Dairy Farming Business Plan Report

Feasibility Study for Milk Processing Unit at Household for the Agro Pastoral Communities in Jordan

Strengthening Innovation and Technology Adoption towards Sustainable Agricultural Productivity in Arab Countries

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Science for resilient livelihoods in dry areas

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LIST OF ACRONYMS

AFESD	Arab Fund for Economic and Social Development
CGIAR	Consultative Group on International Agricultural Research
Du	Dunum (1 du=0.10 ha)
FGD	Focus Groups Discussion
Hr	Hour
ICARDA	International Center for Agricultural Research in Dry Areas
JD	Jordanian Dinar (1 JD= 1.41 US$)
Kg	Kilogram
NARC	National Agricultural Research Center
$	United Stated Dollar

KEY MESSAGES

Summary

There is a serious threat posed to agro-pastoral communities by food insecurity, especially among vulnerable households living in dry land areas. The overwhelming effects of the land degradation, low productivity, and food insecurity in the agropastoral farming systems have again called attention to the need for a longer-term response to the problems of food security and rural development in the agropastoral dry areas.

While the general objective of the study is to develop an economic feasibility study of on-farm sheep and goat milk processing, packaging, and marketing through an inclusive business model and modalities plan to encourage these householders to contribute and benefit from the dairy sector value chain, and to help formulate government policy recommendations for improving dairy production in the dry land communities in Jordanian *Badia*, in this study we are mainly providing an economic and financial analysis for dairy processing business model as a response to food and nutrition insecurity for agropastoral communities. It emphasizes the role of small business projects (i.e., women) at household level, non-donor dependent tool for improving the health, food and nutrition security, and livelihoods of agropastoral communities and their families.

Two communities have been selected to implement this study: Al Khanasri (Mafraq Governorate) and Al Majidyya (Amman Governorate). Focus groups were carried out in each of the two communities to collect detailed information about dairy processing and marketing practices, problems, options, risks, and priorities, supply chain, and patterns of supply and demand, collect information for describing the marketing channels, for identifying the different market actors and their roles in the dairy value chain, and the volume and pattern of demand and supply for each dairy product. A socio-economic questionnaire was designed and implemented to elicit basic numerical data on animal wealth, manufacturing production dairy processing, marketing livestock products, source of fodder and animal feed. About 26 respondents distributed between Al Majidyya (15) and Al Khanasri (11) villages has been selected for the purpose of collecting information at the household level with the aim of conducting a study related to dairy production issues in *Badia* communities in Jordan, to understand the systems of dairy production and marketing, and identify the problems faced by the *Badia* regions in Jordan and to study feasibility study of dairy processing (Sheep and goat milk).

Results showed that livestock numbers are declining in Al Majidyya due to the lack of pastures, land degradation and the lack of veterinary services. It was noted during data collection and entry that the young ladies lack the interest and skills of dairy processing among young people at the household level and it declines among older women. Women contributes in all livestock activities, especially milkmaid, and in spite of her knowledge of these activities, but she is still working in traditional system and there are no skills or understanding of the importance of new technologies that are directly related to the increase of production. The study found that manual milking was the only method used to extract milk from livestock and the vast majority of milk is reserved for processing rather than consumption. *Jameed*, *ghee*, and *labaneh* are the main dairy products produced, and the bulk of the work is undertaken by women. The "Jameed" is the most common product in the area, and improvement of the quality and quantity is possible.

The study recommended that there should be an interest in the manufacturing of dairy products to have milk product which comply with standards, activate the role of agricultural extension in dairy processing and veterinary services, women need more training to enhance the quality of the product, women in Al Majidyya should find a source for buying milk in low prices and women should try to have a certificate of their products to market and sell for internal and external markets. It was found also that "*Jameed*" gives the highest net return and it has long shelf life so this study recommend to enhance the awareness regard producing this product as it gives good return and can be exported to other countries benefitting from the geographical indicator.

Keywords

Dairy products; processing; livestock; market; business model; gender; household; agropastoral communities, Jordan.

Highlights

- Business planning is an important part of owning and managing a dairy processing business.
- Willingness from agro-pastoral producers traditionally to go through the dairy business planning process.
- There is an interest in the manufacturing of dairy products to have milk product which comply with standards; there can be no food security without food safety.
- The is a need to activate the role of agricultural extension in dairy processing and veterinary services.
- Women need more training to enhance the quality of the dairy products.
- Women in Al Majidyya should find a source for buying milk in low prices.
- Women should try to have a certificate of their products to market and sell for internal and external markets.
- Enhancing the awareness regard producing "*Jameed*" as it gives good return and can be exported to other countries benefitting from the geographical indicator.

I. INTRODUCTION

There is a serious threat posed to human survival by food insecurity, especially among vulnerable communities living in the agro-pastoral areas. The overwhelming effects of the land degradation, low productivity, and food insecurity in the agropastoral farming systems have again called attention to the need for a longer-term response to the problems of food security and rural development in the agropastoral dry areas. Despite, the large animal wealth in Jordan, yet the agro-pastoral communities are still suffering from milk production and consumption gap. In addition, livestock numbers are declining in the agro-pastoral regions due to the lack of pastures, land degradation and the lack of veterinary services. Sheep and goat farming as serious business venture and the sector which can generate a significant number of working posts and income for poor rural population is the Jordanian agro-pastoral regions. Within this premise, providing a general overview of the dairy processing sector and sub-sectors in these typical farming systems in terms of structure and market trends, major challenges and opportunities for development and growth is a must mainly within the social, economic, and environmental dynamic change the communities are witnessing.

