Dairy value chain Report
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Diary value chain

This report provides a description of the actual situation for the dairy value chain in the Gaza Strip, a mid-term vision for a more effective and inclusive dairy market sector, constraints and scenarios that have to be taken into account as well as proposed strategies to enhance systemic changes in the sector necessary to progress towards the mentioned vision. Specific attention is given to gender dynamics and risk analysis.

1. Value chain characteristics

The number of dairy cattle in OPt has remained relatively constant from 2004 to 2008 (about 20.000 heads) while there has been a negative trend in the Gaza Strip\(^1\) due to a limited profitability of the production model as a consequence of increasing restrictions in trade movements and raising prices of raw materials (i.e. fodder prices) (PCBS, 2011). In 2010 a study of WFP and Oxfam International estimated the presence of 200 dairy farms breeding about 1.500 dairy cattle. Comparing to the period before the military operation named “Cast Lead”, conducted by Israel from December 2008 to January 2009, the number of cattle has decreased substantially\(^2\). The PCBS in 2011 estimated 4.355 female-cattle (out of a total 13.148, 8.793 males) but without disaggregating into dairy and beef cattle. In December 2011, a survey conducted by Oxfam Italia (OIT) identified a total of 518 dairy farms breeding 2.332 dairy cattle\(^3\) for an average of 4,5 dairy cow per farm (see Table 1). 10% of the 518 dairy farms are led or owned by women, directly or in partnership with men belonging to their own families (husband or brother or son).

Despite a greater presence in the Northern Area, dairy cattle breeders are widespread along the Gaza strip and live in close proximity one to another. In 2012, the MoA has confirmed that around 2800 dairy cattle have been raised by 500 breeders/farmers (5,5 cows/breeder). The dairy cattle breeders can be categorised in small scale breeders (from 1-5 cow), medium scale (from 6-15 cows) and large scale breeders (≥16 cows), with women breeders dominantly being in the small-breeder category. Although different breeds of dairy cattle are reared, breeders largely prefer the Holstein Friesians (HF).

Other kinds of dairy cattle are generally identified as local breeds. These cattle are usually crossbreeds of HF coming from Egypt\(^4\) or produced locally where the HF is often crossbred with beef cattle in order to increase profit and spread risks (dairy products vs. meat products). However, the local kind is generally characterised by erratic productive performances. Since 2006, it is possible only to import HF from Israel, typically of poor quality, while until November 2011 some cattle of poor quality have been also smuggled through the tunnels, raising serious health concerns. Consequently, there is not a clear picture about the total number of dairy cows that are yearly imported into Gaza. With the

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\(^1\)From around 4.000 dairy cattle in 2004 to 2.500 dairy cattle in 2008.
\(^2\)Over 4.000 units – restriction of imports and good access to the GAZA STRIP (WFP, 2012)
\(^3\)It considers only heifers and cows.
\(^4\)Until november 2013 livestock were smuggled through the tunnels with Egypt. After this data seems no possible for the distruction of the tunnels by Egyptian authorities.
recent closure of a large number of tunnels between Gaza and Egypt, cow smuggling from Egypt is believed to have stopped.

On average, milk productivity is quite low with an average of 16 litres/day and a lactation of 210 days (260 maximum). The estimated calving interval\(^5\) is around 360 days (from interviewed breeders). On the basis of these productive parameters, total milk production in Gaza is estimated to be in the order of 10,000 tonnes per year, covering only around 40 percent of local demand which is estimated to be around 25,000 tonnes of milk-equivalent products per year (MoA, 2011).

