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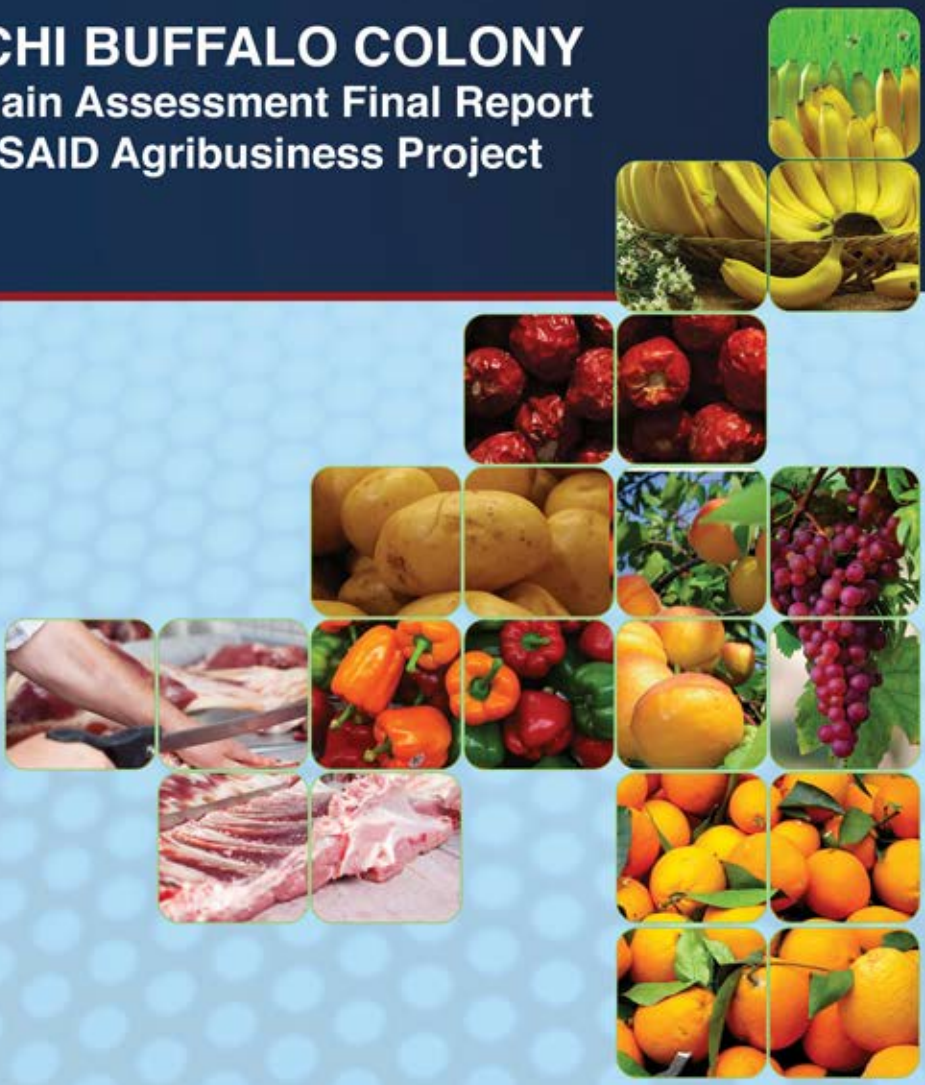
KARACHI BUFFALO COLONY

Value Chain Assessment Final Report for the USAID Agribusiness Project



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Meat- Value Chain Competitiveness Assessment

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This manual is a live document which can be changed/updated as the project progresses. Any suggestions for further improvement are most welcome.

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FOREWORD

A series of Training manuals , Guide Books and Reports have been developed by The Agribusiness Project (TAP) to facilitate the capacity building of farmers involved in TAP's targeted value chains, thereby enabling them to make the requisite transformation from 'subsistence farming' to 'farming as a business enterprise'. The Agribusiness Project is funded by USAID|Pakistan, with the overall goal of supporting improved conditions for broad-based economic growth, enhance profitability and employment opportunities and contributing to poverty alleviation through product and process transformation of selected value chains in horticulture and livestock sub-sectors." The strategy of TAP focuses on:

1. strengthening capacities in horticultural and livestock value chains to increase sales to domestic and foreign markets;

2. strengthening the capacity of smallholders (through farmer enterprise groups-FEGs), individual farmers and agribusinesses to operate effectively and efficiently; and,

3. increasing productivity and profitability through adoption of new techniques and technological innovations (among farmers, agribusinesses and business development services providers).

Through TAP, farmers have been organized as Farmer Enterprise Groups (FEGs) for cultivating the benefits of scale, through optimized production and marketing, and serving as a vehicle for transferring of the benefits of TAP interventions to its stakeholders - the farmers. TAP is providing active support to the FEGs and farmers for improving small producers' positioning in a value chain through support in incorporating producers and their product into stable, profitable market channels, and provision of necessary services and assistance in business development, planning and marketing through inter-linkages. This requires intensive capacity building of the stakeholders placing capacity building at the heart of all interventions.

This report/Manual can be used by anyone involved with the production, cultivation, harvesting and enterprise development training of and for farmers/farmer business groups. The contents have been finalized with the consultation of stakeholders engaged with the value chains.

While these Reports/Manuals/Guide Books are project specific and for a farmer audience, they can also be used for the capacity building of government and non-government agency representatives, processors and exporters who are involved in implementing production/cultivation, enterprise development and value chain programs, through the communities. Finally, I want to thank USAID|Pakistan for funding The Agribusiness Project under which this intellectual capital has been prepared. I would also like to thank ASF for successfully implementing these manuals/guide books across Pakistan for the benefits accrued to the farmers.

Shad Muhammad
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THE AGRIBUSINESS SUPPORT FUND

ASF is a 'not-for-profit' company registered under Section 42 of the Companies' Ordinance 1984 with Securities & Exchange Commission of Pakistan (SECP). ASF has extensive experience in strengthening and supporting demand-driven private sector service delivery mechanisms throughout the agribusiness value chain this includes supply inputs, production and export markets ASF aims to achieve this objective by mobilizing angel investment grant provision and technical assistance support of farmer and agribusiness enterprises. The company supports start-ups as well as existing enterprises, enabling them to employ modern technique and practices and build expertise and markets understanding required by a fast-changing economic environment and to improve their productivity, profitability, competitiveness and creditworthiness

THE AGRIBUSINESS PROJECT

The Agribusiness Project is an initiative of the United States Agency for International Development (USAID) and the Agribusiness Support Fund (ASF) Pakistan .the project aims at enhancing competitiveness of agricultural value chains in Pakistan, with a focus on Horticulture and Livestock including dairy, meat and fisheries. The objective of The Agricultural Project is to support and create improved conditions for poverty alleviation. Since Pakistan's economy is agrarian in nature, The Agribusiness Project aims to invest in interventions at the primary, secondary and tertiary levels of production. Under the International Market Access Program (IMAP), the project supports the creations of linkages between exporters and importers. The objective is to facilitate market access and enable trading linkages which translates into agribusiness through trade.

LIST OF ACRONYMS

ASF	AGRIBUSINESS SUPPORT FUND
EU	EUROPEAN UNION
FAO	FOOD AND AGRICULTURAL ORGANISATION
FMD	FOOT AND MOUTH DISEASE {USA HOOF AND MOUTH DISEASE}
HS	HAEMORHAGIC SEPTICAEMIA
KDFA	KARACHI DAIRY FARMERS ASSOCIATION
TB	TUBERCULOSIS
UHT	ULTRA HIGH TEMPERATURE
UK	UNITED KINGDOM
USA	UNITED STATES OF AMERICA
USAID	UNITED STATES AGENCY FOR INTERNATONAL DEVELOPMENT
USDA	UNITED STATES DEPARTMENT OF AGRICULTURE

GLOSSARY OF TERMS

BHAINS	WATER BUFFALO BUBALUS BUBALIS
BHOOSA	CHOPPED WHEAT STRAW
DODHI	THE MIDDLE MEN/MILK DEALERS IN THE MILK MARKETING CHAIN
PEKKARS	THE MIDDLE MEN/MILK DEALERS IN THE MILK MARKETING CHAIN

EXECUTIVE SUMMARY

In short the new English word: OMNISHAMBLES sums up the situation in the colony completely. One impediment to the preparation of this report was the short time permitted to visit the colony due to the deteriorating security situation in Karachi during the holy month of Muharram. Only two half-day visits were possible. The colony is usually referred to as a Cattle Colony even though 90% of the milking livestock are buffalo; (Babulus bubalis). Conditions for humans and livestock are appalling. The area is filthy, overcrowded, fetid and nasty. The colony has grown since its recognition in 1957 from 752 acres to 3,000 acres into what can only be described as an environmental disaster and the sooner it is closed the better as it will continue to grow and become even worse until closed.

The level of animal husbandry is very poor, animals are chained all day except for twice a day watering, they are forcibly milked out using chemical injections, there is no cooling system for water buffaloes which need to shed heat, feed is low quality, diseases are rife and at the end of ten months of this the great majority are slaughtered. The daily 7,200 tons of manure produced is disposed of by liquefying of the faeces and then washed down the streets to a river and out to Korangi creek leading to the sea. The shore is deep in manure, village ponds are dilute manure, the wells taste of manure (I am told), in fact, the whole place smells of manure.

Animals are brought from Sindh and Punjab to the colony; they bring in whatever diseases are present on the farm. There is no quarantine so the colony has become a hot-bed of all the diseases of Pakistan, FMD is endemic and HS the main killer, mortality is 4% at the lowest estimate. Milk from the colony is sold in Karachi city and is watered down before retail sale. Other additives are used some of which are less than healthful and in other societies would not be tolerated. The hygiene standards are poor to very poor and utensil cleaning is at best perfunctory which reduces milk shelf life.

The animal husbandry applied in the colony is virtually non-existent, animals are underfed, rations offered do not balance the milk produced, the long term use of oxytocin destroys the female reproductive system so the animal cannot be recycled and is subsequently slaughtered. There are 50 vets practicing in the colony but even so it is a home to every livestock disease of the country, there are no functioning laboratory facilities and no husbandry advice.

The main and most obvious recommendation is to close the whole expanded colony down. The longer the delay the worse the colony will become, the more farms will be involved, the manure problem will be that much larger and it will get increasingly costly to achieve a closure. A further study has been recommended as to how the closure can be realised. If this closure cannot be accomplished quickly then the next most pressing problem is the manure matter. A study has been recommended to work out how the modalities of clearing this enormous amount of manure out of the category of waste to it becoming an attribute. The study will consider the issue of moving such a vast quantity daily. It is assumed that faeces; in digester tanks producing methane is the way forward and this paper suggests pipeline technology to move the manure from the colony stream to the tanks. Unfortunately there is no ready answer for taking the used waste slurry from the tanks to the agricultural areas of Sindh, dual purpose slurry tankers/sprayers are a possibility.

Those are the two MAJOR recommendations. Other interventions are:-

Short term interventions

- Equipping and staffing a training centre within the colony teaching animal husbandry.
- Establishment of a nutrition laboratory to help with providing a balanced diet to the livestock
- The manufacture and Introduction of stainless steel cans
- Extend the use of showers for buffalo, possibly owned and used communally.
- Establish, equip and staff a veterinary hospital with a high grade diagnostic facility.
- Encourage timely/bulk purchasing of feedstuffs.
- Discourage the use of Diclofenac Sodium, preferable to use Meloxin instead, and to discourage the deleterious use of oxytocin.

Medium term interventions

- Assist a milk processor to install equipment to manufacture mozzarella cheese and to assist him to obtain access to the EU and/or USA markets.
- Assist a dairy equipment manufacturer to produce an affordable milking machine, either for single buffalo females or a buffalo milking parlour which could be community owned.
- Pressure the Government to remove the fixed prices on meat and milk which is holding back the development of the livestock industry.

For long term interventions see above regarding closing the colony and removal of 7,200 tons of manure daily.

The exchange rate in this paper US $ 1 = Pak Rs. 95

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Zahid Anwar, Chairman of Pakistan Agriculture and Dairy Farmers Association ALSO Chairman on the Pakistan Chambers of Commerce & Industry Dairy Committee

MAPS

The Islamic Republic of Pakistan

Figure 1 1.1.Karachi City showing Landhi Buffalo

Pollution from the Colony

Flowing to the Sea

Pollution of the sea is one of numerous reasons for the need to move the colony. Living conditions for the denizens of the colony is quite unpleasant in both sight and smells. Human health matters have not been probed. Animals in the colony are kept under appalling conditions, reduced to low body condition by chemical induction to produce milk and are usually slaughtered at the end of one lactation as their reproductive system has been destroyed. The place is a breeding ground for livestock diseases; mortality is high and FMD endemic.

2. LANDHI BUFFALO COLONY

2.1. INTRODUCTION

2.1.1. LANDHI BUFFALO/CATTLE COLONY

The dairy colony of 752 acres was originally 'established' sometime in 1957 for 500 people on land belonging to the revenue department at that time 32 km from the city. It is occupied by farmers and a population of around 20,000 animals. The first mention of the colony is around 1925 and one assumes it just grew and the recognition and designation as a cattle colony was a matter of regularising the status quo.

The land allocation was initially for 30 years. This has now long expired and ownership could be legally reclaimed by the revenue department and occupiers ejected. This would obviously be politically unacceptable. The original ± 500 beneficiaries of the 752 acres have mostly retired but families have sold their portion; continue to occupy or sublet the area. Some farmers are third generation.

Presently the people number ± 3,000, and land occupied by livestock is nearly 1600 acres. Although an official census has never been fully carried out it is claimed to have a population of 400,000 heads of livestock (90% buffalo and 10% bovine/cattle) in the neighbourhood among up to 3,000 individual farmers (avg. of 133 animals per farm and 250 per acre) all in about 4 km radius. Milk production is estimated to be around 3.2 million litres per day (avg. 8 litres/head). It is believed that there are around 700,000 other milking buffalo within marketing range of Karachi supplying milk to the city. These figures are mainly guesswork but based on a 2006 livestock census. The colony tends to be referred to as a 'Cattle Colony' but as there are only 10% cattle there, and on the map the area is referred to as 'Bhains Colony' preference is for the term 'buffalo colony'.

2.1.2. COLONY DESCRIPTION

The land designated for these livestock is called a colony. In this nominal 752 acre allocation are reputed to be around 15,000 buffalo and cows but could be as high as 20,000. However, the colony is not the only part of Bin Qasim with livestock as the colony is surrounded by other farms with an estimated 400,000 cattle and buffalo. These other areas are usually considered as part of the buffalo colony but are called by different names though many of the owners are members of the Karachi Dairy Farmers Association (KDFA) but are outside the original designated area. These new areas are not legally part of the colony but the keeping of cattle/buffalo has expanded as the city has grown over time. The colony is expanding into new areas mainly to the east and north however most of the new farms are of a better standard than the older ones.

The colony is a series of livestock holdings where animals are tied in standings with little or no exercise other than being released for watering twice per day, within the same land area are the houses of owners plus feed and fodder storage, water tanks and piles of manure. Fortunately there are few zoonosis (diseases transmitted from animals to humans). The main one is tuberculosis (TB) and this can only occur when an animal has TB of the udder and the milk is drunk fresh from the cow. Other TB sites on the animal do not affect the milk. As almost all householders boil the milk on its delivery, TB from milk is seldom a problem but for owners living in the colony who quite possible drink the milk 'raw,' TB could be an issue.

There is one surprising aspect of this colony, despite being the largest in the world and is well known within the international livestock industry there is precious little written about it. There are a few notes on Wikipedia, and other organisations such as World Bank and FAO have some information. I have seen various dates for its establishment, one said 1925 but the rest are between 1957 and 1963. I assume that animals were kept there quite early but only formally recognised as a colony in the late '50s or early '60s. The market for virtually all the milk is, and always has been, Karachi which today has an estimated population of between 20 and 30 million inhabitants. Most of the meat from milked out animals is also consumed in the city.

On Wikipedia there is also a mention of the New Zealand proposal for the installation of a bio-digester located at Landhi to produce electricity for the city.

Located in Bin Qasim Town, a 'district' of Karachi, this 'colony' is not what one expects from contemplating such a place. Bin Qasim is a designated business section of Karachi and the Landhi sector has been designated for livestock keeping. Landhi is approximately one mile from the sea and is a low-lying area; the patch of sea, Korangi Creek, into which the effluent runs, seems to be only slightly tidal and has a screen of mangrove before one can see the open sea. It is in an area of town which is not residential in the true sense of the word but there is a high population density. Most of the population are owners or employed in the colony or the outlying 'farms'. These farms are not what one expects when you think of a 'farm'; here a farm is an area of covered floor space with standings for livestock. Also to be found are owner or staff housing, troughs, water-tanks and feed stores. A 'farm' is in reality a rather congested farm-yard. There is no grazing land or other open land in the area where buffalo can graze, exercise or wallow.

Around the original 752 acres more farmers have settled and the colony now covers some 1,600 acres. Some of these 'areas' are considered to be 'colonies' and named such as Bilal, Surjani, Al-Momin, Nagori and Baldia which is the biggest with around 300,000 head. Currently manure can be seen in heaps along the roadsides overflowing into the road, in any open spaces and piled in the 'farms'. Most of it is 'liquefied' during cleaning out the livestock standings using water that is said to come from boreholes, sunk to 120ft. or so, or from open wells and this water is saline as the site is so close to the sea. This liquefied manure is washed into storm drains from where it travels to the sea via a purpose built channel or concrete sided canal which runs at varying flow rates throughout the 24 hours. This effluent enters the Korangi Creek then the Arabian Sea. The problem of this magnitude can hardly be imagined. The team was informed by the veterinary department that there were 140,000 Cu. metres of raw human waste going into the sea daily too.

Figure 2 A street scene in the colony

Surrounding Karachi there are also said to be around 700,000 more buffalo in the nearby rural areas all supplying fresh milk to the population. Here the manure is of little problem as it is collected by farmers needing fertiliser for crops of vegetables or growing fodder, etc.

There are also many businesses to be found servicing the livestock enterprises; mainly livestock feed suppliers and veterinary pharmacies. There are said to be at least 50 veterinarians operating in the colony, many are employed by "companies" such as the major milk purchasers. When travelling through the colony, vehicles supplying the farms can be seen loaded with sacks of concentrate feed or chopped straw (bhusa), maize stalks etc. Roads are congested by trucks unloading and the many heaps of manure dumped at the roadsides. These dumps are eventually removed by the city council using tractors for loading and taking away.

