Chapter 1

General introduction

1.1 Pakistan's dairy sector

Agriculture has been and still is an important sector of Pakistan's economy. It has continued to intensify in response to population growth and changes in food and non-food markets. Pakistan occupies nearly 80 million hectares of land and is currently hosting a population of about 160 million (Government of Pakistan, 2006). The livestock sector is an important sub-sector of agriculture and plays a key role in the economy of the country. This is evident from the fact that it contributes 52.2% to the agricultural GDP, 11% to total export and the livelihoods of 53 million rural people (Economic Survey, 2010-11).

In terms of market value, milk production contributes more to the GDP of the country than any single crop, accounting for almost 52% of the value of agriculture products. Buffalo milk is more important with approximately 38%, followed by cattle milk with 11%. Traditionally buffalo milk is preferred over cattle milk because of its high fat content (Habib et al., 2007) and it usually sells at higher price (Burki et al., 2005). Pakistan is the fourth largest milk producer in the world, even though the dairy sector was badly neglected by the government in the past. According to the 2006 national livestock census, approximately 80%of the milk is produced in the rural areas. Yet, the dairy sector in Pakistan is performing much below its potential (Government of the Punjab, 2006): especially the milk yield per animal is very low (Burki et al., 2005; Habib et al., 2007) and the operation is labor intensive. Multiple interacting problems have been recognized, including effects of nutrition, reproduction, environment and genetics (Ghaffar et al., 2007), poor management and housing, restricted access to capital, breeding animals, veterinary services and public support. Pakistan's dairy sector is dominated by private farms and milk plants, and the role of the government is mostly regulatory (Jalil et al., 2009). As a consequence, imbalanced feeding, poor animal health, low fertility and low genetic potential characterize most of the dairy farms irrespective of herd size (Burki et al., 2005; Moaeen-ud-Din and Babar 2006; Habib et al., 2007). If livestock production does not intensify to keep abreast with the growing human population, Pakistan will face massive deficits in meat and milk supplies by the year 2020 (Rosegrant et al., 2001).

1.2 Opportunities and challenges of peri-urban milk production in Pakistan

The ongoing urbanization that is observed globally as well as in Pakistan is intensifying the demand for foods, particularly those of animal origin, in the urban centers. Traditionally, the dairy sector has generated employment and business opportunities particularly in the rural areas. The growing demand of urban dwellers for milk has been a major driving force for the establishment of urban and peri-urban dairy farms in cities such as Karachi, Lahore, Islamabad and Faisalabad (Moaeen-ud-Din and Babar, 2006; Habib et al., 2007; Jalil et al., 2009), and their number in Pakistan has tripled from 1986 to 1996 (Habib et al., 2007). During the same period, urbanization in Pakistan has also increased by 78%. Herd sizes of peri-urban farms range from 10 to 200 head, averaging 50 animals, with 90% buffaloes and 10% cows (FAO, 2011b). Peri-urban dairy production systems have their unique characteristics, opportunities

and constraints. Although in general they are economically profitable, the profitability varies tremendously between farms. Therefore, efforts must be made towards optimizing profit margins especially through improved management practices (Fonteh et al., 2005), and in fact, intensive commercial peri-urban livestock production systems have emerged around the cities over the past decade (Lanyasunya et al., 2001). While market access is no problem to peri-urban milk producers, the principal constraints to peri-urban livestock rearing are of technical nature and policy related (Smith and Olaloku, 1998). Poor managerial practices, lack of knowledge about feed production and water quality, poor quality of milk production and handling, and unsupervised use of veterinary medicines leading to drug residues in milk are recognized as major technical challenges for peri-urban dairy farmers in Pakistan. Further problems are high calf mortalities especially in milk buffaloes, unsystematic breeding, high loans and a hostile marketing system dominated by middlemen (Qureshi, 2000). In addition, (peri-)urban dairy farmers are usually poorly connected to financial institutions and livestock services, and some of them even get negligible returns from their dairy enterprise (Qureshi, 2000).

