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Hector Kobbekaduwa Agrarian Research and Training Institute
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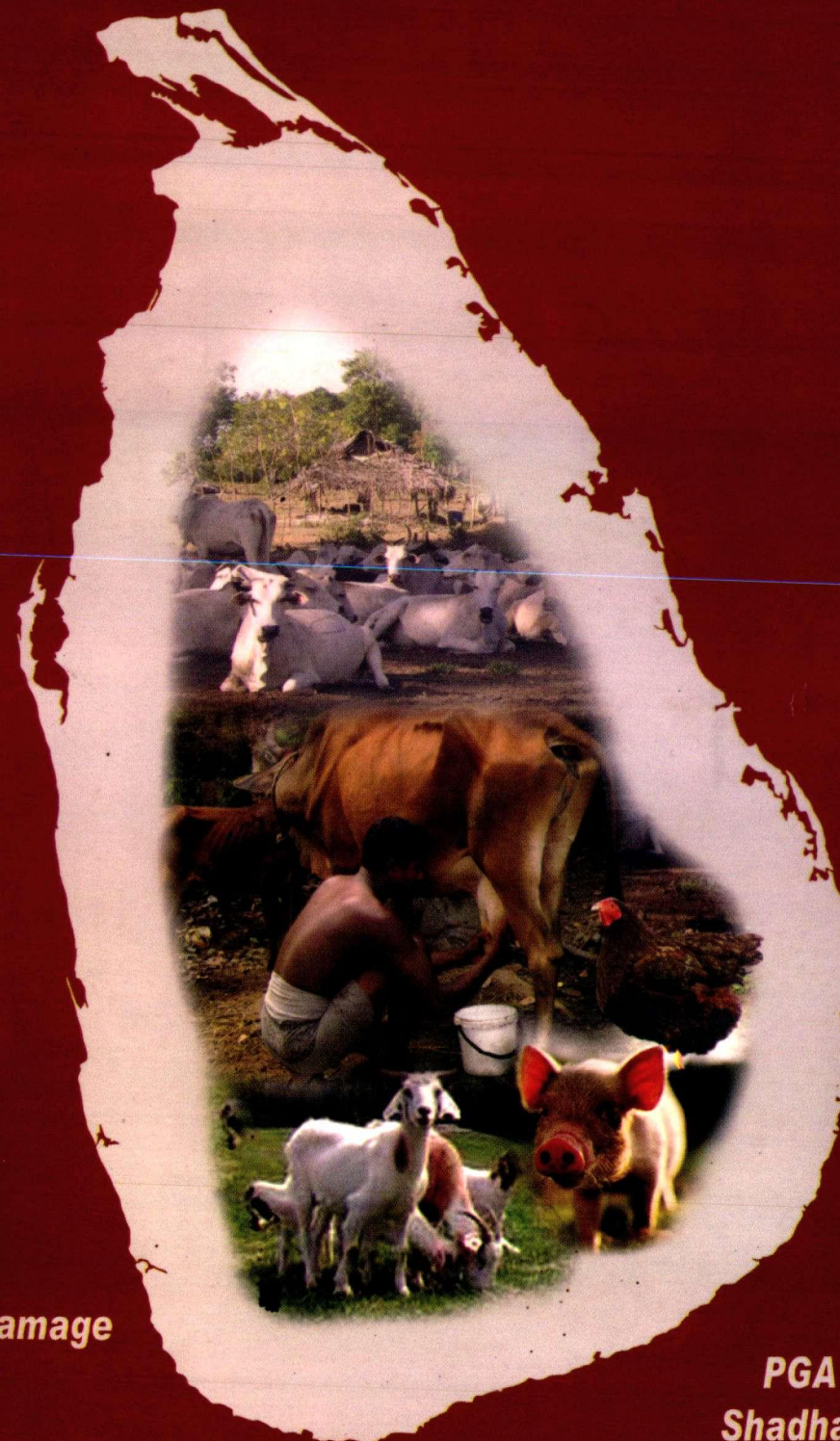


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LIVESTOCK FOR RURAL DEVELOPMENT AND POVERTY REDUCTION: SRI LANKAN EXPERIENCE

LIVESTOCK

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SRI LANKAN EXPERIENCE



Dhanawardana Gamage
DVS de S Gamage
SP Gunaratne
ADN Chandrasiri
DHA Subasinghe

BMAO Perera
PGA Pushpakumara
Shadhana Gajanayake
Thakshala Seresinhe
KK Pathirana

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Livestock for Rural Development and Poverty Reduction: Sri Lankan Experience

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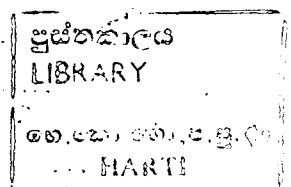
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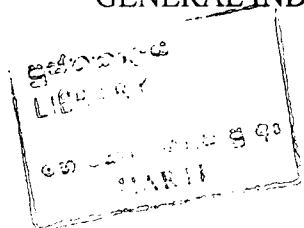
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PREFACE

In Sri Lanka, there is a vast income disparity between the most urbanised and industrialised western province and other provinces. Containing about 72 percent of the total population, the rural sector has been the repository of poverty. Amongst those smallholders engaged in crop farming, poverty has been high at all times. It is found that the livestock production in Sri Lanka, excepting the poultry sub-sector is mainly located in remote and ecologically marginal areas and such sub-sectors of livestock like the cattle, buffalo and goat farming are largely found amongst the small-scale farmers who integrate crops with few animals. Existing experience indicates that small-scale livestock production and marketing can contribute significantly to diversify the rural livelihoods, increase rural incomes and nutrition and reduce poverty. It is clear that the Sri Lankan Government has given priority to crop production after independence. The National Livestock Development Policy and Strategies of 2006 places greater emphasis on cattle, buffalo and goat farming sub-sectors. This book explores the potential of livestock for increasing smallholder farmer incomes while contributing to reduce the import burden of livestock products and reducing malnutrition.

Analysis of this book reveals that development of smallholder livestock sector to achieve the above objectives will depend on many factors. One is treating livestock as a high priority area for rural development strategy and enhancing its integration with the crop sector in a mutually beneficial manner. There are many problems identified and analysed as affecting the small-scale livestock producers in this book. The authors contributing to this book show the need for improving the existing stock through crossbreeding of native or local animals with high producing exotic animals, improving feeding and management practices and how to achieve them in a practical manner. Another major area of policy stressed is the need for improving marketing.

This book is the result of endurance of many including the authors contributing with different chapters. Dr Dhanawardana Gamage, former Deputy Director (Research) and Research Fellow (Development Sociology) of HARTI initiated the work to examine the existing state of the agrarian sector and explore how livestock can be developed to reduce rural and agrarian poverty. He designed the subject matter and thereafter coordinated the work with Miss M K Nadeeka Damayanthi, Research Officer as co-coordinator. After Dr Gamage left the Institute in April 2009, Miss Damayanthi coordinated the work to its successful completion.

The Swedish Agency for Research Co-operation (SAREC) had provided funds to compile a report on the "Rice Sector of Sri Lanka" in the early 1990s on the request of the then Director Mr Gamini Senevirathne. However, after his transfer money remained unspent at HARTI. When Dr Gamage initiated a programme to assess the "State of the Smallholder Farming Sector in Sri Lanka," provisions for it were made available from the saved SAREC funds. I am thankful to SAREC and former Director of HARTI Mr Senevirathne for making available the funds with which we could address major issues emerging in the smallholder farming sector such as agrarian poverty. I appreciate very much the help extended by Dr L P Rupasena, Deputy Director Research in reviewing the three chapters written by Dr Gamage and made necessary arrangements for publishing the book. Much thanks are due to Mr Nandana S Talagune, HARTI editor who did a thorough job of editing the manuscript.