3. PROS AND CONS OF THE COLONY

Advantages	Disadvantages
3.2 million litres of milk produced daily	Location within the city
1,200 animals slaughtered daily	Short shelf life of milk
7,200 tons of natural fertiliser produced daily	Quality of milk churns/cans
Easy access to veterinary services, livestock replacements & inputs	**Depletion of the National Herd**
Cost effective input supply	**Environmental effect of Manure Disposal to the sea**
Market access in close proximity for produce	Size of the holdings/high stock concentrations
Strong association of farmers	Disease transmission
All at one location	Controlled milk price (national)
	High cost of feeds and fodder
	Apparent minimal/negative profit margins
	Use of Diclofenac sodium is killing off the vultures
	Use of Oxytocin, destroying the elite of Pakistan's animals

4. THE PROPOSED NEW ZEALAND BIO-DIGESTER

The proposed New Zealand bio-digester project for the production of methane from manure to be used as a fuel to produce electricity has not yet started and seems to be a long way from being anything more concrete than a proposal. It would seem to have little chance of approval in its present format; the application has been submitted four times with no success. As it stands, it is far from being an answer to the disposal of the manure and can only be viewed as a pilot project if it is implemented. The management committee members give me the figure of 7,200 tonnes of faecal matter produced per day, which is appropriate for the number of animals; the digester would handle just over 1,000 tonnes of manure and an equal amount of water per filling. However the digester would 'run' for an as-yet-indeterminate number of days, but probably twenty-one, before being emptied and re-filled. The emptying would leave 2,000 tonnes of 'used' slurry (a 50/50 mix of manure and water) to be disposed of as (the project statement) 'high quality fertiliser' which would seem to be an optimistic description.

One bio-digester would be able to handle around 2% of the manure produced in 21 days and the colony would still have around 2, 000 tons of residual waste to be carried away. To handle all the waste perhaps 50 digesters of this size would be required and there is no space for them in the area currently. The team was informed by the city council that 100 acres of land would be made available for a bio-digester 'tank farm' to ferment the manure into methane gas and then into electricity. Unfortunately there would still be the problem of disposing of 14,000 tons of slurry daily, which local people suggest should be washed into the sea.

Figure 2 A street scene in the colony

5. MILK CHAIN

The milk chain for this scheme begins at the farm by twice daily milking. The milking of buffalo is not quite as simple as milking a cow. The natural let-down of milk is controlled by a natural hormone, oxytocin, produced by the hypothalamus. In cattle this is rapid and a cow can be milked out in a few minutes. In buffalo the let-down is much more controlled and does not respond to the usual stimuli of a milking regime, i.e. sight and sound. The buffalo requires having its calf present and under-foot; in good buffalo husbandry, a farmer will have the calf present at foot during milking and usually the calf is given one teat while the owner milks the other three. This compared to cow milking is a relatively slow process and as time is of the essence in Landhi, the milk has to be ready for collection at a certain set time, one man is assigned 12 buffalo to milk in a given short time. However, it is said that after a period of injecting oxytocin into the buffalo at milking time, the buffalo become used to this as part of the milking process and will let down milk if only injected with water, or even just the puncture effect of a needle. This could not be ascertained in the time of the consultancy.

Due to Karachi's temperatures, the milk has to be taken from the buffalo to the consumer within three hours or it goes sour. Therefore the milk HAS to be ready for collection at the set time or is left behind. Milking 12 buffalo is time consuming, much slower than a cow, and to enable one man to get the milk out rapidly, a culture of using oxytocin has grown where every animal receives an injection of 3 ml of the hormone at each milking from the herdsman. This allows rapid extraction and enables the tight schedules to be maintained. The use of oxytocin is banned in the EU and the USA except by a veterinarian or authorised person.

Milk is accumulated in 500 litre open tubs where often ice is added "for cooling" and then transferred into 37.5 litre (40kg) galvanized steel cans which are immediately tightly capped. Within 2 hours of the end of milking, all 40 kg cans are picked up by a network of pickup trucks twice daily. The "pekkars" or middlemen are usually also milk hauliers (around 300 in Landhi Cattle Colony) who deliver to an organized establishment of milk collection which is owned by a master distributor (sometimes referred to as a 'company'). The milk is then delivered via the cans to households and multiple milk selling stores throughout the entire city of Karachi and its surroundings all within the first 3 hours of milking. Pekkars negotiate the form of payment with farmers who sell their milk in advance. They maintain a constant payment schedule as agreed between them. Within 5 to 6 hours, all cans are returned to all farmers by a return visit by the pekkar. All cans are washed prior to the second daily milking and the same process is repeated a second time during the afternoon milking. The milk is normally presold for a month or even up to a year to a pekkar so the farmer is tied into a contract.

The metal used to make the cans is far from perfect and tends to rust. This adds to the speed of acidification of the milk and going 'bad'. Stainless steel cans would be preferable; the actual shape of the can does not lead to easy cleaning so residual sour milk also speeds up the souring process.

Some milk in Karachi is imported for the upper end of the market, some from as far away as THE USA but amounts are small. Karachi does not have any large commercial dairies and reports from locals say that 98% of the milk is sold door to door or to milk shops in the city. There is little processing of local milk, and all butter and cheeses are brought in. The population of Karachi prefers a fresh milk delivery. Buffalo milk is also much more popular than bovine (cows) milk for its high butterfat, sweet taste and whiteness. Pasteurised or homogenised milk is not greatly appreciated.

6. LIVESTOCK MANAGEMENT

Feeding procedures of the animals in these colonies is carried out in a structured, common manner among all farmers. Cows are tied all day with chopped wheat straw available 24/7 and let loose for a specific time period to drink water twice daily. On an average, the daily ration of feed to the buffalos and cows used for meat and milk production is approximately 8 kg per day (in two daily portions) and can include cottonseed cake, wheat bran, rice shell, broken rice, bakery waste (old/hard bread residue) molasses, bean mix, mustard oil, sunflower meal, minerals & vitamins; 8 kg daily of greens-usually maize, alfalfa or sorghum; and 7 kg of wheat straw. The above 'ration' cannot be verified and was not observed. This gives a total of 23 kg of dry food intake per animal in addition to perhaps 30/40 litres of water. There is no mention of urea/molasses feeding which enhances wheat straw. Also no mention is made of feeding according to milk production.

Livestock management is not good, reported food rations per head is inadequate for full production from a buffalo. The livestock in the colony comprise estimated, 90% buffalo and 10% bovine (cattle). It is reported that a few farmers have now introduced automatic water bowls which supply water 24 hours per day to the tied animal. The animals drink non-saline water supplied by the city council which arrives for 12 hours per day at low pressure; this has to be pumped up to header tanks for use in water bowls. The reports from owners say the buffalo and cattle are released from their ties twice per day to drink and then re-tied. Exercise for the animals is severely limited due to the fact that the open yard is usually quite small. The owners claim that 24 hour drinking increases milk production by 10% to 20% or so. However this may mean that the animals get no exercise at all during their stay in the colony.

The logistics of getting enough feed to each animal are problematic and costly. The animals themselves are in a better condition than reported before I visited but mortality is high; put at 4 - 10%. When the KDFA secretary was asked as to the method of disposal of a dead animal he stated that, "The city council come and take the carcass away to dump them on the shore." I did not visit the site of dumping but one dead dog served as an example at the shore line.

It is reported that buffalo calves seldom live for more than one day which some farmers feel is due to the fetid air at ground level which they blame on gases emanating from the manure lying around. In a healthy environment on a well-run buffalo dairy farm, it is usual for a farmer to allow the buffalo calf to suck one teat while the milker takes from the other three. The attention of the calf produces natural oxytocin hormone, the milk let-down hormone, which releases the milk to the udder for the calf and milker. Where there is no calf, buffalo are difficult to milk without a lot of effort and good management. In this colony where there are no calves and management is less than ideal, an oxytocin injection is the norm. The cow is injected twice a day with oxytocin prior to milking. This is accepted practice in the colonies. However in Europe and THE USA the indiscriminate use of oxytocin is banned. Oxytocin is only to be used by a veterinarian or someone authorised by a veterinarian and limited to clinical cases of post calving milk let-down problems or to assist in parturition. It is said that buffalo can become used to these injections as part of the milking routine and react just as well to an injection of water or even to a dry needle. The continual, regular use of oxytocin damages the animal's reproductive system making it difficult to get back in calf after one lactation period in the colony, and also if a cow is pregnant, it is likely to induce abortion.

Current thinking is that if there is any residual oxytocin in the milk it is of no danger as oxytocin is a protein and as such is digested by the human stomach before it can enter the blood stream.

7. MINISTRY OF FOOD AGRICULTURE AND LIVESTOCK

The Additional Secretary of Livestock was unable to provide any papers on the colony and its history. His statement was that the land was allocated in 1963 and since then the colony has mushroomed. Initially it was allocated for 15,000 animals but today their latest statistics from 2006 say that Landhi and its environs now hold 342,000 animals which quite reasonably accounts for 7,200 tons of manure daily. It was pointed out that around 130,000 Cu. metres of raw sewage is also pumped into the sea daily by Karachi city. ('Fresh' fish are on sale in the city).

The Department would like to see the colony taken out of the city and already have a proposal to move it to Bhambhore; they have calculated the cost at 2,800 million rupees, or 29 million dollars. Obviously the Department lacks the funds for this. They are also appreciative of the social aspects of such a move and accept that vigorous action would be needed to prevent the take-over of Landhi by other famers hungry for a place to keep their buffalo. To get the farmers to move would involve strong legislation against keeping animals at Landhi and surrounding area after a set date. The new facilities would need to be seen to be more attractive than city life for them to go willingly.

The proposed site at Bhambhore of 800 acres will provide 500 acres for dairy farms and basic amenities such as roads, parks, school, mosque, veterinary hospital, feed mills etc. External development such as roads, sewage, water supply, drainage and electricity will be provided by the Government of Sindh. Other plots will be developed for biogas plants, milk processing, a livestock market, fodder market, feed mill, veterinary clinic, general stores and shops. The plan suggests 5 acres per farm which means that it will accommodate 100 farmers. There are ± 3.000 farmers at Landhi. So there is a lot more thinking required.

There are stipulations which may be less palatable to the current Landhi residents such as a minimum of 200 head of stock increasing to 400 within 3 months of entry. Animals in the colony must not be slaughtered after one year of milking but must be got into calf and used for multiple lactations. Calves cannot be sold less than three months of age. The possibility of a pilot project was mooted.

7.1. An alternative

Rather than a mass movement to a site which has rules with which few occupants can comply would be a slow exodus with financial assistance to an area outside the city where farmers would carry on in a more eco-friendly manner without the strictures of Bhambhore. Their 'farms' in Landhi would be bulldozed and no resettlement permitted or allowed to be used by residents to extend the area of their farm to enable animals to get at least some exercise. How this can be controlled would be a problem as farmers used to the present situation would tend to fill the extra space with more animals which would negate any benefits of the relocation investment.

One major difference would be that manure would become an appreciable asset to be sold to crop farmers of the locality. It would become a saleable commodity rather than a liability.

8. LIVESTOCK HEALTH

There is a government veterinary hospital in the colony but the place is quite run-down, lacks facilities and seems to be the office of a veterinarian who attends to a few local farmers. A veterinary hospital which charges for professional services at a sensible rate and provides farmers with a rapid diagnostic service would, in all likelihood, be self-sustaining. For it to be fully functional the Government subsidised place should close.

The livestock in the colony comprise 90% buffalo and 10% bovine (cattle). The animals drink non-saline water supplied by the city council which arrives for a set period daily. The reports from owners say the buffalo and cattle are released from their ties twice per day to drink and then re-tied. Exercise for the animals is severely limited due to the fact that the open yard is usually quite small. Management is poor.

The health of livestock in the colony is not good. The mortality rate is high at around 4 - 10%. The government veterinarian could not give any specific reason for this and says no post mortems had been carried out but the reason could be the general low level of husbandry, leading to gradual decline. Death could come from anything once the natural defences are destroyed. The only vaccines used are Foot and Mouth Disease (FMD) (or as in the U.S.A Hoof and Mouth). Foot and Mouth is sometimes said to be 8 different diseases with the same symptoms. A vaccine for one type has no effect on others. Typing is possible to ensure that the correct vaccine is used but typing costs money and this is a commodity that the farmers of the colony are loathe to use. In Pakistan a combined vaccine is now available to combat the three prevalent strains in Pakistan. There have been 444 'outbreaks' of FMD in the last 6 months. Some vaccine is made in country, and some are imported. The only other disease which vaccination is used to control is Haemorrhagic Septicaemia (HS). Animals, particularly buffalo, do not die from FMD, but they are very susceptible to HS, and it is said that this is the main cause of mortality in the colony.

It is reported that the next major problem in health of the livestock is 'respiratory problems' which suggests viral pneumonia. This is probably due to the close confinement and poor housing conditions after rains. Due to the housing conditions, the cramped location, the malnourished condition, lack of sufficient water, the heat, pollution and general low standard of husbandry, the animals are susceptible to all sorts of ailments and have a low threshold of natural resistance. For Buffalo the lack of a wallow to help them lose heat particularly in the hot season is a problem. There are a few farmers who have reputedly installed showers to help in heat shedding for the animals, but for others in the Karachi colony, environmental heat is a serious factor.

The animals in the colony are under stress; stressful conditions are not conducive to milk production. Under a better management system, a calf would be at foot at milking time and nuzzling the udder which induces 'let down' in the udder. When an animal is under stress, the adrenaline produced cancels out the effect of oxytocin. As the animals of the colony are continuously under stress and the calves are not kept with the mother, it is difficult to stimulate the let-down hormone production. This has resulted in twice daily injections of synthetic oxytocin to become standard practice thus enabling rapid milking to go ahead. However this twice daily injection continues late into lactation despite the poor condition of the recipient animal, often until the animal is too weak to survive. The use of oxytocin is banned in EU and the USA except by a veterinarian or under his authorisation. In Pakistan a cow is injected by the milker twice daily usually at a rate of 3 ml per milking. There is no control on this act at all.

Another serious malpractice in the health sector is the use of Diclofenac Sodium. This drug is a painkiller and anti-inflammatory. It is a useful drug when used properly but it is often misused by people who are unable to identify the underlying causative problem of an animal's ill health; it appears to be a good drug as it takes the pain away; the animal becomes active again but later dies as the original problem is not treated. In Landhi, we are informed that animals which die in the colony are dumped on the shore where the carcass is consumed by scavenging animals and birds. Unfortunately the arch scavengers are vultures and the residues of Diclofenac in the meat affects the vultures' renal system resulting in death and also affects the reproductive system too. Consequently the skies of Pakistan and much of India are now devoid of vultures. This is a thing of sorrow particularly for the Parsees who depend on vultures to eat their dead on the Tower of Silence. It is reported that 98 to 99% of vultures have disappeared over the last 25 years. Nature's sanitary officials have been killed off by misuse of a veterinary drug. Diclofenac is banned in Pakistan but is still being manufactured and sold as 'Voren' and is believed to be produced in Karachi.

Some dead animals are sold to the 'sweepers' who sell the skins for leather. The bones are sold to makers of poultry feed, and the fat, if any, goes for soap manufacture. The selling price of a carcass is around Rs. 2,000 or often taken away free of charge.

9. ECONOMICS OF THE COLONY

The economics of the colony are difficult to understand, figures provided show an evident loss. The buying in price of a buffalo is Rs. 135K to 160K, the scrap animal sold to a butcher is around Rs. 45,000 to Rs. 65,000. The price of milk is Rs. 64 per litre and a cow can produce in the 10-month stay at the colony around 2,000 litres. Reported cost of feedstuffs for bulk and concentrates is around Rs. 300 per day, i.e. 90,000 per 10 months. The farmer pays an annual rental of Rs. 5,000 and an annual fee for water of Rs. 1,500 per head. Only one cow in 20 gives birth in the colony as they are usually purchased immediately after calving and are not put to a bull so soon after parturition. Little or no breeding is carried out at the colony. If an animal dies as one of the 4 - 10% mortality, then a famer's income can be reduced by Rs. 65,000. The figures supplied to the questionnaire cannot be verified. Farmers are notorious for both not having the figures as few weigh their milk or record their costs and even fewer keep records and, to make matters worse, almost all prefer not to disclose figures which will allow people or the authorities to calculate their income. The estimated costs and returns from information gathered can be seen below.

COSTS	**Rs.**
Buying in price of a buffalo	145, 000 to 160, 000
Feed Rs. 300 for 300 days	90, 000
Water/power	15,00
Rental of space per head	5,000
Health costs	1,000
Labour	12,000
Total	254,000

INCOME	**Rs.**
Selling of scrap cows per head	65,000 - 45,000
Milk sales 2, 000 L @ Rs. 64 if production is 3000 L	128,000 - 192,000
Total	193,000 - 237,000

A 10 litres per day average is not possible. Many buffalo will only reach 10 litres immediately after calving.

A continual loss of Rs. 61,500 per animal is not possible; the figures supplied are obviously suspect as stated earlier. The maximum profit margin according to figures provided would be Rs. 17,500. The only possibility of accounting for this oddity if the figures are anywhere near accurate is that the farmers are paid for watered milk which inflates the price received, but even so it would have to be around 30% water to break even. The often stated reason for adding water is that buffalo milk is watered to 6% butter fat as though this is accepted practice and appreciated by the consumer. On the returns of the questionnaire obtained by ASF staff, some farmers were quite open about the fact that they added water. Some say that they do not add water but do use ice.

9.1. Milk farm gate prices:

The price paid to farmers in Landhi is avg. +/- Rs. 64 per litre
The price paid farm gate in UK is Rs. 40 per litre
The price paid farm gate in USA is Rs. 38 per litre
The majority of consumers in Karachi, as in all Pakistan, prefer buffalo milk to cow milk. However it can be pointed out that the buffalo is a relatively poor milk producer in terms of volume, and the Karachi herd of 1.2 million buffalo could be replaced by 400, 000 cows (bovine) which would produce 1/3 the amount of dung, require 1/3 the space, 1/3 the amount of fodder and produce just as much milk with ½ of % butterfat.

Buffalo milk has 58% more calcium
40% more protein
43% less cholesterol than cows' milk.

Another anomaly is that milk is sold at the farm gate for Rs. 64 to the pekkar; he then sells it to a bulk buyer in Karachi for Rs. 65 who sells it on to a retail rounds-man for Rs. 66 who then sells it to the consumer for Rs. 70, which does not leave much of a margin for profit for transport and handling. One assumes it accumulates a little more water en-route.

10. MEAT CHAIN

The quality and quantity of meat which leaves the buffalo colony is extremely poor. The animals seem to be invariably sold to local butchers who sell retail to local people. Having been milked out for the last 10 months by the use of oxytocin they are almost devoid of fat and the amount of lean meat is negligible. Their diet is inadequate and I really fail to see how they can be traded at Rs.65, 000 which is $685. However, meat is at a premium in Karachi and animals are brought from great distances to feed the city. It is understood that many animals are brought in from India, either legally or illegally. Since the recent serious outbreak of foot and mouth disease when it was stated (erroneously) that people were in danger when eating FMD infected meat, the consumption of beef has declined.

Given the fact that 400,000 animals stand in the colony for just 10 months, it is clear that 40,000 animals are sold off each month or 1,300 per day. Normally that would be a lot of meat but most/many of the animals are in such poor condition that they are of limited quality for the butchers market. These animals are sold to Karachi butchers or travel to urban centres such as Rawalpindi or Peshawar. Some may go through to Afghanistan but amounts cannot be ascertained.