Nevertheless, peri-urban livestock keeping is a multi-functional activity that fits different livelihood strategies and contributes to food security, income and employment generation, savings and social status (Guendel, 2002). Therefore, research on production structures in this sector would allow for the identification of the necessary structural changes (Burki et al.,2005); the lack of a systematic classification of Pakistan's peri-urban dairy farms in view of their resources endowment, socio-economic characteristics and management strategies is an obstacle to policy and development efforts that aim at increasing the milk output per farm (livelihood aspect) and from this sector in general (food security aspect). Systematic classification and characterization approaches would promote a sound understanding of the diversity of dairy production systems and contribute to the prediction of their future evolution (Girard et al., 2001; Mburu et al., 2007).

A second area that relates to fine-tuning of technical solutions to the above described management problems is the determination of an animal's body weight (BW), which is necessary to calculate its feed requirements, monitor growth, determine breeding age, marketing weight and estimate its cash value (Payne, 1990). In Pakistan, however, small and medium scale buffalo owners depend on 'eye-judgment' when assessing body weight. Managerial decisions are, therefore, mostly based on rough and inaccurate weight estimates. Animal weighing instruments are costly to obtain, heavy to transport and need technical maintenance which often is beyond the reach of smallholders (Abdelhadi and Babiker, 2009). Body weight depends on various genetic and environmental factors; among the former are body size and other morphometric traits, which are also associated with productivity (Shankar and Mandal, 2010). Morphometric measurements are simple and easy to conduct, and allow estimating the animals' BW at low cost and with reasonable accuracy. Body measurements have been used to evaluate breed performance and characterize various types of ruminants. Msangiet al. (1999) reported that heart girth (HG) can be used with great accuracy for

estimating the BW of all classes of dairy cattle, and for various buffalo breeds a high correlation between HG and BW was also reported. Other authors found a good relationship between the body condition score and BW of cattle (Nesamvuni et al., 2000; Abdelhadi and Babiker, 2009). Establishing easy-to-use formula for BW estimation of the dominant Nili-Ravi dairy buffalo breed would greatly help small and medium scale dairy farmers in Pakistan to improve their animal management.

1.3 Feed use efficiency in peri-urban milk production systems

The global dairy sector has seen a major intensification during the past five decades, with the increase in scales and efficiency of production driven by the demand from a growing human population and increasing incomes of parts of the population (FAO, 2011a). The increase in milk output was achieved through the advances in animal nutrition and breeding, feed use efficiency, health management, housing, and automation strategies, along with supporting policies (FAO, 2011b). In Pakistan's peri-urban commercial dairy farms, feed accounts for more than two thirds of the operational costs (Habib et al., 2007), because animals are stall-fed year-round on wheat straw, purchased green fodder, and concentrate feed, which farmers obtain from the markets. High feed costs negatively affect the profitability of milk in peri-urban dairying, and seasonal variations in quantity and quality of the forages are a major concern especially during the scarcity periods (Gillah et al., 2012). Although producers in the emerging peri-urban dairy production systems face various constraints to production, inadequate nutrition of milking animals is considered one of the major limitations to dairy production (Olafadehan, 2007).

Very often feed resources available in the vicinity of cities cannot satisfy the high feed demand of peri-urban livestock production systems, and feed has to be purchased in remote rural areas, which increases the price. Garcia et al. (2003) calculated various farm input cost per 100 kg fat corrected milk (FCM) in rural and commercial peri-urban farms in Pakistan (Layyah and Lahore districts). In peri-urban farms, feed costs exceeded other input costs (land, capital and labor) and was estimated at PKR 1082 per 100 kg FCM in 2003, while it varied from PKR 38-40 per 100 kg FCM in rural small holdings. The urban dairy farms only received a profit margin of 25% as they were forced to purchase all feed for their animals (Garcia et al., 2003). In another study the average cost of production per liter of milk in peri-urban areas of Lahore was reported at PKR 30 per liter, but most of the time these costs were higher due to shortage of labor, feed, and morbidity and mortality of high yield animals. It pushed farmers to unethical practices like adulteration of milk for compensating their losses (Jalil et al., 2009).