A first assessment of the dairy processing sector is selected regions for Jordan (Al Khanasri and Al Majidyya) reveals that some of the constrains for development of sheep and goat dairy processing units are similar to the constrains in other agriculture sectors such as inadequate technologies, low productivity, lack of extension support etc. However, there are aggravating factors which are related to sheep and goat production only. One of them, if not the biggest, is too small goat population. In addition, extension support to the sector is weak and responsible institutions do little in this regard. It results in inadequate technology and mistakes which can be seen even in the farms where significant investments in facilities and equipment is undertaken. This is related to production of poor-quality fodder, inadequate feeding, herd management techniques, food safety procedures etc.

Despite growing interest of processing sector to collect and process sheep and goat milk, current quantities of raw milk are so low that it is not justifiable to organize collection in the agropastoral communities. This fact suggested the development and implementation of dairy processing units at the household level (AL Hiary et al. 2013). Thus, within the global sustainable development goals particularly to end hunger and achieve food security, there is a need for viable solutions to the global hunger problem, particularly focusing on sustainable agricultural business that will increase food security and also enhance economic growth in the agropastoral communities. Thus, in the frame of the Strengthening Innovation and Technology Adoption towards Sustainable Agricultural Productivity in Arab Countries project, the International Center for Agricultural Research in the Dry Areas (ICARDA in collaboration with the National Agricultural Research Center (NARC) are implementing a smallholder inclusive business models and modalities plan to encourage these householders to contribute and benefit from the dairy sector value chain, and to help formulate government policy recommendations for improving dairy production in the dry land communities in Jordanian *Badia*.

This study is an informative document which may help in designing potential projects aimed at development of the sector and ultimately poverty reduction in agro-pastoral areas. Agro-pastoral communities in Jordan, with all its natural resources can feed themselves and, with some preconditions which are quite achievable, can offer good milk processed products. Sheep and goat products are amongst them. The key driver and initiator of this study in broader terms is revitalization of the local economy, facilitating sustainable economic growth, via the creation of the employment opportunities and making better use of available physical and human resources in the agro-pastoral communities.

II. OBJECTIVES OF THE STUDY

While the general objective of the study is to develop an economic feasibility study of on-farm sheep and goat milk processing, packaging, and marketing through an inclusive business model and modalities plan to encourage these householders to contribute and benefit from the dairy sector value chain, and to help formulate government policy recommendations for improving dairy production in the dry land communities in Jordanian *Badia*, in this study we are mainly providing an economic and financial analysis for dairy processing business model as a response to food and nutrition insecurity for agropastoral communities. It emphasizes the role of small business projects (i.e., women) at household level, non-donor dependent tool for improving the health, food and nutrition security, and livelihoods of agropastoral communities and their families. Particularly, this study aims:

- To collect information at household level from dairy milk processors.
- To conduct a study concerning dairy production issues in the *Badia* communities in Jordan.
- To understand dairy production systems, marketing and identifying problems encountered these specific dry land areas.
- To study feasibility study of Dairy processing (Sheep and goat milk) at the household level.
- To develop an economic feasibility study of on-farm sheep and goat milk processing, packaging, and marketing through an inclusive business model.

III. DATA SOURCES AND METHODOLOGICAL FRAMEWORK

III.1. The site of the study and units of analysis

This study has been implemented in tow selected sites: Al Khanasri (Mafraq Governorate) and Al Majidyya (Amman Governorate). The governorate of Mafraq constitutes (28%) of the total area of Jordan, and it comes in second rank after the Governorate of Ma'an in terms of area , the population of Mafraq Governorate constitutes (7.4) %) of the Kingdom's population (Mafraq Governorate Development Program, 2017). Al Khanasri is one of four villages (besides Al-Harsh, Faa'a, and Barika) in Al Mafraq governorate, the village is inhabited by 964 people, according to the Department of Statistics report of the estimated population for the year 2019. (Wikipedia). It suffers from poor infrastructure in the main and secondary roads, and basic services such as electricity and water are available on a permanent basis, and it has three schools (mixed primary, secondary for boys, and secondary for females), and distance education continued in it during the curfew period, according to the people's talk, Those who describe the economic situation of the majority of the population as average, as they depend on the monthly salary. Al Majidyya village is located southeast of Amman and has a population of approximately 441, according to the Department of Statistics 2019, and it is considered a desert area with an average of 100 mm of rain, where most of the village's people cultivate rain-fed barley to provide a source for livestock feed. Al Khanasri is one of four villages (besides Al-Harsh, Faa'a, and Barika) in the Mafraq governorate, belonging to the municipality of Al Basiliya, within the district of Hosha, which was established in 1996 and includes seven other villages, in the northwestern Badia district, in Al Mafraq governorate. the village is inhabited by 964 people, according to the Department of Statistics report of the estimated population for the year 2019. The units of study will be the household in both selected villages.

Al Majidyya village at Al Muwaqer district, which is located in the southern part of Amman, with a population of (441 inhabitants, and the number of households is (40) families, the family number range is about (5) members. Al Majidyya centered at the latitude 31.742452; the longitude is 36.116534 with an average elevation of 831 m above sea level. The average rainfall is around 130 mm, and the estimated area is (600) dunums, and the farmers' land holdings vary from (0.5 to 60) dunums (Figure 1). The old name of the former area, "Al-Matabba," has been changed to Al Majidyya. The residents of Al Majidyya are from the same family, which is the Bani Sakhr tribe. The houses in the area are characterized by concrete buildings, some of them are built from stone, and everyone lives in his own home.

III.2. Data collection and data sources

This study adopted a mixed methods approach, which combines philosophy, research design, and orientation methods. It is a procedure for collecting, analyzing, and mixing both quantitative and qualitative research methods within a study. To do so, the data has been collected using several resources:

- The secondary data was obtained from official documents and reports of the Ministry of Agriculture and from relevant sources.
- Questionnaire Survey (Questionnaire Survey instrument) (The questionnaire will contain sections on milk availability and prices. Constraints faced related to processing, hygiene and available knowledge, marketing problems, opportunities).