VK Nanayakkara
Director
HARTI
10 June 2009

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Bringing to a book form after a considerable amount of research covering almost 90 percent of the subject is a task as well as a challenge which at last came to fruition due to Dr Gamage's dedication, devotion and determination. Dr Gamage - a go-getter and achiever who is always willing to undertake challenges, is thanked with gratitude for giving me all the support. In this two-year task there is another person who deserves a special mention here. It is none other than Mr VK Nanayakkara, Director, HARTI. Therefore I devote a few lines to place on record my indebtedness to Mr Nanayakkara, for his unstinting and unflagging support and guidance throughout the project, which contributed to completion of this book, without which this would not have been possible. I appreciate very much the help extended by Dr LP Rupasena, Deputy Director Research/HARTI in administrative matters, besides reviewing some chapters in the midst of his busy environment. As co-ordinator I am deeply thankful to him.

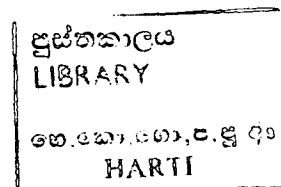
Thanks are also due to authors and reviewers. As authors, Dr Dhanawardana Gamage, Dr DVS de S Gamage, Dr ADN Chandrasiri, Dr DHA Subasinghe, Professor BMAO Perera, Dr PGA Pushpakumara, Dr SP Gunaratne, Ms S Gajanayake, Professor T Seresinhe and Professor KK Pathirana should be commended for their valuable contribution, while as reviewers Professor Sivali Ranawana, Professor H Abegunawardena, Dr DD Wanasinghe and Mr A Bedgar Perera should deserve a special thank for taking extra effort to review chapters and giving many useful comments and suggestions for improvement of the chapters.

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MK Nadeeka Damayanthi
Co-ordinator

The Project of The State of the Smallholder Farming Sector in Sri Lanka
HARTI

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ABOUT AUTHORS

Dr Dhanawardana Gamage (BA, B Phil, MSPD, RPP, PhD)

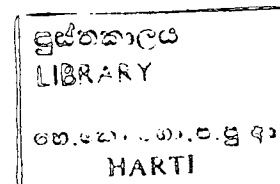
Dr Gamage who conceptualised and initiated the subject dealt in this book, has previously functioned at the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) as the Head of Agricultural Policy and Project Planning Division, Deputy Director (Research) and Research Fellow (Development Sociology). He holds B A and B Phil (honors) degrees in Sociology from University of Colombo; Post Graduate Diploma in Rural Policy and Project Planning from the Institute of Social Studies, the Hague; Master of Social Planning and Development from University of Queensland, Brisbane and PhD in Development from University of Wisconsin, Madison.

While at HARTI, Dr Gamage has completed numerous evaluation and research studies on projects dealing with rural and agrarian development and nutrition; research reports and articles on poverty, agrarian policy, impact of ethnic conflict and social context of environmental degradation. He has written a book on research methods titled as "Socio-economic Surveys for Development" which was published by the Sri Lanka Institute of Local Governance in 2003. He also has compiled a book titled as "Assessment of Rural Development Initiatives in Sri Lanka and Future Opportunities" which is being published by the Centre for Rural Development for Asia and Pacific. The latter book analyses the economic, rural and agrarian development policies and programmes in Sri Lanka in terms of their linkages to existing rural and agrarian conditions, discontinuities in policies and programmes and identify the major thrust areas to be addressed in future interventions. At present he is compiling a book on agricultural and agrarian transformation.

Dr Gamage has hands-on experience in development by working as a consultant/ sociologist/ social planner/socio-economist/social impact assessment specialist etc in projects assisted by the World Bank, the Asian Development Bank, the Japan Bank for International Cooperation (JBIC), Japanese International Cooperation Agency (JICA), Australian Agency for International Development (AUSAID), UNICEF, FAO, and WFP as well as for international development consultants like Fin Roads (Finland), the Scot Wilson Ltd of UK, egisbceom of France etc. He also has completed work for the chr. Michelsen Institute (Norway) and the University of Wageningen (the Netherlands) and the Hosei University, Japan and national and international NGOs like Arthacharya Foundation, Plan International and Practical Action.

DVS deS Gamage (BSc – Animal Husbandary)

Sunil Gamage is the Deputy Director at Veterinary Research Institute of Sri Lanka. He has



been a researcher in the field of poultry management and breeding for the last twenty-seven years. He is also the national co-ordinator for indigenous farm animal resource (FAO) in Sri Lanka

Dr ADN Chandrasiri (BVSc, MSc, PhD)

Dr Chandrasiri obtained his BVSc degree in 1978 from the University of Peradeniya and joined the Department of Animal Production and Health in 1979 as a veterinarian. He has 10 years experience as a field veterinarian in charge of many veterinary ranges in Sri Lanka. He obtained a Post-graduate Diploma in Animal Husbandry in 1985 and an MSc in Animal Breeding in 1987 from the Agricultural University of Norway. In 1989, he joined the Veterinary Research Institute of Sri Lanka as a veterinary research officer. He obtained his PhD degree from the University Putra Malaysia in 1998. His field of speciality is Animal Breeding and Reproductive Physiology. Up to date he has to his credit more than hundred research and other publications related to the livestock sector. At present he serves as the Additional Director General of the Department of Animal Production and Health.

Dr DHA Subasinghe (BVSc, MS, PhD)

Dr Subasinghe obtained his bachelor's degree in veterinary science from the University of Ceylon in 1956, and his MS and PhD in microbiology from the University of Hawaii, USA in 1965 and 1971, respectively. He specialised in virology for the PhD degree. After graduation in 1956, Dr Subasinghe joined the Department of Agriculture as a veterinary surgeon and worked as a district veterinarian as well as veterinary surgeon at the headquarters. In 1963, he proceeded to the University of Hawaii for higher studies, on an East West Center scholarship. On his return to Sri Lanka in 1967, he joined the Veterinary Research Institute as a veterinary research officer (VRO) and worked for over a decade in that capacity, being in charge of the Microbiology and Diagnostic Division. In 1969, he returned to USA and completed his PhD in 1971. Dr Subasinghe was promoted to Class I of the Animal Production and Health service in 1978 and was appointed Deputy Director (AP&H) in 1980, and was in charge of livestock farms of the department for over ten years in this post and retired in 1991. Between 1990 to 1995 Dr Subasinghe was actively involved in farmer oriented participatory research and transfer of technology, under the SAREC/NARESA Buffalo Research and Development Programme. Dr Subasinghe has to his credit over forty-five scientific publications, in national and international journals, chapters in several books and educational leaflets on animal production and health for extension workers and farmers. Dr Subasinghe is currently on the teaching staff of the Faculty of Veterinary Medicine and Animal Science as a senior visiting lecturer and consultant to the Veterinary Teaching Farm.

Professor BMAO Perera (BVSc, PhD)

Professor Perera obtained his bachelor's degree in veterinary science from the University of Ceylon in 1970 and a PhD in reproductive physiology and endocrinology from the University of Glasgow, UK in 1975. He joined the academic staff of the Department of Veterinary Clinical Studies of the University of Peradeniya in 1971 and worked as assistant lecturer, lecturer, senior lecturer and associate professor upto 1988. Prof Perera then moved to Austria and worked for the United Nations with the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, based at the International Atomic Energy Agency in Vienna, during two assignments of seven years each (1988–1994 and 1998–2004). His work involved providing technical support for research and

development projects on animal production and health in developing countries in Asia, Africa, East Europe and Latin America. He returned to Sri Lanka and was appointed Professor of Farm Animal Production and Health at the Faculty of Veterinary Medicine and Animal Science at the University of Peradeniya in 2005. His current work includes teaching and research on reproduction of domestic and wild animals, with emphasis on smallholder livestock production systems and reproductive management, application of reproductive biotechnologies, farmer participatory research methods, and the biology and conservation of wild elephants. Prof Perera has published over forty-five research and review papers in international journals, thirty-five full papers and fifty abstracts in proceedings of scientific meetings, twenty-two book chapters and monographs, and several educational leaflets for livestock farmers.

