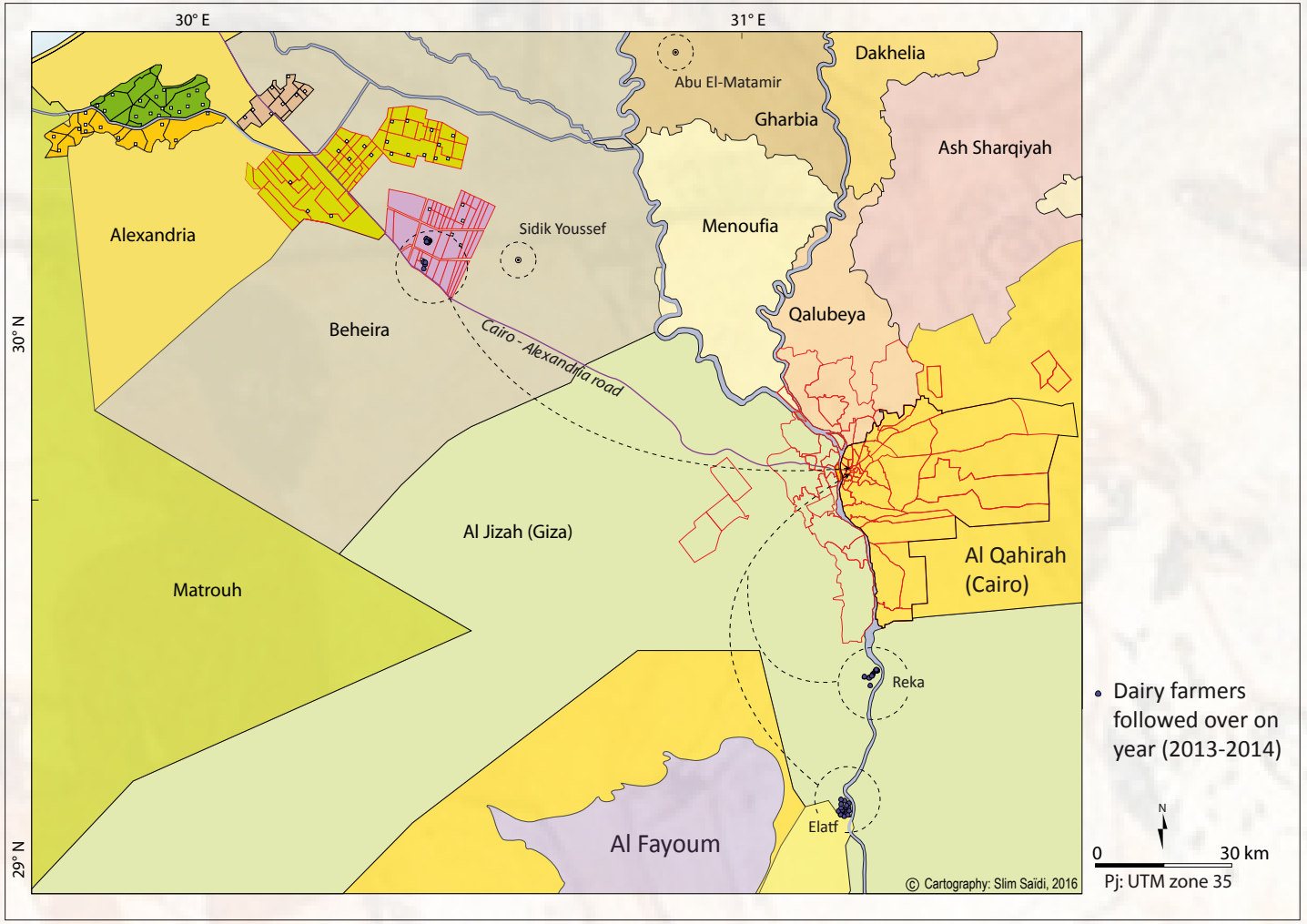


Figure 47: Localization of the studied areas of milk collection

Here, we have used the approach of "filière" (see part 1.1.b) or value chain based on the identification of the main stakeholders and milk products along the circuits, their functions and connections with the other stakeholders downstream and upstream, and the flow and prices of products along the chain.

4.2. El-Atf : Milk collection based on traders and buffalo milk

El-Atf is a village located in the middle of Giza Governorate (Figure 47). The milk circuit is mainly based on three private traders connected to milk shops in Greater Cairo and local consumers (Figure 48).

One of these traders started to collect and trade milk in 2005. Firstly he started with 5 farmers and collected around 200 kg/day at an average price of 3.0-3.20 EGP/liter; this fresh milk was sold to two milk shops in Greater Cairo, with a selling price of 4 EGP/liter. In 2011, he started to extend his activity by purchasing a cooler with a storage capacity of 350-400 liters.

In 2014, in the original village, he collected buffalo milk from 6 farmers for a total amount of 440-490 liters with a farm price of 4.4 EGP/liter (February 2014). Near to the original village, he collected around 210 liters of buffalo milk from two large farms, with a farm price of 4.75 EGP/liter due to the high fat percentage of the milk (more than 7% fat). In total, the buffalo milk collected by this trader has been multiplied by more than three between 2011 and 2014 (Figure 48 & 49).

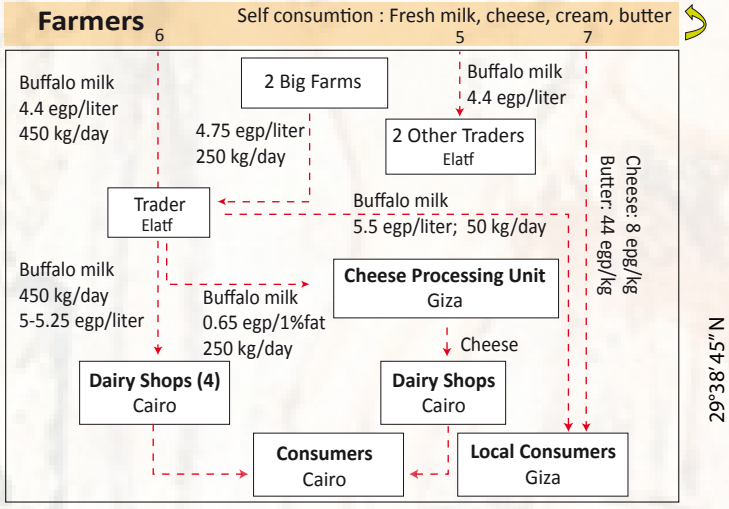


Figure 49: Schematic representation of the milk circuits in Elatf village with volume and price

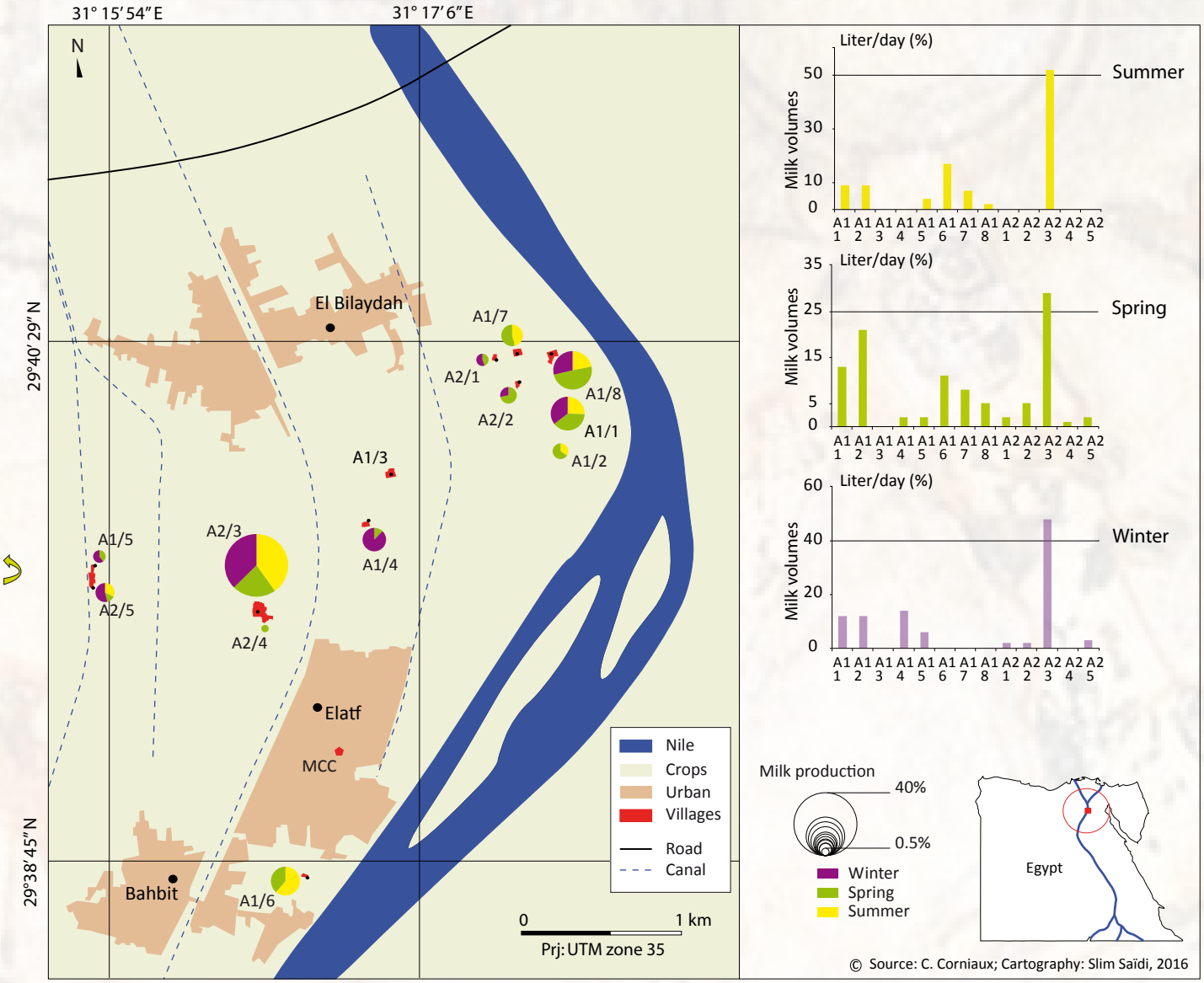


Figure 48: Geographical distribution and volume of collected milk from farmers by one trader in El-Atf village over one year