11. FEED QUALITY TESTING

The colony would seem to be relatively well provided for its level of production and management. Trucks bring bulk feeds in to order which is unloaded into storage clamps. Water is supplied by Karachi city and extra requirements are pumped from both deep and shallow wells. Pekkars and their pick-up trucks come twice daily to take the milk away. The dodhi or pekkar usually pays the farmer in advance for milk which keeps the stockman happy and in effect ties him to the individual retailer. This arrangement holds well throughout Pakistan. Farmers either mix their own rations for concentrate feed or buy from millers with the colony; concentrates arrive in bulk on trucks and mixed to a ration known only to the mill owner. No feed mixer/manufacturer seems to use computerised least cost analysis for production of a balanced ration for milk production. One dairy owner who sells some feed to the farmers claims that he does so. He volunteered the information rather than responding to a question so it is assumed to be correct

Generally the ration is not guaranteed to be of any specific quality but a degree of trust has developed between supplier and buyer. The ration varies throughout the year depending on what ingredients are available. The farmer and probably the mixer/miller possibly only have a vague idea of quality required such as protein or energy content of the ingredients and so the ration cannot be considered to be a standard or adequate quality.

It would be advantageous for the colony if there were to be a laboratory established to test feeds and advise on the current best mix given the ingredients seasonally available. This would enable the miller or mixer to be able to say that his ration for feeding to milking animals was of a specific content and the farmer would be reassured that he is buying quality feed. If there were differing charge bands the laboratory could be self-supporting, a lower charge for members of KDFA would have samples tested for a lower price than non-members.

There is a small veterinary laboratory in the colony and it is probable that a building could be made available there for a nutrition/feed analysis laboratory if the project agreed to establish such a facility. Such a laboratory would increase milk production through a more complete balanced diet for the buffalo.

12. MILK TESTING

Milk testing does not seem to occur in the colony. However, farmers are able to tell you exactly what the butterfat content of their product is but as to who tests it and when is difficult to ascertain. One or two farmers said that the price of milk is dependent on butterfat content. It does seem to be accepted that the farmer will add water, most contend that they do not; however, the householder understands that the milk has been tampered with on the route to the door. Some farmers say that the milk wholesaler does test but only for butterfat on which the price is based.

From a farm survey the farmers state that the middlemen put additives in the milk before it gets to the consumer. Listed are hydrogen peroxide (increases shelf life), Sodium bicarbonate, urine, water, ice (oddly this is often not considered to be water) to keep it cool and adds to shelf life, powder unspecified but could be clothes washing detergent powder (why? not known), milk powder, oil to maintain fat levels and white paint. Simple hygiene would increase shelf-life; careful washing of utensils, buckets, tubs and churns/cans using a dairy detergent would make a lot of difference to the speed of acidification. Another factor is the metal used to make the carrying cans placed on the vehicles, this is steel which rusts and stainless steel would add to the shelf life. The present cans are flat bottomed; a rounded bottom would make for easier cleaning.

12.1. Purchasing Of Milk

If any organisation wished to purchase milk from the colony they would have stiff competition from the dodhi. The dodhi pays in advance for the milk which has become a socially accepted method and suits the farmer. The dodhi also will sometimes give extra funds to trusted suppliers for other things such as feedstuffs or non-business related purchases such as school fees. There is a large element of trust built up over the years between buyer and seller.

If a commercial company were to try to capture this market, they would have to pay more than the current Rs.64 per litre as the company would demand undiluted milk. If the suspected figure of 30% final dilution rate is anywhere near correct a figure, then Rs. 90/litre would be asked by the farmer. However, Rs. 90 is above the government fixed price of Rs. 70 for milk and could lead to prosecution of the supplier. Additives are accepted; selling at over the fixed price is illegal.

For cheese making the milk has to be free of antibiotics; otherwise, the bacterial action required in cheese making is destroyed by the antibiotic. It will take some time before this is believed by the suppliers and would result in milk being returned to the supplier which will make on unhappy supplier. It will be a matter of education.

13. COMPARATIVE ANIMAL PRODUCTION SYSTEMS

The animal production systems practiced in the colony are all very similar. The only real variations are in hygiene levels which in reality depend on the water supplies available and the inclination of the farmer. Where there is copious amount of the saline borehole or hand dug well water then the manure is turned into slurry using a hose and washed into the 'monsoon' type drains and eventually out to sea. A few, perhaps 15% of animals, are provided with a shower for the hotter parts of the year.

The basic production system is one where a recently calved buffalo is purchased from Sindh (35%) or more likely from Punjab (65%) and brought to the colony by a trader or farmer. Depending on visual inspection, a fee between 135 and 165 thousand rupees is paid. The animal is then taken to the owner's livestock compound and tied. Even the farmers refer to this as being in jail.

From that date on for the next ten months the buffalo is untied twice daily to drink 'sweet' water, i.e. non-saline; it is fed on whatever roughage is seasonally available which is usually "bhusa" or chopped wheat straw. Even this is expensive at Rs. 8 per kilo when supposedly balanced concentrate feed costs around Rs. 25 per kilo. Some farmers state that they feed chopped green fodder when available, such as maize stalks or even Lucerne. Throughout the next ten months this animal is underfed.

Due to the low level of feeding, the cramped environment, the proximity of other farms and other animals, the cross infection of various health issues, heat and lack of heat shedding possibilities even during the very hot periods, limited water intake, lack of exercise and so on, the animal is far from content. Milking of buffalo is problematic even under ideal conditions and is only trouble free if the calf is around. Away from the strictures of a colony the buffalo calf is usually retained to feed on one teat while the milker takes from the other three. There is an exceptionally high mortality, reportedly "almost all", among calves born in the colony and these are very few anyway. The high mortality could be caused by malnutrition of the dam, or as mentioned by farmers the noxious gasses at ground level from manure.

To overcome the lack of management, every animal owner has taken to the twice daily injections of oxytocin to induce milk let-down in the milking animals. This is carried out by the milker and provided by local pharmaceutical shops. Current thinking is that there is little residue left in the milk and even if there is it is easily digested in the human stomach when drinking the milk. There would seem to be no adverse effect on consumers though some people interviewed claimed health issues from the milk and blamed the oxytocin. However the animals are forced to produce milk despite their poor diet and by the end of the ten months the animal is so weak that it dies (4-10%) or is sold off prior to death to a local butcher.

A few animals, 10 to 15%, are sent back to farms for recycling, i.e. to be fattened and put to a bull for more milking after calving. However, the fattening process between purchase by the farmer and a heat period depends on body condition and after attaining oestrous and pregnancy, there is a 10 month gestation period meaning that this type of enterprise is not overly profitable. It depends once again on feed prices. Often/usually the reproductive system of the buffalo is so damaged by oxytocin the cow fails to conceive in which case she goes for meat anyway.

As far as animal health is concerned, the regular influx of animals from various places outside Karachi means that every disease in the country comes to the colony. The only vaccinations used are Foot and Mouth Disease and occasionally HS. Other problems are treated as they appear by veterinarians local to, or within, the colony. There seems to be little variation to this theme. One worrying aspect is that there is liberal use of Diclofenac Sodium by herdsmen and farmers. The uncontrolled use of this banned substance has had a seriously deleterious effect on the vulture population of South Asia. It is still being manufactured in Karachi despite a government ban. It is obviously readily available and used in the colony. Farmers mention this among the medicines they use to treat animals. This suggests that it can be purchased in local veterinary pharmacies. When animals leave the colony to be recycled or fattened they are carrying many diseases from the colony which are spread through the herds they join.

As counterpoint to the levels of mismanagement within the colony is a farm visited and owned by a big, perhaps the biggest, farmer in Sindh. He had his 4, 000 buffalo wandering loose within paddocks; they had 24 hour access to water; and the animals appeared well fed and contented. He did not use oxytocin but had a calf at foot at milking time. He had his own feed mill and his own ration mix. He was not at all mechanised, using ox carts for all transport within the farm. He raised his own replacements and sold off bull calves for fattening to neighbours at around 3 months of age. He kept bull calves from his best milkers to use for breeding, thereby improving the genetic potential of his herd. His milk is also sold in Karachi.

One very serious effect of the present "buying in - ten months of milking - selling the spent animal to a butcher" scenario is that this colony is stripping Punjab of its best milking buffalo and sending them to slaughter. This is depleting the genetic quality of the national herd as the best animals are deprived of breeding opportunities after entry to the colony. This can be construed as buffalo genocide; it is destroying the national herd. In fact, Landhi has been likened to a Buffalo prison.

14. IMPROVING THE PAKISTANI BUFFALO

There has been little attempt to improve the breeds of buffalo in South Asia; individuals often breed from their best females, but it is all on a very small scale and the improvement is lost when the herd breaks up. There needs to be a well organised co-ordinated breeding programme for buffalo. Using the techniques of embryo implants and artificial insemination (A.I.), the methods of up breeding of cattle is proven, well known and widely practiced. The improvement of buffalo through up breeding is more problematic. There are few of what could be termed elite herds. A bull is 'half the herd' but few bulls are progeny tested before being used for A.I., and even though they come from 'best milking dams,' they are not necessarily providing particularly good calves. Bulls are chosen on their phenotype or good 'looks,' which is not a particularly good basis for a breeding policy. The bigger the pool of available females the quicker improvement will be accomplished.

An up breeding programme should be instigated country wide utilising the good buffalo farms both private and semi-government as a breeding base and selection for elite bulls based on scientific genetic improvement. This is a long term project which will implement the tried and proven breeding practices used in the past to improve the various breeds of milk and meat of bos taurus cattle.

Farmers involved would benefit from their sale of improved bulls for breeding as is carried out by pedigree breeders of cattle worldwide. The programme would be managed by a geneticist with good experienced farm managers employed to supervise the day to day activities on the participating farms. Incentives should be offered to participating farmers to ensure that the results returned are genuine. It is possible that there are top performing bulls in other countries that out-perform the local bulls. Italy and Indonesia are two possibilities; these will give a good start to the up-breeding if used on top dams.

Breeds are not important and the Nili Ravi may not have the highest yielders of all.

15. MARKETING

This would seem to be a weak area, but a system has grown up which suits this low cost, low output milk production industry. Karachi, a city of perhaps 30 million people, the only city within perhaps 400 miles, does not have a functioning dairy. Ninety-eight percent (98%) of the milk produced by the 1.2 million animals is purchased or consumed as fresh milk. The milk is boiled on arrival with the buyer, often the cream is then skimmed off after standing a while. The cream is often used as butter or to make ghee, etc.; yoghurt is also made at the home.

There are two milk processing plants in Karachi, but as both produce UHT which is not very popular except among the wealthy, they get little business. Pasteurised milk is even less popular as Karachi residents greatly prefer fresh milk. Some flavoured milk drink is produced and packaged.

Individuals make some soft cheeses and yoghurt. Milk shakes are sold in the city, but all milk is sold untreated and usually with additives, usually water, of some sort to householders and small businesses. Householders generally make their own soft cheese and yoghurt but it can also be purchased on the street from small milk shops. A few of the larger farmers own their own milk shop, but they are open for long hours (closing at 11.00 p.m.) to be competitive, and this means employing staff or a family member being there full time.

The Karachi Chamber of Commerce is very interested in the idea of trading mozzarella cheese but think that the USA might not be too eager to allow its import. The EU is a second option. They would hope for backing of USAID for their application if mozzarella production were to go ahead. USAID staff feels that their appeal to USDA would be enough to sway the balance in favour of Pakistan. They do not seem too interested in interfering in the marketing of milk as it stands. The local people like fresh milk delivered to the door. They like high fat milk even though the fat is often skimmed off in house saving them having to buy ghee or butter. They usually produce their own yoghurt.

One problem, which was only hinted at during the meeting, was the power of the middle-man. The dodhi or pekkar plays an important role in the marketing chain; they are a powerful force as in that they wield financial control over the producers who often will sell their milk to the middle-man for up to a year in advance. No interest is paid on this loan which is where the middleman gains over a bank in finding clients. It is a form of Islamic borrowing.

16. VALUE ADDITION FOR MILK

16.1. COMMERCIAL DAIRIES IN KARACHI

Currently there are no commercial dairies producing packaged milk in Karachi such as found in Lahore. Ninety-eight percent (98%) of milk produced by the 1.2 million (est.) cattle and buffalo in and surrounding Karachi is sold to householders or milk shops in the city. Milk shops tend to sell only "fresh" milk rather than enhancing it as flavoured milk or milk shakes. Skimming cream has not been mentioned as a retail trade but households will separate the cream by standing overnight to make butter. Home-made yoghurt is also produced.

Anecdotal evidence tells the story of a large company wishing to purchase milk from a VERY large farmer to produce flavoured milk drinks. However, the farmer demanded prepayment as is the norm by a supplier in Sindh. The company refused, the deal was lost and to date there is no dairy buying much milk in Southern Sindh.

Milk is sold exclusively in the city; it is carried in by middle men or 'pekkars' twice daily to be sold to consumers mainly householders, milk shops and hotels, etc. The price to producers is around Rs. 64, and the selling price to consumers is reported to be Rs. 70. The profit margin is presumably enhanced by the amount of water added. There would seem to be no excess milk for manufacturing for the domestic market unless a good profit over the raw milk price is possible and there is no shortage of milk products in Pakistan.

Ninety percent (90%) of the animals around Karachi are buffalo while only 10% are cattle. Buffalo milk is preferred for its high butter fat content, despite being watered down, for its white colour, and for its sweetness.

The pizza industry likes to use mozzarella cheese for its stringiness/elasticity and white colour. In Europe; Italy produces buffalo mozzarella cheese but other countries have few buffalo. There are a number of herds in the USA, but those are limited, and assuredly there is a market niche there to be exploited. Pakistan should aim for an overseas market for mozzarella, particularly in the USA, where

the retail price of pure buffalo mozzarella at $51 per kilo leaves a sizeable profit margin as milk in Pakistan is obtained for US $0.75 per litre (Rs. 70 per litre). At 4.6 litres of milk costing Rs. 3.22, 1 Kg of mozzarella cheese can be produced with a retail value in US of Rs. 4,845.

17. VALUE ADDITION FOR MEAT

The idea of value chain improvements for meat is really a non-starter. Worn out animals at the end of the milking cycle are often in such poor condition that they have little meat of any quality on their bones. The regular use of oxytocin ensures that all their body reserves have been sold off as milk and the carcass is worth little. Live animals are purchased by local butchers and meat sold locally at meat shops. Skins go to the local leather industry from the butcher and bones go toward poultry feed. The leather produced from diseased, poor conditioned buffalo is of little value and hides sell locally to tanneries at Rs. 700.

Better quality animals are trucked out to Islamabad or Rawalpindi to enter the meat market there. The spent animal is not suited to fattening in a feedlot, if such a commodity existed, as it is too old, and even if young (4 to 5 years would be young for an ex-colony animal) she would take months to get into condition for quality meat. There is really no 'chain' to develop. Currently any animal with meat on it at the end of the milking cycle goes to Karachi, Peshawar or Rawalpindi/Islamabad for slaughter.

18. RECOMMENDATIONS/INTERVENTIONS

18.1. Short term

• Owner and farm labour training. Establish a day release training centre for animal husbandry tuition covering all aspects of livestock management applicable to the system used in the colony. The head of this training centre should be an animal husbandry specialist rather than a vet. Courses should be arranged at times to suit the attendees, not the trainer; the courses should be tailored to the colony's requirements/shortcomings and not from a set text book or course curriculum. Hygiene is a major factor in the woes of the colony both in the colony itself and in the cleanliness of the milking utensils. Training would ensure that the colony's milk had a longer shelf life and cleaning up the environment would improve living conditions.

• Establish a nutrition laboratory in the colony for farmer and feed mixer use. A feed testing laboratory is needed which provides fast results. The existing government labs are far away (Tando Jam) so that results are a long time arriving and are usually no longer applicable to the current available feedstuffs. Training for the lab staff will be required and the lab should be headed by a nutritionist. The quality of the current concentrate feed is highly suspect. Rations are formulated on guesswork and which ingredients are cheap. If a scientific approach were used with ingredient testing and least cost computerised formulation practiced, top quality feed would be available every time. This would require a feed testing laboratory headed by a nutritionist at the colony with chemicals and trained operatives which should be self supporting.

• Assist in the introduction of stainless steel milk cans of approx. 38 litres and the use of dairy detergent so that cans are thoroughly cleaned to increase milk keeping quality. Stainless steel milk cans should be introduced to increase 'shelf life' of milk; the current metal cans are rusting and difficult to clean which means that the new filling starts to go bad immediately when it is put in the can. Manufacturers of cans are found in Lahore, and a change of material and can shape are needed. Buffields Ltd., the dairy company mentioned, has imported a stainless steel 40 L. can from Turkey. It is quite expensive but could probably be manufactured in Lahore without too much of a problem at a lower price as they are experienced in using stainless steel for other commodities. This could be an ASF assisted program.

• Communal showers for buffalo during the hot season to enable stress reduction by heat shedding. The large rumen of a buffalo produces a lot of heat during the fermentation process of roughages. This heat has to be dissipated particularly during the summer heat. The water buffalo enjoys water, hence its name.

• Establish a well-equipped veterinary laboratory/hospital. The current Government laboratory is in a run-down condition and is in act no more than a poor clinic. It would seem to be run almost as a private practice. Farmers from outside Karachi would also be able to use the facility. Currently samples are sent to Islamabad and the results return far too late to be of use. This laboratory would be run on commercial lines and be self-supporting once established.

• Encourage farmers in timely and bulk purchase of feedstuffs. Possibly co-operation to be able to order full loads at reduced cost. Bulk buying keeps prices down as does the bulk purchase of feeds at glut time.

• Discourage the use of diclofenac sodium, which is illegal, and where possible, the use of oxytocin, which is unethical. Both of these chemicals are anathema to anyone caring for live animals.

18.2. Medium term

• Assist a local processor close to Landhi Colony and who preferably already has an established client base in the colony to establish a mozzarella cheese plant and assist the company in obtaining access to international markets. There are perhaps two processing dairies in Karachi who have dairy facilities, if not cheese making knowledge/experience. Annex 1 shows the steps of cheese production.

• Introduction of an affordable milking machine. There are machines on the market but are not popular; possible further development work (agricultural engineer) needs to be carried out and perhaps a parlour system would be preferable. This could be private or community owned. The introduction of parlour milking would/should result in cleaner milk especially if coupled with correct cleaning of stainless steel cans. This is a topic for a further study.

• ASF should work toward the removal of the 'fixed prices' for meat and milk. These fixed prices are a disincentive for improvement in livestock farming, a disincentive for development. These prices are currently too low resulting in losses or minimal profits to farmers who then have resort to such things as adulteration of milk to increase its volume and their income. This is to the detriment of the consumer who receives adulterated milk.

18.3. Long term

• Close the colony. Move it out of the city. The system of buying in animals that are to be slaughtered within one year is non-sustainable. It is killing off the elite of the national buffalo stock. It is wasteful, it is buffalo genocide. It would seem that everyone would agree that the colony should be moved out of Karachi including some of the colony dwellers. Initially it was 32km from the city, but the city has now grown to the extent it now surrounds the colony. Not only has the city grown to extend around the colony, but the colony has now grown to exceed its original acreage of 752 acres to an estimated 1,600 acres. The livestock population has grown from 15,000 to almost 400,000.

The daily production of manure is calculated at 7,200 tonnes and is a health hazard. Currently it is flushed into the sea becoming an environmental hazard.

Even the occupants of the colony can see the benefit of moving to a rural area, but for them the cost is prohibitive and they would have to receive major financial assistance for it to be feasible.