Dr PG Anil Pushpakumara (BVSc, PhD)

Dr Pushpakumara obtained his bachelor's degree in veterinary science from the University of Peradeniya in 1991 and a PhD in reproductive physiology and endocrinology from the Royal Veterinary College, University of London, UK in 2001. He worked as a research associate at the same institute for one more year and subsequently returned to the Faculty of Veterinary Medicine and Animal Science of the University of Peradeniya in 2002 as a senior lecturer. Presently he is the Head of the Department of Farm Animal Production and Health of the Faculty. His current work includes teaching and research on reproduction of domestic and wild animals, with especial emphasis on biotechnologies, and the biology and conservation of wild elephants. Dr Pushpakumara has published five research papers in international journals, two full papers and over twenty-five abstracts in proceedings of scientific meetings locally and internationally.

Dr SP Gunaratne (BVSc (SL), PhD (Nottingham, UK))

Dr Gunaratne is a senior lecturer in Farm Animal Production and Health, at the Faculty of Veterinary Medicine and Animal Science, University of Peradeniya. He has more than 30 years of experience in animal production and health sector in Sri Lanka holding different positions in the state sector and participated in many committees and programmes related to swine production. Dr Gunaratne is a specialist in farm animal production and nutrition.

S Gajanayake B Sc (Agric), M Sc (Agric Economics, PGIA)

S Gajanayake is an assistant director attached to the Ministry of Livestock Development, Colombo. She has experience in project evaluation and monitoring of databases related to livestock. She has several publications and presented many papers on swine production. A series of papers on swine production by Gajanayake which appeared in last few issues of The Sri Lanka Veterinary Journal cover many aspects of swine production in Sri Lanka. She is a specialist in agriculture economics.

Professor Thakshala Seresinhe (BVSc, MSc, PhD)

Professor Seresinhe graduated with a BSc (Hons) degree from the University of Peradeniya in 1977. She obtained her MSc and PhD in Animal Science / Forage Sciences from Federal Institute of Technology (ETH), Zurich, Switzerland during 1985-1992. In 1978, she joined the Faculty of Agriculture University of Ruhuna as the pioneer lecturer in the Department of Animal Science and

is at present holding the position of Professor of Animal Science. She had been the head of the department from 2001-2007. Research is mainly on ruminal microbial nitrogen production from non-conventional feeds such as straw and tree legume forages for ruminants. Professor Seresinhe was involved in conducting research with several locally and internationally funded projects. She has won two presidential awards for international publications with Prof KK Pathirana in 1999 and 2000.

Professor KK Pathirana (BVSc, MSc, PhD)

Professor Pathirana graduated with a BVSc (Hons) degree from the University of Peradeniya in 1967 and worked as a research officer at the Veterinary Research Institute, Peradeniya from 1968 to 1983. He obtained his MSc and PhD in Animal Science/Nutrition from McGill University, Canada in 1979. After returning from Canada, he developed and introduced the popularly known "Instant Method" of feeding urea with straw, which is one out of the two practical methods of feeding straw, as adopted to date in Sri Lanka. In 1983, he joined the University of Ruhuna as the first Professor of Animal Science. He was the head of the department and the dean of the faculty (1987 to 89) prior to retirement as a senior professor in 2007. He was co-winner of two presidential awards for international publications with Professor Thakshala Seresinhe.

ABBREVIATIONS

AAIB	-	Agricultural and Agrarian Insurance Board
ADB	-	Asian Development Bank
AFC	-	Age at First Calving
AGDP	-	Agricultural Gross Domestic Product
AI	-	Artificial Insemination
AIBP	-	Agro Industrial by Products
AIDA	-	All island Dairy Association
ALDL	-	Agro Livestock Development Loan Scheme
BCS	-	Body Condition Score
BI	-	Back Cross 1
BL	-	Black
BOI	-	Board of Investment
BQ	-	Black Quarter
BV	-	Biological Value
CBSL	-	Central Bank of Sri Lanka
CEA	-	Central Environmental Authority
CI	-	Calving Interval
CIDA	-	Canadian International Development Agency
CPRS	-	Central Poultry Research Station
CR	-	Conception Rate
CRB	-	Co-operative Rural Bank
CS	-	Chemical Score
D	-	Duroc
DAP	-	Draught Animal Power
DAPH	-	Department of Animal Production and Health
DCS	-	Department of Census and Statistics
DFCC	-	Development Finance Corporation of Ceylon
DOCS	-	Day-Old-Chicks
EC	-	European Community
FAO	-	Food and Agriculture Organisation
FI	-	First Generation
FMD	-	Foot and Mouth Disease
FP	-	Fowl Pox
FPP	-	Family Poultry Programme
FPR	-	Farmer Participatory Research
FSR	-	Farming Systems Research
GDP	-	Gross Domestic Product
GI	-	Gastro Intestinal

GTZ	-	German Agency for Technical Co-operation
HACCP	-	Hazard Analysis and Critical Control Points
HARTI	-	Hector Kobbekaduwa Agrarian Research and Training Institute
HCR	-	Heifer Calf Rearing
HDI	-	Human Development Indices
HIES	-	Household Income and Expenditure Survey
HNB	-	Hatton National Bank
HS	-	Hamemorrhagic Septicemia
IBD	-	Infectious Bursal Disease
ICE/APH	-	Institute for Continuing Education in Animal Production and Health
ILSDZ	-	Irrigated Land Settlement in the Dry Zone
IMF	-	International Monetary Fund
INFPD	-	International Network for Family Poultry Development
IRDP	-	Integrated Rural Development Project
JE	-	Japanese Encephalitis
Kg	-	Kilogram
KVSs	-	Krushikarma Vyapthi Sevakas
L	-	Local pigs
LBM	-	Live Bird Market
LBP	-	Livestock Breeding Project
LKR	-	Sri Lankan Rupee
LR	-	Landrace
LW	-	Large White
MASL	-	Mahaweli Authority of Sri Lanka
MDGs	-	Millennium Development Goals
ml	-	Mililitre
MT	-	Metric Ton(s)
NARESA	-	Natural Resources Energy and Science Authority of Sri Lanka
ND	-	Newcastle Disease
NDB	-	National Development Bank
NERD	-	National Engineering Research Division
NGDP	-	National Gross Domestic Product
NLDB	-	National Livestock Development Board
NLL	-	Nestle Lanka Limited
NMB	-	National Milk Board
NPU	-	Net Protein Utilisation
NWP	-	North Western Province
OFCs	-	Other Food Crops
OT	-	Orange Tan
PCI	-	Participating Credit Institute
PER	-	Protein Efficiency Ratio
PRRS	-	Porcine Reproductive and Respiratory Syndrome
RIR	-	Rhode Island Red
RP	-	Rinderpest
RSPCA	-	Royal Society for Prevention of Cruelty to Animals
SAREC	-	Swedish Agency for Research Co-operation
SFS	-	Smallholder Farming Sector
SILEP	-	Smallholder Integrated Livestock Extension Project