**Table 1** Breeders in the Gaza Strip categorised by size (number of dairy cattle owned) and the geographical area.

<table>
<thead>
<tr>
<th>District + Gaza City</th>
<th>Kind of breeders per cows owned</th>
<th>Small Scale Breeders (1 to 5 cows)</th>
<th>Medium Scale Breeders (6 to 15 cows)</th>
<th>Big Scale Breeders (≥16 cows)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n° of Breeders</td>
<td>women</td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>Northern Area</td>
<td>239</td>
<td>13</td>
<td>178</td>
<td>3</td>
</tr>
<tr>
<td>Middle Area</td>
<td>133</td>
<td>21</td>
<td>82</td>
<td>4</td>
</tr>
<tr>
<td>Southern Area</td>
<td>146</td>
<td>9</td>
<td>97</td>
<td>1</td>
</tr>
<tr>
<td>Total in GAZA STRIP</td>
<td>518</td>
<td>43</td>
<td>357</td>
<td>8</td>
</tr>
<tr>
<td>Total in GAZA STRIP</td>
<td>518</td>
<td>400</td>
<td>102</td>
<td>18.2</td>
</tr>
<tr>
<td>%</td>
<td>100.0</td>
<td>8.3</td>
<td>68.9</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: elaboration on data collected by OIT in 2011.

As observed, the economic scale of the dairy cow breeders is generally quite small as most of small breeders, keep livestock for self-consumption and for income diversification. Livestock is kept with low investments. They use by-products and low quantities of bought concentrates to feed the animals.

Small breeders, particularly women, have limited capacity to invest in growing and expand their farms or to engage with commercial dairy processors (small scale). They are not competitive and not well marketed as the costs for marketing is high for the small quantities they produce. This is caused by limits and constraints in accessing good

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\(^5\)The time between when the cow delivers a calf until the next calf is born.
market information and new technologies. In addition quality of their milk is generally low, a.o due to lower quality of fodder and animal health management/production conditions.

On the other hand, the few breeders with a larger number of cattle do deal with the dairy factories in Gaza. Their different scale of economy allows these breeders to sell the raw milk directly to the factories for processing.

It is hence possible to roughly identify two distinct value chains and markets in the dairy sector. The first one is very short and is based on the dairy processing at household level. In this chain, women (as owners, partners, or family members) play a significant role in milking cows and processing of milk into traditional products (white cheese, yogurt and labneh). Dairy products from this chain are marketed directly to end consumers by men, mostly in the area of production (neighbourhood), along informal channels. Some women involved in processing are known for keeping not adequate hygiene standards, this represents a key factor that influences marketability and price of dairy products. This notwithstanding, the profit margin is very low and the scale of economy remains too small for the growth and development of a real market; while low profit margins also inhibit investments to be made in the sector.

The second value chain involves mainly the medium to large scale breeders with higher level of specialisation and all the capacities for a systematic processing of dairy products.

Only 30% of the local milk production is transferred to the local dairy manufacturers and the remaining production as fresh milk, cheese or labaneh is sold to retailers and to end consumers (WFP, 2011).

Table 2  Estimation of profitability of dairy sector in the GAZA STRIP per scale of breeder.

<table>
<thead>
<tr>
<th>Breeder Scale</th>
<th>Average Cows</th>
<th>Income (nis * year)</th>
<th>Production Costs (nis * year)</th>
<th>Profit (nis * year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>2.5 (1-5)</td>
<td>35.000</td>
<td>30.000</td>
<td>5.000</td>
</tr>
<tr>
<td>Medium</td>
<td>7.5 (6-15)</td>
<td>100.000</td>
<td>90.000</td>
<td>10.000</td>
</tr>
<tr>
<td>Large</td>
<td>20 (&gt;16)</td>
<td>350.000</td>
<td>300.000</td>
<td>50.000</td>
</tr>
</tbody>
</table>

*To calculate income we considered income from both dairy and meat production. To calculate production costs we consider average fixed costs, running costs and depreciations for the different scales of breeders. The major costs considered are: Fodder, Equipments, Veterinary assistance, Milk machine, Water, Electricity, Labour. We were not able to estimate packaging and transportation costs. The data reported in the table are rough estimates. Further studies would be needed in order to consider these data as scientifically reliable. Source: own estimation from primary and secondary data.