The study sample has 26 respondents distributed from Amman 15 respondents from (Al Majidyya village) and 11 respondents from AL Mafraq Governorate (Al Khanasri village).

III.3. Methodological framework

To develop an economic feasibility study of on-farm sheep and goat milk processing, packaging, and marketing through an inclusive business model in the agro-pastoral farming system, the methodology

followed a multi-method approach, which involved analyzing quantitative and qualitative data by applying the following tools:

- Desk review: At the outset, a desk review was conducted to gain an understanding of the current situation of the dairy sector in general, and in the agro-pastoral farming areas, in particular.

- Stakeholder/farmers workshop: During these workshops (i.e., focus groups discussion -FGD's) implemented in each one of the two communities, detailed information about dairy processing and marketing practices, problems, options, risks, and priorities, supply chain, and patterns of supply and demand, collect information for describing the marketing channels, for identifying the different market actors and their roles in the dairy value chain, and the volume and pattern of demand and supply for each dairy product has been collected and gathered to identify and discuss the main drivers of sector growth and potential.

- Survey questionnaires: During the field research, specialists were interviewed face-to-face using a semi-structured questionnaire. This socio-economic questionnaire was designed to elicit basic numerical data on animal wealth, manufacturing production dairy processing, marketing livestock products, source of fodder and animal feed. The farmer was questioned on social status, educational level, size and age of the family, size of the land holding, cropping system, number of livestock, sources of income, level of education, and agricultural practices. The study also explored association conditions in addition to the packaging and difficulties the dairy processing.

The study used the financial and economic for evaluating the financial feasibility of the business plan. Data collected has been analyzed using Statistical Package for Social Science (SPSS.V20).

IV. RESULTS AND DISCUSSION

4.1. Socio demographic characteristics of the sample

The analysis of the study sample reveals that 57.7 % of the interviewees are from Al Majidyya village and 42.3 % was from Al Khanasri village. With respect to the marital status, empirical findings suggest that the percentage of married people was 71%, which is the highest and the percentage of widows and unmarried was equal at 14.3%. Regarding to the distribution of the ages of the study sample in table (1), the highest percentage was 61.6 % for the average age between 31-50 followed by the age rate between (51-60) with a rate of 19.2 % and the lowest for the average age (higher than 60) which was 3.8%. The distribution of the educational level of the study sample indicates that the highest percentage was those with a secondary education by 46.2 %, followed by the percentage of 19.2 % of primary education, then 15.4 % was illiterate.

With regard to family numbers characteristics, empirical findings shows that the highest number of family members in the study sample is 57.7% of the group whose number ranges from (5-8) individuals, followed by the group that includes from (1-4) individuals at 30.8 % and the lowest is the group that includes (9-12) individuals with a percentage of 11.5 %.

4.2. Association and professional organizations

The analysis of the survey indicates the existing of 28 agricultural cooperative societies in Al Mafraq Governorate. In this study, three associations, formally manufacture and sell milk products, have been included in the study process: Two in Al Khanasri and one is in Al Majidyya region:

- Al Majidyya: Al Mataba Charitable Association
- Al Khanasri:
    - Al Rahma Association
    - The Twasel Association for Family and Childhood Development

The distribution of participants in associations from the study sample suggest that about 57.7 % of the study sample respondents are from Al Mataba Charitable Association Women, followed by 14.3 % from at Al Rahma Association, 13.6 % from the AL Twasel Association for Family and Childhood Development, 3.6%

of them are from Al Khanasri Women's Solidarity Association and 15.4 % are non-participants in any association.

With regard to the affiliation of participants in the survey with associations, empirical findings indicates that around 53.8 % of the study sample is members of these societies and 30.8 % are participants only in the activities of the associations and 15.4 % are not affiliated and not participating in any association. As for the association's members, they pay membership fees for each association. The subscription fees vary from one association to another. In Al Mataba Charitable Association Women, the subscription is monthly, and the fees are 12 Jordanian Dinars. In Al Rahma Association and Twasel Association for Family and Childhood Development, the fees are for about 5 JD and it is monthly. The assessment of potential funding opportunities for small project in the region, the survey results indicates the lack of funding from either government or from donors to support the small projects in the two regions Al Majidyya and Al khanasri.

An additional analysis to understand the role of associations for the community services and individuals show that most important services provided by the association to the community are training on dairy processing as mentioned by 30.8 %, 7.7 % mentioned the manufacturing and marketing, 7.7 % mentioned that they have had training courses, 3.8% financial services and aid, 3.8% mentioned the marketing services, while 46.2% did not receive any service from the associations. In terms of the most important services provided by the association to individuals, it appears that 15.4 % of respondents mentioned that associations have employed women, 11.5 % said that they get benefit from marketing services, 7.7 % mentioned that they have got training courses (processing and markets) and 7.7 % get financial aid, while 57.2 % of the study sample did not benefit from any service. Indeed, based on the number of beneficiaries of the activities, their rate is 43% of whom 83.3% in dairy processing and 16.7 % in the productive kitchen with respect to the income-generating activities in the association. Regarding to the use of association records, the vast majority, 95.5 % of the participants, use records in the association's business. It includes the work and tasks that they perform, the names of the participants in the courses and accounting matters.

Finally, some suggestions have been outlined by the participants to develop the association. Interviewed respondents suggested that association can have role 20 % in food processing courses, 13.3 % providing markets for selling products, 13.3 % providing transportation, 33.5 % financial support, 13.3 % providing a building for the association and 6.7 % providing basic service (water infrastructure).