To move the colony would be a massive operation if it were to be attempted. There would have to be sites arranged, water and electricity provided, roads, schools, veterinary and health clinics, shops, transportation, etc. for residents. In fact, all the services available in the city would need to be replicated.

There are perhaps 33,500 labourers and 3,000 livestock owners plus families in the colony making their removal a massive undertaking.

To set up a pilot project would be one possibility, where a small number of farmers are moved to a rural locality and their current location bulldozed with no-one else permitted to move onto the site in the colony. If their relocation went smoothly and they were happy, others would follow.

From this pilot project lessons would be learned about where a project to move the rest could be produced.

It is suggested that a team of consultants be taxed with providing the Sindh government with a blueprint to tackle the problem. The team would be multi-disciplinary.

• Solve the manure disposal problem if the colony remains in the city, the manure problem can only grow as the colony grows. The colony is expanding daily as new farms are constructed to the east and north of the Landhi area. The manure problem is such that even the residents see it as a major hazard and would like something to be done about it. The problem is so large that tractor/trolley removal daily to a bio-digester is not possible; 7,200 tons is a matter of 3,600 trolley loads, which if each tractor managed ten loads per day would require perhaps 400 tractor trailers plus another 200 tractors for fork lift loading all to be maintained and fuelled. The answer perhaps is in the use of pipeline technology. The slurry would be intercepted as it exits the colony on its way to the sea and pumped along pipes to the 'bio-digester farms' which the city has identified and can be sited on this area of land between the colony and Bin Qasim port.

A possible problem could be that as the manure is presently washed out of the farm and into a drain using saline borehole water, the residual salt would not be acceptable to farmers using the manure/slurry on their land, non saline water would be necessary from either the city supply, which is unlikely, or deep drilling to find a salt free water supply.

A multi-disciplinary team would be required to offer a solution to this complex manure disposal matter. Once a practical solution is found it would be up to the Sindh or National Government to come up with the funds for implementation.

19. PROPOSED FURTHER STUDIES

• Feasibility study for the removal of farmers from the city
• Suggested team: Sociology, Animal Husbandry, Logistics, 'Town' planning, and Environmentalist.
• This study would provide a blueprint for the closure of the buffalo colony and return the area to city control.
• Study to resolve the effluent problem
• Suggested team: Bio-digester expertise/experience, Pipeline engineering, Effluent handling/environmentalist.
• In the event that the above study is not implemented this second study must be implemented as the living conditions for the inhabitants both people and livestock are appalling. This would turn an embarrassment into an asset; producing electricity to the city which is short of power.
• Production of a buffalo milking machine
• A milking machine experienced manufacturing engineer.
• Milking machines are currently available for buffalo so the necessity is to make machine milking available to the occupants of the colony. This means either a cheaper individual bucket system or an affordable parlour possibly for communal ownership/use.

20. ANNEX 1

20.1. Production of Mozzarella Cheese

20.1.1. Process Flow Chart

After the fresh milk is received, it is filtered and pumped into the dump tank. It is then chilled with help of a chiller so that the growth of bacteria is minimized. On average, fresh buffalo milk contains 7.5 to 8.0% fats. The milk will then undergo the pasteurization process. This is based on heating the milk to 70°C and holding at that temperature for at least 15-20 seconds. This heat treatment ensures the destruction of unwanted micro-organisms and all bacteria. During this process the temperature is reduced to 4°C as at this temperature ideal growth of bacteria is stopped. After the pasteurization process is completed, the following process is completed to make the cheese.

Steps in cheese making

21. ANNEX 2

21.1. Landhi Buffalo Colony questionnaire

Is milk measured or weighed?	
Milk sold to whom? locally to householders?	
Milk Shops?	
Informal Dairy?	
Industrial Dairy e.g. Nestle	
Is milk testing carried out?	
For butter fat	
For water	
For additives	

Does the producer use any additives?	
Does he know of additives used by others If so, what?	
What price does he get per litre?	

OBSERVATIONS

Hygiene levels?
Warm or cold water used
Any chemicals used in cleaning
Adequate rinsing

HEALTH COSTS

	HEALTH COSTS
Annual cost of vet fees per cow	
Vaccinations carried out	
Treatments	
Drugs purchased by owner And used by him	
Oxytocin, used each milking, daily or occasionally?	

FEED SUPPLIES

Bulk feeds? purchased from where at what cost?	
Dry bulk feeds	
Green feeds	
Any other feed costs	

HOUSING COSTS

Cost of housing one animal	
Cost of water (measured)	
Cost of manure removal Per day/number of animals	
Any other costs?	

ANIMALS BUYING AND SELLING

Purchased from traders Price per cow?	
Purchased by the owner direct from farmers, price per cow?	
Sales	
Old cows sold to who; Price?	
Calves sold to? Price	
How many calves are born in the colony? %?	

DEATHS

Disposal of dead animal, price paid/cost?	
Disposal of dead calf, where?	
Disposal of placenta, where?	

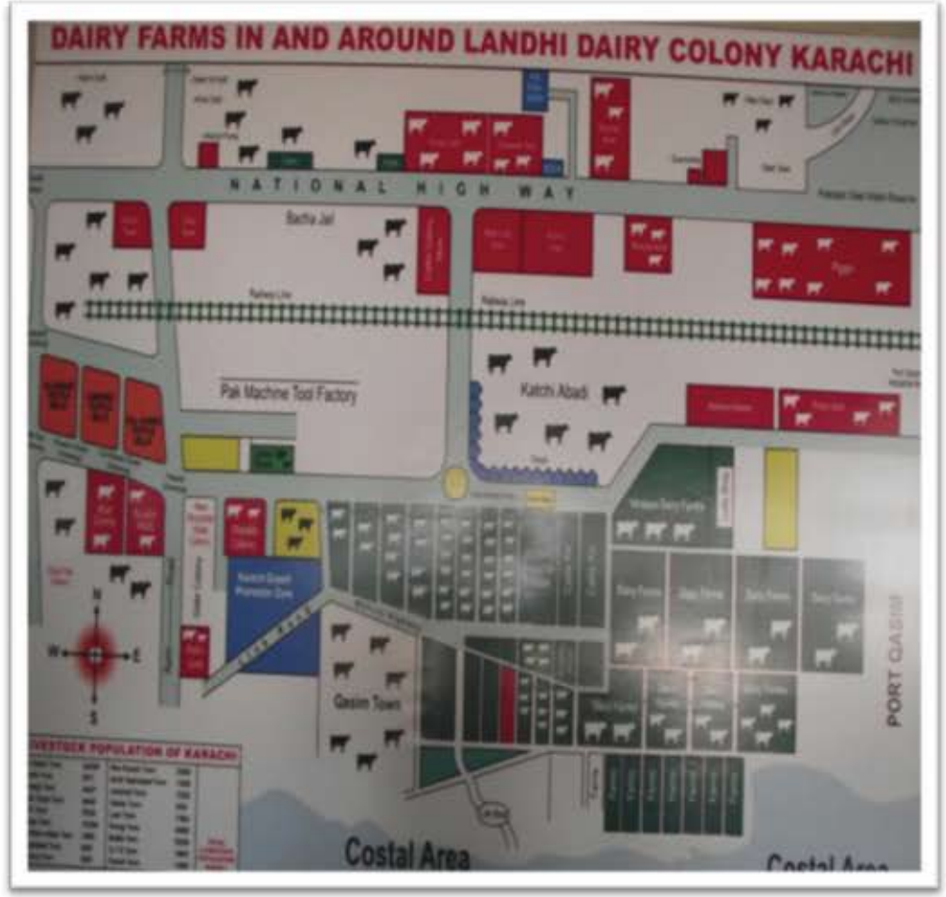

Figure 9 Comparative Analysis of existing dairy and livestock systems practiced in the Buffalo colony. Value chain assessment for milk and Meat from the colony.

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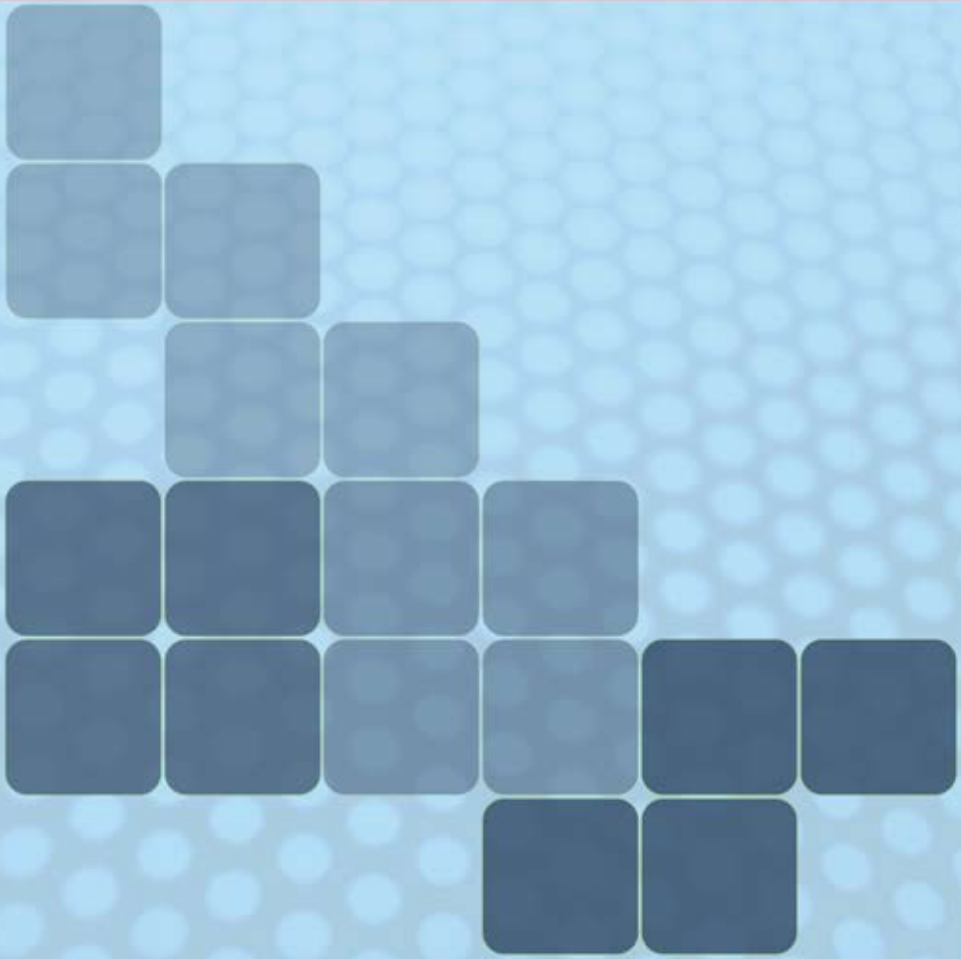
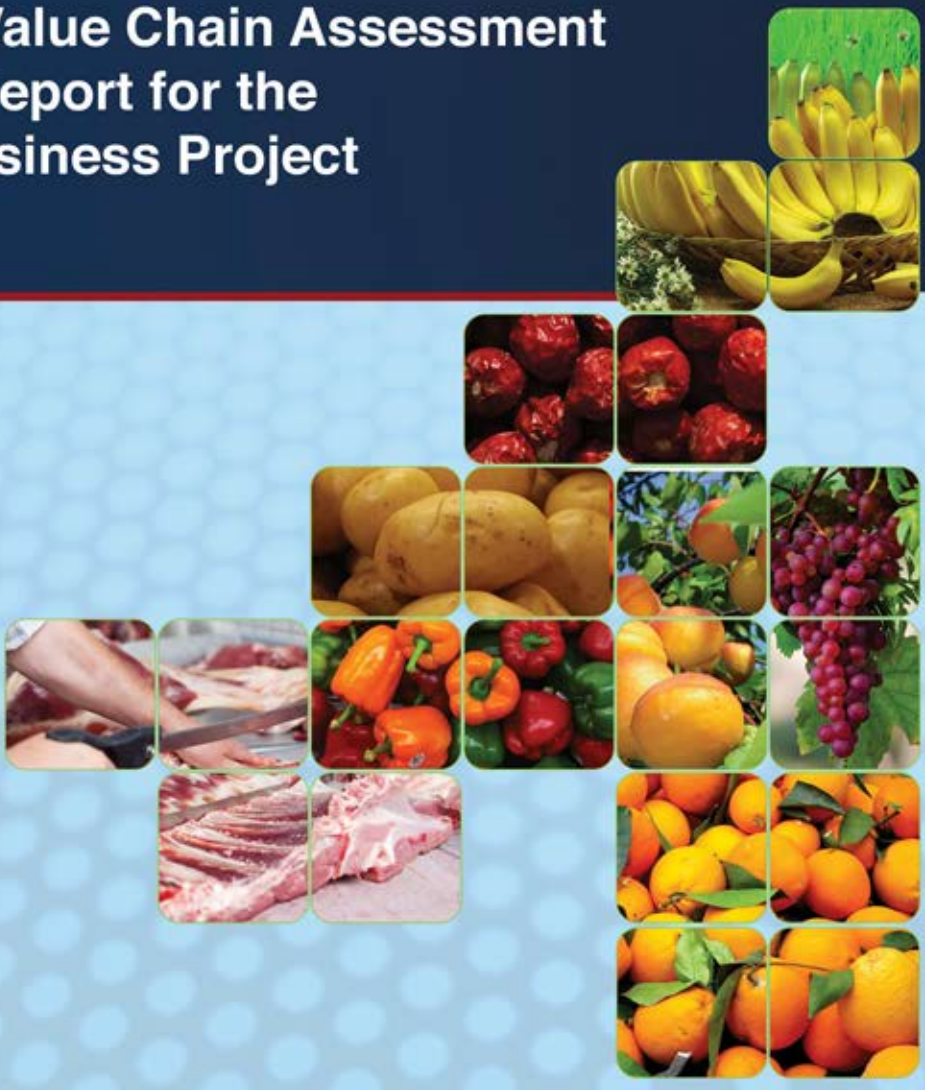


Together we will create a Roshan Pakistan

Dairy Value Chain Assessment Final Report for the Agribusiness Project



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This manual is a live document which can be changed/updated as the project progresses. Any suggestions for further improvement are most welcome.

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Lastly, the consultant would like to thank all of the stakeholders visited and met with who provided valuable (practical) information and who were very frank and open in the discussions held.

Contents

FOREWORD

A series of Training manuals , Guide Books and Reports have been developed by The Agribusiness Project (TAP) to facilitate the capacity building of farmers involved in TAP's targeted value chains, thereby enabling them to make the requisite transformation from 'subsistence farming' to 'farming as a business enterprise'. The Agribusiness Project is funded by USAID|Pakistan, with the overall goal of supporting improved conditions for broad-based economic growth, enhance profitability and employment opportunities and contributing to poverty alleviation through product and process transformation of selected value chains in horticulture and livestock sub-sectors." The strategy of TAP focuses on:

1. strengthening capacities in horticultural and livestock value chains to increase sales to domestic and foreign markets;

2. strengthening the capacity of smallholders (through farmer enterprise groups-FEGs), individual farmers and agribusinesses to operate effectively and efficiently; and,

3. increasing productivity and profitability through adoption of new techniques and technological innovations (among farmers, agribusinesses and business development services providers).

Through TAP, farmers have been organized as Farmer Enterprise Groups (FEGs) for cultivating the benefits of scale, through optimized production and marketing, and serving as a vehicle for transferring of the benefits of TAP interventions to its stakeholders - the farmers. TAP is providing active support to the FEGs and farmers for improving small producers' positioning in a value chain through support in incorporating producers and their product into stable, profitable market channels, and provision of necessary services and assistance in business development, planning and marketing through inter-linkages. This requires intensive capacity building of the stakeholders placing capacity building at the heart of all interventions.

This report/Manual can be used by anyone involved with the production, cultivation, harvesting and enterprise development training of and for farmers/farmer business groups. The contents have been finalized with the consultation of stakeholders engaged with the value chains.

While these Reports/Manuals/Guide Books are project specific and for a farmer audience, they can also be used for the capacity building of government and non-government agency representatives, processors and exporters who are involved in implementing production/cultivation, enterprise development and value chain programs, through the communities. Finally, I want to thank USAID|Pakistan for funding The Agribusiness Project under which this intellectual capital has been prepared. I would also like to thank ASF for successfully implementing these manuals/guide books across Pakistan for the benefits accrued to the farmers.

Shad Muhammad
Chief of Party
The Agribusiness Project | ASF
Islamabad, Pakistan

THE AGRIBUSINESS SUPPORT FUND

ASF is a 'not-for-profit' company registered under Section 42 of the Companies' Ordinance 1984 with Securities & Exchange Commission of Pakistan (SECP). ASF has extensive experience in strengthening and supporting demand-driven private sector service delivery mechanisms throughout the agribusiness value chain this includes supply inputs, production and export markets ASF aims to achieve this objective by mobilizing angel investment grant provision and technical assistance support of farmer and agribusiness enterprises. The company supports start-ups as well as existing enterprises, enabling them to employ modern technique and practices and build expertise and markets understanding required by a fast-changing economic environment and to improve their productivity, profitability, competitiveness and creditworthiness

THE AGRIBUSINESS PROJECT

The Agribusiness Project is an initiative of the United States Agency for International Development (USAID) and the Agribusiness Support Fund (ASF) Pakistan .the project aims at enhancing competitiveness of agricultural value chains in Pakistan, with a focus on Horticulture and Livestock including dairy, meat and fisheries. The objective of The Agricultural Project is to support and create improved conditions for poverty alleviation. Since Pakistan's economy is agrarian in nature, The Agribusiness Project aims to invest in interventions at the primary, secondary and tertiary levels of production. Under the International Market Access Program (IMAP), the project supports the creations of linkages between exporters and importers. The objective is to facilitate market access and enable trading linkages which translates into agribusiness through trade.

LIST OF ACRONYMS

ADDP	AGRIBUSINESS DEVELOPMENT AND DIVERSIFICATION PROJECT
AI	ARTIFICIAL INSEMINATION
ASF	AGRIBUSINESS SUPPORT FUND
AUSAID	AUSTRALIAN AGENCY FOR INTERNATIONAL DEVELOPMENT
DM	DRY MATTER
DOODHIS	MIDDLEMEN IN THE MILK SUPPLY CHAIN
DP	DIGESTIBLE PROTEIN
DVCA	DAIRY VALUE CHAIN ASSESSMENT
FAO	FOOD AND AGRICULTURAL ORGANIZATION
GDP	GROSS DOMESTIC PRODUCT
KPK	KHYBER PAKHTUNKHWA
LDDB	PAKISTAN LIVESTOCK AND DAIRY DEVELOPMENT BOARD
LFBA	LIVESTOCK FARMERS & BREEDER ASSOCIATION
MANDI	PAKISTANI MARKETS WHERE ANIMAL ARE BOUGHT AND SOLD
MAUND	37.3242 KG
NIR	NEAR INFRA RED
NWFP	NORTH WEST FRONT PROVINCES
PDDC	PUNJAB DAIRY DEVELOPMENT BOARD
PLDDB	PUNJAB LIVESTOCK AND DAIRY DEVELOPMENT BOARD
PSQCA	PAKISTAN STANDARDS AND QUALITY CONTROL AUTHORITY
RS	PAKISTAN RUPEE
SME	SMALL TO MEDIUM BUSINESS ENTERPRISE
SMEDA	SMALL AND MEDIUM DEVELOPMENT COMPANY
SNF	SOLID NON FAT
SPU	SEMEN PRODUCTION UNIT
TDN	TOTAL DIGESTIBLE NUTRIENTS
TS	TOTAL SOLIDS
AP	USAID AGRIBUSINESS PROJECT
USAID	UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
VMCC	VILLAGE MILK COLLECTION CENTRE

EXECUTIVE SUMMARY

The underlying report is prepared by M. de Jong (Dairy Value Assessment Consultant) on behalf of CNFA within the framework of the Agribusiness Project, Pakistan. The overall objective of the consultancy by the Dairy Value Chain consultant was to conduct a value chain analysis of the Pakistani dairy subsector, including buffalo milk, and to identify effective intervention strategies for the AP. These strategies should clearly establish the linkages and networks to facilitate the integration of the smallholder producers into commercial value chains.