The analysis of the profitability of the dairy sector highlights that breeders in all categories breed dairy cows for both milk and meat production. In fact, the profitability of dairy farming would be much diminished, if not become negative, without the profit generated by the meat production. The profit and income are the same for both women and men owners in the small and medium scale category. Women also receive profits from larger scale farms depending on their contributing in capital. Despite some doubts
related to its long-term sustainability (for increasing pressure on land, decreasing availability and quality of water), the dairy sector plays an important role in securing the livelihoods and baskets’ food item. Keeping dairy cattle is part of the traditional culture in Gaza, and dairy also represent stocked cash, dignity and resilience for people.

According to the MoA, about 1,700 labourers work in the dairy sector, especially in the small dairy cattle farms. Thus, it is considered quite labour intensive although the majority of workers and especially women are unpaid and informal family work force. The dairy sector is characterised by a large participation of youth and women of the household, who are often directly involved in the farm activities (animal feeding, milking and dairy processing). Therefore, it can be concluded that dairy production is a typical family business where men usually buy fodder, feed the cows, take care of cleaning works and removing manure, while women are highly involved in milking and processing work. Sometimes, they also sell the products to end consumers in their communities. Women’ involvement varies according to the breeders size. In fact, while women are involved in 40-60% of the activities of small and medium scale breeders, they are hardly involved in any labour in the large scale breeders.

Regarding demand and consumption patterns, dairy products are one of the main popular daily products consumed by all wealth groups families as it is a survival basket’s item. An increased demand is expected for the next years as consumers believe that dairy products are among the primary items to be consumed. Dairy products are consumed by different income (wealth groups) segments:

- Low income consumers usually purchase cheap dairies from small producers within their neighbourhood, or - for the poor big families - are using lower priced imported powder milk, while
- medium and high income consumers prefer to buy processed products in central and well furnished marketplaces such as minimarkets and supermarkets

Usually, within the household, parents as head of family are responsible for shopping (buying), with mainly women (70%) taking care of this task. However, consumers prefer to buy dairy fresh products at central public markets because of good quality and lower prices. They might also buy from supermarkets, mobile sellers and shops small quantities at need. Households choices are also made in consideration of the market’s price but also if match quality standards. Poor households with a different expenditure pattern will definitely opt local products as they are cheaper than the imported ones.

Though, consumers tend to prefer imported products due to a general perception of better price/quality and better packaging. According to consumers perceptions, food safety is very important even if it can imply higher prices. Generally, products from Israel and products with well-designed packaging material are considered of higher quality and better safety than local produce. Usually, imported and packaged products, both from Israel and West Bank, are also more costly compared with the dairy products produced
by local small scale farmers. Therefore, consumers may look for types/lines of dairy products that are sold in a small quantity (i.e. small packages), at low prices, but that also are attractive (type of packaging material used). Hence, there is a need for good packaging and marketing promotion that takes into consideration consumers’ preferences and taste. Consumers also tend to believe that poor sanitary practices of local, especially small scale, cow producers affect the safety/quality of milk. This is coupled by insufficient quality control on local processed dairy products. This resulted from lack of funds and capacities of the regulatory body, and this leads consumers to distrust the locally processed products.