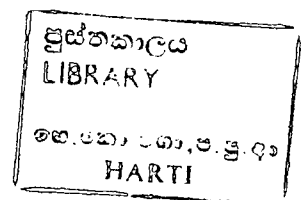
SIMBU	-	Smallholder Intensively Managed Buffalo Units
SLDHS	-	Sri Lanka Demographic and Health Survey
SLIS	-	Sri Lanka Integrated Survey
SLSI	-	Sri Lanka Standards Institute
SMILE	-	Small and Micro Industries Leader and Entrepreneur Promotion Project
SNF	-	Solid Non Fat
TB	-	Tuberculosis
UHT	-	Ultra Heat Treated
UMM	-	Urea Molasses Mineral
UMMB	-	Urea Molasses Multinutrient Block
UNDP	-	United Nations Development Programme
US \$	-	United States Dollar
USA	-	United States of America
VAT	-	Value Added Tax
VDCA	-	Veterinary Drug Control Authority
VIC	-	Vaccine Production and Disease Investigation Centre
VRI	-	Veterinary Research Institute
VROs	-	Veterinary Research Officers
VS	-	Veterinary Surgeon
WB	-	White Brown
WLH	-	White Leg Horn
WPSA	-	World Poultry Science Association

Chapter

1

INTRODUCTION

Dhanawardana Gamage



1.1 Objective

Livestock development will have a direct impact not only on employment and incomes of the smallholder farming sector (SFS) in Sri Lanka as elsewhere, it will also have indirect and positive impacts on employment in the labour intensive rural non-farm sector. These indirect benefits of livestock development outweighs direct benefits but are rarely emphasised in policies and programmes aimed at development of the livestock sector. By considering the immense benefits of developing the livestock sector including the local non-tradable goods and services, this book attempts to make a case for development of small-scale livestock for agrarian poverty reduction and rural development in general and in particular for Sri Lanka¹. By way of conclusion, this document also examines the major thrust areas to be addressed by policies and programmes. In other words, the principal objective of the analysis in this book is to highlight the role the livestock can play in rural development and rural and agrarian poverty reduction. The book combines technical analysis to make it a readily usable source of information for planning and implementation of livestock development projects and programmes by the government as well as non-government organisations focusing on rural development and poverty reduction.

Prime objective of profiling this book was to examine and analyse the extent to which the livestock production could be used as a complementary sector to crop production system in the smallholder farming sector in order to help reduce agrarian poverty and contribute towards rural development in Sri Lanka. Our objective is well founded and justified. Firstly, Household Income and Expenditure Survey of the Department of Census 2002 found that nearly a quarter of the rural population in Sri Lanka was in poverty. Secondly, various assessments, as examined below, show that about two-fifth of those engaged in agriculture continually have been in poverty though this situation might have changed somewhat during the past three years with increasing commodity prices.

¹ However, significant achievement in poverty reduction and rural development through livestock development is likely to depend on targeting livestock development policies on the 'not so poor, yet still poor' smallholders, rather than on the 'poorest of the poor'.

Thirdly, the scope of development of agriculture in Sri Lanka at the extensive margin or using large landholdings is limited due to land scarcity and continuous fragmentation of existing holdings to uneconomic holdings. Finally, the present government's agenda of development gives high priority for reduction of poverty and lessening rural urban disparities which we have taken into consideration in compiling this document².

The chapters that follow this introduction deal with the existing state and major issues of the livestock sub-sectors. In particular, each chapter deals with the present state of the livestock sector: in terms of livestock population, production (milk, meat, egg etc), and collection, processing and marketing issues. They also provide an in-depth analysis of issues related to policies and programmes focusing on livestock development, technical and institutional support systems that have been put in place by the government to support the sector and major drawbacks. The authors also analyse major livestock development programmes that have been implemented or are implemented, involvement of government and private sector agencies in promoting livestock development and their effectiveness.

This chapter is set off by assessing the current state of the smallholder farming sector in Sri Lanka, the major policies the government has followed in developing it, the trajectories it has followed in evolving into the present situation, identifying the major factors influencing its development. It particularly focuses on existing states of the rural and agrarian sector.

In specific terms, the analysis in this chapter scrutinises the following:

- i. Wider context of agricultural and livestock development.
- ii. Economic policy and performance.
- iii. Social and welfare policy and performance.
- iv. Issues related to economic and social development.
- v. Government policies on agrarian sector development and the observed outcome.
- vi. Role of the livestock sector in the economy and the potential it presents towards growth.
- vii. Extent to which the small-scale livestock plays or can play in reducing rural agrarian poverty and contribute towards rural development.
- viii. Brief introduction to major focus and analysis contained in chapters that follow.
- ix. Brief account of conclusions and recommendations for the development of the livestock sector.

2 In November 2005, the basic policy framework (*Mahinda Chinthana*) of the present government for development and governance was released. The goal of the government as to the new policy frame is to reduce the poverty rate to 13 percent nationwide by 2015. It states that efforts will be made for poverty reduction and for improvement of regional disparities through rural development. Under this background, the government launched a new regional development programme called *Gama Naguma* (village development) in 2005. This programme endeavours to alleviate poverty and develop the rural areas through development of basic infrastructure based on local people's needs. The programme includes construction/improvements for electrification, communications networks, water supply, roads, public health centres, day-care centres, and community facilities (Department of National Planning, 2006).

1. 2 Wider Context of Agricultural and Livestock Development

1.2.1 Agro-ecological domain

Sri Lanka is a small island in the Indian Ocean with a land area of about 610 square kilometres and a population of about 20 million. This places Sri Lanka in the category of densely populated countries with over 300 persons per square kilometre. Despite its small size, Sri Lanka has a rich biodiversity distributed within a wide range of ecosystems, ranging from rainforests to grasslands, rivers, wetlands and freshwater bodies and coastal and marine ecosystems showing its favourable character for human settlements and crops and livestock farming.

Topographically the island consists of a south central mountainous region which rises to an elevation of 2,502 metres and is surrounded by broad lowland plains at an elevation of 0-75 metres above sea level. From the mountainous regions, nine major rivers and 94 other rivers flow across the lowlands into the Indian Ocean. The average temperature in the island varies between 29-35 centigrade with mean annual temperature of about 27 centigrade in the lowlands and 15 centigrade in the central highlands.

Two monsoons dominate the precipitation pattern in the island with markedly seasonal rain distribution in most areas. The monsoons bring much of the rains into the island in varying intensity over time and the space. Rainfall occur during the south-west monsoon (May to August) and the north-east monsoon (November to January). The mean annual rainfall is 2,000 millimetres which varies throughout the island. The region with highest rainfalls is the central highlands. However, average rainfall in the highland region too varies with high intensities on the western slopes. In contrast, the mean annual rainfall on the eastern slopes of the central highlands is less than 3,500 millimetres. The lowest values of rainfall are in the northwest and southwest lowlands with a minimum value of 935 millimetres recorded at the Ambalantota gauging station in the Hambantota district of the southern province. Therefore, the distribution pattern of rainfall throughout the year is more important than the total annual rainfall for agriculture, vegetation and human settlements.

Owing to the differences in temperature, rainfall, elevation and soil factors, Sri Lanka's climate varies in different regions within its broader tropical setting. Based on rainfall and patterns of distribution, three major agro-climatic regions (wet zone, intermediate zone, dry zone) have been recognised. Area classified as the dry zone encompasses south, north, east and eastern parts of the hill region and covers about two-third of the land mass of the country. The dry zone experiences heavy rains during the north-east monsoon, with the annual rainfall averaging 1,000 to 1,900 millimetres. Second largest covering nearly one-third of the land mass in the country is the wet zone which encompasses the south-west sector of the island including the western part of the central highlands. The rest is the area between the two major zones. The region classified as the dry zone is all lowland while the other two zones are further subdivided on the basis of altitude. Besides, the agro-ecological environment, country inherits a culture and a lifestyle favourable for to the development of livestock such as dairy and buffalo.