In spite of the substantial contribution of livestock to the national economy, per head productivity of dairy animals under the existing farm conditions is relatively low. Among dairy buffaloes, 98% are producing less than 10 liters of milk/day (Khan et al., 2012), and the country's major increase in milk yield has resulted from an increased number of cattle and buffaloes, while the increase in milk yield per head has contributed relatively little to overall

growth of milk production. Optimum productive and reproductive efficiency of livestock can only be achieved if animals receive the required quantity of feedstuffs providing all nutrients in the needed proportion (NRC, 2001), and are well-managed in terms of health and environmental conditions (Oltenacu and Broom, 2010). A sound intervention strategy to increase income from dairy animals should focus on two fronts: firstly, lowering feed costs, and secondly increasing individual animal productivity (Habib et al., 2007). Both require improved nutritional management to increase the efficiency of feed utilization.

1.4 Research hypotheses, study objectives and setup

Against the above background, the present research project aimed at analyzing the socio-economic aspects of peri-urban dairy farming, in order to identify sustainable options for improved livestock management, based on the case of Faisalabad, the third-largest city of Pakistan.
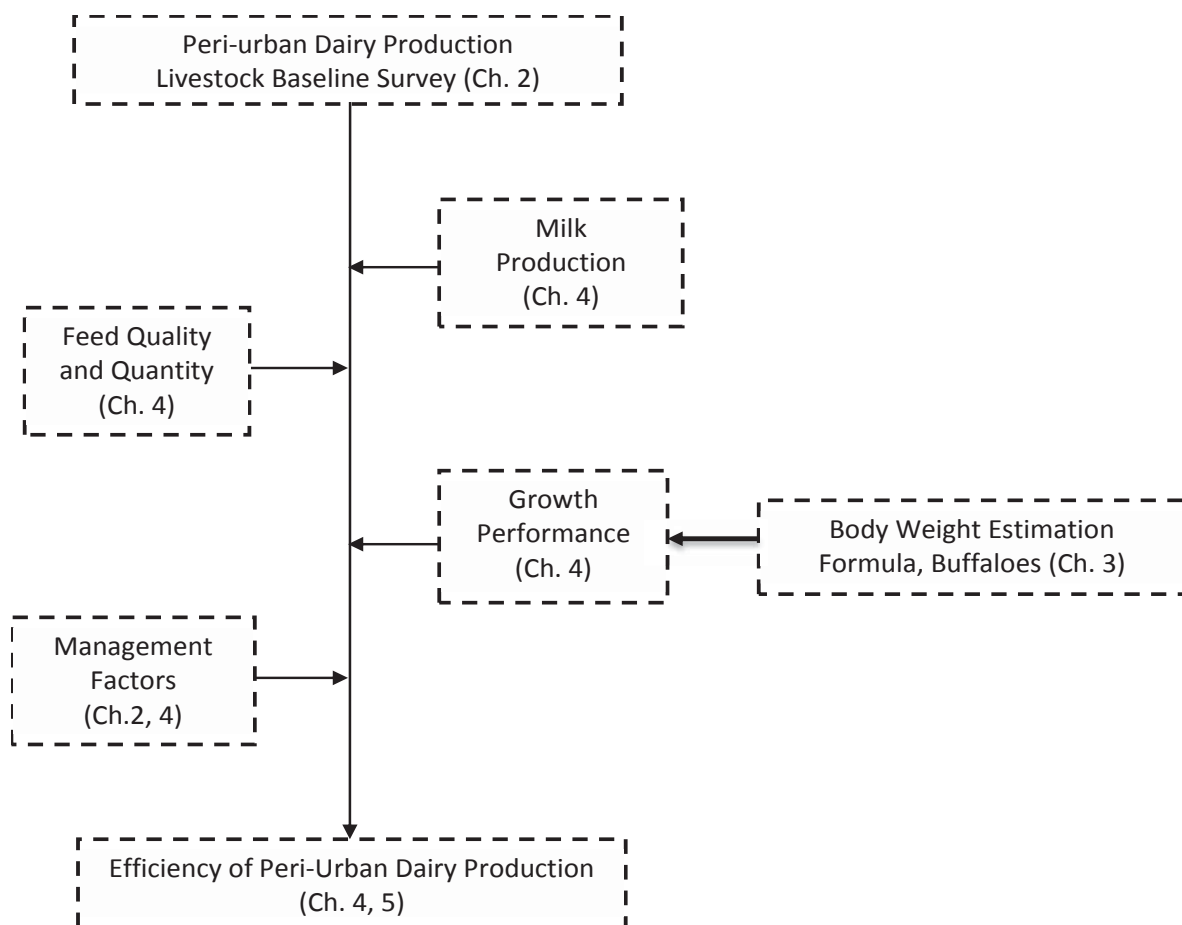
Figure 1. Flow chart depicting the different steps of data collection and thesis chapters