4.3. Livestock sector: Flock, milk production, and management practices

Livestock ownership

The study revealed that 61.5 % of the study sample didn't own herds, but they buy milk from the milk seller and 38.5 % of the study sample own herds , 90 % of them own a small number of animals ranging from 8 to 50 heads and 10 % of the study sample own 500 heads. With respect to the number of goats, the study sample indicates that the ownership of the farms is estimated approximately from 3 to 50 goats, the percentage of farmers who have (1-10) goats are 40 %, and the percentage of farmers who have (11-20) goats are 50 %, and the farmers who have (41-50) goats are 10 %, 61.5 % from the study sample didn't own goat. The number of sheep has been also assessed. The findings reveal that most of the study sample does not own sheep by 89.3 %, and 10.7% have small number ranged from (1-16) heads and only one farmer owned 480 head of sheep.

Milk production

The study showed that the amount of milk produced per milking ranges between 5 to 30 kg for most farm animals, The average number of mother goats was 14 and the average amount of milk was 11 kg /milking, the average amount of milking 0.74 kg /goat, the average milking time 10 /week (7-14) days and the average milking time 163/season (the season is from 3-4 months (90-240) days). The study showed also that the amount of milk produced per milking ranges between 10 to 12 kg for most of the farm animals, the average number of mother sheep 7 and the average amount of milk 11 kg /milking. The average amount of milking 1.29 kg /sheep, the average milking time 11 /week (7-14) and the average milking time 210 /season (2-3) months, (90-240) days.

Mechanisms for establishing dairy farm

The assessment the mechanisms for establishing a dairy farm has been also undertaken. The results displayed in table 1 revealed that 57.7 % of the study sample do not own farm animals and they buy milk from the milk seller .Only 42.3 % of the study sample own farm animals, divided as follows: 30.8 % of the study sample set up the farm themselves, 7.7 % had a fund from donor and 3.8% borrowed from non-governmental institutions (NGOs).

Table 1. Ways to creation of dairy farm

Dairy farm creation way	Frequency	Percentage %
Credit by NGOs	1	3.8
Bought it	8	30.8
Fund from donor	2	7.7
Don't own herds (buy the milk)	15	57.7
Total	28	100

Source: Project team elaboration based on field survey (2020).

Dairy farming management

With regard to the ownership and management of the dairy farms, the empirical findings presented in table 2 show that 57.7 % of the respondent doesn't have animals and 39.4% own farm animals and they are, distributed as follows: 17.9% of the farm animals belong to the husband's, and 7.1% of the husbands manage them. Only 3.6% of the wife owns herds, and 7.1% of the wives do manage the farm animals. 10.6% of the animals are owned by the husband and wife together, and7.1% husbands and wives run the farm, 3.6% are owned by children, 3.6% are owned by the daughters, and 3.6% are owned by father, with an equal percentage in management, which is 3.6% for each (Table 2). It is worth to indicate that 42.9% of the study sample interviewees works individually when manufacturing milk and 57.1% of them work together when manufacturing milk.

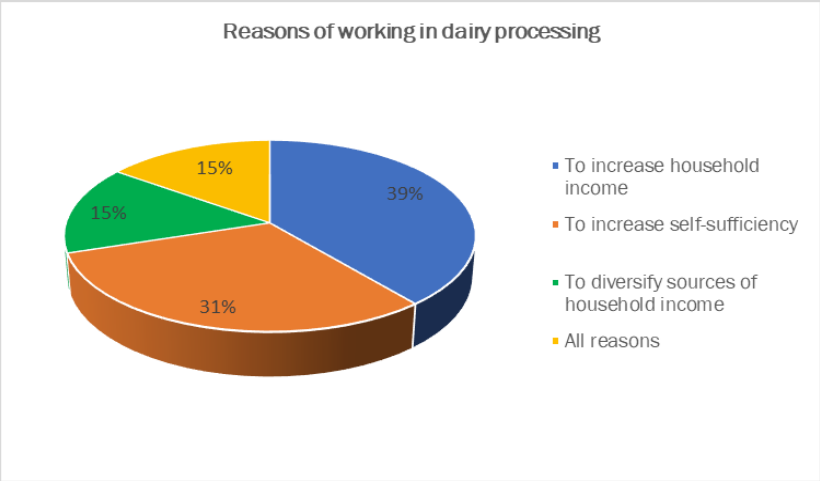
Table 2. Family members contribution to the management of dairy farm

Family Member	Owner ship of the farm (%)	Management of the farm (%)
Husbands	17.9%	7.10%
Wife	3.60%	7.10%
Husbands and wife	10.60%	7.10%
Children	3.60%	3.60%
Daughters	3.60%	3.60%
Relatives	-	3.60%
A farm worker	-	7.10%
Total	39.40%	39.20%

Source: Project team elaboration based on field survey (2020).

By assessing the reasons behind for working in dairy processing, the study shows that 39 % of the sample work in order to achieve self-sufficiency, 30.8 % work to increase income, 15 % work to diversify sources of income, and 15% work to achieve all the previous reasons (Figure 1).

Figure 1. Reasons of working in dairy processing



Source: Project team elaboration based on field survey (2020).

Labor and family labor in dairy farming management

In terms of contribution to labor in dairy farming management, the study showed that 89.3% of the workers did not rent labor while 10.7% do rent labor. The distribution of the work between of the same family was as follows: The men participate with 36.4% in feeding while the women participate 27.3% in feeding the flock. 9.1% of the sample was workers, 18.2% children (sons) and 9.1% was brother-in-law.

Table 3. Family labor share in dairy farming management

Dairy farming activity	Men (%)	Women (%)	Hired labor (%)	Children (sons) (%)	Brother-in-Law %
Feeding	36.4	27.3	9.1	18.2	9.1
Drinking	30	30	10	20	10
Milking	20	70	10	-	-
Cleaning	9.1	63.6	9.1	18.2	-
Dipping	12.5	75	12.5	-	-
Marketing	33.3	66.7	-	-	-

Source: Project team elaboration based on field survey (2020).

