

The Impact of Extension Programs to Increase the Productivity of the Small-Holder Dairyfarming Industry of Pakistan

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Abstract

Dairy farming operations with small animal numbers producing low volumes of around three litres per animal per day predominate in Pakistan's dairy industry. Although much of this is consumed domestically, many farmers sell small volumes into traditional milk marketing chains which feed the product into urban retail outlets. Analysis of these marketing chains show that these farmers make a loss on every litre sold, while at the other end milk available to the consumer is of poor quality and often diluted as much as 1:2 with water. Small incremental profit margins are achieved by dilution and the use of distorted volume measures as the product is passed from small dealers to larger distributors and then to retail outlets. It is important that farmers are able to improve the efficiency of production by boosting the productivity of animals. This can be achieved through the adoption of better nutrition and animal husbandry practices. At the same time small scale local marketing chains require refinement to ensure profits generated from milk production stay with local communities. This paper reports on the development of effective extension strategies involving the whole family including the farmer, his wife and children. They have led to significant improvements in the profitability of small-holder dairy farming and a growing awareness of farmers of the commercial potential for their household cows and buffalo. The sustainability of these small-holder production systems in the face of changing consumer demands for higher quality products and world dairy product trade remains to be seen.

Introduction

The current status of the industry

Pakistan's economy is heavily reliant upon agricultural production which accounts for 21% of the country's GDP, with livestock production contributing 56% of agriculture's contribution [1]. The livestock sector is dominated by milk and meat production with 62% of milk coming from a buffalo population of 34.6 million and the remainder coming from 39.7million cattle, not all of which are kept for milk production [2]. The combined value of milk and meat of \$16.7 million exceeds the economic value of all cash crops [3]. There are 8.5million rural smallholder and peri urban dairy producers milking two to three milking animals which produce about 95% of the total milk production in Pakistan [4]. Around 80% of this comes from rural areas, many of which are isolated from major urban communities, while 15-20% is derived from peri-urban production units [5]. Larger herds comprising more than 30 milking animals constitute only 0.3% of the total holding [4]. Most of the milk is produced in Punjab (63%) and Sindh (23%) while KPK and Baluchistan provide only 12% and 2% of total milk production of Pakistan [5].

While the statistics for milk production are impressive, the productivity per cow is very low by world standards. Animals produce as little as 3.15 litres per day when in many cases they have the genetic capability to produce 4 or 5 times this volume. While annual production is increasing at the rate of 53.2% per annum [2], consumer demand is increasing by 15% each year to an impressive 43.2 million tonnes, some 5 million tonnes more than is produced. While the average length of lactation for the international dairy herd is 305 days which in many cases can be extended to 600 days [6], Pakistani buffalo and cattle struggle to maintain productivity beyond 200 days. Furthermore, the estimated 3.2% increase in production annually is offset by a 15% increase in consumer demand which is currently at 43.2 million tonnes, some 5 million tonnes above annual total production. The shortfall is made up from imports of whole milk powder, of which there is up to 50,000 tonnes being traded globally every month [7].

Sustainability of the industry

Increasingly livestock rearing and the consumption of animal products are seen as being environmentally unsustainable. Yet global demand for meat and dairy products continues to rise with the increase in urbanization of our world population [8]. The contributions of methane, nitrous oxide and carbon dioxide from livestock to global warming are significant with 18% of total global emissions coming from this source [9]. The use of poor quality roughages and overstocking of fragile environments leading to low productivity per animal in the developing world exacerbates this problem. Clearly improvements in the efficiency of production per animal is required to reduce averse environmental impacts while at the same time providing more high quality food for the world [10]. Given the structure of the dairy industry in Pakistan based on small-holder production and the reliance of both urban and rural communities on milk as the major source of animal protein, we have focused on ways of increasing milk production per animal on small-holder farms. Dairy animals are ideally suited to meeting these basic requirements since the family’s daily needs can be provided in just a single milking of one or two animals for up to 250 days over the course of lactation. In contrast the lack of refrigeration prevents the storage of meat in village households and so slaughter of livestock is not viable unless the family is able to sell meat into the local community.