One part of the buffalo milk (450 liters) was sold to four milk shops in Greater Cairo with a selling price of 5.00-5.25EGP/liter, and the rest (around 150-200 liters/day) was delivered to one cheese processing unit in Giza with the selling price of 0.65 EGP per percentage of fat (eq. 4,22 EGP/liter). At the end of April 2014, the farm price increased up to 5.00 EGP/liter for buffalo milk and the selling price to around 5.5 - 5.75 EGP/liter. This price change is mainly explained by the increase of feed costs at the farm level and transportation cost for the intermediaries.
In 2014, this trader didn't want to increase the number of farmers and milk volume. Firstly he was satisfied with his family business. Secondly he didn't want to recruit workers for trust related reasons and also due to the fact that he did not want to risk having a competitor in a few years. Other factors can also constrain the trader such as investing in logistics and securing the outlets.

4.3. Sidik Youssef: Milk collection based on a small MCC and a big trader

Nubaria is a district at mid-distance along the desert road (Cairo to Alexandria) (see Figure 47). The milk circuit is mainly based on traders that deal with a big trader in Abou El Matamir and a small MCC connected to modern sector (Figure 50).

4.3.1. Story of the milk collection center of Sidik Youssef

In 2009, in the context of a bilateral cooperation between the Ministry of Agriculture and Land Reclamation in Egypt and the French Ministry of Agriculture, one milk collection centre (MCC) was established in Sidik Youssef village, located in the Extension Bustan area (called also Entilak). This project was initially based on the development of a milk collection unit and feed mill unit to promote the development of milk activity in the region. The MCC consisted of 2 coolers with a capacity of 1.1 tons and 5 tons respectively. The MCC started to collect cow milk at the end of the year-2009 from 30-40 farmers in the village and 6 large breeders around the village.

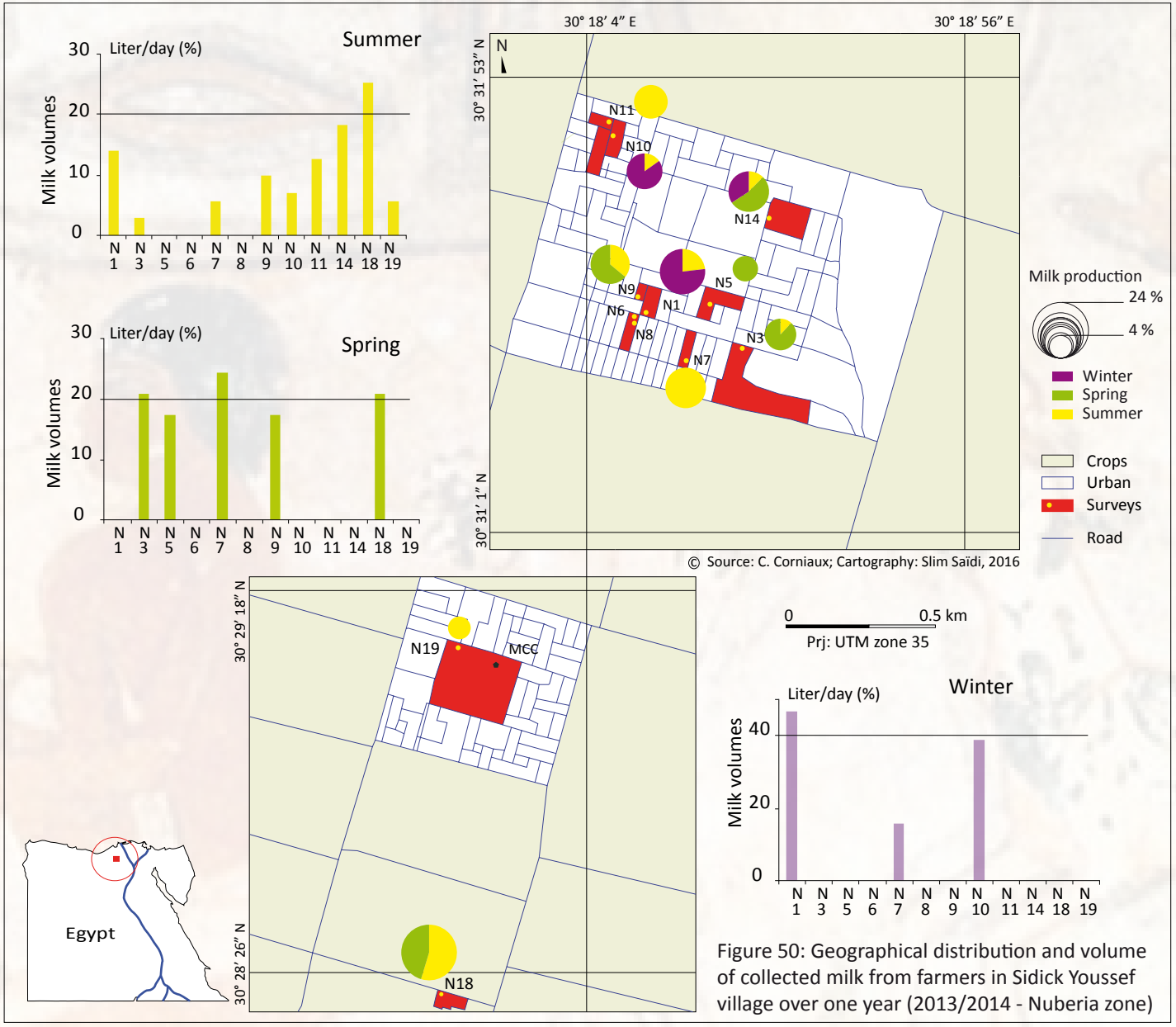


Figure 50: Geographical distribution and volume of collected milk from farmers in Sidick Youssef village over one year (2013/2014 - Nuberia zone)

At the same time, the traders collected milk at the farm price of 0.60 EGP /litre for cow milk.

In April 2011, after the 25th January Revolution, the MCC stopped its activity. In 2012, the head of the agricultural association entered into an agreement with two corporations Danone and Tama, two modern milk processing units, to restart the activity. In 2013, the MCC collected milk from 50-60 farmers and 3 traders for a total amount of 1.5 tons/day with a purchasing price of 3.2 EGP/l.

At the end of 2013, the MCC started cheese processing activities. It produced mainly white cheese (Talaga, Diametti with full cream), which was sold in the village at the price of 18 EGP/kg.

In January 2014, the MCC stopped delivering cow milk to Danone due to disagreements regarding pricing. It started to supply milk to a large trader located at Abo El-Matamir (South west of Alexandria) who sold this milk to a cheese processing unit and also to Juyana company in Greater Cairo (6th October at the south west of Cairo). However, after long negotiations, in October 2014, the MCC collected 5 tons with a farm price of around 2.50 EGP/kg and sold it again to Danone Company at a selling price of 2.9 EGP/EGP.

4.3.2. Story of the big trader at Abou El-Matamir

The story of this milk trader started in 1989 after completing his studies at the Agricultural Secondary school (Animal Production Department) in El-Beheira.

He started his activity in Abu El-Matamir by collecting buffalo and cow milk, about 300-400 liters/day in summer up to 1000 liters/ day in winter. The majority of the collected milk was buffalo milk with a farm gate price of 65 piasters/liter, compared to 35 piasters for cow milk. At that time, the margin was around 5-10 piasters per liter which was considered good. At the beginning, different constraints limited the expansion of his enterprise:

(i) the lack of outlets due to the limited number of cheese processing units at proximity (only two units with a small capacity),(ii) the dairy manufactures didn't accept the collected milk from small and medium scale farms;

(iii) it was not well perceived to sell raw milk due to traditions; moreover only milk processed products like butter and cheese could be sold in the community.