Grazing and animal feed practices

The analysis of grazing and feeding management practices indicates that 16.7% of the study sample carried out free grazing in pastures for a period of 4 months,16.7% mentioned that grazing period was 5 months and 16.7 % grazing was for a period of 6 months. While 49.9% of the study sample mentioned that the grazing period was only 8 months in the pastures. With regards to grazing on public lands, the study shows 66.7% was grazing on public lands all over the year and 33.3% was grazing for a period 5 months. Finally, the analysis of the feed type used for the livestock, reveal that 28% of the study sample use concentrated feed to feed their herds which is the highest percentage, followed by 20% of the study sample was using barley and bread in the same percentage and followed by 12% of the study sample who use straw and bran in the same percentage to feed their herds, while 8% use grass.

Milk production and constraints

The number of times milking vary between the seasons. About 63.6% of respondents mentioned that they milk animals twice a day and 36.4% mentioned that they are milking once daily. The average milk yield in the high season is 12 kg per day. Whereas, in low season the average milk yield is about 5 kg of milk per day. The survey results show that largest percentage of the interviewees (90 %) do not mix morning and evening milk, and only (10%) mix milk morning and evening milk before the manufacturing process. With regards to their future intension on increasing milk production, results indicate that 63.6% plan to increase milk production and 36.4% do not plan for any increase in the production because they face a problem in marketing.

Indeed, the farmers planning to increase milk production provide three options outlined in the table below (Table 4). From this table, around 41.8% of farmers plan to regenerate flock every four years (old, type), 16.6% plan to produce more feed and 41.6 % plan to buy more feed.

Table 4. Options on how farmers plan to increase milk production

Options to increase milk production	Percentage (%)
Regenerate flock every four years (old, type)	41.8
Produce more feed	16.6
Buy more feed	41.6

Source: Project team elaboration based on field survey (2020).

Therefore, farmers are facing several difficulties in production and dairy processing. The empirical findings indicated that 64.3% of farmers does not face any difficulties in dairy processing, and 35.7% faces difficulties in production. The following table (Table 5) shows difficulties facing farmers in the dairy processing such as the high price of animal feed as mentioned by 40%, lack of fodder, low milk production and high cost of concentrated feed are mentioned by 20% each.

Table 5. Type of difficulties facing farmers in dairy processing

Item	Percentage (%)
Lack of fodder	20.0
High cost of concentrated feed	20.0
Low milk production	20.0
High price of animal feed in general	40.0

Source: Project team elaboration based on field survey (2020).

Milk production and hygiene

The hygiene factor has been also considered in this study. For cleaning hands before milking, about 91.7% of the study sample mentioned that they clean hands before milking, and 8.3%, of the sample do milking without cleaning their hands before milking. With regards to cleaning of milking tools, the findings show that all interviewed farmers clean the milking equipment before milking.

Livestock wealth and vaccination

The vaccination of the livestock herd is considering very important by the farmers. In fact, about 91% have vaccinated their animals for the following diseases: Brucellosis (37.5%), Enterotoxaemia (50%), Pregnancy intoxication (12.5%), and only 9% do not provide vaccine to animals. With respect to the veterinary services, the study showed that 9.1% of the study sample has governmental veterinary services, 81.8% bring a private veterinarian, and 9.1% do not have veterinary services. The study also indicated that 81.8% of the study sample was satisfied with the veterinary services and 18.2% were completely dissatisfied for any suggestions on how to increase the effectiveness of the services. When assessing the vaccination price, the findings reveal that 90% of the study sample pays the price of vaccination. 50% of them pay for vaccination about 6-7 JD, while 50% of them pay about 30 JD.

Animal diseases and causes of death

The study indicated that the majority of the veterinarian provides treatment to their animals in the event of illness, at a rate of 63.6%, 27.3% of the farmers provide treatment themselves for their animals, and a rate of 9.1% provides treatment by the farmer in cooperation with the veterinarian. In addition, the study showed that 90.9% of the study sample have death of animals on their farm, which occurred in the past year and 9.1%, mentioned that were no deaths of animals in the farm. The interviewed farmers reported that major causes of death are diseases (66.7%), cold and frost (11.1%), and by both diseases and frost (22.2%).

Extension services

As for extension services in the region, 25% of them obtained extension services from non-governmental organizations, 15% from the government, 5% from both governmental and non-governmental

organizations, and 55% do not have any extension services. It is noted that all the study samples do not have an extension guideline (i.e., documented reference) in the area.

4.4. Dairy processing

4.4.1. General overview on dairy processing

The amount of processed milk during the production season was (2-5) month, which varies from one farmer to another according to the purposes of the manufacturing. In fact, if the milk production is from the same farm (home consumption), survey results shows that farmer who has a herd of goats between 12-20, the average number of mothers was 15 and the range of milk production was (1200-1350) with average of 1250 kg during the season, this quantity of milk was used for home consumption only. If the farmers haven't flock and buy milk for home consumption only, the average amount of milk was 128.75 kg during the production season. Finally, If the farmer has a herd of sheep and goat, the quantity of milk products for home processing and for sale, the survey results shows that the farmer who owns a herd was between 8-20, the average milk production was1300 kg during the season, while the farmer who has herd between 25-50 heads, the average milk production was 2400 during the season.

With respect to the diary processing and marketing of processed dairy products, findings from the survey shows that 57% of farmers have quantity of milk ranges between (1000-3000) kg, having flock and do milk processing and sell it, while 43% of farmers mentioned that the range quantity of milk was between 3000 and 4000 kg. From another hand, if the farmer buys milk for processing and selling, the average quantities of milk differ from one farmer to another, so there are those who buy in large quantities and those who buy in smaller quantities. The range of the milk quantity bought was between 300 kg to 5000 kg with an average 2219 kg.