Challenges Associated with the Dissemination of Information to Small-Holder Farmers

Firstly it is important to understand the reasons that farmers own animals. Apart from providing milk the number of animals owned by the family conveys social status within their community, while at the same time acting as a bank or insurance to meet essential family expenses such as the financing of weddings, funerals and expensive medical care. So profitability of any small-holder dairy enterprise is not necessarily a prime concern for the farmer. Often the most profitable aspect of any farm is the cropping component, with the

Table 1: Gross margin analysis of small-holder dairy operations in the Okara irrigated dairy region of Punjab state in 2011. The farms are categorized according to the volume of milk produced each year. Data are given as means and variance estimated as a mean SED for each variable (source: 2008-2009 Agriculture Sector Linkages Dairy Program farmer survey- unpublished).

Milk production per year (kg)	<2,300	2,300-3,700	3,700-10,100	SED	P-Value
Number of farms	39	38	38		
Ave production/animal (kg/yr)	780	990	1234		
Ave milk price (PKR/kg)	22.89	22.84	23.25	0.60	0.752
Cost of production (PKR/kg)	57.05	33.66	24.15	4.94	<0.001
Profit (PKR/kg)	-34.16	-10.82	-0.9		
Enterprise milk profit (PKR/kg)	-43,072	-32,064	-679	8,355	<0.001
Total crop GM (PKR)	271,487	353,346	442,862	68,443	0.047
Whole farm GM (PKR)	228,202	299,082	464,162	89,724	0.019
Whole farm op. profit (PKR)	134,651	170,029	303,281	78,667	0.082
Total finance costs (PKR)	401,817	489,926	594,840	77,836	0.049
Net profit	-267,166	-319,896	-291,559	70,390	0.755
Return on assets (%)	3.27	1.37	4.24	1.84	0.290

dairy enterprise very much a secondary concern. Very often there is no informal marketing chain for milk particularly in more isolated regions where up to 70% of farmers produce milk solely to feed their families [11].

In a recent survey reported by Godfrey SS [12] of a 115 small-holder dairy farming operations in the irrigated region of Okara, gross farm analysis showed that the predominance of these dairy operations were not profitable (Table 1). The financial viability of the whole operation was dependent on the amount of finance borrowed to remain operational. Given that the profitability of the farm was carried by the cropping component, farmers were less receptive to any advice offered to improve the profitability of their dairy operations. Interestingly the return on assets was similar to that observed in many Australian farming operations.

The failure of farmers to be compensated adequately with a fair market price for their milk is due to the structure of marketing chains connecting them to consumers, most of whom are urban based. Factors influencing price received on farm are dependent on whether milk is derived from buffalo or cattle, location of farms relative to markets, season, the educational status of the farmer and the pricing policies of statutory organisations. Milk processors have the potential to collude to control prices, which are based on the economic imperatives of the companies rather than the cost of production for small-holder farmers. The structure of one marketing chain described in detail by Godfrey [12] is given in (Figure 1).

Given the number of participants in these informal marketing chains relative to the number of farmers being serviced and the fixation of milk prices in the urban marketplace, there is little room for profit sharing for the milk collectors or dhodhis that form the chain and even less scope for a realistic price being offered to the farmer. The dilution of milk with water and the addition of other adulterants to boost perceived protein and fat contents by these operators are essential for profit sharing along the chain.

A survey of marketing chains in 3 districts of Punjab and found that the addition of water added up to 40% of the volume of milk sold in the urban marketplace (Table 2).

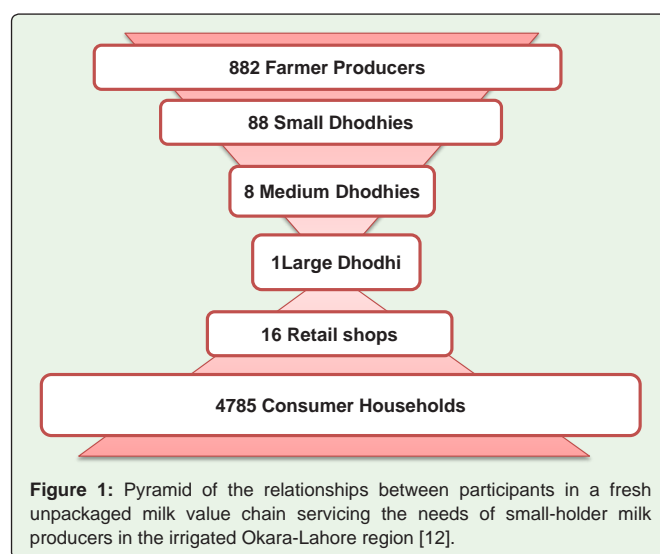


Figure 1: Pyramid of the relationships between participants in a fresh unpackaged milk value chain servicing the needs of small-holder milk producers in the irrigated Okara-Lahore region [12].