In 2000, the milk market has known its expansion due mainly to the dynamic of the modern sector. Some large manufacturers (like Domty) accepted to receive fresh milk from collectors and traders. In 2005, this milk trader purchased two coolers with a capacity of 4.5 and 5 tons, respectively. He also invested in two generators: one in 2005 and the second in 2007. In 2008, he became officially the milk supplier of Tama Manufactory (cheese processing unit established in 2008 at Abu El-Matamir). In 2009, he purchased the third cooler with a capacity of 5 tons and he exchanged his generator for a new one. In 2010, he purchased a lorry with tank double shell with a capacity of 5 tons. In 2011, he purchased another big car with a tank.

In 2012, he established a Roomy cheese unit as an alternative way for milk including three incubator tanks to produce cheese: two with a capacity of 3 tons/ tank and one with a capacity of 2 tons. The cheese unit was also equipped with three separators.

In September – October 2013, he collected up to 20 tons of cow milk per day that were sent to Tama and Siclam Companies with a selling price of 2.90-2.95 EGP/liter.

In May 2014, the milk collection was reduced from 20 tons/ day to 11-12 tons/ day due to the non-attractive prices of dairy companies and some delays for farmers; and he was obliged to sell a lorry. He developed his activity of cheese processing, mainly the production of Roomy cheese in winter.

In 2015, he collected about 3000 to 4000 liters of milk per day from 250-300 farmers at Abu El-Matamir village. 80% of the fresh milk was cow milk paid at a farm gate price of around 2.8 -2.85 EGP/ liter. For buffalo milk, the price was established according to the percentage of fat: 65 piasters per 1% of fat. Buffalo milk was sold as fresh milk for drinking or it was mixed with cow milk to produce Roomy cheese. More recently, he started to deal with 3-4 traders to increase his capacity to around 8000 liters of cow milk per day, with a purchasing price of 2.75-2.80 EGP/liter.

This amount of cow milk was used in his own Roomy Cheese processing unit. Around 1000 liters of fresh milk produce 100 kg of Roomy cheese and around 5 kg of butter. The cheese was sold after one day at the selling price of 28 EGP/kg to a storage company in charge of adding salts and storing the cheese for a period ranging between 3 to 6 months in refrigerator units. In the agreement between the trader and the head of the storage company, the trader will have to reimburse the storage company if the cheese is not conform at the end of the process. The production period of Roomy cheese lasts from October to April.

4.3.3. Representation of the value chain in Sidick Youssef

Figure 51 represents the value chain around the milk collection center (MCC) of Sidick Youssef in 2015. This figure shows clearly the diversification of milk products (with the development of cheese processing units) and the diversification of outlets for the two studied intermediaries, the MCC and the trader, to maintain their activities.

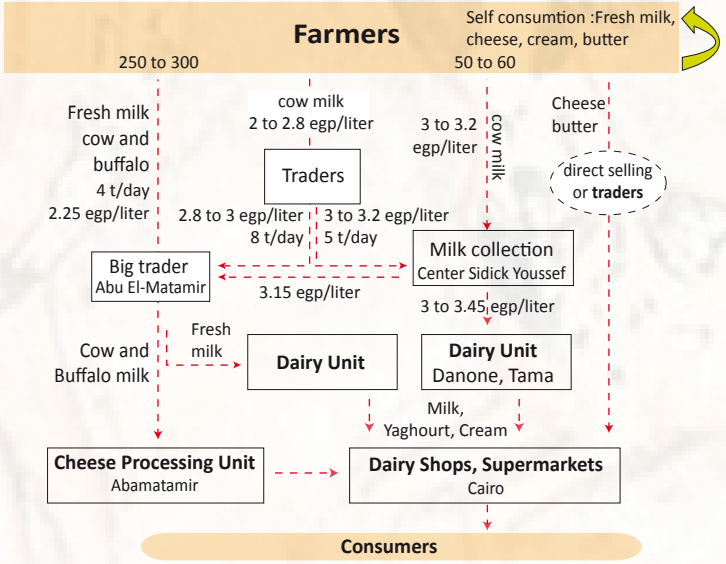


Figure 51: Schematic representation of the value chain around the milk collection centre of Sidick Youssef (Egypt)

4.4. Reka: a dynamic MCC connected to farmers and Cheese Processing units

In Reka, South of Giza, milk and milk products were seldom marketed in the eighties. It was mostly considered as a subsistence activity or a sign of extreme poverty when one was obliged to sell one's milk. Here is related to story of a trader who started collecting milk at the end of the 90's and who reached a capacity of more than 20 tons in 2015.

4.4.1. Story of the Reka milk collection centre

In 1998, a man who worked as laborer in a brick company started trading many things like clothes or household equipment. However he had difficulties with being paid back so he looked to buy products in the village to sell outside. This man started collecting liquid milk in three related families (around 20 kg) and transported it by microbus and sold it in a small cheese processing unit (at Hayat, around 10 km from his village). The milk was sold for around 1.3 EGP per liter in 1998. He started to associate one relative for the transportation. Little by little, he increased the collection of skimmed milk by dealing with young ladies who possessed separators to make skimmed milk in the neighborhood villages.

In 2000, he decided to buy one cooler with a small capacity (170 liters) that was installed in his family house. In 2002, he contracted orally for the first time with a milk separator unit to collect only skimmed milk. In this new arrangement, he paid each farmer on a weekly basis through the milk separator point which became a milk collection point (MCP) for the enterprise. The same year, progressively, he bought two coolers (500 liters per cooler). With the rapid development of the MCPs in different villages, he bought a big tank (1250 liters) in 2005 and four coolers in 2008 (1250 liter/cooler). In 2014 he received three tanks of a capacity of 5 tons from Tamaa Company, a large cheese processing unit located at 10th Ramadan city. Quickly, the MCC reached a daily capacity of around 20 tons for skimmed milk (buffalo and cow milk), 5 tons for cow fresh milk and 1 ton for buffalo fresh milk (Figure 52, Photo 25).

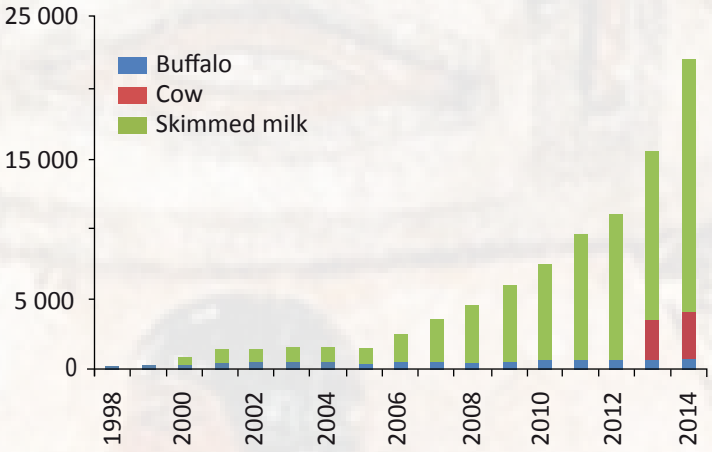


Figure 52: Trend of volumes of milk collected in Tons/year by the MCC Reka from 1998 to 2014

Photo 25: Milk collection center, Reka, Giza governorate (2013)

Figures 53 shows the extension of the milk collection activity between 2013 and 2015. In 2015, the network counted 226 milk collection points established in 16 villages. This corresponded to around 2965 families. In addition to, 75 family farmers and dairy farms supplied in fresh cow or buffalo milk.

This model of MCC has been built on a powerful and solid social network, based on family and community links near the collection points and on personal relations of trust for the transportation of milk from the collection points to the MCC. In 2014, around 25-30 persons, more often with family links, worked in the MCC.

4.4.2. Representation of the value chain in Reka

The skimmed milk was delivered two times per day to around 11 cheese processing units (CPU) (mainly specialized in Karish cheese processing) located in Greater Cairo, along the agricultural road and in Giza governorate.

The fresh cow milk was mainly dedicated to supply two modern dairy companies: Tamaa and Juyana. This fresh milk was collected mainly from modern dairy farms.

Around 60 farmers sold directly buffalo milk to the MCC, representing a volume of 400-450 liters in summer and up to 800-1000 liters in winter. A small quantity was sold in the village and the rest was transported to urban milk shops: 8 in Beni Suef and 2 in Giza governorates. Figure 54 shows the organization of the milk circuit. The spectacular growth of this family enterprise should continue in the coming years with regards to the dynamism of diversification of value chains in order to compensate for some losses in one milk circuit.

The marketing of cow fresh milk to large dairy industries, such as Tamaa and Juyana, shows a diversification of activities both in its procurement, formerly centered on the collection of skimmed milk from small family producers, in markets, previously based on traditional cheeses. The cheese niche remains major in the business strategy, insofar as skimmed milk represents more than three quarters of the volumes processed by the center of Reka.