1.2.2 Economic policy and performance

Since independence from British rule in 1948, Sri Lanka has implemented policies and programmes for economic growth and social development. Following inward-looking policies

during the 1960s and part of the 1970s, Sri Lanka shifted to an outward-looking economic policy in 1977 by introducing a package of policy reforms. Change in policy meant reduction in direct state control on economic transactions, greater openness to trade by giving a larger role to the private sector. Many state trading monopolies too have been privatised and the financial sector has been liberalised. As a result of the reforms, there has been a rapid growth in manufacturing industry and growth in the service sector leading to structural transformation of the economy.

However, economic reforms in Sri Lanka were implemented in an *ad-hoc* or stop-go manner. For instance, macroeconomic instability combined with the eruption of ethnic problem compelled the government to stall the reforms by the mid-1980s. In response to an approaching macroeconomic crisis, a second wave of liberalisation was implemented between 1989 and 1993. By the mid-1990s, the government reduced tariffs, relaxed foreign equity restrictions in key service sectors such as finance, mass transport, telecommunications and professional services. This was followed by the privatisation of telecommunications and insurance etc. By agreeing to further reforms, the government negotiated with International Monetary Fund (IMF) a stand-by loan in 2000.

The protracted conflict by escalating the defence expenditure led to the collapse of the tourism industry. Pre-election spending in 2002 brought about a budget deficit of 10 percent. The government that came into power in 2002 signed a ceasefire agreement (CFA) with the Liberation Tigers of Tamil Eelam (LTTE) and restarted the market-based reforms. The onset of peace, stabilising power supplies that had been disrupted over a lengthy period and a modest recovery in external demand made possible recovery of the economy. In 2002, real GDP grew at 4 percent with a further increase to 5.5 percent by 2003 which has been accrued to strong growth in the service sector and recovery in tourism. The present government that came into power in April 2004 took steps to stall the reform agenda by re-advocating a shift to a mixed economy and advocated development on the basis of protection of agriculture and small- and medium-sized enterprises. The present government emphasised the need to reduce rural-urban disparity and started to pay attention to major rural and agrarian development issues.

However, efforts of the government debilitated somewhat due to escalation of LTTE hostilities in 2006 compelling the government to abrogate the CFA and to take the critical decision of resorting to military action to control three decades of LTTE militancy. Subsequent to this decision, the government forces recaptured all the areas under LTTE control by 18 May 2009. The cost of the war in terms of financial, economic and human lives from 1983 has been high. Escalating war related costs has had a curtailing impact on making resources available for rural infrastructure development and implementing welfare programmes. With the new situation, the government is likely to endure its rural development efforts to reduce rural-urban imbalances and put the country on the growth path.

After liberalisation of the economy, it took years to mark a significant growth in GDP. Economy grew from a low of 322 billion rupees in 1990 to 4,411 billion rupees by 2008 (Table 1.1). In 2006, GNP per capita grew by 7 percent while GDP per capita by 7.4 percent. Taking into account the negative 1.4 percent growth rate in 2001, average growth rate in GDP for the period between 1990 and 2006 was about 4.5 percent. GDP grew in 2007 at an annual rate of 6.2 percent recording 33 billion US dollars with a per capita GDP income of 1,600 US dollars.

Table 1.1: GDP and GNP at current market prices for selected years

Item	1990	2000	2005	2006	2007	2008 (a)
GDP at current market prices (LKR billion)	322	1,258	2,453	2,939	3,579	4,411
GNP at current market prices (LKR billion)	319	1,233	2,423	2,898	3,540	4,312
Per capita GDP at market prices (LKR)	18,934	68,102	124,709	147,776	178,845	218,161
Per capita GNP at market prices (LKR)	18,791	66,790	123,181	145,744	176,893	213,262
Per capita GDP at market prices (\$)	473	899	1,241	1,421	1,634	2,014
Per capita GNP at market prices (\$)	469	881	1,226	1,402	1,616	1,969

Note: (a) Provisional

Source: Central Bank of Sri Lanka (a), *Annual Report 2008*

The data in Table 1.1 also show that per capita GNP at market prices grew from 469 US dollars in 1990 to 1,969 US dollars by 2008. This achievement is in spite of the continuing escalation of war expenditure and shows the resilience of the economy and potential for rapid development.

1.2.3 Structural economic transformation

Sri Lankan economy has transformed from predominantly agriculture cum service to a service and industry dominated economy though it has not yet become a modern industrial economy. The share of the industrial sector to GDP remained more or less the same contributing between 25 to 30 percent to GDP (Table 1.2). In contrast, the share of the service sector increased from about 43 percent in the late 1970s to 59.6 percent in 2008. On the other hand, the share of agriculture in the national GDP reduced from around 30 percent in the late 1970s to 27.7 percent in 1981, 17.2 percent in 2005 and 12.1 percent by 2008. There has been little change in the share of industry's contribution to GDP, though the industry grew in absolute terms.

Table 1.2: Transformation of the economic structure

Item	1981	1991	2000	2001	2005	2008
Agriculture	27.7	26.8	19.5	19.5	17.2	12.1
Industry	28.0	25.6	27.5	26.7	27.0	28.4
-of which Manufacturing	16.2	14.8	16.9	15.8	-	17.5
Services	44.3	47.7	53.0	53.8	55.7	59.6

Source: *Country Assistance Strategy of the World Bank Group (2003-2006)*, 2002, Sri Lanka and Central Bank (a), *Annual Report 2008*

With the transformation of the economy, the base of external earning too changed rapidly. For instance, the agricultural exports constituted 90 percent of the total exports in 1978 with bulk

tea representing half the total exports. Thereafter, the agricultural exports still dominated by tea continued to decline to less than 20 percent by 2000. At the same time, Sri Lankans working abroad contributed significantly to foreign income earnings while the tourism industry stagnated as a result of the armed conflict.

1.2.4 Employment and unemployment

An analysis of employment trends in Sri Lanka shows that employment outside the agriculture grew at an average rate of 4.2 percent per annum from 1990 to 2000 (World Bank, 2002). By contrast, employment in the agricultural sector grew negligibly, at an average rate of 0.3 percent per year during the same period. The data show (Table 1.3) that the proportion of population employed in agriculture decreased from 36.7 percent in 1995 to 32.7 percent by 2008. This shows that in spite of the structural transformation taking place in the economy, agriculture still plays a larger role in employment compared to industry. Though the rate employed in agriculture declined, the absolute numbers engaged in it increased. Of those engaged in agriculture, 16 percent was in the estate sector while the rest was engaged in crop production and livestock production on smallholdings and related activities. However, a sizeable portion of the population engaged in agriculture is employed as casual labourers, it still has a tendency to decrease mainly due to mechanisation. The share of the industrial sector employment increased by 4.2 percentage points from 22.2 percent in 1995 to 26.3 percent by 2006. During the period from 1995 to 2008, employment in the service sector remained around 41 percent. Major contributors to the growth in the service sector employment include community services while trade, hotels, transport, communications and financial services make up the remainder.