**Value chain actors and recent interventions**

<table>
<thead>
<tr>
<th>Actor name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Suppliers</strong></td>
<td>Various: fodder, shed materials and equipments, milking machinery, storage equipment, primary milk testing equipment, and processing machinery and equipments etc. In terms of value the most important input supply is the fodder that is usually imported as concentrated fodder (i.e. grains and/or balanced preparation). Fodder is also produced locally mainly as straw and hay but also – in small volumes- as green fodder.</td>
</tr>
<tr>
<td><strong>Producers</strong></td>
<td>Producers can be categorised as small scale breeders (from 1-5 cows), medium scale (from 6-15 cows) and large scale breeders (&gt;16 cows). Small and medium scale breeders are also processors. They generally process their own milk for self-consumption but also sell dairy products directly to end consumers nearby. About 10-15% of them purchase milk from other breeders to increase their dairy volumes, processing and market. Large scale breeders sell all their production as raw milk to dairy processors. All of the breeders consume themselves (part of) their dairy products. Among breeders, 10% are women and less than 4% of women are partner in capital.</td>
</tr>
<tr>
<td><strong>Farmer Organisations</strong></td>
<td>There is no specific organisation specialised in livestock or dairy production, except one non active cooperative in Khan Younis for dairy cows with a processing unit. This is a primarily male dominated cooperative.</td>
</tr>
<tr>
<td><strong>Household-level processors</strong></td>
<td>Processing is done either at the household level - cheese and yogurt -and at the processing factories level. From our estimation there are about 30 to 50 household-level processors in Gaza, who are not simply processing for self consumption, but they are successful dairy producers having basic knowledge of marketing (e.g. packaging and brand strategies). They usually start processing their own milk, but they expand the market purchasing further raw milk from other breeders in the neighbourhood. Their marketing system is based on selling dairy products from door to door and/or in the open markets. For household-level processors this activity is completely under women responsibility.</td>
</tr>
<tr>
<td><strong>Dairy factories</strong></td>
<td>There are 10 dairy production factories – big and small- in the Gaza Strip, but not all of them use fresh milk but imported powder milk. Dairy Factories are characterised by a high turn-over with a short life span business. They</td>
</tr>
</tbody>
</table>
do not produce UHT milk (Ultra High Temperature), but they mostly produce white cheese, yoghurt and labaneh. Recently some dairy factories are starting to produce creamy yogurt. Processors normally develop a relationship by trust with producers over the years, and buy mainly milk from medium and large scale breeders. They comment that milk from small-scale producers is provided in too small quantity and considered to be of lower quality (i.e. risk of bio-contamination and low fat content).

Dairy factories provide dairy products to retailers, usually mini-and supermarkets. Within the contracts that they have with the retailers, dairy factories are responsible for withdrawing unsold products as well as spoiled and expired products from the retailers. In light of the situation of erratic energy supply this could represent an important economic issue and/or a quality issue in the case that dairy factories re-process those products.

Women work in some dairy factories as employees such the Alaqsa dairy factory in Rafah where two women are working as assistant processor with one male supervisor.

### Retailers and Distributors

About 70% of the products from dairy factories are sold directly to retailers, including those selling at local market places, stores, and larger scale supermarkets. The remaining 30% of the production is supplied through independent distributors, who usually sell local products (cheese) and other products which are imported from Israel and West Bank.

### Extension Services

The extension services of the dairy sector in Gaza are various: vet and drug services, management services, quality control, services and certification. Despite being potentially available, they are characterised by lack of efficiency and effectiveness. The MoA is responsible for health safety of livestock and for agricultural extension and to a limited extent for veterinary services. The MoE with MoH are monitoring the quality standards of processing units. However, farmers are used to ask advice from private veterinary services to solve their needs. However, in reality, the Ministries have a limited function due to lack of funds, coordination, capacities and technical skills. The private sector is somehow working to fill the gap, but they area also limited in outreach for the same reason. In addition, private sector support is not accessible for smallholders for many reasons, but mainly due to the quite high cost in light of their economy of scale.

**Recent interventions.** Next to the involvement of MoA, the dairy sector is mainly supported by local NGOs including UAWC, PARC and MAAN Development Center. International NGOs that work in the dairy sector including CARE, Oxfam Italia (OIT), Oxfam GB, FAO.

During the last five years, International Agencies and NGOs have been supporting the sector in various ways through providing equipment and inputs for breeding and processing, training (to breeders/processors) and developing Artificial Insemination programme (FAO). The main government institutions as the Ministry of Agriculture (MoA) provide extension services to combat/prevent diseases and supporting producers.
practices; the Ministry of National Economics (MoNE) for quality monitoring of locally produced dairy products and the Ministry of Health (MoH) for monitoring the quality (health and food safety) of locally produced dairy products. In 2012-2013 a dairy development project has been implemented by OIT with funds from DANIDA (the dairy project was a component of a broader project managed by OGB). This dairy project focused on increasing quality and productivity of small-scale dairy producers and the upgrading of 3 small dairy processing factories (marketing aspects were a responsibility of OGB). A second DANIDA phase is bound to start in July 2014. A planned evaluation for the 1st phase will guide the inception phase of the 2nd phase. The proposed activities in DANIDA 2nd phase will focus on medium scale cow breeders who have 5 milking cows and more, training them in animal health, cattle management and milk quality and management, rehabilitation of production places and inputs to improve milk production (animal feed; basic equipment for milk storage; etc), veterinarian assistance. WFP has demonstrated interest in the dairy sector for buying local dairy products for their food voucher programme.