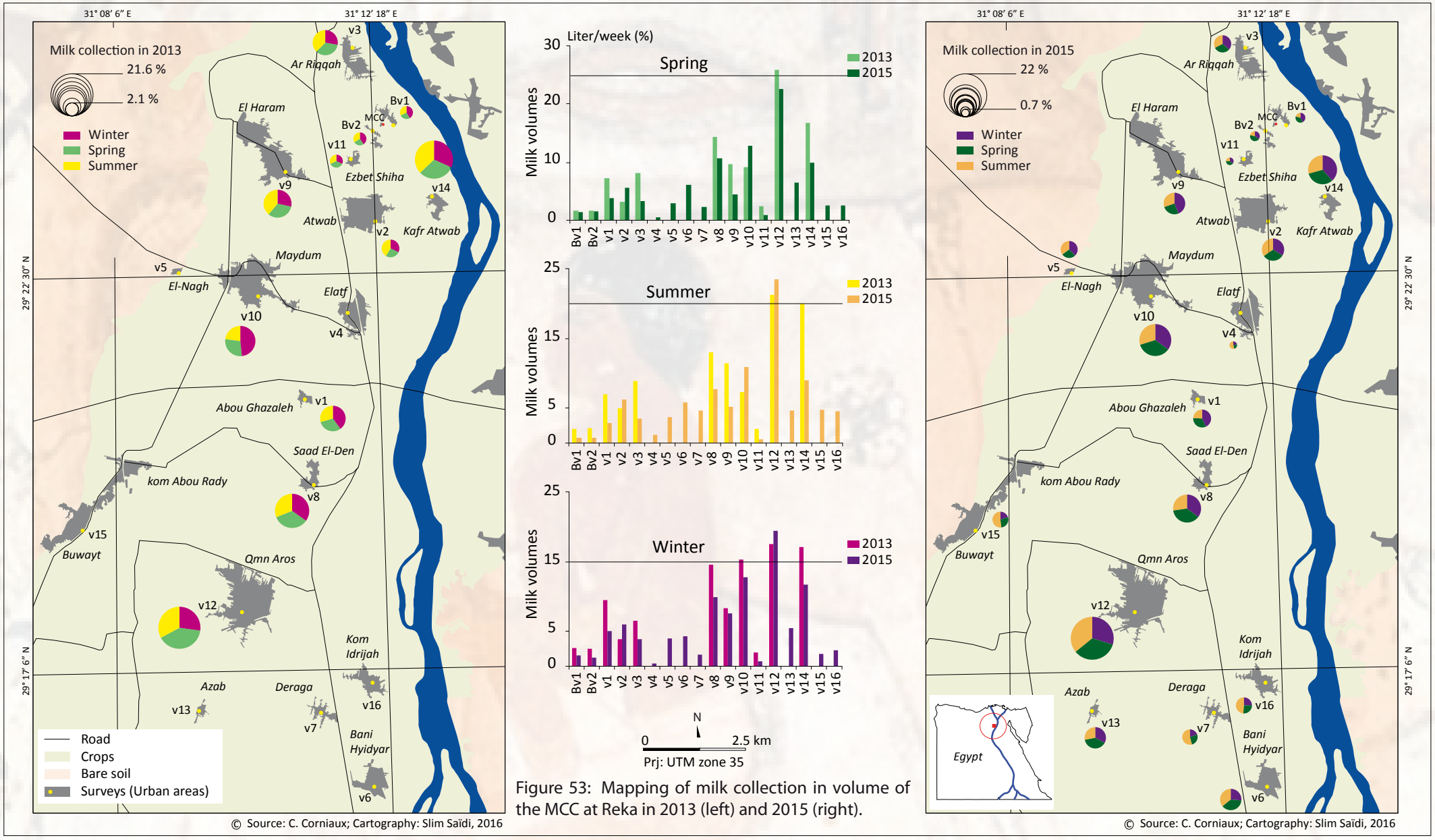


Figure 53: Mapping of milk collection in volume of the MCC at Reka in 2013 (left) and 2015 (right).

© Source: C. Corniaux; Cartography: Slim Saïdi, 2016

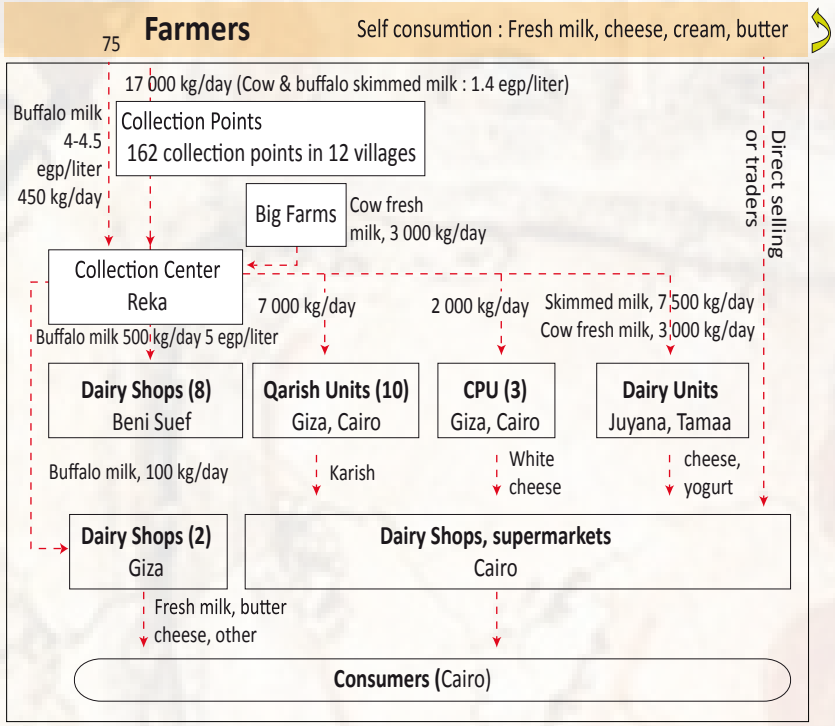


Figure 54: Schematic representation of milk value chain in the Reka MCC (Egypt)

4.4.3. Main drivers of the Reka model

In the absence of a refrigeration chain in the upstream of the Reka center for the small farmers passing through the collection points, the time factor is crucial in MCC management. For that, the MCC Reka has built his procurement on a dense and well distributed system of collection points. The 226 MCP distributed in 16 villages in the neighborhood Reka village, are positioned closer to producers, within a radius of maximum 500 meters. This network, set up ten years ago, is an efficient system to quickly collect several thousand liters of skimmed milk two times per day.

Preserving the quality of milk depends on the efficiency of the logistics established upstream and downstream of Reka Center. The first investment concerned in the transportation of milk. In 2007 he bought a first small car; he sold it in 2008 to buy a big car. In 2010, he purchased another big car. In 2014, he invested in a double shell tank (5 tons). This shift in 2007 corresponded to the arrival of his two sons in the enterprise. During this period, he passed from 1-2 workers before 2006 up to 25 -30 full time workers now, with the involvement of 3 adults sons in the management and 2 other teenager sons working part time in the family enterprise. So, family links are privileged in the enterprise to ensure the management.

If the collection is made in the production area of Reka, processing or packaging of the products and the distribution is on the outskirts of Cairo or in Cairo, in the main area of consumption (Figure 55).

The Reka MCC supplies simultaneously dairy shops, small cheese factories and manufacturers such as the Tamaa cheese processing unit and the Juyana dairy unit. These processing units then distribute their dairy products in the network of dairy shops in Greater Cairo, or small or large supermarkets.

Therefore, the Reka MCC has created a strong link between urban and rural areas by allowing the collection in about 3,000 small producers and by connecting with the processing units in place on the outskirts of Cairo. Beyond the powerful social network that the center of Reka was able to create, develop and maintain, it should be noted that it is also and primarily a real family company governed both by social factors and opportunistic dynamics.

The increase in volumes and related adaptation of equipment (vehicles, cold chain) mark the constant concern of the company to increase the profitability and guarantee its sustainability. The success of this family unit is also in its capacity to valorize a by-product (skimmed milk) from farmers. Farmers keep their traditional milk chains by valorizing the cream in butter and cheese for family consumption or local market.

In summary

The main driver mentioned regularly by the interviewees to develop their business is the trust, mainly based on extended family links. The second driver is the diversification of actors downstream and upstream of the centers. This diversification is facilitated by the specificity of the Egyptian market with the cow, buffalo and mixed milk value chains. Moreover these case studies show also important connections between the traditional and modern sectors that should be considered by decision makers or strategic stakeholders of the sector in order to favor a promising and inclusive business associating the small and medium dairy farms.

The main constraints and difficulties in the sector that have been mentioned by the intermediaries are mainly the strong influence of the international price of powder milk on the local milk prices, the political instability in the zone that affect the international market (like the exportations to Libya or Middle East), the recent economic instability that has affected notably the cost of imported feeds and then the farm gate price.

At last, the high competition between traders concerning the volume, the prices and the services can be considered as a positive factor for small farmers in terms of negotiation. The studied cases like the Reka MCC or the big trader at Abou El-Matamir show some promising growth of small family business that might be encouraged by public decision makers.

