Impact of clusters in dairy supply chains: the case of the Egyptian dairy chain

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Introduction:
The dairy industry, which is a key component of world food systems, especially in developing countries like Egypt, is currently undergoing major changes. This process is being driven by a wide range of forces, including shifts in the regulatory environment for dairy production and trade, technological development in the production of milk and dairy products, rapid changes in consumption patterns, and the restructuring of transnational corporate strategies for this sector. The rapid developments in products and processes, the usage of new packaging technologies and the replacement of full cream milk with specialist milk types are all results of technological and market changes. Moreover, dairy farming is also being restructured via breeding programmes and improved feeding regimes that generate higher yields per cow. Besides, the dairy industry has to face significant constraints as far as hygiene, storage, transport and trade are concerned. This is particularly true for liquid milk (ENPI CBCMED, 2014).

The dairy industry is a major industry in Egypt, occupying a significant place in food supply chains. The dairy industry is characterized by the multitude of products and therefore production lines. The Egyptian dairy supply chain depends on cooperatives activities that are required between processing the milk, transforming it into different dairy products and in some cases distributing it. However, some of those cooperatives do not distribute the dairy products directly and sell their products to consumer packaged goods companies instead (Euromonitor, 2016).

This research aims at evaluating and analysing the Egyptian dairy supply chain. The study is part of an EU funded Mediterranean project called “Lactimed” which aims at initiating the creation of a cluster of typical Mediterranean dairy products and the researchers were leading the research team. The research conducted an empirical study on the Egyptian north coast territory to investigate the impact of clustering dairy products on enhancing the performance of the Egyptian dairy supply chain and highlights the cluster’s expected outcomes. Moreover, the research identifies possible opportunities for establishing a dairy cluster between motivated key players in the Egyptian dairy supply chain. The structure of this paper is organized as follows: first, a literature review on the Egyptian dairy supply chain is presented. Then, field survey and interviews with dairy farmers and processors are conducted and analysed, with a view to highlight the potential benefits of a dairy cluster. Finally the paper concludes with strategy recommendations to maximize the dairy chain’s strengths and opportunities and; at the same time, minimize weaknesses and threats.

Literature Review
Middle East and Africa’s dairy sales growth is notable as 3.5% value CAGR was recorded between 2011 and 2016. Three countries contribute with 60% of the mentioned sales growth, namely, Egypt, Saudi Arabia and Algeria. Egypt’s family changing dynamics especially the rising numbers of working females led to stronger demand for convenient dairy foods and foods in general. Thus, Egypt remains a strong drive to additional sales in the region (Euromonitor, 2017). Although Egypt is one of the largest milk producers in Africa and the Middle East region, a negative balance exists between supply and demand meanwhile consumption is expected to remain higher than local production (BMI, 2015).

Unpackaged loose milk continued to represent a large share of drinking milk market in 2016. A slow shift to packaged milk products is being noticed due to FMCGs’ marketing and promotional efforts to sway consumers. Nevertheless, unpackaged loose milk is still popular in many areas of Egypt, because
the availability of packaged milk remains limited. In addition, unpackaged milk is less expensive and a misconception exists among consumers that unpasteurised loose milk is healthier despite the initiatives to promote the health risks of loose milk consumption in specific and unpackaged dairy products in general (Euromonitor, 2016). Unpackaged loose milk is unhealthy because it contains high level of bacteria that is beyond international standards because the milk is poorly stored, not chilled and in unhygienic environments. The largest dairy product segment in Egypt is cheese, accounting for 38.8% of the market total value followed by the milk segment accounting for 28.4% (Euromonitor aassport statistics, 2015). Fresh unpackaged milk in Egypt is mainly used in processing traditional products such as cheese (White, Ras & Mozzarella), yoghourt, Rayeb, Labnah, cream, butter and ice-cream (ENPI CBCMED, 2014).

Although packaged milk occupies the smaller portion of the Egyptian milk market, it occupies the second place after packaged bread with 13% sales value share. It is expected that health conscious and wealthier consumers will increase their consumption of packaged food. On the other hand, the economic situation in Egypt is challenging, the local currency has devaluated and inflation is rising which led to an increase in production costs for dairy producers, thus, a rise in prices for several products. Nevertheless, imported products and raw materials raised more in prices to final consumers which resulted in favour of Egyptian products and foreign brands produced in Egypt (Euromonitor International, 2016; Haddad, 2016).