4.4.2. Dairy processing products

Jameed

Jameed is a form of dried and cooked dairy products. Hard balls of dried and salted yogurt (usually made of goat's milk), obviously from the process of making *Jameed*, it can keep for ages since it is dried and super salted. Usually buy *Jameed* balls, crush them into chunks, and store them in a zip lock bag and freeze, or you can let them harden and dry. The average sold quantities of *Jameed* varies from one farmer to another according to the manufactured quantities, and there are those who manufacture in small quantities and they are the highest percentage, and some of them manufacture in large quantities. The empirical findings from the survey shows that the jammed sold quantities are ranging from 30 kg to 350 kg with an average 100.9 kg. The average price of *Jameed* ranges between 6 and 11 JD for one kg with an average of 8.5 JD depending on the quality of the product and according to the beginning or end of the season.

White cheese

White cheese is one of the types of Arabic cheeses, white cheese is prepared from sheep or goat milk, white cheese is prepared by boiling the milk, then cooling it, curdling it, filtering it and pressing it with something heavy, and cutting and salting it to store the longest period. the quantities of cheese manufactured by farmers for domestic consumption and selling which range from 3 kg to 400 kg with an average of 90.2 kg. The average of the quantities sold of cheese varies from one farmer to another according to the manufactured quantities. The survey results suggest a range between 13 and 320 kg of white cheese sols with an average of 99.6 kg. The price of cheese ranges between 4 and 5 JD for one kg of white cheese, depending on the quality of the product and according to the beginning or end of the season.

Butter

Butter is the fatty substance that is found in milk, and it is produced by shaking the fermented milk or fermented cream and placing it in special containers during the shaking process. Softer, then salted until it tastes acceptable and palatable, and the butter is made of 78% fat, while the rest of its components are proteins, a few mineral salts, and a small percentage of water. The quantities of butter manufactured by farmers for domestic consumption and selling range from one kg to 120 kg with an average of 24.3 kg. The average sold quantities of butter varies from one farmer to another according to the manufactured quantities; result showed that the quantities of butter are ranged from 2 kg to 110 kg with an average 36

kg. The average price of butter was 5 JD for one kg of butter, depending on the quality of the product and according to the beginning or end of the season.

Ghee

Ghee is made from butter, clarified butter, but more fat is concentrated in the *Ghee* than butter, as the water and solids from the milk are removed from it and spices are added to gain a distinct taste (Gibson, 2018) . the quantities of manufactured *Ghee* by farmers for domestic consumption and selling. Results showed that the quantities of *Ghee* ranged between 2 kg to 100 kg with an average of 25.5 kg. The average of the quantities sold of *Ghee* varies from one farmer to another according to the manufactured quantities; results showed that the quantities of *Ghee* range between 5 and 100 kg with an average of 30.4 kg. The average price of *Ghee* ranges between 9 and 10 JD for one kg of *Ghee*, depending on the quality of the product and according to the beginning or end of the season and area of sale.

Labneh

Rolled *labneh* balls are considered food storage for every home, they are prepared from goat yogurt, add salt to it and put it in a fiber bag until all the water is removed and then formed into circles and kept in olive oil. The quantities of manufactured labneh by farmers for domestic consumption and selling ranged between 5 and 200 kg with an average of 69.8 kg. The quantities of labneh manufactured by farmers for domestic consumption only, it ranged between 6-45 kg with an average of 16.6 Kg. The average sold quantities of *labneh* varies from one farmer to another according to the manufactured quantities; result showed that the quantities of *labneh* sold range between 15-200 kg with an average of 97.5 kg. The average price of *labneh* ranges between 2 and 5 JD for one kg of *labneh*, with an average of 4.2 JD depending on the quality of the product and according to the beginning or end of the season and the selling area.

Buttermilk

Buttermilk also known as mattha or *chaas* or *chaach*, is refreshing milk based natural drink. It is an easy to use low-calorie drink that refreshes immediately with the goodness of nature. It is usually taken along with the meal in most parts of the country. Traditionally, buttermilk was the liquid left behind after churning cream during production of butter. Alternatively, it can also be prepared during the pre-stratification process and comes in the bottom most layers. The buttermilk which is now available in the market is prepared from milk that has been pasteurized and homogenized and then inoculated with lactic acid bacteria (LAB). The traditional butter milk is less viscous compared to the cultured buttermilk. (Gandhi and Kumar, 2018). The total production quantities of buttermilk which range between 20 to 2400 kg with an average of 491.2 kg. The average quantities of buttermilk by farmers for domestic consumption only, range between 5 kg to 120 kg with an average of 41.4 kg. The average sold quantities sold of buttermilk varies from one farmer to another according to the manufactured quantities. Survey results showed that the quantities of buttermilk range between 40 kg to 2400 kg with an average of 853 kg. The average price of buttermilk ranges between 0.50 and 1.00 JD for one kg of buttermilk, with an average of 0.6 JD depending on the quality of the product and according to the beginning or end of the season and area of selling.

4.4.3. Methods of manufacturing of milk products

Number of manufacturing during the season: The number of manufacturing times weekly from one to seven with an average of 3.6 times the number of manufacturing times was monthly from one to 30 times with an average of 14.7 times.

Methods of cleaning equipment used in manufacturing in Al Majidyya village: For cleaning equipment, women use scrub sponge (silk), liquid for washing, chlorine, vinegar and lemon, and water.

The mechanism for milk processing: The study showed that the percentage of women who pasteurized milk was 46.4%, and the percentage of women who was boiling milk 53.6%, and the percentage of study samples are used thermometer to measured temperature 32.1% and the rest of the sample are not used thermometer.