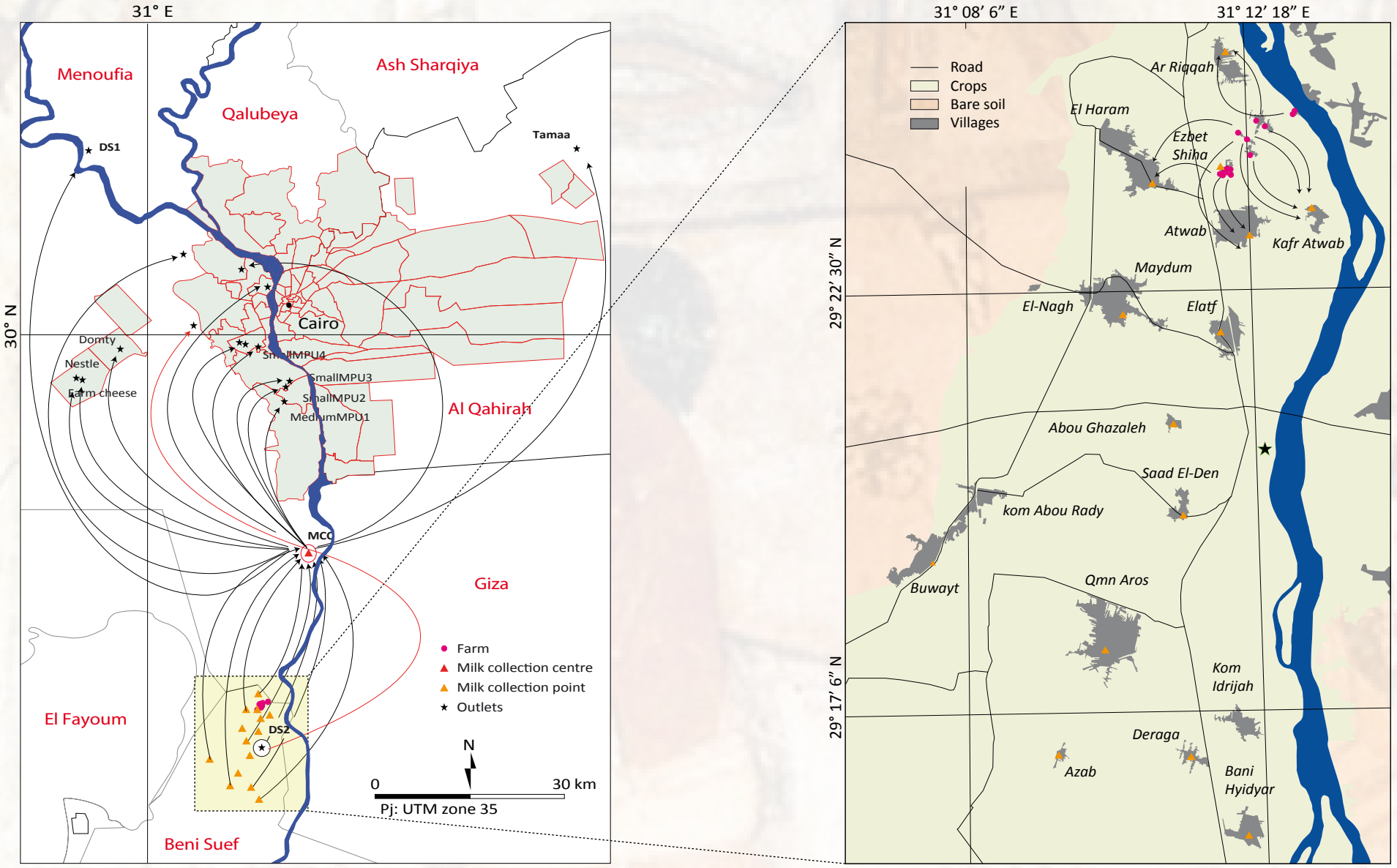


Figure 55: Representation of the milk flow from the producers to the distributors managed by the Reka MCC

5. Milk demand and consumption in Greater Cairo

5.1. Rapid appraisal of the traditional milk urban demand

Based on the production of buffalo fresh milk (Faostat, 2013) or the consumption (estimated from rapid interviews), the fresh milk consumption would be around 27-32 kg/capita/year (Table 20). These two gross estimations from the production and the demand reach similar consumption with a significant gap in the milk demand.

5.2. Protocol to approach the buffalo fresh milk demand in Greater Cairo

In order to approach the demand for fresh buffalo milk in Cairo, a rapid appraisal survey has been conducted in three contrasted geographical sectors of Cairo. The choice of sectors resulted from differentiation in population density and sociological characteristics (Table 21 & Figure 56).

Three "rectangular" areas have been delineated based on the road axis that define one sociological quarter (Figure 56).

In November and December 2013, three groups of five students from Agricultural Faculty of Cairo University went in every street of these three sectors (Photo 26). They located all the dairy shops with a GPS and conducted rapid appraisal of the demand in the dairy shops which had a cooler. In total, 73 dairy shops have been visited in the three sectors.

Photo 26: Interviews in one dairy milk shop in El-Tabia (Oct. 2013)

Table 20: Estimation of buffalo milk demand and consumption from the production and the consumption

Estimation from:	Hypothesis	Buffalo milk consumption
Production	Buffalo milk production: 2.6 millions tons/year (Faostat, 2013) Half of the production is self-consumed Then : 1.3 million tons/year for citizens Around 650 thousand tons/year is sold in Greater Cairo (representing around 50% of the sold milk)	32 kg/capita/year
Consumption	By family : purchase of 1 kg buffalo milk/day + Cheese + butter (estimation from observation) Around 4 million of family in Greater Cairo (5 persons/family) Need of 4 million liter/day or 1.5 millions tons/year	27 kg/capita/year

Table 21: Presentation of the three studied areas for the approach of the urban demand in Cairo

Sector	District	Population density inhab./km² in 2006	Main characteristics
Shubra	Shubra Khaymah 2	32 651	Low to middle social classes
El Tabia	Al-Umraniyah	41 359	Middle social class (just behind Cairo University campus)
El Sayda Zeibna	Ancient Cairo	21 870	Middle social classes and urban slums

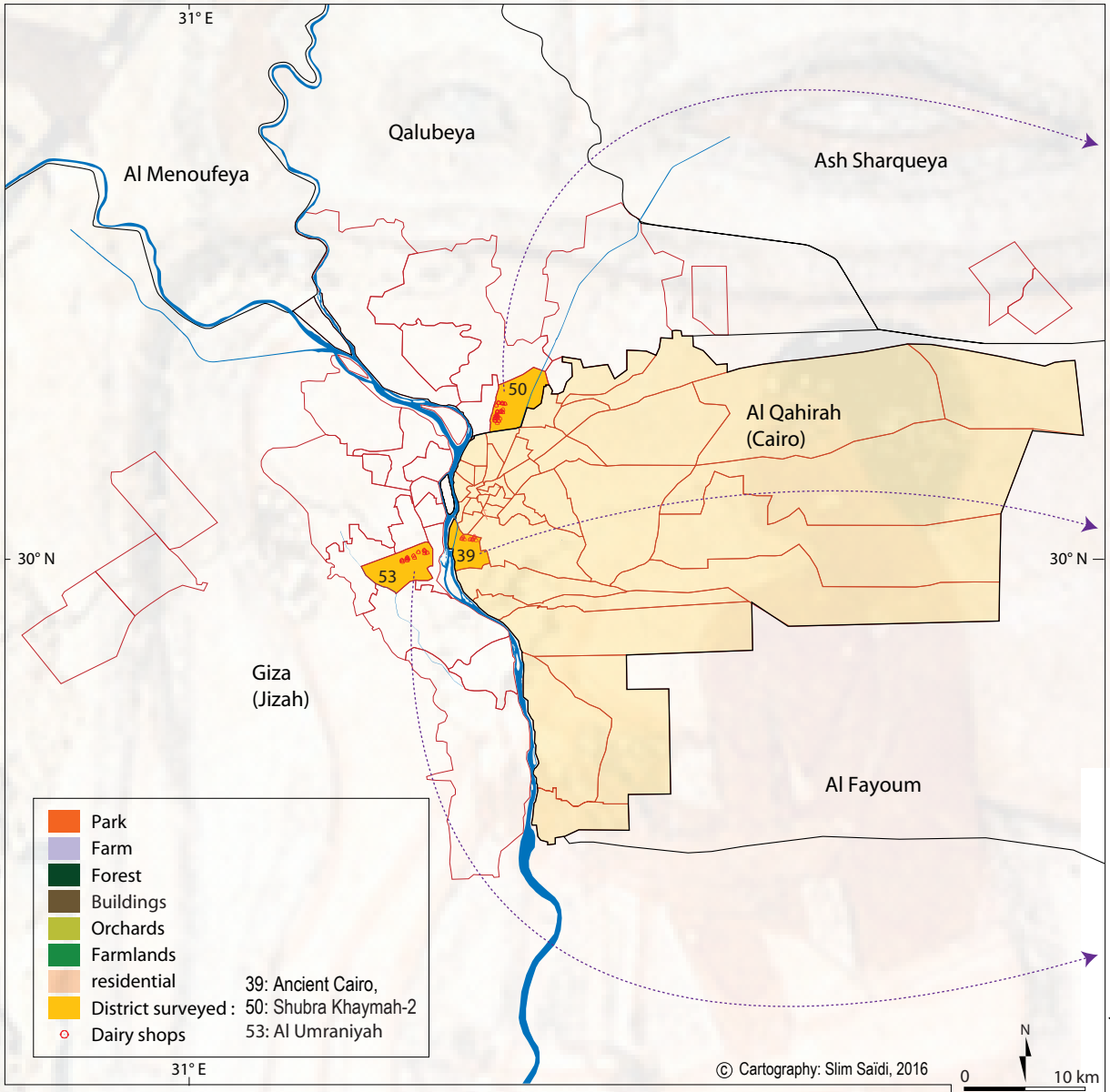
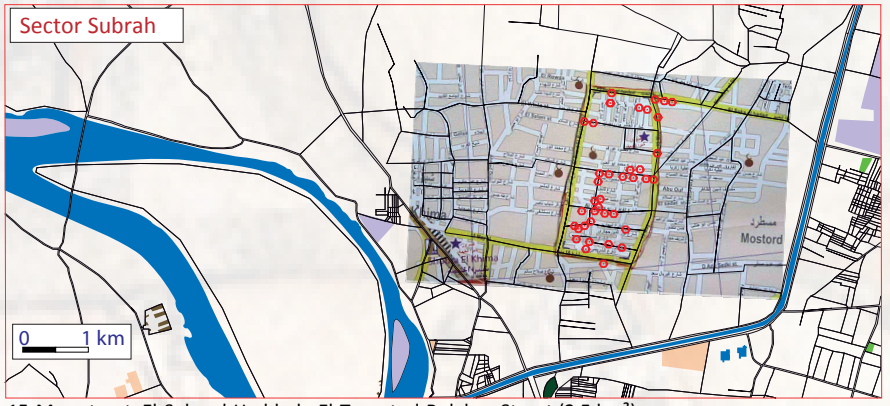
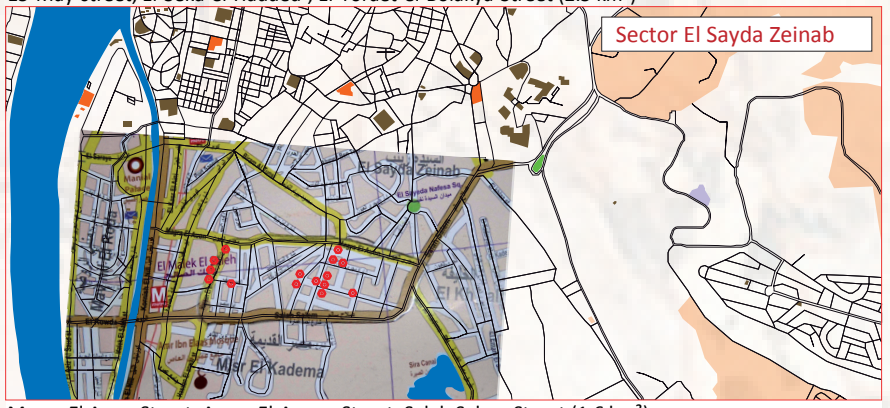