1.3 Challenges and constraints in the Dairy Sector
The dygram below represents problem tree analysis highlighting the key challenges and constraints encountered in the dairy sector, detailing underlying causes and effects on Palestinian men and women farmers/processors. This problem tree was drafted with the participation of the key actors of UPA Platform’s workshop held on 20 March 2014 in Gaza City. Participants are representatives of the 30 organizations that are playing a key role in the Urban and Peri-urban Agricultural sector.
Diagram 1. Problem Tree Analysis for the Dairy sector in the Gaza Strip

The section below will further describe constraints and challenges identified in the diagram above with inputs from the field studies/ undertaken by the project staff in the Inception Phase.

The main challenges and constraints of the dairy sector are:

**Low quantity of milk production:**
- Lack of suitable and good milk cow breed due to import restrictions imposed by the occupation:
Tendency to have also mixed breed cows (lower milk productive) for coping strategy (farmers can easily sell the meat);

**High dependency on imported expensive fodder:**
- The dairy sector is not self-sufficient in terms of inputs supply especially of animal fodder. As a consequence the entire productive sector remains highly unstable due to the dependency on imports regulated by Israel (e.g. increasing imports restrictions; irregularity of imports; high prices of imported fodder).
- Breeders tend to use lower quality feed due to increased fodder prices, crop and waste by-products or to decrease the amount of ration for the cows that hence are generally malnourished, resulting in low production in terms of quantity and quality (fat content).
- This is aggravated by insufficient supply of alternative fodder produced in the Strip (green fodder), also because of inadequate water for irrigation of green fodder.
- The free distribution response (notably of fodder) provided by the humanitarian intervention in supporting the dairy sector, may have deteriorated the basis for long-term production strategies and created unsustainable dependencies.

**Weak competitive market advantage of local products**
- Difficulties in processing and transportation (lack of cold chain), the low quality of the raw milk, small production capacity and lack of efficient management are critical for the small-scale dairy sector. Furthermore, Israeli imports have strong reputation for quality and safety in the Palestinian market and their goods obtain a premium price at the retail level. Israeli products are much more sophisticated and diversified to meet Gaza consumers demand.

**Technical constraints in processing capacities and knowledge that affect milk quality:**
- Lack of hygiene of milking and milk collection;
- Lack of proper techniques of transformation and control of microbiological contamination (mainly at household level where women are mostly involved);
- Lack of quality control; lack of a funding and capacity of regulatory body for monitoring quality and hygiene of dairy products (i.e. HACCP - Hazard Analysis and Critical Control Points);
- Lack of a cold chain system.

**Improper farmer practices**
- Low levels in animal husbandry capacities and knowledge;
- Breeders lack knowledge and information on appropriate animal husbandry techniques. While this is applicable to the overwhelming majority of breeders, it is most notable among women breeders who face particular constraints in accessing extension services. Due to cultural setting, it is mainly men who
attend technical training courses. Also if (male) extension and support agents arrive at the farm, they interact with the men only.
  o Lack of alternatives nutrition strategies.
  o Low level and expensive extension services: the veterinary service system, both public and private, lack resources and have limited capacities to respond effectively to the sector needs. From a profit analysis of the dairy sector both for production and processing, seems not possible for breeders and small processing units to support the costs of external extension services.

**Lack of investment in and insurance for the dairy sectors.**

This results particular evident for small scale breeders and for women.

Furthermore the dairy sector is constrained by lack of resources – land and water: competition for resources is an increasing trend in the Gaza Strip in light of low availability of land and high salinization of water resources. In particular, for the dairy sector, lack of land means low possibility to be self-sufficient in fodder production; while water salinisation means low production and also potential health problems (i.e. kidney disease) for dairy cattle.