As listed in the Terms of Reference, the study will consolidate information and previous studies about the sector and provide insights into the private sector-led business opportunities for improving the industry, specifically under the activities of the USAID Agribusiness Project (AP). It will also identify the inherent mitigation factors for business development and make pragmatic, cost effective recommendations for improvement. Such recommendations will have a local focus while reflecting international standards and best practices.

Mr. de Jong visited Pakistan twice i.e. 8 -22 November 2012 and 28 January – 6 February 2013. During the first visit, two workshops were held (Lahore and Karachi), whereas during the second trip, there were meetings and visits to key stakeholders. Based on the findings a number of interventions were formulated.

During the second visit, the proposed interventions were presented and discussed in five (5) focus group meetings, in which subject matter experts and stakeholders participated. The discussions in the focus groups were extremely useful, as this provided the "blessing" of the proposed interventions as well practical advice on the structure, content and "pitfalls" of these interventions.

Summary - Issues and Constraints (2)

In short, the following constraints are limiting the productive and financial viability of the dairy/livestock sector.

- **Subsistence Production System**

Under a subsistence production system, farmers have limited access to inputs required for exploitation of the genetic potential. There is marginal benefit from production. In most parts of the country the dispersal of livestock is so thin that access to services becomes impossible. The milk available is sold based on quantity rather than quality, so there are currently no incentives for value addition of the products.

Reliable data on farmers' cost of production was not available. However, the poor genetic resource and poor management practices significantly impacted milk yield per animal and tended to keep the production cost high. Therefore, enhancement in milk yield will reduce production cost and increase farmer's profit margin. More data collection and cost price calculation is required.

- **Inadequate Fodder Production**

The overall situation of fodder production is not satisfactory in the country. Fodder production has never received priority in any planning and improvement program. In spite of the fact that fodder is grown on 14-15% of the area, there are severe seasonal shortages both in summer and winter. These seasonal crunches negatively impact the livestock output. The buffaloes are at the peak of milk production when the winter shortage starts.

- **Supplementary Feeds**

Supplementary feeds are essential for maintaining the animal nutritional requirements and also animal productivity, especially in the form of milk yield. During the field visits, it was found that quality of feed available in the market is poor. There is a significant element of adulteration with highly toxic materials.

Also, these are very expensive. This almost entirely prevents the use of feeds and thus directly impact animal productivity.

- **Improper Breeding Services and Policy**

There is an overall shortage of breeding services in the whole country. Some areas have a particularly severe deficiency of breeding bulls. It was also noted that the males being used might not even be classified as breeding bulls. This has led to overall low productivity of the stock due to long calving intervals and short lactations. The shortage of breeding services leaves open ground for untrained professionals to resort to unacceptable practices. Para-veterinary staff are promoting cross breeding by selling poor quality semen at high prices. The regulatory procedures do not exist to stop these practices.

The national breeding policy is not well defined. The provinces have no direction for conservation of the well defined, well adapted local breeds. This has led to deterioration of several breeds in the country. Indiscriminate breeding of Sahiwal with exotic blood has produced unforeseen results.

The Sahiwal and Red Sindhis, both of which have built in ruggedness to withstand extremes of weather, disease and management conditions, produce about the same amount of milk as most of the crossbreds under the same regimes. If the fat corrected milk is compared, these two breeds have an edge over the crossbreds. Genetic potential of breeds such as Nile-Ravi has been overlooked. Similarly the Cholistan livestock has received very little attention. Genetic potential of most of the breeds has not been documented on scientific lines.

- **Institutional Weaknesses**

The institutes conducting research on various aspects of production are not properly geared to undertake it. The research agenda of the institutes also completely overlooks problem-oriented research since there is no feedback from the farmers. The regional importance of the livestock also gets cursory attention. There is also no mechanism for undertaking adaptive research.

- **Technology Transfer**

The technologies generated do not reach the stakeholders well in time and to the full extent. Also, there is no system of revalidation of the technologies with the changing conditions. The present (poor) extension system attends to animal health aspects only and has no mechanism for transfer of production technologies at the grassroots level.

Finally, high quality vocational training is lacking, although several private companies are providing practical training courses.

- **Extension Services**

There are variations and gaps in the provision of extension services. The extension services cover less than 30% of the livestock population. The logistical arrangements with the departments are limited. Extension workers stay away from the remote areas. The field staff had apprehensions against devolved services. The quacks are filling the gap and generally add to farmers' problems through inappropriate knowledge and unscrupulous practices. In addition, the hospitals and other service-providing agencies are located far away from the production centers.

- **Inadequate Human Resource Development**

There is no system of imparting adequate hands-on training skills at neither the grassroots level nor any arrangement for post degree refresher courses or updating the skills of middle level workers.

Livestock production activities revolve around women and children who use their local knowledge to redress issues. It is also, under the prevailing social system, difficult to reach this important segment. Despite a growing awareness of the need to reach female farmers, extension services are still skewed towards males.

- **Policy Implications**

The existing policies for price fixation and capping are not supportive to the farmers, and they therefore stick to outdated methods of production.

Quality control measures have not been implemented for the livestock and products. Since there is no incentive for improved quality, farmers continue to produce whatever outputs they can.

The budgetary allocations to the livestock sector are very low, and there are very limited funds for development expenditures. The larger part of the budget allocation is spent on salaries with poor maintenance of existing infrastructure.

- **Access to Credit**

Access to credit is limited by cumbersome procedures. The information collected from different stakeholders indicated that high mark up rates, misuse of credit, lengthy procedures, and lack of collateral prevented small holders' access to credit.

Women who perform major livestock production activities have limited access to credit. A large chunk of landless livestock farmers (particularly women) were always prevented from availing this facility because the procedures required agricultural pass books which are only issued to persons owning agricultural land.

- **Bargaining Power**

A lack of group/collective action in the absence of cooperatives and associations limits the benefits of economies of scale including farmers' bargaining power vis-à-vis traders.

- **Shaken Confidence in Public Sector Organizations**

Over time, people have lost faith in the public sector organizations. Most of the services were devolved without any prior field-testing of the program. The major shuffle in the departments caused confusion and chaos. At places there was rivalry amongst the incumbents. Several instances were quoted during field visits.

- **Interventions**

Based on the findings during the visits made and discussions held with major stakeholders seven (7) major interventions are indentified i.e.:

1. Awareness, information and dissemination
   1.1. Consumer awareness on milk and milk quality
   1.2. Information and documentation centre

2. Fodder and feed resources
   2.1. Broadening and strengthen hay and silage making
   2.2. Establishment of small scale grinding & mixing unit
   2.3. Introduction of GMP+ at commercial feed mills
   2.4. Introduction of NearInfraRed (NIR) feed and forage analysis

3. Animal genetics
   3.1. Upgrading of existing commercial SPU's
   3.2. Establishment of a herdbook
   3.3. Increased skills of inseminators
   3.4. Commercial youngstock rearing farms
   3.5. Information dissemination on bulls for sale from imported "pedigree" cows inseminated with proven bulls

4. Vocational training
   4.1. Inventory of existing vocational training programs (Universities and private companies)
   4.2. Quality assessment of the existing vocational training programs
   4.3. Adjustment (enlargement) of existing vocational training programs i.e. Curricula and facilities
   4.4. Promotion of existing vocational training

5. Manure utilization
   5.1. Establishment of on-farm biogas units
   5.2. Establishment of (solar) powered manure separation units

6. Milk handling and pasteurization
   6.1. Establishment of farm bulk milk coolers (500 – 1.500 ltr)
   6.2. Establishment of small scale pasteurisation units (1,000 – 5,000 ltr/day)

4 KEY DATA AND FACTS

Numerous reports have been read by the consultants (see references). Below a summary of information is provided which is extracted from various reports and other observations. As expected, data provided in these reports are not identical and are sometimes even contradictory.

Indicator	Total Production	Total Production-Alternate Source (if contradictory)
Farming households	8 million (2)	N/A
Animals held at farming households	50 million (2)	40.64
Number of cattle (2009)	31.8 billion (1)	33
Number of buffaloes (2009)	29 billion (1)	N/A
National milk production	42 billion	40 billion
Buffalo milk production	62 %	26 billion
Cow milk production	34 %	14 billion
Sheep/goat milk production	6 %	N/A
Share of rural milk producers	71 %	80 %
Share of peri-urban and urban producers	29 %	20 % of which 5% urban
Milk sold in the informal sector i.e. dodhis	97 %	
Milk processed and marketed through formal channels	3 %	

The Pakistan population is forecasted to grow to 234 million by 2025. The country has been facing a domestic deficiency in milk supply and will grow to an estimated deficiency of 55.48 million tonnes in 2020. (1)

The dairy sector plays a significant role in the national economy, and its value is more than that of the wheat and cotton sectors combined. (1)

Over the past ten years, milk production in Pakistan has risen by 36%. This gain in production is largely a result of an increase in animal population rather than in animal productivity (1)

2006 Livestock Census Report: (1)

Location and Type of Livestock	Total Production in Pakistan
Total Livestock Population	40.64 million head
Punjab Buffalo Population	**64 %**
Sindh	26 %
Khyber Pakhtunkhwa (KPK)	7 %
Baluchistan	1.2 %
Punjab Cattle Population	**48 %**
Sindh	23 %
Khyber Pakhtunkhwa	20 %
Baluchistan	7 %

No. of Animals/Household	% of Total Households	% of Total Animals
1-4	84	51 %
5-10	14	28 %
>10	2	21 %

Women are involved in major management activities such as feeding, watering and housing, while men are involved in marketing.

The number of small farms is continuously increasing due to land division under inheritance law. On farms of this kind, crop-livestock mixed farming is practiced.

Province-wide milk production

Region	Milk production X billion ltr	% of Total
Punjab	20.79	63
Sind	7.59	23
NWFP	3.96	12
Baluchistan	0.66	2

Milk production from cows increased in the last 10 years at a pace faster than buffalo milk i.e. 42 % versus 33 %.

Data presented in some reports mention that 51.3% farms maintained only buffaloes and 20.9% only cows. The remaining 27.8% maintained mixed herd of buffaloes and cows.

Nearly 30% of household expenditure on food items is on milk and dairy products. Buffalo milk is usually preferred, so it is more expensive than cow's milk. (1)

Region	Capita consumption x kg
Sindh	246
Punjab	132
Baluchistan	108
KPK	86

5 FARM OPERATIONS AND ANIMAL PERFORMANCE AND BREEDING

5.1 FARMING STRUCTURE

The dairy farming sector is generally characterized as fragmented and subsistence. With the exception of some peri-urban units, most dairy farming is practiced in mixed crop-livestock systems. Four main systems of milk production are identified:

Comparison of Farming Structures

Type of Farm	% of Total Farms in Pakistan	Type of Owners	No. and Type of Animals	Avg. Daily Yield	Type of Feed Provided
Smallholder Subsistence	85.4	Family	1 - 3 buffaloes	3 liters/day per animal	Animals are fed grown fodders (residuals and crops used as cut-and-carry livestock feed)
Smallholder market-oriented semi-subsistence	12.6	Family	5 buffalo (3 adult, 1 to 2 calves, 1 male calf)	4 - 5 litres /day per animal	Feeding crop residues and other agro-industrial by products. The use of green fodder depends on its economical availability
Rural commercial medium sized	1.7	Family and hired labor	5-30 animals	7-10 liters /day per animal	Feeding crop residues and other agro-industrial by products. The use of green fodder depends on its economical availability
Peri-Urban/ large commercial & market oriented	0.3	Family and hired labor	ranges from 10 to 200 animals (average 50 animals) 90% buffaloes and 10% cows	10 liters/day per animal	Green fodder supplemented with concentrates and feeding crop residues and other agro-industrial by products.
Large scale dairy corporate farming	> 0.1	Corporate	1,000 animal 100% cows	20 liters/day per animal	Feeding crop residues and other agro-industrial by products as well as maize silage and hay

1. Smallholder subsistence

Main goal is to meet family requirements at minimal cost.

Still over 60% buffaloes are maintained under this system. Farmers keep 1-3 buffaloes in milk with a heifer or a young calf. The farmers grow some fodder and graze the animals on field bunds/road sides or canal banks. Depending on the location and access, part of the milk is sold. The majority of the production is consumed as raw milk or converted to ghee. The average lactation yield is around 1,200 liters. Women play important roles in raising these animals. (2)

2. Smallholder market-oriented/semi-subsistence

Main goal is to have satisfactory access to a milk market, encouraging them to produce in excess of family requirement.

In the last two decades, due to infrastructure development, the subsistence production has been changing into market oriented production system in the majority of Punjab. The herd size is increasing but, 5-7 animals are usually present in the herd. These animals are stall-fed with some seasonal grazing, and diets are supplemented with concentrates. The management of these herds is better, and average production ranges from 1,800 to 2,000 liters. Over 50% of the milk is marketed mainly through middlemen who collect it from the farm gate. (2)

3. Rural commercial/ medium

Invested in milk production. Same milk marketing channels as the small holder market oriented

This system has developed during the last 25-30 years when some milk processing plants were installed. The herd size is 30 or more animals most of which are lactating. Most of the milk is sold. The management of such herds is better than foregoing systems. Feeding is based on grown or purchased fodder. Home mixed concentrates consist of cotton seed cake, wheat bran, milling by products. Mineral mixes are also used by majority of the farmers. The buffaloes kept under this system produce from 2,000 to 2,500 liters of milk. The family labor is supplemented with hired labor. (2)

4. Peri-Urban/ large commercial & market oriented

Commercial-scale units in the peripheries of major urban centers. Milk sold twice/day to direct sale to retail shops or to intermediaries

These units also emerged as the demand of milk and by-products grew. Depending on the location in a small or big town the number of animals kept varies. Mostly 10 to 50 lactating buffaloes producing up to 2,500 liters of milk per animal form such herds. Since almost all of the milk produced is sold at a comparatively higher price, the farmers can afford better management of these animals. The stall feeding consists of green fodder, straw and home-mixed concentrates. Good quality concentrate feed is readily available. (2)

Progressive Farmers Production System

During the last two to three decades there was importation of pure bred cows as well as of semen from abroad. This triggered crossbreeding mostly using Sahiwal and Red Sindhi cows. The milk production was doubled. The unit size is 20 to 30 cows. The estimated number of these animals is over 2.0 million. These animals are raised under good management. The green fodder is supplemented with concentrates. Introduction of exotic blood has resulted in increased lactation yield (2,200 to 2,600 liters), improved age at first calving and better breeding efficiency.

Large scale dairy corporate farming

For the last 5 years, several corporate companies have established large scale dairy farms ranging from 1,000 to 5,000 milking cows. These corporate farms are established by Pakistani companies who are managing other business outside the agricultural sector.

These corporate farms are established with the technical support of foreign consultants and suppliers and are mostly "state of the art" farms with imported high genetic cattle and expatriate management.

5.2 CATTLE AND BUFFALO PERFORMANCE

The cattle population is slightly larger than that of buffaloes, whereas cows produce on average only 55% of the yield of buffaloes. (1)

Type of animal	% of cattle population
Cattle cross-breeds	13
Pure breeds	43
Non-descript	44

The productivity of cross-breeds is far higher than of pure-breed and non-descript, with longer lactating periods, higher milk production per lactation and shorter calving intervals. An average quality cross-bred animal costs almost 40% more than an average buffalo. (1)

National milk yields are only 1,195 Liters/lactation for cows and 1,800 liters for buffaloes, while Oxytocin injections are used to boost milk production (common among market-oriented farms in the cattle colonies). (1)

Low milk productivity per animal is generally attributed to:

- Low genetic potential
- Poor nutrition
- Inadequate health coverage

The difference between the milk production per animal of progressive and average farmers is 30-50%. (2) This yield gap can be filled in the short term by proper feeding and water supply, which will increase the production of existing animals by 30-35%. Similarly, proper disease control can improve production by 10-20%; thus through the adoption of short-term strategies for improved nutrition and disease control, productivity can be enhanced by approx 40 to 50%. (2)

A survey revealed that of the total herd, 55% animals were dry but were still being maintained. One of the reasons for maintaining dry and young stock was lack of capital to replace them with wet animals. The price of animals was also very high. (2)

For most of the year, the amount fed is barely sufficient to support maintenance requirements of a mature buffalo/cow. Lactating animals therefore, never attain the genetic potential for milk production.

Feeding of the non-lactating animals always gets a cursory attention. Consequently the age at first calving was reported at 60 months in buffalo. Under better management the same is around 48-52 months.

In a lifetime production cycle there will be fewer lactations and less production. The calving interval in well fed buffalo herds is 15-16 months. (2)

The information collected through meetings with the stakeholders indicated that yield levels varied from farm to farm. The majority farmers with average management were able to get yield at 6-8 liters per day. There were very few farmers who applied improved practices including feed, fodder, health cover, etc. who in turn were able to obtain good yields ranging from 12 to 16 liters.

According to the experts and information disclosed by Nestle and Dairy Pakistan, yield levels of 10-12 liters were attainable by improving management practices (fodder, feed, watering, health cover, etc).

Seasonal fluctuations

Production of milk falls to 55% of peak production at its lowest point in mid-June, while the demand increases 60% during this time compared to December when the milk supply is ample.

The huge difference between lean and flush seasons is a significant problem. During the lean season, when the availability of the milk is very limited, the price goes up. During lean periods there is insufficient milk on the market and some of the processors have to close down their factories.

Farmers have adjusted their calving patterns for the lowest cost production and hence concentrate calving for winter milking. Counter cyclically, dairy consumption increases during summer with higher consumption of yogurt, ice cream, and other refreshing dairy products.

The seasonal fluctuation in milk production occurs due to lower water and fodder availability, and importantly the predominance of buffaloes in the herd. A good combination of buffalo and cow in dairy herds can partially help in reducing seasonal supply-demand gaps.

5.3 FEED, FEEDING AND WATER

Contributions of different feed sources for dairy animals is presented in the table underneath

Region	% of Total
Fodder and crop residues	51
Forage/grazing	38
Cereal by-products	6
Post-harvest grazing	3
Oilcakes, meals, animal protein	2
Total	**100**

Data shows that about one-fourth of the cultivated area was under fodder in order to support feeding of animals. Fodder production is an important part of the crop rotation. The main winter fodders include barseem, brassica species, turnips, and oats. A few farmers grow Lucerne mostly for feeding to horses and maize is grown both in early winter and spring for grain and fodder. The summer fodders are sorghum, millets, maize, and Mott grass. Multi-cut sorghum was introduced in the past decade. A few farmers grow a mixture of sorghum, millet and leguminous moth varieties.