Table 1.3: Total employed population and percentages by sector

Year	Total Employed	Agriculture	Industry	Services
1995*	5,357,110	36.7	22.2	41.1
2000*	6,310,247	36.0	23.6	40.3
2005	6,788,119	30.3	26.3	43.3
2006*	7,105,322	32.2	26.6	41.2
2008*	7,175,000	32.7	26.3	41.0

Note: * Excluding Northern and Eastern Provinces

Source: Labour Force Survey-2006, Department of Census and Statistics and Central Bank (a) Annual Report-2008

Between census of population of 1981 and 2001, the unemployment rate declined from 18 percent of the workforce to 7.9 percent. The rate further declined to 7.7 percent by 2005, to 6.3 percent by 2007 and 5.2 percent by 2008. The unemployment rate declined from 14.8 percent to 6.4 percent in the urban sector and from 11.7 percent to 7.8 percent in the rural sector from 1995 to 2005. However, the unemployment female rate was twice compared to that of males in the past though this gap had a tendency to decline. For instance, from 1995 to 2005 the male unemployment rate reduced from 9 percent to 5.5 percent while the rate for females declined from 18.7 to 11.6 percent. The female unemployment rate in the urban sector almost halved from 20.9 percent in 1995 to 9.3 percent in 2005 while in the rural sector the rate declined with a lesser percentage point from 18.3 to 12.2 percent. The unemployment in Sri Lanka has been largely a problem effecting youth. About 80 percent of Sri Lanka's unemployed are in 15-29 age groups.

While employment opportunities in the estate sector have been progressively reduced, the

unemployment amongst youth in this sector has been increasing. By 2002 about 50 percent of those in the age group of 15-29 years in the estates were unemployed. The reason for this was their reluctance to take up plantation work due to factors like insufficient daily wages, lack of incentive schemes, the low status accrued to the work, low promotional prospects and the lack of income security in the old age. Thus, the need to provide non-traditional forms of employment to youth in the estate sector as well as making employment in estates more attractive are very clear. In spite of the emerging situation, estate workers are constrained from finding alternate employment due to their background as residents on estates. Thus, the urgent need to create opportunities to provide employment to youth in the estate sector is clear. Socially and culturally plantation workers have a better disposition to take up livestock as a livelihood or complementary source of income.

Given the emerging situation like inadequate income from crop production, people located in rural cum agriculture sector adopt many coping strategies. For instance, increasing numbers of persons from rural areas migrate for employment abroad.³ The total departures for foreign employment by 2007 were 217,306 persons. Of this 102,629 (47.22) persons were males and the rest (114,677 persons or 52.78 percent) were females (Department of Census and Statistics, 2008, Statistical Abstract). A large number of females (102,176 or 47 percent) were working as housemaids. Of these 49,609 (22.8 percent) were engaged as skilled workers while 52,191 (24 percent) were unskilled workers. The rest of 3,435 (1.6%) were semi skilled. Above account shows that the majority of those migrating to the Middle-east are females and their being away for long periods from home causes disruption of the family institution and childcare with far reaching implications for quality of life of members of those households and disruptions in the social fabric.

1.3 Social and Welfare Policy and Performance

Since independence, the government has much invested on social sector programmes like health, education, subsidies, food rations and social safety net programmes. Social sector expenditure on free education, free healthcare and food subsidies by the government was around 4 percent of GDP. The government's social expenditure increased during the late 1980s with the implementation of poverty alleviation programmes. As a percentage of GDP, social expenditure including that of poverty alleviation programmes increased from 11.3 percent in 1995 to 18.2 percent by 2005. Expenditure on social programmes, especially of social transfer programmes could be reduced by better targeting and reduction in poverty incidence through income diversification.

Programmes of economic and human resources development enabled Sri Lanka to achieve a comparatively a higher quality of life at low per capita income levels. The cumulative impact of the government investment on social sector has meant the performance of certain social indicators on par with international standards. In relation to the measures of 'social development' like Millennium Development Goals (MDGs) and Human Development Indices (HDIs) employed by the international organisations like the United Nations Development Programme (UNDP), Sri Lanka's achievements in literacy, life expectancy, infant mortality and fertility have gone beyond expectations in relation to its per capita income in any given period.

³ The Airport Survey carried out by the Sri Lanka Bureau of Foreign Employment in 1994 revealed that over 120,000 persons were securing new jobs annually; the number of departures for employment in 2007 totalled more than 217,306 (Statistical Abstract, 2008).

An illustrative example of Sri Lanka's achievements in the social sector is the Human Development Index (HDI)⁴. HDI for Sri Lanka increased from 0.613 in 1975 to 0.740 in 2002 ranking 96th among 177 countries for which the indicators were available (UNDP & Government of Sri Lanka-NCED, 2005; UNDP, 2007/2008). HDI for Sri Lanka was 0.743 for 2005, giving Sri Lanka an HDI ranking of 99 out of 177 countries while being ranked 82nd for life expectancy at birth, and 55th for adult literacy rate compared to its economic status in terms of GDP per capita ranking 105th (Department of Census and Statistics, 2006 a). By now, Sri Lanka has made significant strides in reaching several of the MDGs including education, gender equality, safe water, sanitation etc.

1.4 Economic and Social Development Issues

1.4.1 Regional disparities in growth and income

There are significant disparities in economic growth rates amongst Sri Lanka's nine provinces. For instance, GDP of the western province grew at an average rate of 6.2 percent annually from 1997 to 2003 while GDP grew on average by 2.3 percent in the rest of eight provinces. However, since 2007 there has been a change in trend of the provincial contribution to the national GDP with the result of reducing regional disparities (Central Bank of Sri Lanka 2006 (a) and 2008 (b), www.cbsl.gov.lk). The contribution to the national GDP by the western province dropped from 50.1 percent in 2006 to 48.4 percent in 2007. Contribution from all other provinces except the north central province increased over the previous year. Southern province and north western provinces contributed 10.5 percent and 9.6 percent to the GDP in 2007 compared to 10 percent and 9.1 percent in 2006. Meanwhile, the central province, Sabaragamuwa province, Uva province, eastern province and northern province also recorded some improvements even though the contribution of each of those provinces to total GDP still remained at less than 10 percent (Central Bank of Sri Lanka, 2008 (b) www.cbsl.gov.lk). Prices were favourable for agricultural products during 2006 and 2007 (Central Bank of Sri Lanka, 2007a).

Though the data reveal an overall improvement in the provincial contribution to national GDP in 2007, the western province continues to dominate as the main income earner and key spending province of the country. This is a result of the concentration of resource base within such as infrastructure facilities, banking and finance, industries, business centres, airports and the main sea port. On the other hand, the recent trend reflects that there is more room for further development in other provinces by making a concerted effort by provincial authorities as well as the central government.

1.4.2 Income and distribution

Sri Lanka's GNP per capita income increased from 755 US dollars in 1995/1996 to 899 US dollars in 2000. By 2005, a further increase of GNP to 1,160 US dollars was noted (Table 1.4). However, a major problem has been the tendency towards skewed distribution of income in different sectors of the population.

⁴ The HDI provides a composite measure of three dimensions of human development: life expectancy, adult literacy and enrolment at the primary, secondary and tertiary level and having a decent standard of living (measured by purchasing power parity, PPP, income).

Table 1.4: GNP per capita income at constant prices (\$)

Year	Per Capita Income (\$)
1995	755
2000	899
2005	1,160

Source: Vidyaratne DBPS and Nigamuni WJ (2006), *Department of Census and Statistics and Summary Education Profile: Sri Lanka*. www.worldbank.org

Sri Lanka's average monthly household income (at constant prices) increased from 881 to 1,649 rupees from 1981 to 2005 (Table 1.5). From 1995/1996 to 2005, the urban sector households experienced the largest increase in income (550 rupees) and the estate sector experienced the smallest increase (255 rupees). With already existing income inequalities at the base in 1995, high disparity between urban and rural sector incomes as well as rural and estate sector incomes were prevailing by 2005. For instance the average estate household income was only 38 percent of the average urban household income.