Typically consumers are looking for milk containing 4% fat and this can be achieved by vendors strategically by blending the higher fat buffalo milk (<6%) with cow milk together with water. Yet in our survey of milk collected from milk outlets in Okara, Pakpattan and Kasur fat content was as low as 2.2% (Table 2). At this level the yield of ghee upon boiling is unacceptable for the consumer. It is also the low protein levels that should be of concern to the consumer with concentrations of less than 2% (Table 2) often being found in the marketplace suggesting that the dilution rate can be as high as 1:2 along some marketing chains. The containers used for measuring milk volume along the chain also favour the trader, while in many commercial outlets the consumer is provided with 900 ml when in fact he/she has paid for one litre. The alternative source of product from milk manufacturers is also problematic, since product labelling provides no fat concentration information at all, but rather energy content: this provides no information on composition at all. Pakistan, however, is no different to other developing countries where informal marketing systems facilitate the supply of cheaper calories for the consumer [13]. Yet the presence of 97 middlemen in a marketing chain (Figure 1) through which only small volumes of milk flow, each making a small margin on the product they handle, is unsustainable in the long run. Such a finding is not unusual since policies and development strategies in many countries often fail to recognize and provide adequate support for smallholder production systems and associated marketing chains. Instead the future is seen to lie with higher profile industrial production [14]. However there is still a place for informal marketing chains in rural environments, particularly where there is no alternative for selling milk. These however must provide a more direct link between the producer and the consumer to ensure high quality product reaches the consumer while adequate profits generated from the sale pass back to the farmer.

The Challenges of Improving Extension Services to Small-Holder Farmers

Given the poor scope for improved milk prices received on farm and the secondary importance of milk production in the whole farm budget for many farmers, it is little wonder that high rates of adoption for extension messages delivered by veterinary staff are rare. Of course it is important to note that no more than 40% of small-holder farmers in Pakistan receive any form of extension services from government, NGO or private industry sources. The effectiveness of extension using the traditional format of didactic delivery of information to male farmers has also found to be wanting.

This can easily be explained by the fact that males mostly have very little to do with the collection of fodder, feeding, shed management and value adding to the milk produced (Table 3).

Given this information logic would dictate that an extension program focussing on improving animal productivity should focus on women and children and not the male members of the household.

Table 2: Composition of milk collected in the urban marketplaces of Okara, Pakpattan and Kasur in Central Punjab Province Pakistan [17].

Districts	Fat %	Protein %	SNF %	Lactose %	Added water %
Kasur	2.2	1.7	4.5	2.4	30.5
Okara	2.7	1.9	5.1	2.7	41.2
Pakpattan	3.2	2.4	6.3	3.3	26.0

Yet the social structure of the traditional Pakistani family shows clearly that the male is the family leader and therefore the recipient of all information that is important for the sustainability of the family.

The Agriculture Sector Linkages program (ASLP) dairy program has focused on refining their extension approach to incorporate the farmer, his wife, his children and then those that provide ancillary services to the community. These included the village school teacher and community health worker. This has led to much higher adoption rates of key extension messages, which initially were as low as 15% using the traditional “male only” approach. Anecdotal evidence has suggested that this approach leads to significant discussion within the family unit on each extension message. In the case of calf rearing, the children were often active participants in the family debate, with their interest being engendered from the school environment in which extension messages are displayed prominently on bulletin boards.

Assessment of the Impact of Our Extension Program

The success of any extension program can only be gauged by monitoring the increase in knowledge on the subject material among the farming communities. There was a requirement for a carefully constructed survey in which farmers and their families were assessed on their level of knowledge of the fundamental principles underlying the key messages. These messages related to major limitations to productivity that has been observed in small-holder dairy production systems.