It was hypothesized that peri-urban dairy farms in Faisalabad are characterized by low resources use efficiency, leading to low milk production and economically critical conditions. It was further hypothesized that the low resource use efficiency has its reasons in an over-supply of nutrients to lactating buffaloes and an under-supply of nutrients to lactating cows.

To this end structured interviews (Figure 1) were conducted with 145 dairy farmers in Faisalabad, and a typology of farms was developed (Chapter 2). Secondly, a cheap and easy-to-use approach to estimate body weight of buffaloes was developed (Chapter 3) as a basic requirement for the evaluation of feed conversion efficiency (Figure 2; Chapter 4). In addition, the milk practices and use of oxytocin in peri-urban buffalo and cattle herds were investigated (aspect of Chapter4). The thesis ends with a reflection on how changes in feeding practices and other managerial factors might increase the productivity of different types of peri-urban dairy farms in Faisalabad and beyond (Chapter 5).
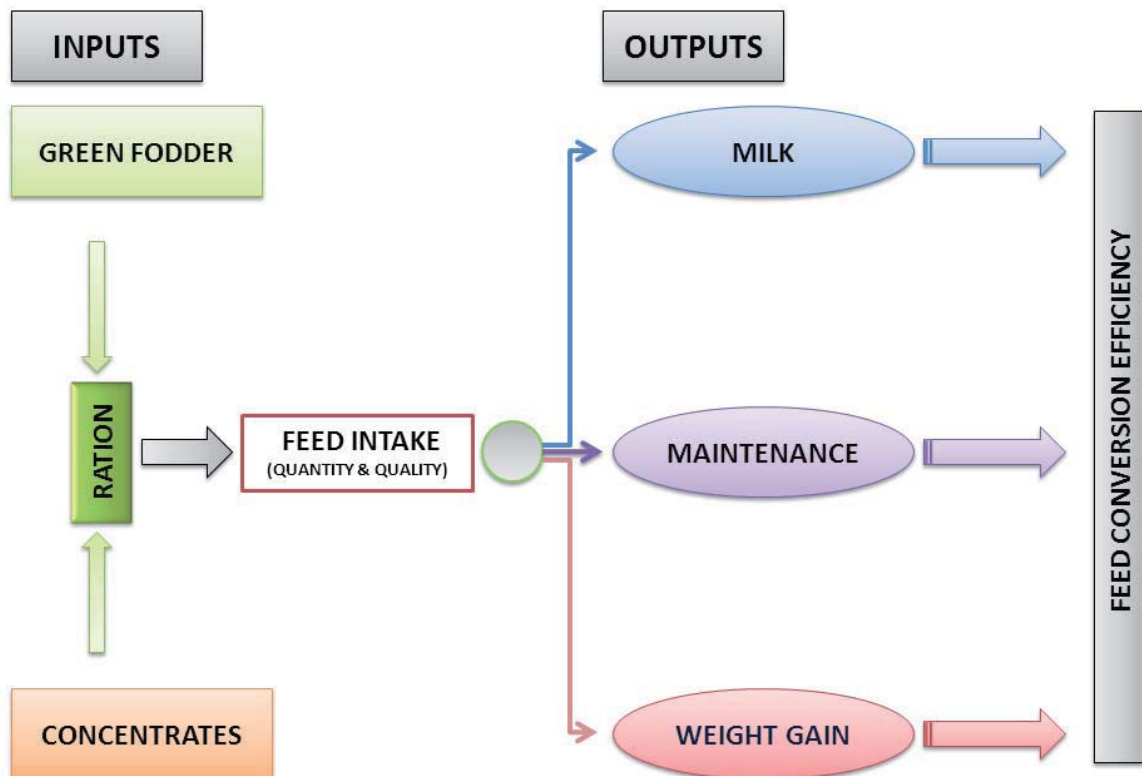