Table 1.5: Average monthly household income (Rupees) by sector and year (at 1980/81 constant price)

Year	Sector			
	Urban	Rural	Estate	Sri Lanka
1980/1981	1,274	795	753	881
1995/1996	2,044	1,064	738	1,177
2002	2,386	1,246	777	1,362
2005	2,594	1,533	993	1,649

Source: *Household Income and Expenditure Survey 1980-1981, 1995/96, 2002, 2005*, Department of Census and Statistics

Related to distribution of household income in different sectors in Sri Lanka are the large differences in per capita income. For instance, average per capita income in the country was 3,141 rupees in 2002 while urban income was higher than average per capita income. On the other hand, rural per capita income was 55.4 percent of urban per capita incomes and estate sector incomes were only 61 percent of rural per capita income (Table 1.6).

Table 1.6: Per capita income per month by sector-2002

Sector	Per capita income (Rupees)	Ratio of rural and estate income of urban income
Urban	5,203	100.0
Rural	2,885	55.4
Estate	1,763	61.0

Source: *Household Income and Expenditure Survey – 2002*, Department of Census and Statistics

Data in Tables 1.5 and 1.6 indicate that the major factor explaining the differences in household and per capita income in Sri Lanka is the sector of location of households and persons. Household Income and Expenditure Survey of 2002 reveals that there is a wide difference of per capita incomes in different sectors of the economy. The per capita income per month was the highest in the urban sector at 5,203 rupees. The rural and estate sectors had per capita income of 2,835 and

1,763 rupees respectively.

Similarly, the share of income received by income deciles too has distributed skewed over the years (Table 1.7). Further, the share of the total income – the lowest decile of income group had declined from 1.8 percent of the total income in 1995 to 1.5 percent by 2005. For the highest income decile, the share of the income reduced from 39.8 percent in 1995 to 36.4 percent in 2005.

Table 1.7: Income shares by deciles of income receivers' income in percentages

Deciles	1990/1991	1995/1996	2002	2005
1	1.9	1.8	1.7	1.5
2	3.3	3.0	3.1	3.0
3	4.3	4.0	4.1	4.1
4	5.3	5.0	5.0	5.1
5	6.4	5.7	6.0	6.1
6	7.5	6.9	7.3	7.5
7	9.2	8.4	8.8	9.1
8	10.8	10.7	11.2	11.3
9	14.8	14.7	15.4	15.9
10	36.5	39.8	37.4	36.4

Source: Household Income and Expenditure Survey- 1990/91, 2002, 2005, Department of Census and Statistics

The trend in increase of income inequality in Sri Lanka is more notable after economic liberalisation in 1977. Gini coefficient of the average household income increased from 0.34 to 0.43 between 1969/1970 and 1980/1981. Gini coefficient of household income further increased to 0.46 by 1985/1986 and to 0.47 by 1990/1991 (Table 1.7). The highest Gini ratio was noted by 2006 at 0.48.

While Gini coefficient of household income has increased from 0.43 in 1980/81 to 0.48 by 2006 for the country as a whole, the changes in the Gini ratio in terms of the sector could also be observed. For example, Gini ratio in the rural sector declined from 0.46 to 0.45 between 1995 and 2006. In the estate sector, the Gini ratio was relatively low in 1995/1996 at 0.34 but by 2006 it increased to 0.41.

Table 1.8: Gini coefficient for household income by sector and survey period

Sector	Survey Period						
	1980/81	1985/86	1990/91	1995/96	2002	2005	2006
All Island	0.43	0.46	0.47	0.46	0.47	0.47	0.48
Urban	0.44	0.48	0.62	0.47	0.48	0.48	0.55
Rural	0.38	0.43	0.42	0.46	0.45	0.45	0.45
Estate	0.27	0.31	0.25	0.34	0.34	0.34	0.41

Source: Household Income and Expenditure Surveys from 1980/1981, 1985/1986, 1990/1991, 1995/1996, 2002, 2005, 2006/2007, Department of Census and Statistics, www.statistics.gov.lk

The growth in income has changed somewhat the patterning of household expenditure between food and non-food (education, health, housing, durable goods, transport etc) items. For instance, the overall food ratio decreased from 45.6 percent in 1995/96 to 35.8 percent by 2006. Most drastic declines from 55.9 percent to 37.6 percent and from 65.4 percent to 52.7 were noted for rural and urban sectors. In contrast, the ratio declined in the urban sector from 43.9 percent to 35.7 percent in the above period. The data however show that, though the estate sector expenditure on food has

On the other hand, under the patronage of the national government, the smallholder agricultural frontier has expanded into the dry zone areas. The smallholder farmers in the dry zone share common production problems due to their location in marginal agro-ecological regions characterised by highly seasonal and erratic rains, lack of irrigation, infertile or deteriorating soils, the farmer dependence on low potential crops and animals and an overall risky marketing environment. SFS is also characterised by heavy reliance on family labour, inadequate technology adoption, and dependence on underdeveloped infrastructure, weak institutional support systems.

1.5.2 Livestock

Livestock Population

At the start, it should be noted that there are significant disparities in data and these are reflected in figures used in the present analysis. However, the available data show that except for cattle and poultry, livestock population in some sub-sectors has decreased between 1954 and 2002. During this period, buffalo population decreased from 706,644 to 642,600 and goat population declined from 563,912 to 453,100 while the cattle population increased from 1,277,310 to 1,510,400. Agricultural Census of 2002 reported a further reduction in livestock population. The latter source indicates that the number of cattle at 1,203,770, buffalo at 303,281 and goats at 404,917 (Chandrasiri, in chapter four).

The observed trend in buffalo population is in spite of the prohibition of killing for meat purposes. Use of buffalo as draught power has declined too progressively over the years due to increase in the use of machinery. Per capita production of milk per buffalo cow is lower than dairy cow while buffalo milk is in high demand, as making traditional curd industry which is thriving. Among livestock, the poultry industry registered the highest growth in the 1990s at 10.5 percent per annum and local milk production supplied 20 percent of domestic milk requirement in 2005 (<http://www.adb.org>). Livestock (comprising cattle, buffalo, swine, goat, sheep, and poultry) accounted for 5.4 percent of the total agricultural GDP and 1.5 percent of the total GDP in 1975. This rate reduced to 4.4 percent and 0.72 percent respectively by 2001 though the absolute values increased remarkably between the two periods. The respective rates recorded for 2008 7.2 percent and 0.87 percent.

1.5.3 Continuing dominance of livestock in small-scale farming

Except for the poultry sub-sector, the livestock sector in Sri Lanka is largely located in SFS. The data in Table 1.9 show that the majority of livestock are located in medium-sized holdings. Given that average size of land holding in SFS is about 2 acres, a great majority of farmers operate less than two acres. Relatively large numbers of goats are located in the category of land less than two acres, thus showing the implication of goat farming for landless and poor farmers. Goat production also has been a traditional form of livestock production among farmers in the dry zone and intermediate zones which accounts for about 75 percent of goat population in the country⁶. Goat farming is usually practised as an extensive production system though there are other production systems. Goat farming usually varies according to the agro-ecological zone, land/fodder availability, type of

⁶ This volume does not provide a chapter on goat farming as the coordinators of the book were unable to find a specialist on the subject. However, authors dealing with other sub-sectors sufficiently discuss the state of the goat sub-sector.

breed and socio-cultural values of the people. The extensive management system is mostly found in the dry zone and intermediate zones whereas the semi-intensive management system is practised mainly in the coconut triangle. The intensive management system is practised in the urban and sub urban areas, hill-country and mid-country and in the Jaffna peninsula. Goats in the extensive and in the semi-intensive systems are produced primarily for meat. Goat milk is becoming popular for its health benefits and, rearing dairy goats under intensive management is therefore getting popular in recent times. However, the total population of goats in the country has not shown any significant increase over the past decade. According to the Department of Animal Production and Health sources, the number of goats in the country declined from 520,700 in 1997 to 395,295 by 2007. During the period, the production too declined from 952 to 743 metric tons (Ranaweera, 2007). On the other hand, the imports too declined from 922,929 to 646,951 kg during the same period.