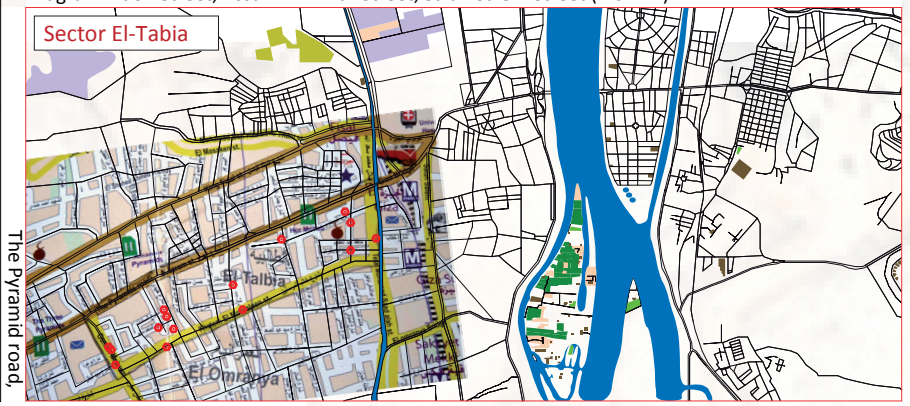
Figure 56 : Localization of the three studied sectors in Cairo for approaching the urban demand



15 May street, El Seka el-Hadded , El Toraet el-Bolakya Street (2.5 km²)



Magra El Auon Street, Assan El-Anwar Street, Salah Salem Street (1.6 km²)



Osman Mohram St., Khatem El Morsaleen St., Telal Mohamed Saad Alah St. (1.25 km²)

5.3. Estimation of the demand of traditional milk products in Greater Cairo

The density of dairy shops varies by a factor of 1.8 between low to middle social class sectors (like Shubra) and middle class sectors (like Zeibna). The sector of Talbia is intermediary due to its location between Al-Doqi (Middle and upper classes) and the more popular sector of the Al-Umraniyah district (Table 22). This reflects well the actual national dairy policy that favors the consumption of packaged liquid milk. This policy finds more echoes in the middle and upper classes. However we observe a demand of buffalo fresh milk in all social classes.

Table 22: Estimation of buffalo milk consumption (liter /capita/ year) in 2013 (survey)

Zones	Shubra	Talbia	Ziebna
Number of milk shop visited	42	16	15
Average date of establishment	2003	2001	2003
Population density (2006) (km2)	32651	*41272*	21870
Milk shop (/km2)	16.8	12.8	9.4
Inhabitants (/milk shop)	1944	3224	2333
Milk capacity per milk shop (litre)	244	258	320
Declared daily milk supply per milk shop (litre)	172	142	126
Buffalo milk consumption (litre/capita/year)	32	16	20

The consumption of buffalo fresh milk can double between the sectors, from 16 to 32 kg/capita/year. It is the most developed in low social class sectors in the North. This reflects different consumption patterns between low and middle class. Families in popular sectors continue to cook the majority of their meals at the opposite of the middle class sector where families consume more and more prepared food and, consequently, they prefer packaged milk. Finally we can observe that the gross estimation at the national level (5.1) reflects more or less the reality estimated from our survey.

5.4. Diversity of dairy shops and dairy products

5.4.1. Diversity of dairy shops

We can distinguish three types of milk shops. The first ones are specialized. They sell only fresh milk and local milk products (photo 27a). The second ones sell fresh milk, ready made milk products and also sell agro-industrial milk products. There, milk products represent more than 50% of the all products (Photo 27b). The third type are grocery markets with a variety of products (Photo 27c).

5.4.2. Diversity of traditional milk products sold in dairy shops

The main consumed dairy products in Cairo are the fresh milk (mainly buffalo milk, but sometimes mixed buffalo and cow milk) and cheese that represents more than three-quarters of milk consumption demand (in equivalent milk liter). Then, we can observe a lower consumption for yoghurt and butter. In Cairo, the wide availability of industrial yoghurt and butter at a reasonable price explains this lower consumption (Figure 57).

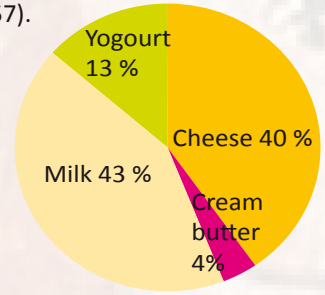


Figure 57 : Main traditional milk products (% in equivalent milk liter) sold in dairy shops in Cairo

However, table 23 shows a significant gap of consumption for the traditional dairy products like yoghurt and cream butter between the urban zones. For instance, in Ziebna, the most bought traditional products are buffalo fresh milk and cheese. As for the other products, they are usually brought packaged from super or hyper markets.

Photo27a: Specialized dairy shops, Talbia, 2013

Photo 27b: Dairy shops where milk products represent more than 50% of the all products

Photo27c. Grocery type: Dairy milk shop in El-Tabia

Table 23: Average consumption of traditional dairy products by sector (in eq. milk, out of the month of Ramadan)

Items	Shubra	Talbia	Ziebna
Cheese	38 %	45 %	38 %
Cream butter	6%	3 %	1 %
Fresh milk	45%	*34 %*	53 %
Yogourt	12%	19 %	9 %

The cheese category covers a large variety of cheeses. Table 24 presents the average daily sale of dairy products in dairy shops over two periods: out of the month of Ramadan and during Ramadan. The most common cheeses sold in the dairy shops are: Roomy, Estanbuli, Baramili and Talaga. Two thirds of the dairy shops sell this type of cheese. Low-salt content cheeses, such as Talaga, are preferred during Ramadan in order to reduce thirst. During the rest of the year, Karish cheese is the most popular and famous cheese sold in big quantities in some specialized dairy shops.

The demand for fresh milk is multiplied by a factor of 1.75 and 3 for, respectively, buffalo and cow milk, between the period out and during Ramadan. During the month of Ramadan, fresh milk is mainly used for the preparation of home-made pastries.

5.5. Key-drivers of dairy shops

Dairy shops are key actors in the distribution of dairy products of the traditional chains. They are located in all districts of Cairo, particularly in the commercial streets (see the GPS point of dairy shops in each studied area, fig.57). All inhabitants of Cairo have access to traditional dairy products within a kilometer of their homes. In this configuration they assure the best link between the producers (rural or urban) and the consumers. They form a dense and efficient social network upstream of the chain. 61% of the milk is supplied by milk traders that have links of kinships with the owners of the dairy shops.