It is important to note that the constraints not only limit the sustainability of the dairy industry, but are also eroding the responsiveness of breeders and make them more vulnerable to shocks and risks.
2. Vision, scenarios and proposed interventions

2.1 Vision for the Dairy Sector

The following vision was developed by a large number of local actors actively involved in the dairy sector in a workshop facilitated by the project of the Gaza Platform for Urban and peri-urban Agriculture (March 20th 2014)

“All households that depend on dairy production and processing are food secure, and maintain all their living requirements associated with health, education, housing, and resource development through their income, while preserving their dignity and ensuring sustainability in their work. We look ahead towards increasing our self-sufficiency, while enhancing the efficiency of livestock system in dairy production and delivering produce that meet the quality and quantity requirements. Our local products meet the needs of local consumption. The dairy sector grows and benefits from locally available inputs, as well as uses treated water to irrigate fodder crops and green fodder. The dairy sector employs modern technology, benefiting from an effective extension and support system, to generate local products that are competitive and of high quality, encouraging, consequently, investment in the dairy production and processing”.

2.2 Scenarios under which to achieve the above vision

The dairy production and marketing is affected by a series of social, economic, political and institutional factors, which vary in terms of influence, as well as the possibility of their occurrence over the coming three years. Two scenarios were defined that represent the projected political and economic contexts that could affect the way the dairy sector may grow in future.

- **First scenario: Political stability.** A political stable environment will entail the existence of a national unity government grouping all spectrums of society. This government will establish diplomatic relations and will gain international support and Israel’s commitment towards a long term reconciliation and progress in the peace process.

- **Second scenario: Political instability:** Foreseen political instability entails the continuation of political disagreement, reluctance towards national reconciliation, failure of negotiation efforts with Israel, constant tension at all levels, with potential signs of a third popular uprising (Intifada). Political instability will also mean that the Government in Gaza does not enjoy international support, entailing the continued siege and closure, while donors continue their support to provide urgent humanitarian assistance with some development projects. This situation entails a lack of stability in all political, social and economic aspects.

In view of the unlikelihood of the first scenario to materialize, strategies and interventions for the dairy sector in the Gaza Strip will work under the assumption of the second and current scenario. Resultant strategies to achieve the vision formulated in section 2.1 will take into account the immense constraints posed by this scenario and work notably on
systemic changes that encompass the highest independence possible of external inputs and of export markets (improving the local markets to such a degree that when export markets open these can be more easily expanded to) and that booster local resilience and self-reliance as well as a self-sufficient internal market. Section 2.6 below will assess the risks that are related to working under this scenario.

2.3 Needed systemic change
In view of the vision above, the analysis of the current context for the dairy sector, the challenges and constraints mentioned, and the scenario under which strengthening of the dairy sector in the Gaza Strip has to be achieved, the project Consortium recommends that the following systemic changes are facilitated by the project and operated by the local actors involved in the sector.

Where most of the here recommended needed systemic changes in the dairy value chain would be necessary under both scenarios (more and less political stability), they become critical for the survival of the dairy sector under the second scenario. For the dairy sector the following systemic changes are essential to pursue:

1. Increase local dairy production to fill the gap with local demand that is currently satisfied by imported products.
2. Decrease dependency of imported services and inputs, notably translated in increased substitution of imported fodder by locally produced green fodder.
3. Increase knowledge and capacity of breeders and processors to produce high quality dairy products.

2.4 Potential interventions and approach
The vision for the dairy sector is to work on achieving increased income and a good standard of living for dairy producers and processors. This can be achieved through the improvement of their production and processing practices, requiring producers and processors to capitalise on and use improved skills and practices. Furthermore, by improving product quality and applying production quality standards to dairy products competitiveness of the Gaza dairy products with foreign products (mainly from Israel, West Bank and Egypt) will be improved. As a consequence, it is foreseen that the livelihood conditions of small producers and processors will improve. Improved processing and production may also trigger more demand from service providers and support organisations.