They included:

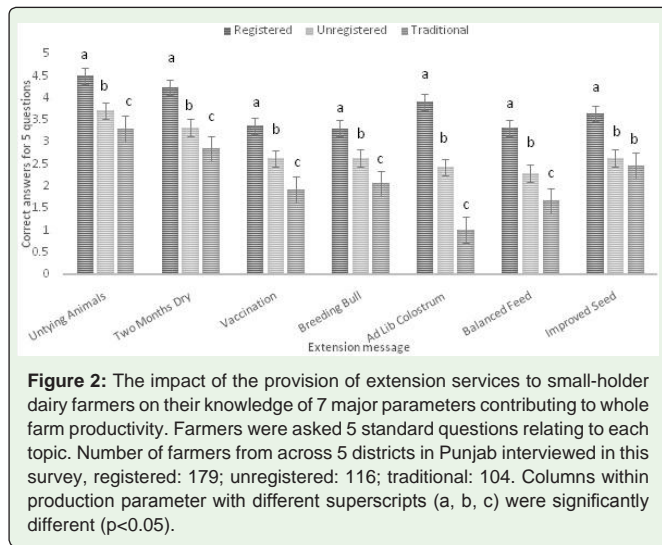
- the need to untie animals to provide free access to water and feed;
- the requirement for a 2 month dry period between lactations;
- the need to vaccinate animals using high quality effective vaccines;
- the selection of proven sires for mating;
- correctly balancing feeds to provide adequate energy, protein and trace minerals;
- The use of high quality seed to maximise forage production.

The survey of 399 farmers showed that the knowledge of so called traditional farmers who have not been trained in the program varied markedly over these subject areas (Figure 2). Remarkably their knowledge of the importance of colostrum to the survival of the newborn calf was very low, while at the other end of the spectrum, a

Table 3: The extent of involvement of members of the small-holder farming family in livestock production practices on farm.

Activity	Men	Women	Girls	Boys
Feeding	0.70 ^a	2.53	1.50	0.60
Collecting fodder	0.60	2.70	0.5	0.40
Shed management	0.70	2.75	0.95	0.45
Marketing of products	2.00	1.00	1.00	1.00
Vaccination and treatment	2.10	1.30	0.80	0.30
Dairy product preparation	0	2.00	2.00	0
Average	1.01	2.04	1.13	0.45

^aRanking, 0-1, minimum participation; 1.1-2, Some participation; 2.1-3, Maximum participation (source: adapted from Zia, Mahmood, & Ali, 2011).



very high proportion understood the concept of the importance of providing water and feed ad libitum.

While the impact of the extension program is clearly visible with these results, the interesting observation is that farmers who attend meetings but do not want to be engaged directly with our program also benefit. However it is not possible to assess whether these farmers implement the knowledge they have acquired as their production systems are not monitored. It is fair to say that our program refined over 7 years in the two major provinces, Punjab and Sindh has generated significant advances in productivity in the farming communities we have worked with.

The Future of Traditional Marketing Chains and Small-Holder Dairy Farming

History has shown that traditional informal marketing chains evolve over time. In North America and Europe in the 19th century, grain, milk, meat and fibre produced by small-holder farmers at the local level were traded to local small scale merchants in the raw state or perhaps with a single step of processing such as churning cream to form butter or grinding grain to flour. Governments often set the price but there was little regulation of product quality. Then with the advent of the industrial revolution the food production and marketing systems of Europe and North America underwent profound change. The establishment of large scale first stage processing companies to for example grind grain (e.g. Cargill) or process milk led to the development of secondary processing companies producing refined food products (e.g. Nestle). Mass distribution of milk was not possible until the advent of the milk bottle sealed with wax in 1884 and then the plastic coated cardboard milk carton in 1932 [15]. These changes led inevitably to large scale chain stores and supermarkets with associated large wholesale and logistics companies. Inevitably this led to pressure on farmers to produce more with lower profit margins per litre. If farmers were not able to increase their herd they went out of business, which had led to commercial herds in California of more than 2000 cows. Similar trends have been seen in Australia. While the sceptics said this would not happen in developing countries, this has not proved to be the case. Food systems in developing countries in Latin America, Asia, Eastern Europe, and some of Africa have undergone

a revolution since the 1980's resulting in the demise of small-holder farming systems [16]. Inevitably Pakistan's 8.5 million small-holder dairy farmers will be subjected to the whims of the world's economy. The industry will be subject to change as the expanding middle class consumer demands higher quality dairy products that meet world food safety standards. However any expansion of the industry will have to involve improved efficiencies in production that also account for environmental sustainability. Whether small-holder farming communities can meet these challenges remains to be seen [17].

Conclusion

The 8.5million small-holder dairy farmers of Pakistan produce over 90% of the nation's milk from 74 million animals averaging little more than 3 litres per day. Current marketing practices determine that they produce milk at a loss. This paper reviews our strategies to improve efficiencies in the industry to ensure that high quality milk will be available for the consumer into the future.

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