Sunflower leaves are mostly fed to small ruminants. Dried maize, sorghum and millets are staked for winter feeding. These are mixed with small quantities of barseem, mustard (sarson) or turnips. Sugarcane tops are also fed to large ruminants in winter. In spite of fairly large area (range 14-17%) under fodder, still seasonal shortages are observed for two periods during the year.

Overgrazing is a serious threat to the environment. Fodder crops cover 16-19% of the total cropped area.
The fodder area is decreasing by 1.6% per year as cash crops such as wheat and sugar cane obtain higher prices and have more economic potential.

Green fodder shortages occur between May/June and December/January. The first period is early winter which starts from mid November and lasts until mid February. The second crunch period starts in May when barseem growth stops. This period will run till early July when summer fodder becomes available.

The reason for this gap is that farmers do not allocate separate area for fodder and wait till wheat harvest in April/May. The summer fodder thus grown will not be mature for feeding after Barseem growth is retarded/stopped in April/May. (2) Farmers also have limited access to better varieties, and cultural practices often are too inadequate to have a year around fodder supply.

Since livestock is an important source of farm income, farmers must adjust the periods of sowing, acquire and sow high yielding varieties and improve production practices. Furthermore, farmers should begin growing multi-cut fodder crops such as:

- Sorghum-Sudan grass hybrids
- Lucerne
- Barseem
- Mixtures of cereals en legumes
- Mott grass

There is also no awareness about conservation of the seasonal surpluses of fodder. Most of the stalks or hay is stored outside, apt to severe leaching by sun and rain.

Fodder crops need to be incorporated into the crop rotation, and land needs to be assigned to fodders rather than the existing practice of sowing fodder after wheat and cotton harvests. This practice delayed fodder maturity and in turn reduced availability of fodder to animals at critical periods of production (for instance, peak calving of buffaloes from July to mid September coincided with shortage of summer fodder).

There have been radical changes in the crop rotation during the last five years. Recent spot checks and appraisals indicated a drop in the fodder production area because most of it went for wheat production due to revised wheat rates. (2)

Feeding of the non-lactating animals always gets little attention. Consequently the age at first calving was reported at 60 months in buffalo. Under better management the same is around 48-52 months. In a lifetime production cycle there will be fewer lactations and less production. The calving interval in well fed buffalo herds is 15-16 months. In general the calving interval is reported to be around 23-27 months. The farmers have to bear the costs on feeding of these animals during unproductive phases too. This puts enormous pressure on the dwindling feed resources. (2)

Some studies and field data collection revealed that daily per head fodder consumption has been reported at 29.6 kg for wet and 15.1 kg for dry animals. Similarly, the consumption of roughages per animal has been reported at 3.8 kg for wet and 3.7 kg for dry animals. These are quite low and hence adversely impact animal milk production. The under feeding of dry animals further reduced their productivity in the subsequent years. The average lactation period for buffalo has been reported at 260 days and for cows (local breed) at 130 days. (2)

Supplementary feeding (concentrated feed)

In addition to forages, concentrates are fed to dairy cattle. This can be done as single grains (maize, wheat etc.) or as compounded feed i.e. concentrates produced by feed mills. There is a great variety of concentrates suitable for feeding to dairy cattle, ranging from the individual ingredients which can be used on the farm to mix rations, to the ready-mixed commercial compound feeds. Different concentrates contain different levels of major nutrients such as protein, energy and minerals.

In Pakistan, there are a large number of feed mills ranging from small scale rural area based to large scale industrialized factories. It is estimated that 90 to 95% of the concentrated feed produced by these large scale feed mills are for poultry feed. These feed mills are interested to produce more cattle feed, but the market is still too small and fragmented. Moreover feed mills have severe problems to obtain good quality of feed ingredients. The quality of ingredients over time has deteriorated immensely. Cotton seed cake which is one of the preferred and major feed ingredients is usually highly toxic stuff (aflatoxin). The same applies to wheat maize and other grains.

Aflatoxins

Aflatoxins are naturally occurring mycotoxins that are produced by many species of Aspergillus, a fungus. Aflatoxins are toxic and carcinogenic to animals, including humans. After entering the body, aflatoxins are metabolized by the liver to an intermediate reactive, aflatoxin M_1, an epoxide. Crops which are frequently affected include cereals (maize, sorghum, pearl millet, rice, wheat), and oilseeds (peanut, soybean, sunflower, cotton).

The maximum tolerance level for aflatoxin for milking animals is 20 ppb. One of the leading feed mills provided information on the test results of ingredients that they like to use for animal concentrates i.e.:

Cotton seed cake S1	ranging from35 to 90 ppb
Cotton seed cake S2	ranging from 1,500 to 2,000 ppb
Corn gluten	ranging from 40 to 97 ppb
Maize	ranging from 60 to 61 ppb
Maize cake	79 ppb

It is obvious that these test results in limits which are far above the tolerance levels and thus unfit for milk animals.

The information gathered from the farmers and stakeholders during field visits, exhibited that cost of concentrated feed (wanda) has tremendously increased and became almost unaffordable. On the other hand, its quality has also deteriorated. Barring a few exceptions, most of the concentrates available in different brands was adulterated and mixed with inferior and even toxic ingredients such as aflatoxin. The crude protein seldom exceeds 10%. Some reports indicate that high percentage of urea was incorporated in the compound feed to increase the protein contents by overlooking the harmful effects.

Farmers producing crops like maize, sorghum and millets can prepare cheap concentrates for dairy animals. Ground maize, millets and sorghum can be mixed with wheat bran/dry bread (roti) and left over wheat and other grains. If sugar-cane molasses (home produced) is mixed with into it, all the requirements of nutrients can be easily met.

Single grain feeding is still in practice and is a cheap and simple source of keeping livestock healthy and more productive. The information collected during the meetings and field visits showed that both homemade and commercially available concentrates were fed to the animals. The level of concentrates feeding is also low and thus a factor directly contributing towards low milk production.

In one of the read reports, the daily feeding was reported at 2.2 kg per wet animal (2) of which;

- 23.6% was home made
- 76.4% purchased from the market.

The Pakistan formulated feed industry is underdeveloped. Compared with an estimated annual demand of 40 million tonnes, only 0.20 million tonnes is produced (0.5%). This feed is unaffordable for smallholders and used by only market-oriented dairies. (1)

Another aspect that is underdeveloped in the animal nutrition and feeding sector is the availability of laboratories for forage and feed testing. Although most Universities have advanced testing equipment, these are hardly used for large scale testing for the private sector. It is estimated that around 7 commercial labs are able to test feed and forage. However the number of samples tested for dairy cattle feed and forages are very low. Furthermore, the availability of these testing labs is hardly known to the stakeholders in the dairy sector.

Most commercial feed mills have their own testing labs, used for testing the quality on the ingredients. These tests are expensive and time-consuming, resulting in having the test results only available after the ingredients have been unloaded and purchased. Near Infra Red (NIR) testing would overcome this time constraint.

Water (a critical input for milk production) is scare. Pakistan's per capita water availability has declined from 5,600 to 1,200 m^3 per year over recent decades, and may fall to the water-deficit level of less than 1,000 m^3/year. (1) This is also a threat to increased milk production.

5.4 BREEDING AND ARTIFICIAL INSEMINATION (AI)

The central semen production of the Government is at the Farm Qadirabad. Selected bulls from all Governmental farms are sent to Qadirabad for semen production There are about 130 buffalo bulls and 120 Sahiwal bulls at Qadirabad. The semen prices ex Qadirabad are Rs 50.-/straw for both breeds.

The Government has a semen production unit for Cholistani breed in the vicinity of Bahawalpur. Cattle records in both Government semen production units are insufficient and there are no progeny tested bulls. The issue is to improve local breeds and for this a herd book is required for all local breeds.

The private sector, ex- Governmental veterinarian and private farmers are extracting semen from all kinds of unproven bulls of the same breeds, with no records or progeny testing. They are undercutting the market prices, since they sell between Rs 15.- and 25.-/Dose. The PLDDB has a semen production unit in Renala with Canadian Friesian, using 97 bulls. This semen is sold at 80 to 100 .- Rs/straw.

In the Punjab there are around 15 private semen production units (SPUs). Almost all private SPUs in Pakistan are running their operations without even the basic standards. They use a very poor selection of bulls, drawn mostly from animal markets with the poorest genetics. There is almost no lab equipment; semen straws are being filled by mouth; and bulls are not tested for disease because there are no rules and regulations by the Government.

In general, semen quality and semen handling is very poor. Buffalo semen is sometimes lacking in motility. Even in some cases cheating is done by refilling straws of imported semen from top Friesian bulls.

The total estimated semen output quantity by Government per year is around 2.5 Mio dose. The total estimated semen quantity, including imports by the private sector, is about 3.6 million doses/year.

High quality imported semen is available on the market at cost of Rs 200.- to 400.- per straw (some selected Friesian straws are available at up to 10 000.- Rs/dose). Sexed semen imported of European breeds is available at Rs. 4,000.- to 7,000.- per dose.

Currently new legislation concerning breeding is under discussion with the relevant Governmental organizations. In case the new breeding legislation would come into force, most private SPUs have to be closed. Al-Haiwan Sires seems to be the only semen production unit in Pakistan that is meeting the maximum standards, although even this SPU is short of adequate lab equipment.

In January 2012 a report on the Breed Improvement in Punjab was presented by Dr. Hans Gerhard Wagner as part of the Punjab Government Efficiency Improvement Project – a project of the Government of Punjab, managed by the Punjab Resource Management Programme (PRMP). A part of his executive Summary is provided in the Annex as it gives a clear insight into the current breed and genetic issues. Although the research was focused on the Punjab only, the findings are applicable for the whole country.

5.5 ANIMAL HEALTH

The rural areas of Pakistan are home to several livestock diseases of viral, bacterial, nutritional and parasitic origins such as:

- Bovine Tuberculosis
- Brucellosis
- Foot and Mouth Disease
- Contagious Bovine Pleuropneumonia
- Rinderpest
- Hemorrhagic septicaemia
- Red Water

Vaccination against hemorrhagic spticaemia and foot and mouth diseases is regularly done but still a large number of farmers have a limited access to vaccine. Both ecto and endo parasites (ticks, mange mites, round & tape worms) are commonly observed in livestock. Programs for eradication do cover a fraction of the livestock.

Livestock diseases are a major limiting factor in enhancing animal productivity. It is particularly true for a disease like Foot and Mouth Disease (F&MD) that adversely affects milk yield and body condition. In Pakistan, estimated losses due to this disease are about Rs. 8 billions/year. The FAO is currently implementing (with financial support from USAID) a project named "Progressive Control of Food and Mouth Disease in Pakistan.

Detailed information on the cattle diseases within Pakistan can be found at the website of the World Organisation for Animal Health (OIE) www.oiw.int

5.6 ROLE OF WOMEN AND CHILDREN (2)

Except for the large scale corporate farms and at the cattle colonies, women and children play an active role in livestock production. Children help the elders in feeding, grazing crop residues and wallowing. Women carry out feeding, cleaning and milking. Men haul fodder and help in chopping.

The chores start with morning milking. Depending on the location and economic status, 25-50% of milking is carried out by women. Cleaning of sheds and animals, disposal of farm yard manure, feeding thrice a day, watering and washing are entirely performed by them. These activities take 3-5 hours a day.

Women are solely responsible for home made milk products such as yogurt, butter milk, butter and butter oil. Generally the women have a great attachment with the buffaloes due to economic reasons and raise them as a family member.

5.7 RURAL INCOME

Little accurate information is available on rural and farmers' income. The only report that has "field tested information is the report named Value Chain Analysis of Livestock Sector (Dairy) in District Vehari, Punjab from Inter-cooperation – August 2009. This report listed the following information:

The average annual income per household surveyed was Rs. 141,175 per annum. It was contributed by:

Source of income	%
Agriculture	46.4
Livestock	36.0
Labour	6.1
Business	6.1
Others	5.4
Total	**100**

The average per capita income was Rs.19,109 per annum compared to the national average of Rs.78,575 per capita per annum (Pakistan Economic Survey 2008-09).

The analysis of household consumers (120) survey indicated that average monthly per household income ranged between Rs.4,000 to Rs.65,000 depending upon the source. However, the majority fell in the income bracket of Rs.15,000-25,000.

The average household income was about Rs.20,000 per month. The survey further revealed that milk consumption was directly related to the level of income, i.e. the higher the income, the more milk consumption and vice versa. The price of milk paid varied from Rs.25 to Rs.35 per liter.

Studies have shown that small farmers who combine livestock with crop production have an income as high as those with only crops.

6 MILK

6.1 MILK COMPOSITION AND QUALITY

The perishable nature of milk, the long distance between production and consumption sites, inefficient marketing structure and the number of intermediaries in hauling milk through the marketing chain are factors that lead to adulteration and contamination of milk. Milk cooling tanks are only found at the milk collection centers established by the milk processing industry and at large scale farms.

The type and extent of adulteration varies from source to source. Apart from contamination associated with poor practices, malpractices involving use of adulterants is common. The information collected from different sources revealed that there are over two dozen adulterants being used in the milk industry.

In terms of adulterations, following (amongst other) products are added to raw milk:

- Adding water to increase volume
- Adding ice to prevent heat spoilage. Generally 1 kg ice/10 kg milk (made from dirty water)
- Penicillin to prevent spoilage
- Washing powder – to enhance volume and whiteness
- Maize flour – to enhance volume and whiteness
- Singhare flour
- Guar meal
- Chalk
- Urea
- Sodium Bicarbonate
- Formaline
- Hydrogen peroxide

The raw milk quality is not good, and that makes the shelf life of the packed milk very limited. There is a general understanding that real pure milk is hardly available to urban consumers.

In the absence of appropriate legislation there is hardly any check on the use of adulterants. The 1965 Pure Food Rules, which were conferred by the Pure Food Ordinance in 1960, superseded all earlier pure food regulations in the country. These rules specify that cow and buffalo milk is not to contain less than 3.5 and 5.0 % fat (BF) and 8.5 and 9.0% solid not fat (SNF), respectively. Standardized milk is to contain 3.5% BF and 8.9% SNF (2). However, the enforcement of these standards is weak.

Preserving the raw milk quality at farm is critical. The unhygienic practices during milking and on farm handling are serious issues. There is need for hygienic milking, cooling and hot boiling at a temperature sufficiently low to check multiplication of bacteria.

In order to keep milk temporarily "fresh", middlemen commonly add ice to the milk, which results in dilution of milk solids by up to 30%.

In addition, microbiological contamination due to ice being made from poor quality water is frequent. Compounding the problem, middlemen may attempt to counter the dilution by adding vegetable oil, whey powder and other ingredients to improve the solid content of the milk.

Antibiotics and peroxide are also often used as preservatives. Processors report that it is a constant battle against the innovation demonstrated by adulterators in terms of the adulterants added to milk.

Regulation may help to control the adulteration but the root cause of such adulteration is the lack of developed milk collection/logistical systems. Only a small percentage of the milk is properly collected.

In order to avoid contaminated milk, Nestle is conducting a total of 41 tests (divided at various stages in the collection chain) before the milk is processed. It is obvious that these costs are adding to the cost price of raw milk.

6.2 MILK COLLECTION

According to an industry estimate, approximately 60% of the milk produced by smallholders is consumed at home and the remaining 40% is marketed. (1)

Milk collection agents known as dodhis are the most important milk procurers and provide most farmers with their main link to the market.

Dodhis are well established middlemen in the milk supply chain. Dodhis collect milk at the competitive prices with other market players. They have more social and family links with the milk farmers and enjoy more trust and family bonds with them.

They collect milk in small quantities from farmers at their doorstep and supply to urban consumers at their doorstep. Besides supplying direct to consumers, the excess milk is sold to other market players including shop-keepers, khoya makers, confectioners/bakers, mini milk collectors or milk collection centers of processing plants.

Size of operation	Name	Type of operation
Small	katcha dodhis	door-to-door collection up to 100 liters/day
Medium	pucca dodhis	purchase from katcha dodhis ranging from 400 to 800 liters/day
Large	contractors	purchase from pucca dodhis collecting from 1,500 to 2,600 l/day

The gross margin varies from Rs.15 to 30/liter (November 2012). Marketing costs mainly involved labor and transportation charges. They mainly use bicycle/motorcycle for transportation. The volume of their business ranges from 200-400 liters per day per dodhi. The collection area stretches up to 20 km radius from the town.

In various other reports it has been mentioned that most dodhis are skimming milk from one-third to one-half of their daily collection in order to maximize their profits. The skimmed (separate) milk is used for yogurt. They also disclose that whole milk was not liked by the consumers due to the high fat percentage. The de-creaming also reduced the element of adulteration by adding water into the milk. The addition of ice in summer is unavoidable; otherwise, the chances of spoilage are certain. Dodhis also use the tactics of over weighing when buying and under weighing when selling milk.

Purchase prices of dodhis varied from Rs.35 to Rs.40 per liter (November 2012). During the summer period the prices are Rs 5/liter higher. The consumer sale price for "fresh milk" was reported at Rs.50 to Rs.70 per liter. The purchase price of milk was linked with distance from the town. Milk was cheaper in distantly located villages. However, it involved an additional cost, especially for transportation.

The margin for the dodhis is increased by adding water, using incorrect measurements, and de-creaming the milk. Dodhis purchase milk on the basis of quantity rather than quality. Farmers are often paid monthly, under post-sales contracts between farmers and dodhis. As dodhis are major sources of loans, advance annual payments are made to farmers, based on a flat daily rate price. In summer, when retail prices in milk increase, the marginal price premiums are not passed on to the farmers.

Absence of cold chain and cooling tanks (chillers) in the informal system have also resulted in the mixing of chemicals (unhygienic) for milk preservation, particularly when transported for long distances.

The milk processors have introduced an organized system of milk collection. They have introduced chillers and refrigerated carriers. These initiatives have been supplemented by Dairy Pakistan under the Ministry of Production, Industries and Special Initiatives, and the Livestock and Dairy Development Board under the Ministry of Food, Agriculture and Livestock.

Milk processors, especially Nestle, Engro Foods and Halla, have set up collection centres in milk production areas where they have created basic infrastructure in the form of chillers. The milk collected at these chillers (Nestle calls them Village Milk Collection Centres) is transported to sub-centres and processing plants in refrigerated carriers. This has provided competition to the traditional milk collection system dominated by dodhis and has enabled rural farmers to obtain better prices.

The milk is collected from the farmers directly through a network of village milk collection centres (VMCCs) and sub-centres without cooling facilities, i.e. VMC (Village Milk Centre). The VMCCs are established and owned by the dairy company.
The VMCC agent earns his margin from the difference between the purchase price and the sale price. He also gets additional incentives by meeting the quality and quantity targets.

Milk is supplied by different farmers and the VMCC in charge/agent is responsible to test and purchase milk according to the quality specifications prescribed by the company. Milk from the VMCC is transported by the company to the plant directly for processing.