Steps of manufacturing *Jameed*: There are two steps to manufacture *Jameed*

- Step 1: The churned milk that we took out of the agitator is boiled and heated without setting a specific temperature. It is cooled and packed in bags like yogurt.

- Step 2: Salt is added without setting a specific according to the amount, and it forms like balls and they left under the sun until water evaporates and loses water until cracks appear on it.

After an implemented training on development and upgrade on methods of manufacture mik for different dairy products (*Jameed*, *Ghee*, *Labnah*, etc.), some changes have been noted in the manufacturing of the *Jameed* and other dairy products. Such changes in the *Jameed* are as follows:

- The churned milk that we took out of the agitator is boiled and heated at a temperature of 55°C for a period of minutes, it is cooled and packed in bags like yogurt.
- About 5% salt is added to it, and it forms like balls and they left under the sun until water evaporates and loses water until cracks appear on it.

Steps of manufacturing *Ghee*: The manufacture of Ghee goes through two steps

- Step 1: Boiling the butter.
- Step 2: Take butter and put bread or ground wheat to absorb the remnants of the milk after putting the spices for ghee (*hawaja*) and let it boil and remove the impurities that appear on the surface.

It was noted that no changes have been noted after implementing the mentioned training in the manufacture of *Ghee*.

Participation in the training courses: The study revealed that 64.3% of the study sample participated in the previous manufacturing training course and 35.7% of the sample participated in this session for the first time. The study indicated that 32.1% of the study sample changed the manufacturing steps after attending the training courses about the milk processing from the National Center for Agricultural Research and ICARDA, and 67.9 % did not change the manufacturing steps .The study also indicated that the previous training course added knowledge, experience and interest to the majority of the study sample and is estimated at 53.6%.The remaining percentage (46.4%) mentored that the training course did not add more experience to them .

The purpose of manufacturing: 46.4% of the study sample was manufacturing milk for home consumption and selling, 28.6% of them were manufacturing milk for the purposes of selling and improving their income while 25% of them were manufacturing milk for home consumption only

Methods used for storage:

- Putting *Jameed* in a cloth bag in a dry, sunny place.
- *Ghee* is stored in glass containers, plastic or iron in a shady and dry place.

Amount of milk for manufacturing: The analysis of the survey shows that the amount of 10 kg of milk yields 9.5Kg of *Jameed* and 0.5 Kg of ghee, 1 kg Yogurt and 4.625 kg Cheese.

4.4.4. Costs and benefits of dairy processing products

In this section, we examine the economic feasibility of dairy processing facilities for *Jameed*, white cheese, and *Shanina*. Fixed and variable costs, and net profits calculations displayed in table 6 indicate that *Jameed* and *Shaninah* processing products offer the most profitable prospects. A smaller dairy processing plant would have insufficient returns to cover the cost of capital, and fluid milk processing at either scale is economically infeasible (Becker et al. 2007). Economic success in processing is greatly contingent upon individual business, financial management, and marketing skills.

These findings suggest to focus on *Jameed* gives the highest net return and it has long shelf life so this study recommend to enhance the awareness regard producing this product as it gives good return and can be exported to other countries benefitting from the geographical indicator.

Table 6. Costs and benefits for dairy processing products

No	Items	Milk	*Jameed*	White cheese	*Shanina* (buttered milk)
	purchase (or sales) price (JD/100kg)	100			
1	Average amount of fresh 100 kg milk needed to produce (kg)	100	10	21.62	150
2	Gas	0	0.1	0.1	0.1
3	White fabric	0	3	3	0
4	Balance of weight	0	1	1	1
5	Salt	0	0.75	0.3	0.15
6	Milk shaking machine	0	8.2	0	8.2
7	Pot	0	4	2.34	0
8	Enzyme ranen	0	0	0.4	0
9	Cheese piston	0	0	0.2	0
10	Cheese template	0	0	0.2	
11	Water	0	0	0	5
12	Milk cost /kg	0.7	70	70	70
13	**Total fixed costs**		**87.05**	**77.54**	**84.45**
14	Number of labor hours spent to process milk	0	6.5	6	6
15	Wage rate JD /hr	0	2	2	2
16	Cost of labor	0	13	12	12
17	Packaging	0	1.16	1.6	1.16
18	**Total variable costs**	**0**	**14.16**	**13.6**	**13.16**
19	**Total costs**		**101.21**	**91.14**	**97.61**
20	Butter by product	0	5.9	0	5.9
21	Selling price JD /kg main product	0	10	5	0.6
22	Selling price JD /kg byproduct	0	5	0	5
23	Asset residual value	0	1.3	0	1.3
24	Total return main product	0	100	108.1	90
25	Total return by product		29.5	0	29.5
26	Total return	0	130.8	108.1	120.8
27	**Net profit (JD)**		**29.59**	**16.96**	**23.19**

Source: Project team elaboration based on field survey (2020).

4.4.5. Packaging, storing, and selling of dairy processing products

The packaging and storing of the dairy processing products vary between these products:

- ***Jameed*** is placed in burlap or plastic bags, where the price package ranges between (0.25-1.75 JD) with an average 1.16JD the price is usually related to the volume is which between (1-35 Kg) with an average of (10.50) most of the farmers fill manually without using machines or hiring manpower and thus there is no cost for packaging and there is no logo for the associations that produce *Jameed*.

- ***Ghee*** is placed in glass or plastic containers, and for large sizes they use metal cans. The price of package ranges between (0.60-1.0 JD) with an average of (0.80 JD). The price is usually related to the volume which between (1-5 Kg) with an average of (3.0). Most of the farmers fill manually

without using machines or hiring manpower and thus there is no cost for packaging and there is no logo for the associations that produce ghee.

- ***Cheese*** is placed in glass or plastic containers, and for large sizes they use metal cans the price package ranges between (0.40-1.0 JD) with an average of (0.80). The price is usually related to the volumes which between (1-4 Kg) with an average of (2.5 Kg).Most of the farmers fill manually without using machines or hiring manpower and thus there is no cost for packaging and there is no logo for the associations that make cheese.