Figure 2. Flow chart depicting the variables that need to be determined when assessing feed use efficiency in a dairy unit consisting of buffaloes and/or cattle (empty, pregnant and lactating animals and calves).

1.5 References

Abdelhadi, O.M.A. and Babiker, S.A., 2009. Prediction of zebu cattle live weight using live animal measurements. Livestock Research for Rural Development, 21: Article #133. Retrieved April 19, 2012, from http://www.lrrd.org/lrrd21/8/abde21133.htm

Burki, A.A., Khan, M. and Bari, F., 2005. The state of Pakistan's dairy: An assessment. CMER Working Paper, 05-34, LUMS, Lahore, Pakistan.

Economic Survey, 2010-11. Government of Pakistan. Islamabad. Finance Division, Economic Adviser's Wing.

FAO, 2011a. Dairy development in Argentina. Food and Agriculture Organization of the United Nations. Rome, Italy.

FAO, 2011b. Dairy development in Pakistan. Food and Agriculture Organization of the United Nations. Rome, Italy.

Fonteh, F.A, Mubiru, S., Tibayungwa, F., Lammers, W., 2005. System analysis of peri-urban smallholder dairy farming in the Lake Crescent Region of Uganda Livestock Research for Rural Development. Volume 17, Article #79. Retrieved April 5, 2013, from http://www.lrrd.org/lrrd17/7/font17079.htm

Garcia, O., Mahmood K., Hemme, T., 2003. A review of milk production in Pakistan with particular emphasis on small scale producers. Pro-poor Livestock Policy Initiative Working Paper No. 3, FAO, Rome, Italy.

Ghaffar, A., Khan, M.Q., Ullah, N., Whitakar, D., 2007. Integrated approach for improving small scale market oriented dairy systems in Pakistan: Participatory rural appraisal and economic opportunity survey. Italian Journal of Animal Sciences, 6(2), 1400-1403.

Girard, N., Bellon, S., Hubert, B., Lardon, S., Moulin, C.H., Osty, P.L., 2001. Categorizing combinations of farmers land use practices: an approach based on examples of sheep farms in the south of France. Agronomie, 21, 435-459.

Gillah, K.A., Kifaro, G.C., Madsen, J., 2012. Urban and peri urban dairy farming in East Africa: A review on production levels, constraints and opportunities. Livestock Research for Rural Development. Volume 24, Article #198. Retrieved May 6, 2013, from http://www.lrrd.org/lrrd24/11/gill24198.htm

Government of the Punjab, 2006. PFIS "Punjab Livestock and Dairies", PRMP (Punjab Resource Management Program) and PFIS (Poverty Focused Investment Strategy), Faisalabad.

Guendel, S., 2002. Peri-urban and urban livestock keeping in East Africa – a coping strategy for the poor? Scoping study commissioned by the Livestock Production Programme (LPP). Retrieved January 17, 2013, from: http://www.dfid.gov.uk/r4d/PDF/Outputs/ZC0201a.pdf.