Potential interventions include:

1. Facilitate coordination and learning among actors within the dairy value chain (e.g. local value chain platforms) to enhance availability and use of information, and access to efficiency support services (training, extension, financial).
2. Stimulate linkages between producers/processors and consumers so that producers can better understand the needs of processors and consumers to produce quality products.
3. Incentive capacity development of women and men producers on improved processing and production.

4. Explore economic feasibility and provide investment (co-financing) for producers to get their milk to processors through solar-based cooled collection points (e.g. by very simple devices as a earthen pots covered by straw and ventilated by small solar-powered fan) and cooled/insulated transport mini-containers possibly loaded on solar powered electrical mopeds, bicycles or small trucks. The main aim is to ensure the safety and quality of the product while reducing spoilage delivered at processor points. Cost should be offset by improved quality of supply, volumes and reduced losses.

5. Facilitate linkages between producers and processing units and private enterprises and services (as well as training/extension organisations) in developing and introducing new local production lines. Indeed local milk is mainly used for white cheese, yogurt and labaneh with low profit margin. The introduction of new production lines (e.g. mozzarella cheese, etc) especially at dairy factory level needs to be done in close consultation with potential actors at the demand/market side (retailers, super markets, WFP). This can offer the chance to compete with foreign products and enter different market sectors.

6. Stimulate academic and field and action-research research institutions, including the Faculty of Agriculture of al-Azhar University in and Faculty of Science of the Islamic University, to innovative production practices, green fodder production and rations, development of new processing techniques and quality control. Further studies are also needed to explore dairy cattle nutrition requirements vs. quality of green fodder available in the Gaza Strip (see also above under facilitating research). For this they should be involved also in most of the activities above through a true PTD process of participatory technology innovation (see further below).

7. Build capacity of extension and training organisations to stimulate and support improved production (principally innovation in local fodder supply and use through PTD (Participatory Technology Development)/LEISA (Low External Input and Sustainable Agriculture) approaches), as well as processing and marketing techniques and practices. Extension agents could coach and train breeders: through farmer participatory research in producer focus groups (PTD approach) to increase the quality of the daily feeding ration: producers will be encouraged to learn how to exploit better and combine green and concentrated fodders (good ratio between energy, proteins, minerals, vitamins and roughage). with hence positive effects on milk yield and quality (fat content). In addition, a better intake of roughage in the ration could decrease dismetabolic and digestive diseases but also mastitis. These applications would have as a double effects the increase of the health of the animals and the quality of the milk and the decrease of the antibiotics abuse that is very frequent in the Gaza. Finally, replacement of concentrates by green fodder will guide to decrease the dependency from fodder imports and also decrease the costs of the ration.
Table 3–Estimation of profit increment due to replacement of 1 kg of concentrate with 15 kg of green fodder or 5 kg of hay of green fodder (i.e. barseem) in the ration of dairy cattle in the GAZA STRIP for each scale of breeders considered.

<table>
<thead>
<tr>
<th>Breeder Scale</th>
<th>Average Cows</th>
<th>Increment of dairy production (%)</th>
<th>Costs Reduction (%)</th>
<th>Profit Increment per year(%)</th>
<th>Profit Increment per year (nis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>2.5 (1-5)</td>
<td>10%</td>
<td>2%</td>
<td>82</td>
<td>4.100</td>
</tr>
<tr>
<td>Medium</td>
<td>7.5 (5-15)</td>
<td>7%</td>
<td>3%</td>
<td>97</td>
<td>9.700</td>
</tr>
<tr>
<td>Large</td>
<td>20 (&gt;16)</td>
<td>8%</td>
<td>5%</td>
<td>86</td>
<td>43.000</td>
</tr>
</tbody>
</table>

*By considering the low level of dry matter intake currently observed in the GAZA STRIP, the ratio of replacement (1kg concentrate/ 15kg of green fodder) should also guarantee an increment of total dry matter intake per each cow. Source: our estimation from primary and secondary data.