Table 24: Diversity and quantity of sold milk products in 64 dairy shops surveyed in Cairo (survey in 2013)

Type of products	Number of dairy shops	Quantity out of Ramadan month	Quantity during the Ramadan month
Salty cheese (kg/day)			
Roomy	50	5.3	8.1
Estanbuli	49	6.6	10.1
Baramili	51	6.8	11.4
other salty cheese	7	1.7	2.6
Karish	13	8.7	12
Un (or low)-salty cheese (kg/day)			
Talaga	46	7.9	17.5
Other un-salty cheese	6	1.9	3
Fresh Milk (kg/day)			
Buffalo fresh milk	46	117.1	204.9
Cow fresh milk	19	115.3	340.3
Butter	3	2.3	2.9
Cream	9	8.8	7.7
Yogourt (can 125 g/day)			
Rice with milk	3	121.7	95
Yoghourt	55	122.4	472

It is common that the milk supplier would be the brother or cousin of the responsible of the dairy shop. These kinds of relationships are a guarantee of the quality of the milk. This social network concerned around 24,600 dairy shops in Greater Cairo. With around 4 persons involved per dairy shop, this would represent around 100,000 jobs with half of the jobs employing women. The traders -specialized or not- offer several dairy products to their clients (in average 5 dairy products/dairy shops). They have a real local knowledge, especially for those offering cheeses, yogurt or rice cakes made on site.

Moreover, managing a dairy shop is a real business. The amount of outstanding milk is considerable at the scale of Cairo. The daily sales ensure a consistent income throughout the year. The peak of the activity is during the month of Ramadan (Figure 58).

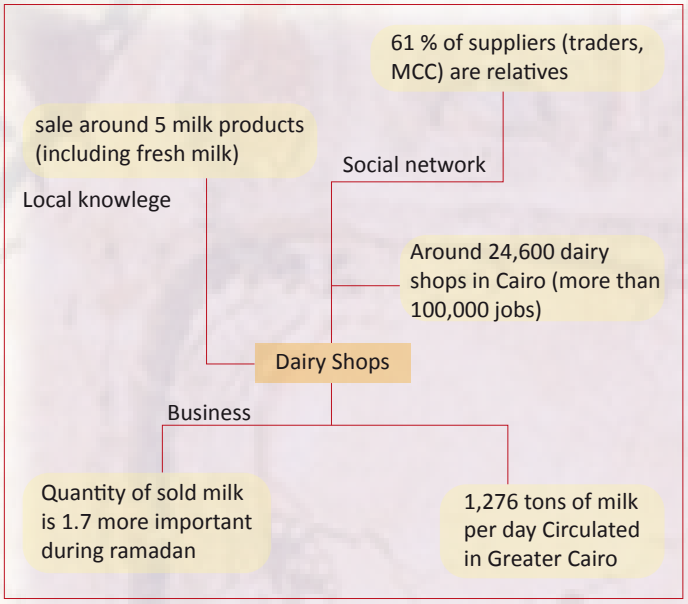


Figure 58: Key-drivers of dairy shops

In summary

This approach of the demand through a sample of dairy shops confirms the high dynamism of the traditional value chains in Greater Cairo in 2013-2014. We can observe some differences of the demand of dairy products between the social class areas. These differences reveal the increasing consumption of industrial products like yogurt and butter or cream in the middle and upper classes. Besides, the demand of buffalo fresh milk and traditional cheeses remains significant in all social classes.

Taking into account the role of this activity in terms of employment but also maintenance of social links between urban and rural areas, it appears important to support this type of business by favoring quality control for the consumers and by the development of added value chains based on these traditional products that valorize the local knowledge and culture.

Conclusion

1. Main achievements of the research projects

The DAIRY project aimed at accumulating knowledge on the traditional dairy value chains in order to: 1) develop expertise on this sector, and 2) reinforce the scientific competences in terms of systemic and interdisciplinary approaches.

Regarding the first objective of the DAIRY project related to accumulating knowledge on the traditional value chains through interdisciplinary approaches, the project has succeeded to have a large and diversified panel of situations. These situations have allowed to reveal the dynamisms of the traditional value chains, especially the buffalo value chain in the urban and peri-urban areas of Greater Cairo and the cattle value chain in rural areas.

This vast data collection concerning four governorates (Cairo, Giza, Beni Suef and Beheira) was possible due to the enthusiastic participation of the Egyptian and French institutes throughout the 2012-2016 period. The team work all along the research process has enabled fruitful exchanges and debates that reinforce holistic approaches, which was the second main objective of the project (Photo 28 & photo 29).

Photo 28: PhD student during field work, 2014

Photo 29. Debriefing after the field work, Cairo, 2012

2. Dynamic of the value chain of the buffalo fresh milk

Firstly, thanks to the Nile, Egypt is an important milk producer in the African continent and the Arab world. One of the main characteristics of the dairy sector is the important part of buffalo milk in the production of whole milk at the national level and the volume of daily flow of buffalo fresh milk from the surrounding governorates towards Greater Cairo. This chain is built on relations of trust (generally of kinships) from the buffalo milk's producers to the dairy shops to secure a daily supply of fresh milk. Until now the demand of buffalo fresh milk is present in all the social classes of Cairo (Photo 30).

However, the increasing awareness about milk quality by the consumers have led to a slight reduction of the consumption of fresh milk in the districts mainly populated by upper or middle social classes. This should directly challenge the stakeholders of the sector development.

Generally, just after milking, the buffalo milk is transported to the dairy shops in Cairo well equipped with a cooler (Photo 31). But due the daily dense traffic of Cairo, a distance of 1-2 hours can turn into 3-4 hours.

Photo 30: Milk shops: the key intermediary to satisfy the demand of buffalo fresh milk in all districts of Cairo

During the hot summer months, this commute is enough to obtain milk with high rate of germs before it is cooled at the dairy shops. Different equipment of cooling for small or medium quantity or easy process (like the lactoperoxidase system) exist.

Photo 31 : The increasing development of the sector thanks to cheap vehicles, El Marg (North Cairo), 2013

So the question is how to favor some public or private supports to invest in this particular sector of milk in order to foster the development of this chain? More than one thousand tons of buffalo milk circulate every day in Greater Cairo, creating more than 100,000 jobs without counting the jobs at the farm level. From our survey of the owners of the dairy shops, there exists a real demand of this traditional product. In medium or upper classes, there is a real niche for an added value products. The absence of policies or measurements could threaten this very promising socio-economic sector.

3. "*The Egyptian eat milk*"... a second dairy dynamic sector

The second characteristic of the dairy sector in Egypt is the traditional consumption of cheese and butter in the majority of daily dishes. In the rural areas, the majority of milk production is transformed in cheese and butter or ghee for home-consumption. Among all milk products including liquid milk, soft white cheese is the most prominent milk product Egyptians consume; the cheese consumption is estimated around 6 kg/year/inhabitant. More recently, Egypt has become the world first producer of Feta. The sector registered more than 3300 dairy processing units in 2012 of which 85% are traditional.

The surveys and interviews conducted through some examples of traditional value chains (part 4) highlight the amazing growth of some dairy traders over the last 2 decades. We can see the incredible growth and success of the Reka MCC:

1) economic success by passing from 20 kg in 1998 to more than 17 tons in 2015;

2) social success: by connecting around 3000 farmers to the dairy processing units and by generating around 30 full part jobs.

This growth has been allowed thanks to the real demand of urban consumers (a population of 17.3 million with an annual growth rate of 2.1% in Greater Cairo), the dynamics and entrepreneurships of the traders and their family (Photo 32), the recent transport facilitations (cheap motorbike or vehicles, infrastructure improvement); but also the rapid development

Photo 32: Milk shop. A family business from the farm to the shops

of the modern sector that has created a competitive atmosphere in the rural and urban areas and new ways of diversification of the outlets. However this development escapes partially to the official dairy sector. Moreover it is underestimated or mispriced (or even disprized) by the modern sector although they can regularly resort to them to satisfy their milk supply.

Therefore, the recognition of these new entrepreneurial initiatives at small and medium scale merits positive incentives and support. Milk quality controls that can often fail must mobilize public and private actors to appropriate and secure protocols. Some small equipment or simple processes (like the use of lactoperoxidase) could easily reduce the risks of poor milk quality. The main lacking factor is the training of these small and medium scale entrepreneurs.

Of course this sector is affected by globalization with the strong variability induced by the international price of powder milk on the national market, the political instability in the region (with the effects on exports to Libya or the Middle East), and the recent economic instability that has disturbed the import market, like the feed importation, with consequences on the milk profitability at the farm level.

Faced with this, the main factors of resistance of this sector are firstly the existence of the specific value chains based on the buffalo milk and its derived milk products (cheese, ghee, etc.), relatively independent of the world prices, and the high valorization of whey in the small processing units.

4. The milk production sector: a varied landscape...

Finally, this sector favors the economic and social valorization of the milk products at the farm level (Photo 33). Dairy products represent between 40% and 90% of total family products at farm level; and the dairy gross products was the highest source of cash flow for landless herders in urban areas.

Photo 33: Dairy animals are part of the whole farming systems, Giza, Greater Cairo, 2012.

It is true that the urban development of Cairo necessitates to develop public policies to regulate this urban dairy farm model in link with sanitary issues (Photo 34), although these dairy urban and peri-urban farms preserve some green areas in the city. Taking into consideration these aspects must be the priority of the public policies of urbanization and economic development plan.