Habib, G., Hameed, A., Akmal, M., 2007. Current feeding management of peri-urban dairy buffaloes and scope for improvement. Pakistan Veterinary Journal, 27, 35-41.

Jalil, H., Rehman, H.U., Maqbool, H.S., Hussain, S.S., 2009. Analysis of milk production system in peri-urban areas of Lahore (Pakistan): a case study. Pakistan Economic and Social Review 47(2), 229-242.

Khan, R., Qureshi, M.S., Mushtaq, A., Ghufranullah, Naveed, A., 2012. Effect of quality and frequency of drinking water on productivity and fertility of dairy buffaloes. Journal of Animal Plant Sciences, 22(2), 96-101.

Lanyasunya, T.P., Mukisira, E.A., Lokwaleput, I.K., Siamba, D.N., 2001. Factors limiting optimization of smallholder peri urban dairy herd production in Kenya. Livestock Community and Environment. In: Proceedings of the 10th Conference of the Association of Institutions for Tropical Veterinary Medicine, Copenhagen, Denmark pp. 27-36

Mburu, L.M., Wakhungu, J.W., Kangethe, W.G., 2007. Characterization of smallholder dairy production systems for livestock improvement in Kenya highlands.Livestock Research for Rural Development 19, #110. Retrieved July 2, 2012, from http://www.lrrd.org/lrrd19/8/mbur19110.htm.

Moaeen-ud-Din, M., Babar, M.E., 2006. Livestock farming in peri-urban areas of Faisalabad, Pakistan.Livestock Research for Rural Development 18, #12. Retrieved June 20, 2012, from http://www.lrrd.org/lrrd18/1/moae18012.htm

Msangi, B.S.J., Bryant, M.J., Kavana, P.Y., Kizima, J.B., 1999. Body measurements as a management tool for crossbred dairy cattle at a smallholder farm condition. In: Proceedings of 26th Scientific Conference of Tanzania Society of Animal Production (Edited by Mbaga et al) 3rd–5th August 1999, LITI - Tengeru, Arusha, Tanzania, Pp.168-175.

Nesamvuni, A.E., Mulaudzi, J., Ramanyimi, N.D., Taylor, G.J., 2000. Estimation of body weight in Nguni-type cattle under communal management conditions. South African Journal of Animal Sciences, 30 (1), 97-98.

NRC, 2001.Nutrient requirements of dairy animals.7th Ed., National Research Council, National Academy Press, Washington, DC, USA.

Olafadehan, O.A., 2007. Potentials for improving dairy cattle production in the agro-pastoral farming system in the derived savanna of Oyo State, Nigeria. PhD. Thesis, Department of Animal Science, University of Ibadan, Nigeria.

Oltenacu, P.A., Broom, D.M., 2010. The impact of genetic selection for increased milk yield on the welfare of dairy cows. Animal Welfare, 19(S), 39–49.

Payne, W.J.A., 1990. An introduction to animal husbandry in the Tropics. 4th Ed, Longman Group Ltd, London, UK.

Qureshi, M.S., 2000. Productivity problems in livestock in NWFP and their sustainable solutions. Journal of Rural Development and Administration, 32(2), 73-81

Rosegrant, M.W., Paisner, M.S., Meijer, S., Witcover, J., 2001. 2020 Global food outlook: trends, alternatives, and choices. A 2020 vision for food, agriculture, and the environment initiative. International Food Policy Research Institute. Washington, D.C.

Shankar, S., Mandal, K.G., 2010. Genetic and non-genetic factors affecting body weight of buffaloes. Veterinary World, 3, 227-229.

Smith, O.B., Olaloku, E.A., 1998. Peri-urban livestock production systems. Cities Feeding Peoples Report 24. International Development Research Centre, Ottawa, Canada.Retrieved September 29, 2012 from http://www.dl-bnc.idrc.ca/dspace/bitstream/10625/22320/1/108521.pdf.