Therefore, various foreign companies started manufacturing in Egypt and others are planning to expand their production capacity in 2016 in order to be able to sell their foreign brands at lower prices to Egyptian price sensitive consumers. Another reason that is attracting the investment to dairy supply chain in Egypt is that demand exceeds supply and the industry entry barriers are low. (Euromonitor International, 2016). The underdeveloped cold chain infrastructure in many MEA markets including Egypt and the potential of the market requires the dairy supply chain to get restructured and mature. This can be realised through the development of dairy clusters to bring all dairy supply chain partners to work in synergy together in order to further improve and develop the Egyptian dairy supply chain.

Clustering is the process of bringing similar entities together (Vivek, 2004). Industrial clusters proved to be an effective tool of industrial development and promotion of SMEs. Moreover, clusters represent a part of a larger value chain mechanism (materials supply, intermediates, semi-processed products, finished products, packaging, marketing etc.) that can extend beyond geographically defined boundaries (Wilson, 2004; Jonsson, 2012). This topic is becoming more popular among the policy makers and recognized as major instrument of development through intervention (Hague, 2010). Organisations can improve their competitiveness when they become connected with specialized suppliers of raw materials, machinery, research agencies, skills and technology in addition to other supporting services. Industrial clusters are also considered a tool for alleviation of poverty, generation of sustainable employment, fostering innovation, enabling better, effective and sustainable credit flow. Thus, clusters have a positive impact countries’ economic status.

In light of the above experience, the dairy products cluster could be considered as a major contributor to the Egyptian economy. Much of the value chain, from dairy farm and supplier network through food processing facility, is well presented in the territory (Alexandria and Behira). The cluster is increasing its competitiveness and supports the dairy products. The dairy cluster includes cow farms producing milk as well as all downstream organizations processing it and distributing derivative products.

**Research methodology**
Secondary data, on the Egyptian dairy production volumes and values, different dairy products, territory traits, animal feed, obstacles facing the Egyptian dairy chain players, was collected from national and international statistical reports, online references, international periodicals and journals
and similar researches related to the topic. Primary data was collected from a sample of dairy chain stakeholders: farmers, small and medium-sized processors, wholesalers, retailers and governmental bodies. The empirical study was conducted in 2 phases: semi-structured interviews with industry experts such as representatives of governmental bodies and local agro-industrial groups; structured interviews with a sample of small and medium-sized dairy farms and processing units in the Egyptian north coast territory. All structured and semi-structured interviews were conducted by the researchers face to face or via telephone with the interviewees.

The area of integration, is understudied, especially at the territorial level. The data collected as part of the research was descriptive in nature and required mainly qualitative methods to identify the relevant constructs and develop an understanding of the situation. As Supply Chain Management (SCM) research has often been criticized of following the positivist approaches, while qualitative and interpretative research is rather scarce (Kotzab et al., 2000), the initial findings of this research were mainly based on qualitative interpretations. Furthermore, the research based on the initial findings followed a more structured approach to generate more quantitative results. As a result, a balanced approach of triangulation has been achieved.

Given the nature of the research, the interviews of the first phase were of the semi-structured format. According to Lee (1999), semi-structured interviews are more flexible than structured interviews, but have more focus than unstructured interviews. The intention was to explore and gain more insights into the territorial dairy process. This semi-structured protocol was not rigid i.e. questions have changed over time as interviewees offered more insight the researcher was enabled to elaborate more with the succeeding participants. Throughout the interviews, more elements, problems and opportunities were uncovered.

The second phase followed a more structured format that was completely composed of pre-set standardised questions. Many field surveys are administered through structured interviews (Seidman, 2006). Telephone interviews were also conducted to revalidate some of the raw data of the structured interviews, to collect missing data, verify invalid answers and extract extra information. A roadmap to the methodology used in this study is illustrated in Figure 1.

After primary and secondary data collection, data was classified, then analysed using descriptive statistical methods (SPSS) and displayed into tables and figures with a view to interpreting their significance. Moreover, primary qualitative data collected from industry’s experts and major players, was analysed to extract specific territorial problems, opportunities and recommendations to improve the dairy chain.
Data analysis and interpretation
Structured interview was conducted with 13 dairy farmers. Summary of statistical responses of farmers is illustrated in table 1. The interviewed farmers highlighted some problems and constraints that hinder farming and animal production quality:

- Reduced quality of animal feed due to different reasons including:
  - Lack of irrigation water that results in lower availability and higher prices;
  - Fraud on the quality of feed;
  - Lack of monitoring and control that facilitates price manipulation.
- Animal diseases that affect both milk quantity and quality (e.g. foot and mouth disease);
- Insufficient quantity and quality of fertilizers;
- Lack of professional medical services and appropriate treatment for sick animals;
- Insufficient supply of several feedstuffs (e.g. soybean and maize) and higher costs related to their import.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you invest in constructing stables, warehouses etc.?</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Did you buy any new agricultural machines or equipment?</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Who is your feed supplier?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Producer</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Merchant</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>What types of feed do you buy from this supplier?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrated feed</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Roughage</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>What are the channels that you use to market your product?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheese dairies</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Cooperative</td>
<td>-</td>
<td>13</td>
</tr>
<tr>
<td>Retailer</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Market place</td>
<td>-</td>
<td>13</td>
</tr>
<tr>
<td>Direct sales</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>
Sales through informal channels: 13
Other: 10
Do you deliver your milk to your client by your own means?: 4
By which means does your client collect your milk?
   By his own means: 11
   Via milk collecting centres: 13
Do you borrow money?: 4
Do you receive any grants or other public aid?: 1
Do you participate in any dairy farmers’ union (formal or informal)?: 3
Are you member of an informal agricultural co-operative?: 3
Are you ready to participate in the functioning of the dairy cluster?: 8

Table 1: Summary of statistical responses of farmers

Structured interview was conducted with seven dairy processors. Summary of statistical responses of processors is illustrated in Table 2. The interviewed dairy processors were concerned about the following problems:

- Frequent power outages that reduce the volume of production as not all of them can afford buying electricity generators;
- Non conformance of loose milk transportation with any standards;
- Unavailability of distributor centres and refrigerated tankers (especially with the short shelf life of some dairy products like yogurt -3 days- or cheese -15 days);
- Mixing of cow’s milk with buffalo’s milk to counter the low quality of liquid milk that in turn reduces the milk quality even more;
- Unavailability of good breeds that negatively affects the quantity and quality produced;
- Complexity of paperwork to export dairy products;
- High production costs, exceeding the common Egyptian market prices;
- High prices of packaging (plastic bottles and packs) and lack of packaging providers in the Egyptian market.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you borrow any money?</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Do you have any activity in dairy farming?</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Other charges of the company:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microbiological analysis</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>ISO certification</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>HACCP</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Organic agriculture</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>AOP certification</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Other costs</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Do you deliver your end products yourself?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>By your own trucks</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>By your client’s trucks</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>By a third party transportation</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Collaboration patterns with raw milk suppliers:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yearly contracts</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Long-term agreement</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Oral convention</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Is there any deficit concerning the milk procurement in the production pool?</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Do you have a packaging unit installed in your company?</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
Do you have a marketing department within your company? 4 3
Have you any promotion activity? 2 5
Are you member of any professional body? 1 6
Did you benefited from any training activity? 1 6
Did you appeal for a consulting agency or a private laboratory for quality tests? 2 5
Was the quality of the analysis satisfactory? 2 5
Are you willing and ready to join to the dairy cluster? 5 2
Would you be interested to participate in business meetings gathering the stakeholders of the local dairy chain? 4 3

Table 2: Summary of statistical responses of processors

Discussion and findings
The analysis revealed that most of the interviewees’ comments were about the shortages, prices and types of animal feed that noticeably affect milk production quantity and quality. They mentioned that, due to the gap between production and consumption, 90% of animal feed requirements are imported although they could easily be produced in Egypt. As for the prices, they indicated that animal feed prices per ton doubled compared to the previous year, which obliged farmers to reduce the amount fed to the cattle and resulted in reduced milk production. The interviewees emphasized that the weakness of animal feed production in Egypt and the lack of animal feeding systems (e.g. specific feeding time) also negatively affect milk production.

Some other weaknesses raised by the interviewees were the absence of governmental support, veterinary services and the inefficiency of available vaccines. Because of this, Egyptian dairy products are banned from entering the EU zone. The interviewees added that, before the Egyptian revolution, the codex specifications were abolished to adopt the EU standards but the project stopped, leaving dairy products with no specifications or international standards. The consumption of loose milk is higher than those of packed milk. Thus, the lack of distribution centres for loose milk in the studied territory and in Egypt as a whole increases the costs and reduces the hygiene measures and control.

However, the interviewees see opportunities to improve the dairy chain through the clustering project and promising perspectives in the Arab and African markets, especially for the Ras/Romy cheese and chilled traditional desserts. Farmers expect the dairy cluster to provide professional training, information and business intelligence, R&D and innovation, and other services. These services should help workers involved in animal production to adopt innovative ways to feed animals, increase their productivity and guarantee their health. They also believe that the key factors which would motivate the producers of any territory to gather within a cluster are: stabilisation of fodder prices, insurance for animals, subsidies on fodders, good management of the cluster.