Farmers who supply more than 40 litres of milk per day are classified as Commercial Farmers (CF). Nestle provides technical assistance to commercial farmers to adopt best practices which ultimately results into improved milk production, quality and hygiene. The same classification system is generally followed by Haleeb and Engro for farmers under the direct collection system. CFs supply milk to the VMCC; they also receive assistance in order to collect their milk directly from farms and receive partial advance payments.

Nestle is using cooling tanks to collect milk from Punjab and Sindh. Nestle has currently about 3,300 milk cooling tanks (ranging from 500 to 1,800 litre capacity) and 550 VMCs. The cooling tanks are equipped with a generator to ensure a continuous supply of electricity. It is estimated that over 2.2 billion Rs. (22 million USD) has been invested in these milk collection facilities.

Engro Foods is collecting milk from Punjab and Sindh with a network of 1,300 farm cooling tanks and 1,500 VMCs. Milk quality control and farmers' support services are provided by a team of 34 Agri service officers, 22 area managers and 8 managers. In addition 180 technical staff on motorbikes are visiting farmers regularly. It is obvious that these efforts are adding to the cost of raw milk procured and thus are reflected in the consumer price.

Under the indirect milk collection system as implemented by some other dairies, a third party is involved to collect and supply milk to the company. Main players involved in the indirect milk collection are dodhis and mini suppliers.

Dodhis supply milk at VMCCs and VMCs and get the base price. The mini suppliers collect milk at their own collection points and the company vehicle collects milk from their collection point (house) after testing. Mostly mini suppliers have only milk tanks without any chillers and use ice for cooling it. They are given a price margin above the prices being offered at the VMCCs of the dairy company in that locality.

Milk prices are based on the contractual arrangements with some individuals who collect milk through their own efforts (i.e. purchased from farmers, dodhis, mini suppliers etc) and supply milk to the industry (at its processing plant using their own transportation). They get higher prices (Rs.1-2.5/Litre) than prices paid to the farmers, along with an allowance for transportation. Some contractors are also given milk tanks, chillers, or other equipment and partial advance payments.

A variety of modes of transportation are used for milk collection by the farmers in rural areas to its haulage to processing plants and shop keepers and consumers in urban centres. Bicycles, motorbikes, three wheelers, and animal carts are used for collection and haulage of milk in small volumes ranging from 200 litres to 500 litres. Comparatively bigger volumes are transported in Suzuki pick-ups or Hi-Lux type of pick-ups. The bus roof tops are also used for haulage of milk from rural to urban centres. The risk of milk spoilage during transportation is higher in summer than in winter.

Farmers selling high-quality milk do not receive any incentives.

See Annex 2 for a schematic breakdown on the milk collection chain and margins made.

Size of operation	% of national production	Milk sales
Rural farming	80	60 % consumed by the farmers 40 % marketed by katcha & pucca dodhis The dodhis are selling their milk 85 % to contractors 10 % to collection/procurement agents of processing plants 5 % to bakers and confectioners Contractors sell 90 % of the milk to retail shops and the remaining to processing plants, bakers and confectioners
Peri-urban farming	15	80 % sold directly to consumers 15 % sold to retail shops 5 % to dodhis
Urban farming	5	85 % direct to urban consumers 15 % sold to retail shops

6.3 MILK PROCESSING

There are 24 units processing fresh as well as dry milk in the private and corporate sectors. The total estimated installed processing capacity is 2.42 billion litre/year. However the industry is running at 50% capacity when averaged for both flush (70-80%) and lean (30-40%) periods.

About 1 billion litres of fresh milk of buffalo and cow and 12.5 million kg of dry milk are processed each year. (2)

The formal milk marketing chains comprise the large-scale corporations in producing UHT processed milk. At least 11 large scale dairy processing plants operate in Pakistan. The large players are:

- Nestle Mainly collection from farmers
- Engro Foods 60% milk collected from farmers and 40% through intermediaries
- Chaudry Dairies Mainly collection from collectors
- Nirala
- Halla
- NoonMilac
- Dairy Bell
- Dairy Crest
- PremierHaleeb
- Prime
- K&K
- Pak Army

The formal dairy processing sector is the driving force behind the establishment of cold chains.

There is a distinct consumer preference for buffalo milk because of the high fat content (6 – 8 %). This is also very attractive for the dairy processors who offer milk with 3.5% fat content.

In the last two years, pasteurized milk has been sold on the market, and seems to be more popular as demand is now greater than supply. Pasteurized milk is either sold in cartons, plastic pouches or hard plastic bottles. Sale prices range from Rs 59 (Pouch pack 3.6% fat content in Lahore) to Rs 95 litre(Metro, Islamabad). Milk in cartons/hard plastic bottles is sold at Rs 90 to 95/litre. The main brands are Preme and Anhaan.

6.4 MARKETING MARGINS (2)

Demand and supply are the main factors for determining/establishing the purchase price of milk in different milk producing areas.

At the farmer level, the distance from the urban areas along with the infrastructure affects the price of milk. The presence of VMCCs also affects the milk price due to higher milk demand and competition between the processing and wet market. However the price offered by the wet market is the major force behind the milk price offered at VMCCs. The price of powder milk in the international market also plays its role in establishing the purchase price of milk by the industry.

The prices offered by different dairy industries remain almost the same within the same area. However, prices vary from area to area. Under the direct collection system, the price at the VMCCs

remained in the range of Rs. 35 to 40/litre for 14 TS or 6% fat content. The prices for contractors and mini suppliers involve additional incentives for services and transportation charges paid. The contractors and mini suppliers are getting Rs.1.0 to 2.0/litre higher than the prices offered to farmers.

The difference in purchase price and sale price of UHT milk ranged from Rs.35 to 40 per litre. Past studies also revealed that margins in the formal sector in the UHT milk chain amounted to Rs.15 to 29 per litre for fresh milk with 6% fat content.

Though farmer's share in consumer rupees for processed milk was lower, the survey revealed that the actual price received by the farmer was higher for sales to processing plants than to dodhis.

While farmers expressed some reservations about the quality based pricing by processors (fat content, SNF, etc.), they were still satisfied due to a much better collection system through VMCCs and regular purchase orders.
The semi-commercial dairy farmers who had set up their own retail outlets were much better off since they obtained higher prices. Their sale price for direct to-consumer ranged from Rs. 66 (sold to milk shops) to Rs. 85 (packed in plastic pouch pack) per litre for buffalo milk.

The other marketing agents included de-creamers and khoya makers. Their margin varied from Rs.10 to Rs.20 per kg. Apart from yogurt, which of course was a major selling milk product in urban areas, in rural areas farmers mostly relied on desi ghee which has a good shelf life and storability.

\The information collected from the farmers indicated that the sale of fresh milk would be their first priority. The desi ghee has a diminishing market. The other milk products like cream and khoya making in the traditional system is highly disorganized and unhygienic and thus there is lot of scope for improvement.

There is a need for preparing high value added products like mozzarella cheese which is used in pizza making. With the increasing popularity of pizza, an expanding market for mozzarella cheese is expected. However, this would certainly require capacity building of the farmers, technology and market linkages.

7 INPUTS AND SUPPORT SERVICES

Although the private sector has started to invest in providing inputs such as concentrated feed, forage production and handling, veterinary support, and AI, the coverage of these services is often limited to peri-urban, market-oriented farmers. This low coverage is due to fragmented rural production systems, low levels of education among rural farmers and costs that are too high for many smallholders.

Services are provided by dairy plants such as Nestle, Engro Foods and Chaudhry Dairies and commercial companies such as Unitech (cold chain equipment); SolveAgri Pak (feed, forage harvesting and handling equipment, training); Altaf&co (bull semen, forage harvesting & handling equipment, training); Maxim International (feed, bull semen); Profarm (feed, bull semen, milking equipment); Hi- tech (feed); ICI Pakistan (feed); Dairy care; FOSS/PakFil Technologies (testing equipment); ABC Agri (Hay and silage company); and Veterinary drugs (Ghazi Brothers).

8 FINANCIAL SERVICES – FINANCING

Lack of physical assets serve as collateral restrictions on farmers' access to formal credit at all levels. (1)

The State Bank of Pakistan has issued guidelines for livestock financing to facilitate commercial banks and financial institutions in extending credit to the livestock sector. Microcredit schemes for small livestock farmers through commercial banks have been started. Under the White Revolution Scheme, two Strategic Partnership Agreements have been signed and are being implemented between the Zarai Taraqiati Bank Limited (ZTBL) and Nestle Pakistan Limited and the Pakistan Dairy Development Company. (2)

The support to the dairy sector under these strategic partnership agreements envisages improvement and modernization of the dairy sector with a view to increasing milk supply and improving milk collection. This support should lead to better economic returns to dairy farmers, in turn alleviating poverty and improving the living standards of the rural population. The bank has earmarked Rs.5 billion for the financing of 50,000 animals (buffaloes and imported cows) during a five year period (2007-2011). Nestle Pakistan identifies good clients for the bank to improve the breed quality of foreign and local dairy animals, who then sell their milk to Nestle. Technical guidance is provided to the farmers through Nestle veterinarians. The company would purchase milk through its network and make weekly payments to the bank for the repayment of the farmers' loans. (2)

Under the given circumstances, Zarai Taraqiatee Bank Limited (ZTBL) was considered a comparatively better option due to comparatively lower rates of mark up (9%) which was further reduced to 8% in the case of those farmers who repaid as per schedule and did not default. However, the maximum limit of Rs.40,000/- was only sufficient for production loans and hardly supported any plans for purchase of milking animals.

9 FARMERS' ORGANIZATIONS/COOPERATIVES

Farmers are not organized, and there is no organized production and marketing in the agricultural economy. This leaves farmers with little bargaining power.

Currently the farming communities are not organized in groups. Consequently they had no power as bargaining agents for their produce. Milk production and collection, which is comparatively more organized as compared to other livestock products, have no milk producers' association. Some of the milk collectors have started organizing farmers in groups in order to collect more volume at one collection point.

10 POLICY / FOOD SAFETY LEGISLATION AND REGULATION

For the first time in the country's history, the government formulated a Livestock Policy in 2007. The following Pakistani Governmental organizations are engaged in the agricultural sector:

1. Ministry of Livestock and Dairy Development
2. Provincial departments of livestock and dairy development
3. Ministry of Industries, Production and Special Initiatives
o Agribusiness Development and Diversification project -2005 (ADDP) (2)
o Livestock and Dairy Development Board (LDDB) (2)
o Pakistan Dairy Development Company -2005 (also known as Dairy Pakistan) (PDDC)
o Small and Medium Enterprise Development Authority (SMEDA)
4. Universities
5. Pakistan Standards and Quality Control Authority (PSQCA)

The Government provides support services, such as veterinary care and extension. However the government's financial and human capacity is weak and cannot cover the larger fragmented farm base or widely spread marketing chain. (1)

Growth targets for milk, meat and meat production, and livestock productivity have been aligned in the Medium Term Development Framework (MTDF), which aims at an annual growth rate of 6-8 %. (2)

Important legislation for the dairy sector are:
- The Pure Food Ordinance – 1960
- The Pakistan Hotels and Restaurant Act – 1976
- The Pakistan Standards and Quality Control Authority – 1996

Enforcement of laws is very poor. The Health Department and local governments are both responsible for implementing food laws. (1)

11 DEVELOPMENT PROGRAMS

Pakistan is flooded by many agricultural development projects financed by international organizations such as the World Bank, FAO, Asian Development Bank, the governments of other countries such as USA, Japan, Australia and The Netherlands, and numerous private organizations and foundations. Some of these projects are listed below.

- Strengthening dairy value chains in Pakistan through improved farm management and more effective extension service CIDA/ AusAid Australian Agency for International Development

- Agriculture Sector Linkage Program (ASLP) by the Australian Centre for International Agricultural Research (ACIAR) (8)

- Smallholder Dairy Development project –establishment cold chain systems - USAID and Department for International Development (DFID)

- EU/Pakistan Livestock Services Project (SLSP) to support and improve livestock production & veterinary services through improvement in nutrition, extension/on-farm advisory services, veterinary hospitals & analytical laboratories (2003-2009) - European Union (EU)

- Government of Pakistan (2008) (1)
o Regulatory measures for imports of high-yielding animals, semen and embryos for cross breeding
o Duty-free imports of veterinary products, dairy equipment and machinery (not manufactured locally)
o Exemption from retail sales tax for processed products
- Others (1)
o Celdac projecttrained 3,000 local extension workers in 1,450 villages – Punjab

It seems that there is little coordination between the main donors in terms of exchanging experiences, lesions learnt, assessment of needs and planning of new interventions. ASF could play an initiating role in establishing an informal exchange of information between the donors.

12 RECOMMENDATIONS AND INTERVENTIONS

On the next pages, interventions are proposed which are the result of personal observations and outcome of the workshops held (Nov 2012) with stakeholders in the dairy value chain.

During the second visit of the Dairy Value Chain consultant (Jan/Feb 2013), the proposed interventions were presented and discussed in four (4) focus group meetings in which subject matter experts and stakeholders participated. The discussions in the focus groups were extremely useful as this provided the "blessing" of the proposed interventions as well practical advice on the structure, content and "pitfalls" of these interventions.

The formulated interventions can be grouped in seven major topics i.e. in random order:

1. Awareness, information and dissemination
2. Fodder and feed resources
3. Animal genetics
4. Vocational training
5. Manure utilization
6. Milk handling and processing
7. Institutional

It is obvious that the above listed interventions are only a limited attempted towards strengthening the Dairy Value chain. The proposed interventions should comprise a mix of technical assistance; training and financial support which should lead to a more effective dairy sector and thus decrease in cost and losses and thus an improved financial income in the dairy sector.

Unfortunately it has been concluded that a major stagnating factor in the development is the lack of adequate legislation as well as the enforcement of legislation. This factor is difficult to address for the private commercial sector and non-organized farmer communities.

Finally, during the visits, several other interventions were identified which are related to legislative, organization and institutional issues. As ASF was/is aiming at Agribusiness, the consultant focused the intervention at the private dairy sector and not directly at the governmental and educational sector as well as rural development and poverty reduction.

The basic principles for the introduction and application of the proposed interventions should be:
1. A private initiative
2. A feasible investment
3. A demand driven request
4. Monitoring of implementation and results

12.1 Ad Intervention 1 – Awareness, Information and Dissemination (Milk Quality and Technical Issues)

Constraints:
1. Consumers are not aware of the quality parameters of (food safe) fresh milk
2. Farmers and investors are lacking practical and unbiased information on existing and new technologies
3. Farmers are unaware about quality issue's in regard to bull semen
4. Farmers are unaware about making silage and hay to preserve forage

Activity 1.1. Regional information campaign in the urban areas, large villages and cities
The perishable nature of milk and the long distance between production and consumption have led to adulteration and contamination of milk. Moreover, the fresh milk supply chain involves many middlemen. To increase profit and to prevent spoilage, milk is adulterated with many non-dairy products and chemicals.

Consumers are not aware what fresh milk quality parameters are. Fat content is the only parameter that they know of and are informed about. Furthermore, price is misleading in buying the products. Consumers are not aware that the milk is adulterated with a wide range of liquids and chemical agents which are hazardous for human health.
As stated in the constraints, some of these adulterations are done to preserve the milk but also to increase profit by the middle man. These adulterations are hazardous to humans and thus this milk should not be consumed. The current governmental price cap on milk has also lead water is added to delete the milk. Obvious this water is not food safe and contaminated.

A regional information campaign in the urban areas (in cooperation with the milk processing plants and corporate farms) should inform the consumers about the key parameters on milk quality issues. Furthermore information should be provided on the nutrition value of milk in relation with price as well as the health risk by chemical adulterations.

It is anticipated that this information campaign will lead to more demand for higher quality milk (most likely against a higher price) and should develop a market segment for dodhis to penetrate into.

Activity 1.2. – Introduction of household testing kits on adulterations
In other Asian countries, milk adulteration is also very common and simple household testing kids have been developed. These kits are able to detect up to 10 different adulterations such as urea, starch, formalin and hydrogen peroxide. Cost of these test are ranging from Rs 120 to 2,400 per 100 tests. These kids should be introduced in combination with activity 1.1.

Activity 1.3. – Information and documentation centre
In general the commercial oriented sector is lacking unbiased technical information in order to make investment and improvements at their farm, milk processing and feed milling. Furthermore, practical benchmarks are not available on any technical subject as well as references and success stories in Pakistan. Last but not least, the info & documentation centre can promote the results obtained through the many development and pilot project implemented in Pakistan. Below some specific topics are mentioned, i.e.:

Promotion of first quality semen
Leading international AI companies are represented in Pakistan but due the low price of local produced semen (subsidy), small scale farmers are not using first class (imported) semen.

Promotion on silage and hay making to preserve forage
Awareness of good hay and silage making (proper cutting and storage).

Promotion of good youngstock care and handling
Promotion of youngstock rearing in order to decrease the investment cost for purchase of imported pregnant heifer, promotion as youngstock rearing as a business model and promotion of calf milk replacer as alternative for feeding raw milk.

Product
- Inventory with the dairy industry and the corporate farms to assess if are interested to have such a promotion campaign. ASF could coordinate and sponsor the campaign
- Inventory with consumers if they are interested to have these testing kits. ASF could approach potential suppliers and promote the use (in cooperation with the dairy industry and Consumer rights committee in Pakistan)
- Technical factsheets with key parameters, Reference lists, listing of training centers

Cost
- Contribution from the dairy industry and corporate farms based on 0,1% of the value in raw milk intake/production (approx 1 billion liter) would give 3.5 million Rs
- Testing kits on adulterants. Price depends on number of adulterants to be tested for and ranges from Rs 400 to 4,500/100 tests.

12.2 AD INTERVENTION 2 – FODDER AND FEED RESOURCES

Constraints:
1. Seasonal availability of forage for dairy animals
2. Lack of forage has a negative impact on productivity, fertility and youngstock growth and first age of calving
3. Hay and silage making is widely known as a viable business model
4. Little use of compounded feed in the feeding ratios of milking animals
5. Large scale feed mills are mainly producing feed for the poultry industry
6. Commercial feed mills are not producing animal feed in accordance to international feed standards
7. Lack of alternative concentrates component sources as well as quality and food safety issues (aflatoxin) at existing component sources
8. Testing of forage, feed and ingredients (raw material) for concentrates in time consuming and costly

Activity 2.1. – Provision of equipment for hay and silage making
Equipment for hay and silage making are simple and worldwide available (mower, rake, bale press). ASF should promote investment in this business by providing bench marks and listing suppliers. Investment support is required by providing grants.

Activity 2.3. - Introduction of GMP+ standards at the commercial feed mills
GMP+ International is an independent organization managing the GMP+ Feed Certification scheme, which consists of two modules, GMP+ Feed Safety Assurance and GMP+ Feed Responsibility Assurance, and is intended for the certification of feed companies active in the feed chain around the world.

The GMP+ FSA module has been developed to guarantee feed safety and to reassure consumers about the way animal feed products are produced, processed, traded, stored and transported. Requirements for feed safety assurance are laid down in the GMP+ standards, which are based on legislation and additional requirements from stakeholders in the market.

To secure high quality feed, GMP+ should be introduced at all feed mills. GMP+ is already introduced at all major sugar mills as they expert molasses which needs to be GMP+ certified.