The analysis show that some problems are facing farmers during selling products. About 36.4%of the study sample, face difficulties in selling their products and 63.6 % of the study sample did not face any problem in selling products. Around 62.5%of them mentioned that there is no market and of them complained from the low price 37.5 %. Another important element was mentioned which is linked to the payment commitment dates during the season. About 50% of the study sample mentioned that they get money in lately for the dairy products and the rest of the study sample get their money. In fact, there is no delay in payment as the sale price is paid directly to 83% people from the sample, only 17% people payment for them is delayed. Finally, most of the samples emphasized on the importance of improving animal nutrition to improve milk quality in addition to storing it properly.

4.5. Problems and potential solutions for dairy processing

The findings from the survey on the existing obstacles encountered during milk production, manufacturing, and marketing of dairy production thus the suggested solutions to overcome these challenges by the farmers and the ICARDA- Jordanian NARC teams are outlined in the table below (Table 7).

Table 7. Matrix on problems and practical solutions for dairy processing in the agro-pastoral farming systems

Problems	Farmers' Proposed Solutions	ICARDA-NARC Team Proposed Solutions
Milk Production		
Not availability of milk at all times (low season)	They didn't mention any solutions	Creation of collecting center for milk collection, storing and transportation
Animal diseases	Treating animals from diseases (vaccinations)	Enhance veterinary services though a milk-producers established cooperatives
Milk conglomerate	They didn't mention any solutions	Supporting farmers to create milk-producers cooperatives
The price of milk is high	They didn't mention any solutions	Supporting farmers to create milk-producers cooperative to reduce the transaction costs
Manufacturing of Dairy Products		
Cheese redness	They didn't mention any solutions	Provide technical and trainings to farmers on dairy processing techniques
Increased acidity of the milk upon sedimentation	They didn't mention any solutions	Providing technical trainings on dairy processing techniques
Marketing of Dairy Products		
The market is far from the farm place	Find marketing	Farmers to act collectively in the marketing of their products (through milk cooperatives)
High transportation cost	Providing transportation	Supporting farmers to create milk-producers cooperative to reduce the transportation costs
Rising prices	They didn't mention any solutions	Supporting farmers to create milk-producers cooperative to act collectively in controlling and fixing inputs and outputs prices

Lack of licenses	They didn't mention any solutions	Government support to provide licenses to milk producers through development of milk producers cooperatives/farmers groups

Source: Project team elaboration based on field survey (2020).

V. CONCLUDING REMARKS AND IMPLICATIONS

Despite, the large animal wealth in Jordan, yet the agro-pastoral communities are still suffering from milk production and consumption gap. In addition, livestock numbers are declining in the agro-pastoral regions due to the lack of pastures, land degradation and the lack of veterinary services. The objective of the study is to develop an economic feasibility study of on-farm sheep and goat milk processing, packaging, and marketing through an inclusive business model and modalities plan to encourage these householders to contribute and benefit from the dairy sector value chain, and to help formulate government policy recommendations for improving dairy production in the dry land communities in Jordanian *Badia*. in this study we are mainly providing an economic and financial analysis for dairy processing business model as a response to food and nutrition insecurity for agropastoral communities. It emphasizes the role of small business projects (i.e., women) at household level, non-donor dependent tool for improving the health, food and nutrition security, and livelihoods of agropastoral communities and their families.

Two communities have been selected to implement this study: Al Khanasri (Mafraq Governorate) and Al Majidyyah (Amman Governorate). Focus groups were carried out in each of the two communities to collect detailed information about dairy processing and marketing practices, problems, options, risks, and priorities, supply chain, and patterns of supply and demand, collect information for describing the marketing channels, for identifying the different market actors and their roles in the dairy value chain, and the volume and pattern of demand and supply for each dairy product. A socio-economic questionnaire was designed to elicit basic numerical data on animal wealth, manufacturing production dairy processing, marketing livestock products, source of fodder and animal feed. Study sample has 26 respondents distributed: 15 respondents from Al Majidyyh village and 11 respondents from Al Mafraq Governorate (Al Khanasri village) for the purpose of collecting information at the household level with the aim of conducting a study related to dairy production issues in *Badia* communities in Jordan,

Results showed that livestock numbers are declining in Al Majidyya due to the lack of pastures, land degradation and the lack of veterinary services. It was noted during data collection and entry that the young ladies lack the interest and skills of dairy processing among young people at the household level and it declines among older women. Women contributes in all livestock activities, especially milkmaid, and in spite of her knowledge of these activities, but she is still working in traditional system and there are no skills or understanding of the importance of new technologies that are directly related to the increase of production. The study found that manual milking was the only method used to extract milk from livestock and the vast majority of milk is reserved for processing rather than consumption. *Jameed*, *ghee*, and *labaneh* are the main dairy products produced, and the bulk of the work is undertaken by women. The product "*Jameed*" is the most common product in the area, and improvement of the quality and quantity is possible.

The following recommendations are suggested for improvement of the situation of milk production process in the agro-pastoral farming systems:

- There should be an interest in the manufacturing of dairy products to have milk product which comply with standards; there can be no food security without food safety.
- Activate the role of agricultural extension in dairy processing and veterinary services.
- Women need more training to enhance the quality of the products.
- Women in Al Majidyya should find a source for buying milk in low prices.
- Women should try to have a certificate of their products to market and sell for internal and external markets.
- Enhancing the awareness regard producing Jameed as it gives good return and can be exported to other countries benefitting from the geographical indicator.

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Personal information including Name, Business Title, Email, Phones, Images and GPS points included in this report have been authorized in writing or verbally by the data subject.

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