8. Breeders could be encouraged to link-up with fodder producers to strengthen their supply relationships for instance through the exchange of fodder and manure. Agricultural farmers, and especially those who practice not very profitable open field vegetable production (see analysis in the vegetable Value Chain Report) could be encouraged to produce forage instead of non-profitable vegetables. Agricultural farmers could also be encouraged to sell crop residues and agricultural by-products to breeders and hence create added value to their own crop production.

9. Breeders and farmers could also be encouraged to engage in planting promising alternative fodder crops with a high fitness to the Gaza environment such as Moringa and Sorghum. Both are saline and drought tolerant and can be cultivated with treated waste water both from houses and treatment plants. Use of Moringa and sorghum increase fat content in the milk. At present, there are two pilot projects on Moringa carried out by Zakher Association (a small women association) and MoA. Zakher Association runs a food processing unit that only involves women. They introduced Moringa as a pilot project and distribute it to women who breed cows, sheep and other animals.

10. Improve knowledge and experiences on fodder drying and on silage techniques to satisfy breeders fodder needs over the year. There is a small unit that produces fodder from palm date by-product that could be used as experimental and training unit to produce pellets from local green fodder.

7Preliminary analysis in the inception phase showed that profitability of green fodder production is about the same or higher than for open-field vegetable production
Table 4 Estimation of profitability per dunum of Barseem (Trifolium alexandrinum) production in the GAZA STRIP cultivated in open irrigated field.

<table>
<thead>
<tr>
<th></th>
<th>Production per Dunum (ton/year or season)</th>
<th>Price (nis) per ton</th>
<th>Income (nis * year)</th>
<th>Production Cost (nis * year)</th>
<th>Profit (nis) per dunum per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barseem</td>
<td>7</td>
<td>250</td>
<td>1.750</td>
<td>955</td>
<td>795</td>
</tr>
</tbody>
</table>

*The income refers to an estimated production of 7 ton per dunum per harvest (totally 5 harvest per year). To calculate production costs we consider the costs for the following items: Labor, Water, Seedling, Pest Management, Fertilizer, Irrigation. The data reported in the table are just a roughly estimation of the reality in the GAZA STRIP. Further studies are needed in order to consider these data as scientifically reliable. Most of the green fodder production from the middle area of Gaza strip, 1 sac of Berseem 18 kg = 2-3 NISource: our estimation from primary and secondary data.

2.5 Gender dynamics
There is a clear lack of participation of women in the formal dairy economy. This is attributed to the fact that setting up dairy businesses in the formal economy requires financial capital which the majority of women in the Gaza Strip do not have. Nevertheless women have a key role, mainly in household based processing.

Although no women work as input suppliers due to cultural barrier which does not allow women to have a public life, there are few involved in other segment of the chain. Extraordinary, a woman owns a veterinary pharmacy in Khan Younis and works as a retailer. All other retailers are men who rarely employ women as secretaries or accountants.

Special efforts need to be made to especially incentivise women dairy productionprocessors to improve their capacity. In particular, women agronomistsextension agents should be empowered to better help women breeders and processors through extension and support services. Such a focus on women economic empowerment should apply to all or most of the interventions and activities mentioned in section 2.4.

2.6 Risk analysis
The intervention strategy is targeting foremost the local market as demand is far from satisfied for dairy products. A major impediment created by inability to import new and better quality milking cows into Gaza Strip.

The main risks as related to development of a viable dairy chain are the following:
1. Urbanisation and the protracting of conflict are decreasing land available for livestock and production of fodder.
2. Increasing salinity and pollution of water due to the continuation of the overexploitation of the aquifer of the Gaza Strip threatens animal health and productivity.
3. Farmers and processors maybe reluctant to make new investments as long as consumer demands do not increase. It may take time for consumers to change their perception of local produce.
4. There is an important risk that farmers will be unwilling to accept a zero distribution approach as the dairy sector has always received large volumes of free support.

5. Fodder imports become more irregular or prices increase; good nutrition practices and volumes of milk will always demand mixed ratios of concentrates and green fodder.

6. Extension, training and support services will not be able to effectively target women on the short term, as this requires a change in social attitudes and presence of more women extension agents.