Activity 2.4. – Development of alternative concentrates component sources
Currently the major ingredients for ruminant concentrates are based on a limited number of communities such as maize, sorghum, wheat and millet. These products are commodities and the prices are subject to international trade and developments. The prices of these products are increasing each year (25% in the last 12 months) and thus having a great impact on the prices of cattle feed in Pakistan. Within Pakistan many agro-industrial byproducts are available and technical support is required to valorize these by-products for animal nutrition.

Activity 2.2. - Establishment of a village based small scale grinding and mixing units
Despite the presence of feed mills, concentrated cattle feed is hardly used and available. This is due to the fact that most feed mills are mainly producing poultry feed and the fact that the distance from the feed mill to the rural farms is huge and thus transportation cost are an important factor in the cost price of concentrates. Introduction of simple and small scale mixing and grinding mills (1 to 2 tons/hour) in the rural areas could increase the use of concentrated feed on the one hand and reduction of costs on the other hand.

Activity 2.4. - Introduction of NIR (Near Infrared) feeding forage analysis
There are two ways that forages are analyzed for nutrient content. Wet chemistry uses established laboratory tests to quantify protein, fiber, fat, and minerals. More recently, near infrared reflectance spectroscopy (NIR) has been perfected to quickly, economically, and accurately measure nutrient content without destroying the sample. Also, NIR technology uses light reflectance and works best with large compounds such as those that compose protein and fiber. The minerals are smaller and, therefore, more difficult to measure with the NIR, and wet chemistry should be used if precise levels are needed. The NIR instrument must be calibrated to wet chemistry which is the standard.

NIR testing is common in countries with developed agriculture and provides real-time, immediate feed test results within 60 seconds whereas the wet testing method might take up to 36 hours.

Product

- TA in development of promotion material on hay and silage cutting and storage including cost and benefit ratio's
- TA in field demonstration on hay and silage making
- TA in the promotion of hay and silage making as business model
- Grants for equipment investments packages
- Grant for establishment of small scale grinding & mixing unit
- Grant for introduction of GMP+ at commercial feed mills
- Grant for introduction of Near Infrared (NIR) feed and forage analysis

Cost

- TA on hay and silage making
- Grants for hay and silage equipment investments packages
  - investment range from $ 10,000 to $ 100,000/unit
- Grant for establishment of small scale grinding & mixing unit
  - investment range from $ 10,000 to $ 20,000/unit
- Grant for introduction of GMP+ at commercial feed mills
  - investment range from $ 5,000 to $ 15,000/unit
- Grant for introduction of Near Infrared (NIR) feed and forage analysis
  - investment range from $ 60,000 to $ 100,000/unit

12.3 AD INTERVENTION 3 -ANIMAL GENETICS

Constraints:

1. Current bull semen production units in Pakistan (cows and buffaloes) are not producing semen from tested and proven bulls. Genetic potential of those bulls are therefore not known
2. Local bull semen is very low in quality resulting in a very low insemination rate
3. SPU's are lacking adequate- or are using outdated equipment
4. Cheating of imported semen by refilling straws or adulteration is very common and thus damaging effeteness' of the semen and the image of imported semen
5. In general, most AI technicians have a poor performance due to lack of skills and practical training, whereas accreditation of skilled technicians is missing
6. To cover the growing gap in milk consumption and production, next to increased milk production/animal also more animals are required in Pakistan. Importation of pregnant heifers is NOT covering the needs of more animals
7. Youngstock rearing is seen as an cost activity and not seen as rearing future milk production animals
8. Youngstock are not housed and fed in correct matter resulting in a late age of first calving and thus cost of rearing is to high

Activity 3.1. - Assist in development of a herd book organization

Genetic improvement of cattle and buffalo is only possible if a pedigree and performance recording system i.e. herd book is in place. A herd book is the basis for allowing the genetic analysis of the data to identify (with high accuracy and reliability) the genetically superior females that will serve as bull mothers and to conduct progeny testing. High accuracy and reliability are important because these sires will be multiplied via artificial insemination through thousands of doses of semen. The present selection criteria of dams based on their milk yield is not considered appropriate and therefore the genetic progress achieved is around zero.

Currently, bulls with a high breeding value are neither identified nor used for large scale semen production and therefore high valued genetics wasted.

Development and establishment of a herd book is there the foundation of introduction of a pedigree and performance recording system in order to map the genetic potential for bull mothers. This herd book should be initiated and owned by the existing cattle breeders' organizations with support of the private SPU's

Next to the establishment of the herd, performance recording has to be introduced and established. Subsequently, a genetic testing analysis has to be introduced, either by progeny or genomic testing.

Activity 3.2. – Upgrading technical equipment at SPU's

Investment in equipment for semen handling, quality control, straw filling and storage is required at almost all commercial SPU's. Modern equipment will preserve semen quality and will decrease production cost.

Activity 3.3. – Training and certification of inseminator

Currently the skills of a major part of the inseminator is very poor and thus adding to the very low conception rate i.e. insemination results. To improve the skills of these inseminators it is needed that these are trained (refreshment courses) at companies and governmental organisations which provide practical training at a certain quality level (see also activity 7 Seal of excellence). Furthermore, the herd book should certify inseminators that have sufficient skills so that the farmers can indentify good inseminators.

Activity 3.4. Information dissemination on bulls for sale from imported "pedigree" cows inseminated with proven bulls

Imported cattle do have a "cattle passport" containing information of its performance and genetic traits. Although most imported cattle are inseminated with sexed semen, still 3 to 5% bull calves are produced. This also applies to the imported cattle in their 2nd and onwards lactations. In most cases these bull calves are culled and thus good genetic potential is wasted.

The establishment of a website on which owners can display these young bulls, might be interested for other farmer who need a bull.

Activity 3.5. - Youngstock rearing

Except at the emerging corporate farms youngstock care is poor or nonexistent. Poor youngstock care has direct effect on the productivity of that animal at mature age. Furthermore, poor care leads to increased cost in feeding due to later maturity of the animal, more animal health problems and lower conception rate at AI.

Young stocks form the foundation of replacement stock, can be used to expand dairy stock and/or can be sold to generate income for the farmer. Moreover, raising youngstock could be less costly than importing pregnant heifers whereas local raised cows are more receptive to the local conditions (feeding and heat) resulting in less mortality.

Product

3.1. Improved SPU's
- Grant for investment in equipment

3.2. Establishment of a herdbook
- TA for Establishment of a herdbook for local cattle breeds in order to get to proven and tested bulls in the local bull semen production units
- Promotion of first quality semen

3.3. Increased skills of inseminators
TA in Training and certification of inseminator

3.4. Commercial youngstock rearing farms
- TA on good youngstock care and handling in order to decrease the investment cost for purchase of imported pregnant heifers
- Promotion of calf milk replacer as alternative for feeding raw milk
- Grant for investment in youngstock rearing as a business model

3.5 Dissemination on bulls for sale from imported "pedigree" cows inseminated with proven bulls
- Website for bulls on sale

Cost
- TA for determination of equipment needs for commercial SPU's
- Grants for investment in equipment for commercial SPU's
- investment range from $ 50,000 to $ 75,000/unit
- TA in the establishment of a herdbook for local breeds
- Grant for cattle registration system
- Grant for software of a herdbook system
- Grant for progeny/genomic testing
- Grant for practical training on inseminators
- investment range from $ 1,000 to $ 2,000/trainee)
-
- Grant for establishment of an inseminator certification system
- investment range from $ 10,000 to $ 20,000
-
- TA on youngstock rearing

- Grant for investment in youngstock farms
- investment range from $ 10,000 to $ 20,000/unit

12.4 Ad Intervention 4 – Vocational Training

Constraints:

1. Management and workers in the emerging commercial dairy farming sector are lacking practical experience and expertise
2. Practical vocational training is not known and widely available whereas there is an quality variation in vocational training programs (not practical, not hands-on training, commercial and sales oriented)
3. Vocational training is time consuming and costly

Activity 4.1. – Promotion of vocational training
- Inventory of existing vocational training programs (Universities and private companies)
- Quality assessment of the existing vocational training programs
- Adjustment (enlargement) of existing vocational training programs i.e. Curricula and facilities
- Promotion of existing vocational training

Product
- Survey on existing vocational training programs and facilities in order to assess Curricula, trainers, training facilities, cost and effectiveness
- Upgrading and development of additional needed vocational training programs (Curricula, train the trainers, facilities)
- Promotion of those vocational training organization who are meeting the required quality standards
- Grant for participants attending ASF qualified vocational training programs

Cost
- TA for curricula assessment and improvement
- Scholarship for participants
- Grant range from $ 1,000 to $ 5,000/trainee

12.5 AD INTERVENTION 5 - MANURE UTILIZATION

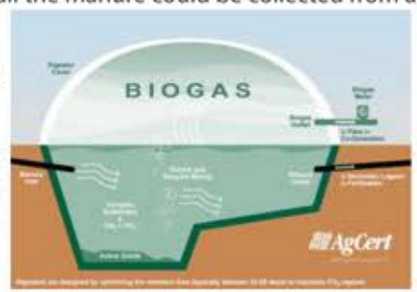
Constraints:

1. Lack of electricity in the rural area's in terms of volume and time
2. Huge environmental pollution in the Karachi area by manure handling

Activity 5.1. - Establishment of on-farm biogas units
Manure can be an alternative energy source for livestock farmers. An anaerobic digester will partially convert manure to energy in the form of biogas which contains methane. The composition of manure varies according to feed rations and different farm management practices. The amount of manure that can be collected will also vary. This depends on the type, weight, and number of animals, the feed ration, and the degree of confinement. For example, if all the manure could be collected from a 680-kg dairy cow, a farmer could collect about 57 kg daily.

The slurry remaining from the biogas production can be used as fertilizer for the land.

A 100 cow/buffalo farm will produce approx. 60m3 gas/day with is equal to 30 l/diesel oil (valued at Rs 110/liter) or 11.66 KW/h (valued at Rs 107/Kw/h). Investment for such a unit ranges from Rs. 700,000 to 1,000,000.



Activity 5.2. - Establishment of (solar) powered manure separation units
Separation of manure could a method to reduce the pollution of the ocean at Karachi. Separation can be done in various ways (methods). De semi-dry manure can be used for bedding the cattle building, fertilizer or can be pressed into briskets to be used in stoves.

To feed the buffaloes in the cattle colonies, 100 and more truck are driving daily to Karachi. The truck could take the dried manure back to the fields in order to be used as fertilizer.

Product
- TA for the promotion of biogas production and manure separation on cattle farms
- Development of investment packages
- Grants for investment in biogas units
- Grants for investment in manure separation units

Cost
- Grant in biogas units
- investment range from $ 10,000 to $ 20,000/unit

- Grant in manure separation units
- investment range from $ 5,000 to $ 10,000/unit

12.6 AD INTERVENTION 6 – MILK HANDLING AND PASTEURIZATION

Constraints

1. Self live of raw milk is very limited and therefore middle-men are adding chemicals to extend shelf life resulting in non food safe fresh milk
2. UHT milk is relative expensive due to its processing and packaging
3. Pasteurized milk is emerging on the market but insufficient to meet the growing demand
4. Shelf life of pasteurized milk is short due to a lack of an adequate cooling chain i.e. bulk milk coolers at farms

Intervention

Activity 6.1. - Establishment of farm bulk milk coolers (500 – 1.500 liter)
Milk cooling tanks will cool the fresh milk from 42 °C to < 5° C within 2 hours and this will reduce the bacteria growth in the milk. This will lead to a longer shelf life of processed milk products. As electricity supply is interrupted several times /day, a back-up generator should be supplied along with the milk cooling tank.

Activity 6.2. - Establishment of small scale pasteurization units (1,000 – 5,000 liter/day)
Because of the dangers of pathogenic bacteria, most milk is treated with pasteurization, a heat treatment originally developed to kill the bacterium that causes tuberculosis. Pasteurization is effective in destroying the bacteria in milk that cause tuberculosis, salmonellosis, diphtheria, typhoid fever, and other illnesses without adversely affecting the milk's nutritional content, flavor or quality.

Rapid cooling of the milk and storage below < 5° C following treatment help prevent milk spoilage and keep treated milk safe to drink. Despite the claims of raw milk advocates, public health agencies maintain that there are no known significant nutritional differences between unpasteurized and pasteurized milk and that pasteurized milk provides all the nutrients found naturally in raw milk. The benefits of destroying harmful bacteria far outweigh any potential health benefits claimed by raw milk advocates, and recent outbreaks of food borne illness associated with untreated milk have helped to renew public awareness of the dangers of raw milk consumption

Product
- Promotion of investment in small scale pasteurization units
- TA for development of equipment investments packages
- Grants in investment in farm milk cooling tanks
- Grants for investment in pasteurization units

Cost
- Grant in milk cooling tanks
- investment range from $ 5,000 to $ 10,000/unit
- Grant in pasteurization units
- investment range from $ 25,000 to $ 100,000/unit

12.7 AD INTERVENTION 7 - INSTITUTIONAL

Constraints:

1. The dairy sector lacks a master plan for the development of the sector in which the private sector has a leading role.
2. Coordination between representatives of farmers, processors, government and input suppliers is lacking.
3. Farmers and consumers are in general not aware about quality and are therefore only price oriented in the purchase of products and services
4. An independent quality assessment system for food, feed and services is lacking

Intervention

7.1. Development of a council/platform stimulating regular meetings between stakeholders of subject matter issues
7.2. Formulation of practical advices and policy papers to the Government
7.3. Development of a seal of excellence for milk traders, dairy companies, feed mills, milk shops, vocational training units who are meeting set standards

Activity 7.1. -Development of a council/platform stimulating regular meetings between stakeholders on subject matter issues

Exchange of information and understanding between all stakeholders in the sector is the foundation for a sound and stable development of the Dairy Value Chain.

Currently the dairy processing sector is having its Pakistan Dairy Association whereas the corporate (large scale) dairy farmers are organized in the Pakistan Corporate Dairy farmers Association. The emerging mid-sized dairy farmers are not organized nor are the 1 million and more rural farmers. The same applies to the input supply sector.

It is recommended that ASF facilitate in regular meetings between the stakeholders on subject matter topics such as milk quality, profitable in the dairy chain etc. etc.

Activity 7.2. - Formulation of practical advices and policy papers to the Government

The Government is failing to prepare and implement relevant and adequate legislation in the dairy sector. The sector is in need of relevant legislation and could provide policy papers to the Ministry as concept papers for required legislation. This could also be one of the outcomes of activity 7.1.

Activity 7.3 - Development of a seal of excellence for milk traders, dairy companies, feed mills, milk shops and vocational training units that are meeting set standards

Serious and reliable companies have huge problems in marketing and selling their services and products as (in general) their costs are higher than companies acting on the gray/black market with inferior quality but with lower prices.

For clients and consumers it is impossible to assess which company is providing service to certain local and international standards and to assess whether the price and quality are in the right balance. Therefore ASF could develop some kind of seal of excellence to be given to those companies that are trading and selling products and services to international standards.

Product

- TA to promote and introduce quality criteria for food, feed and services
- TA for the development of a seal of excellence for those meeting the set standards
- Grant for the introduction of seal of excellence
- Conduct workshops with all stakeholders
- TA for the preparation of a working document for the establishment of a dairy council/platform
- TA for the preparation of subject matter strategy and policy papers

Cost

6. TA for facilitating meetings and consumption during the meetings.

In addition to the interventions proposed in the previous pages, the following steps are recommended in order to continuing advancements:

1. Agreement on interventions to be implemented
2. Development of factsheet on proposed interventions and factsheets
3. Preparation of ToR for additional expertise
4. Assessment model on investor profile
5. Promoting of interventions
6. Monitoring of interventions done

13 ANNEXES

13.1 Excerpt from Dr. Hans Gerhard Wagner's Report on Breed Improvement in Punjab (Jan 2012)

The situation analysis found that Punjab has unique genetic resources that are well adapted to its local conditions. There is an enormous untapped potential to increase the output for milk and meat to meet the requirements of the growing population and for possible export. The gap between supply and demand is projected to be 55 million tons of milk and 2.3 million tons of beef by 2020.

The breed improvement in Punjab is based on artificial insemination, a practice that is well accepted, with more than five million inseminations in cattle and buffalo annually.

Semen is produced by four public SPUs and 11 private SPUs. In terms of production, the private sector is clearly out-producing the public sector, at 3.7 million doses compared with 2.7 million doses in 2010/2011.

There is no mechanism in place for the accreditation of SPUs and AI technicians to guarantee that they meet required standards.

With the exception of some good but limited efforts by the Research Centre for Conservation of Sahiwal Cattle in Jhang, at the Buffalo Research Institute in Pattoki and at the Livestock Production Research Institute for cattle and buffalo, there is no continuous and consistent pedigree and performance recording scheme in place. Bulls are selected on the phenotypic absolute milk production of their dams without any genetic analysis and can therefore only be considered of random quality.

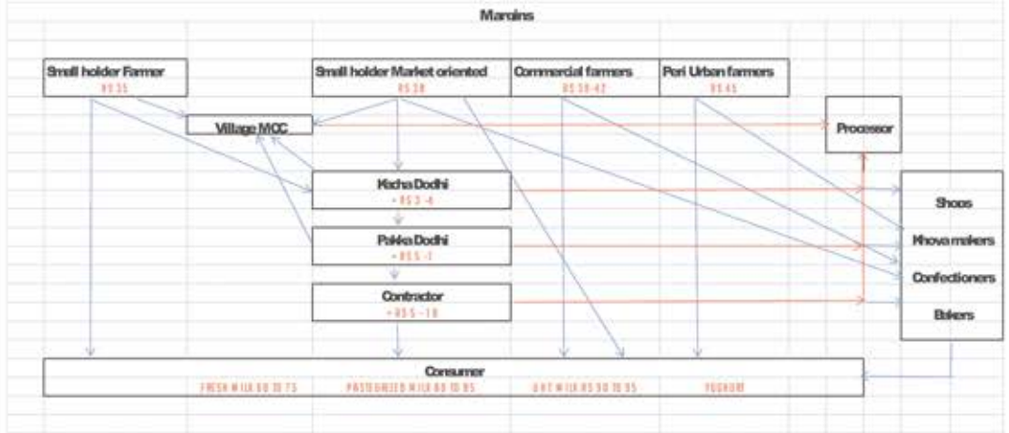
The scanty data that were analyzed in 2008 indicate that over the years, at least for Sahiwal, the genetic progress has hovered around zero.1

There is no pedigree and performance program with the necessary number of animals and the consistency that would allow accurate selection based on the estimated breeding value of young bulls for the SPUs and their subsequent progeny testing. So no genetic progress can really be expected.

The importing of exotic animals alive or through embryos and the unregulated use of imported exotic semen has led to a herd of pure and exotic crosses of more than three million head, already more than the local Sahiwal population. If this trend continues, the local genetic resource that is considered unique in the world could be under threat.

The Directorate of Breed Improvement has developed, over time, a number of good projects, Acts, standards and regulations that, unfortunately, have not had the expected impact. Some of them have not been enacted while others could not be fully implemented due to a number of constraints – technical, financial and lack of human resources.

13.2 Milk Collection Chain and Margins Collected



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