Photo 34: The sanitary conditions of dairy animals in urban dairy systems, El Marg (North Cairo), 2013

In rural zones, land access is one of the main constraining factors in the mixed crop-livestock system. Followed by land condition, the available forage production and finally the animal assets. However our data shows the complex role of the dairy animals in the farm that are major factor of biomass preservation and recycling, an annual capital with the calf, and a daily cash flow. Estimating the dairy profitability make little senses compared to the multiple added value of animals at the farm.

Finally, from our farm interviews, the lack or low dynamism of services for animal production (vet and extension services for improving feed rations) is regularly mentioned by farmers, especially in remote rural villages (Photo 35).

5. Research perspectives

Of course our investigations based on a snowball sampling approach that allowed to fetch hard-to-reach populations don't allow a representation of the whole diversity of milk value chains in Greater Cairo.

Photo 35. Village Vet unit: the low dynamism of services (Beni Suef, 2014)

However this method allows us to reach the targeted population and to draw a first representation of this sector in Greater Cairo that merits deeper specific studies in the near future.

Moreover this comprehensive approach of the milk supply of Cairo was mainly a human and economic approach although this particular sector requires also technical studies, especially on sanitary quality, that is considered as the major challenging factor of milk supply of dairy sector, for dairy processing units or consumers.

Vice versa, the originality of data used in the Atlas makes it a good tool of testimony of the dynamics of this unique and diversified sector in Egypt. It can constitute a basic step to browse the dairy sector, in particular the loose milk sector. Moreover the first analyses show the regular interconnections between the so-called traditional sector and the modern sector that should favor more official debates on the whole development of the sector.

In summary

As mentioned in the introduction and demonstrated in the Atlas, there is a great potential for the milk sector in Egypt in link with the traditional mixed crop-livestock systems in rural areas, the long tradition and culture of milk processing and cheese consumption, and the high and increasing demand due to demographic growth and urbanization.

However, the dairy sector faces important challenges: the increasing consumption of industrial products like yogurt and butter or cream, sanitary control, farm viability in link with feed price, etc. Therefore, taking into account the multiple roles of this activity in terms of employment, local and spatial dynamic between the urban and rural areas, it appears important to support this type of social and economic business by favoring quality control for the consumers and by the development of added value chains based on these traditional products that valorize local knowledge and culture.

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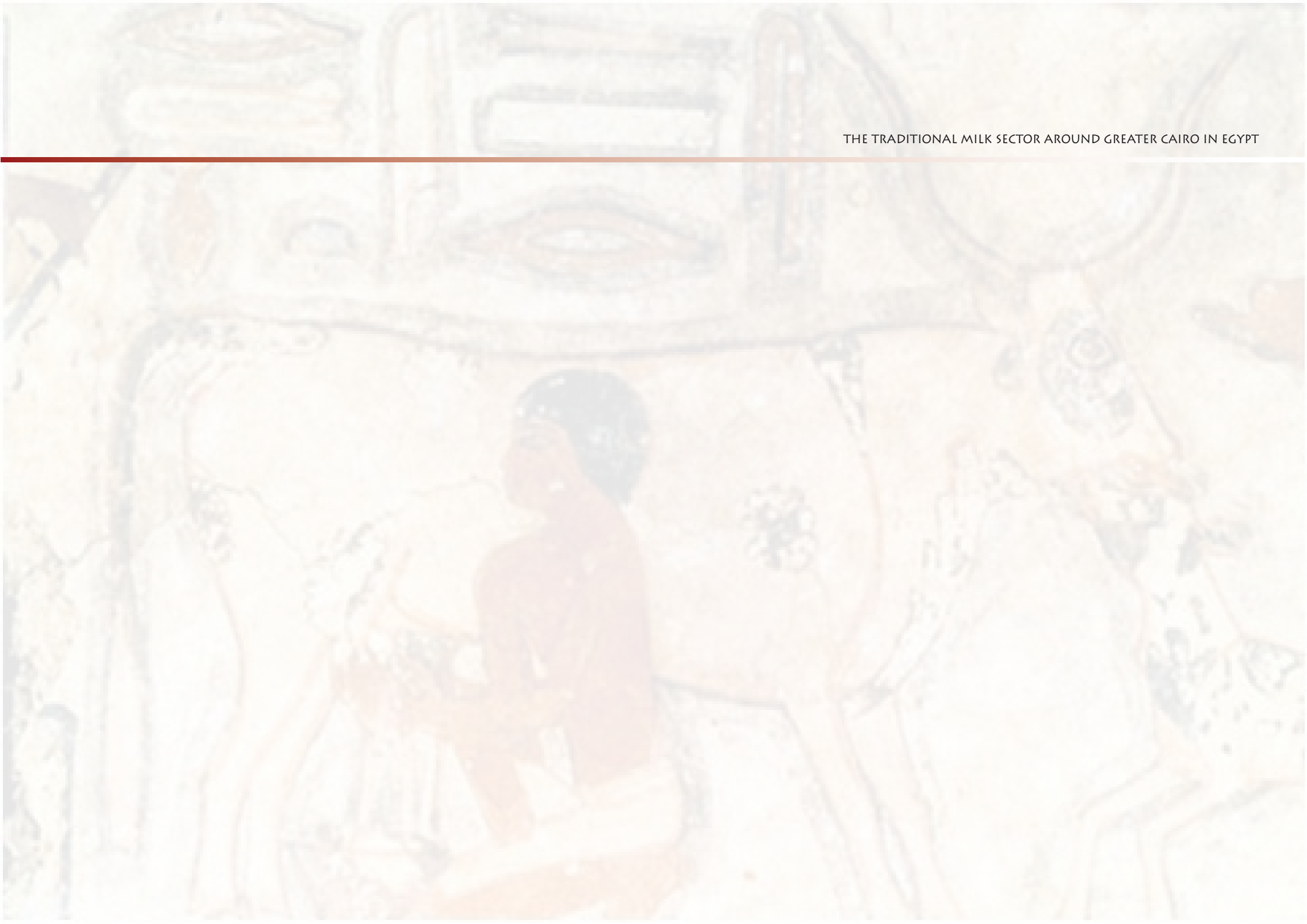
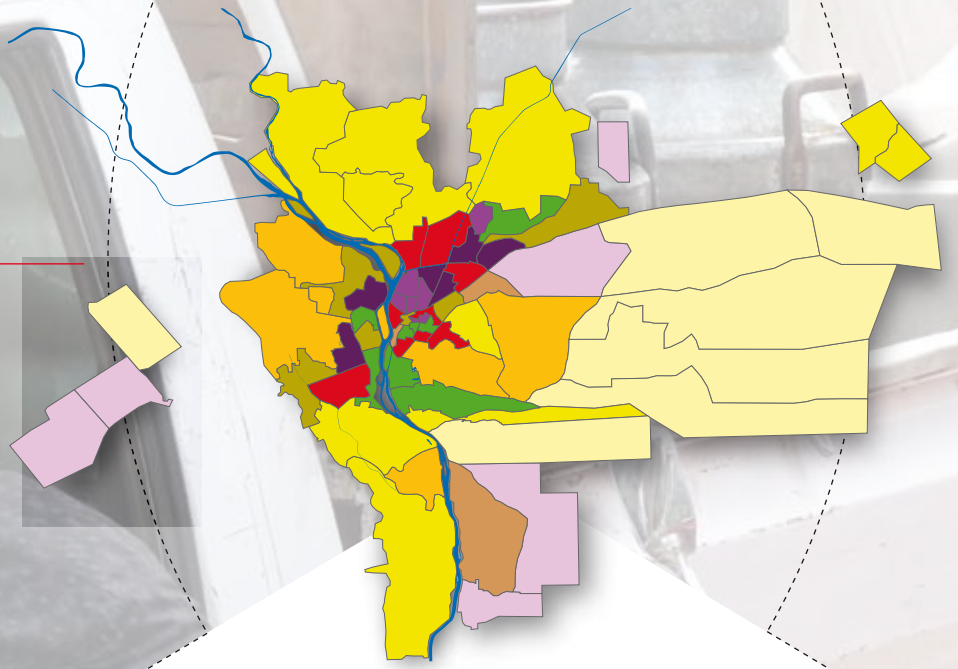


Greater Cairo



Summary

Egypt's milk sector is still largely traditional with a majority of the population consuming unpasteurized milk. This traditional sector represented nearly 80% of Egyptian milk consumers in 2011. The DAIRY project entitled "Understanding the traditional Milk Supply chain functioning in El Cairo City, Egypt" aimed at understanding the functioning of these small dairy units and milk intermediaries and the key-factors of their viability. The approach was based on a combination of qualitative and quantitative methods (narrative approach, interviews, surveys, factorial analyses, cartography of value chain, literature) at the farm and value chain levels.

This Atlas highlights a great potential for the milk sector in Egypt in link with the traditional mixed crop-livestock systems in rural areas, the long tradition and culture of milk processing and cheese consumption, and the high and increasing demand due to demographic growth and urbanization. However, the dairy sector copes with important challenges: the increasing consumption of industrial products, sanitary control, farm viability in link with feed price, etc., that require specific support.

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