As for the processors, their expectations focus on personal training, information and business intelligence, R&D, innovation and other services. These services will allow them to share information and experience on their main concerns. Processors also stated that reaching common goals and increasing productivity could trigger the development of the dairy cluster. They also encouraged collaboration of the dairy cluster with other organisations such as the Faculty of Agriculture, local Chambers of Commerce and farmers in the neighbourhood. According to the interviewees, the producers’ union should have an essential role in the physical and managerial structure of the dairy cluster. Some respondents also stated that punctual payment would be the best financing pattern for any external service needed for the cluster functioning. Others believe that the services and intervention should be financed by membership fees.
The following recommendations were formulated by the different players in the dairy chain, with the goal of overcoming the above-stated problems, weaknesses and threats. They are based on the structured interviews findings.

The farmers highlighted the importance of activating the role of agricultural associations and farmers’ unions in guiding, monitoring and supporting activities related to awareness raising, training and skills development in the dairy chain. They also recommend involving competent bodies in the follow-up and monitoring of the dairy chain to prevent abuses and ensure access to support services by targeted beneficiaries. Farmers mainly suffer from selling their loose milk at a fixed price, which is profitable for processors regardless of their own high costs. Another recommendation is to build animal feed production plants close to dairy farms to save transportation costs. Farmers also suggest the development of new and innovative ways for promoting, distributing and marketing dairy products to improve sanitary conditions and increase prices. According to them, additional facilitation measures to encourage investment and export are required. The coordination and cooperation between the relevant stakeholders within a dairy cluster would encourage the realisation of these recommendations.

Dairy processors’ recommendations of the dairy processors concern a higher level: government support and facilitation, especially for small projects. Suitable equipment, appropriate training programmes, improved breeds of livestock and subsidies or facilitated access to debt financing are some areas where government support could help increase milk and dairy production. According to them, the government could also support the dairy chain by reducing taxes on imported dairy equipment. For example, processors require equipped vehicles to safely transport their products for long distances and guarantee their quality. Training and skills development of farmers and production line workers are also needed to raise their awareness on animal health and nutrition techniques. Processors were very much concerned about traditional Egyptian dairy products, especially Ras cheese (Romi), chilled dairy desserts and spreadable cheeses, since they are the most promising products for the cluster. Indeed, the latter could help develop their presence in the market through improvements in packaging and branding.

**Conclusions**

The formation of the dairy cluster could help in enhancing the performance of the Egyptian dairy supply chain. The threats are similar to those faced by other countries which succeeded in taking advantage of dairy clusters. Most interviewees declared that traditional dairy products could easily be enhanced and become popular if there were activities for strengthening professional qualifications, solving feeding issues, improving hygiene standards, establishing distribution centres. All these activities could be implemented within the dairy cluster.

The dairy farmers and processors interviewed expressed their willingness to join the dairy cluster and cooperate with the Faculty of Agriculture, the Chamber of Commerce, professional distributors, packaging companies, marketing experts, other processors and farmers. They even insisted that clustering with competitors, for example with other milk or cheese producers who have the same scale of production, would be beneficial to share the working experience and solve common problems. Moreover, they consider veterinarians as major partners in the foreseen cluster. The majority of interviewees are also interested to cooperate with suppliers of animal feed and dairy equipment, as well as with exporters. They believe that traditional cheeses and chilled desserts have the highest potential to benefit from clustering.

The issues mentioned by dairy farmers and processors present great opportunities for the dairy cluster, but also major challenges. Therefore, a suitable framework and effective support schemes are required for the successful development of the dairy cluster. It is important to mention that the government’s
role in supporting the dairy industry is essential. The following directions could be an agenda for future research to enable cluster formulation and implementation:

1. Designing and implementing an intensive dairy development programme through:
   ▪ Technical services to increase milk production;
   ▪ Training in procurement, processing and marketing techniques to reinforce the milk supply chain in a cost-effective manner;
   ▪ Skills development to ensure good prices for both dairy farmers and processors;
   ▪ Support for improving the economic, social and nutritional conditions of residents of disadvantaged areas.
2. Improving the quality of milk production through:
   ▪ Modernisation of production systems to ensure milk quality from producer to consumer;
   ▪ Automation and on-the-job training to improve farmers’ milking practices;
   ▪ Awareness raising on hygiene and quality standards to facilitate exports.
3. Encouraging cooperation between the various stakeholders through:
   ▪ Cooperation at all levels, from the district level to the State level;
   ▪ Cooperation between the different stakeholders in the dairy chain.
4. Promoting entrepreneurship in the dairy chain through:
   ▪ Establishment of advanced and modern dairy farms producing quality milk;
   ▪ Support to structural change in the unorganized sector to promote initial milk processing at the village level;
   ▪ Dissemination of automated machinery and modern technology to handle milk on a commercial scale.

References