Table 1.9: Number of cattle, buffalo and goats by operational size of landholdings

Holding	Cattle	Buffalo	Goat
< 1/4 acre	117,181	15,805	109,412
¼ – 20 acres	1,038,368	281,454	264,584
> 20 acres	48,221	5,972	30,921
Total	1,203,770	303,281	404,917

Source: Department of Census and Statistics (2002), Census of Agriculture 2002

Incidence of small farmers in poultry production could be readily understood from the data in Table 1.10. For instance, there are 160,120 poultry farms with less than 100 heads and they together shared 1,546,560 heads (11.8 percent) of the total of 13,103,546 poultry population recorded in the Census of Agriculture in 2002. Similarly, of the total of 170,360 poultry keepers, 160,120 were farmers having less than 100 heads.

Table 1.10: Distribution of poultry population by size of herd

Size class of the herd	Number of poultry farms	For egg production		For meat production	Local		Total poultry
		Laying hens	Chicks including brooders	Broilers including brooders	Laying hens	Cock birds and others	
Less than 100	160,120	206,118	79,344	75,522	698,925	486,651	1,546,560
100 - < 500	5,062	598,115	200,929	404,691	44,716	56,171	1,304,622
500 - < 1,000	2,097	494,605	201,803	661,258	35,593	55,942	1,449,201
1,000 - < 2,000	1,966	628,229	233,844	1,551,298	88,633	155,117	2,657,121
2,000 - < 5,000	830	826,823	209,204	1,217,595	318,676	318,701	2,890,999
5,000 - < 10,000	225	502,188	130,514	487,399	351,007	412,235	1,883,343
10,000 and Above	60	335,200	133,500	536,000	192,003	175,000	1,371,700
Total	170,360	3,591,278	1,189,138	4,933,763	1,729,553	1,659,817	13,103,546

Source: Census of Agriculture 2002, Department of Census and Statistics

On the other hand, there has been a tendency to transform the structure of the poultry sub-sector from small-sized farms to relatively large-sized farms. Data in Table 1.10 indicate that there are sixty farms having over 10,000 birds accounting for 1,371,700 birds at the other extreme. Increasing share of production by large poultry farms is the result of rapid growth in demand for poultry products. In contrast to other livestock sub-sectors, the poultry sub-sector has expanded in the recent past. The growth in the poultry industry is largely attributed to enhanced private sector participation in capital intensive breeder farms, hatcheries, feed mills, processing, and marketing. The spread of out-grower schemes is also a new phenomenon in the poultry industry adding up to its growth and sharing benefits by small-scale out-growers.

1.5.4 Connection between smallholder crop production and livestock farming

The data in Table 1.11 below show that the greatest extent under agricultural land plots is of less than a hectare and the greater majority of farmers operate holdings less than a hectare. The data in Table 1.10 also show the importance of livestock for those operating less than one hectare. Of the total extent of 548,279 hectares located in the category as less than two hectares, 112,201 hectares were used for crop and livestock farming in 2002. However, only 1,079 hectares were used solely for livestock farming. In other words, of the 1,270,308 holdings of less than one hectare category, 4,331 (0.34 percent) of holdings were used for livestock farming only.

Table 1.11: Distribution of agricultural holdings by type of land use and by size class (extent in hectares)

Size class of the holding	All holdings		Holdings with crops and livestock		Holdings with crops only		Holdings with livestock only	
	No	Extent	No	Extent	No	Extent	No	Extent
Less than 1 Ha	1,270,308	548,279	238,858	112,201	1,027,119	434,999	4,331	1,079
1 - < 2 Ha	374,397	491,814	105,801	141,198	268,178	350,251	418	366
2 - < 3 Ha	91,687	210,576	30,914	71,194	60,630	139,181	143	201
3 - < 4 Ha	22,074	74,347	7,565	25,447	14,473	48,830	36	70
4 - < 5 Ha	11,861	51,605	3,775	16,472	8,053	35,077	33	56
5 - < 8 Ha	9,323	56,974	2,948	18,072	6,353	38,841	22	61
8 Ha and Above	3,823	42,402	1,097	12,311	2,715	29,985	11	106
Sri Lanka	1,783,473	1,475,997	390,958	396,895	1,387,521	1,077,164	4,994	1,939

Source: Department of Census and Statistics, *Census of Agriculture 2002*

The data in Table 1.11 above show a number of important facts in spite of the argument in the present document. Firstly, is the importance of smallholdings for crop and livestock farming? Secondly, is the domination of crop farming in SFS, especially by those operating smallholdings? Finally, existence of crop-livestock farming that can be strengthened through effective policy and practical measures suggested in the concluding section of this chapter.

Excepting poultry livestock such as cattle, buffalo and goat are concentrated in the dry zone districts which are physically marginal and have reported relatively higher poverty rates in 2002 and 2006/2007 HIES. Poultry population is largely concentrated in the wet zone districts like Colombo, Gampaha, Kalutara and Kandy. On the other hand buffalo, cattle and goat populations

are concentrated in such districts as Hambantota, Kurunegala and Anuradhapura which also have reported higher poverty rates in 2002 HIES.

Forgoing analysis shows that the livestock sector in Sri Lanka is largely located in SFS by involving smallholder crop farmers. It was also found that the livestock sub-sector contributes marginally to national GDP. This possibly is due to observed policy apathy in the development of the buffalo, swine and goats sub-sectors and problems generally observed in breeding, feeding and management practices observed by the authors contributing to this volume.

1.6. Poverty

Existing analysis of the Household Income and Expenditure Surveys (HIES) of 1990/1991, 1995/1996, 2002 and 2006/2007 conducted by the Department of Census and Statistics (DCS) provides the statistics of incidence and distribution (spatial, temporal, occupational etc) of poverty⁷.

Analysing data of HIES in 2002, it was estimated that 22.7 percent of the population in the island was in poverty⁸. Household Income and Expenditure Survey of 2006/07 by the Department of Census and Statistics estimated that the percentage of population is below the poverty line (head count index) at 15.2 percent at national level. The estate sector reported the highest head count index with 32.0 percent, the rural sector at 15.7 percent and the urban sector 6.7 percent. When districts were compared, the highest head count index (33.8 percent) was reported from the Nuwara Eliya district and the lowest (5.4 percent) was reported from the Colombo district.

Females are heading about one-fifth of the households in Sri Lanka. As revealed by the Sri Lanka Demographic and Health Survey in the year 2000, 17.4 percent of the households in the estate sector and 23 percent of the households in the urban sector were headed by females. About 65 percent of the female heads were widows. There is little evidence to link the gender of the head of the households with the incidence of poverty.

1.6.1 Spatial distribution of poverty

As already noted, there is a wide variation in the magnitude and differences in the reduction of poverty across time. Reduction of poverty over different districts too has been skewed over the years. For instance, excluding the three districts in the western province (Colombo, Gampaha and Kalutara), a population from one-fifth to one-third was in poverty in different district in 2002 (Table 1.12).

⁷ The official poverty line of 1,423 rupees per capita a month using consumption parameters adjusted for price differences over time and across districts were used in estimations of population and households below the poverty line by the Department of Census and Statistics in analysis in 2002. 1,423 rupees were derived as the poverty line at the per capita expenditure for a person (973 rupees) to be able to meet the nutritional level of 2,030 kilocalories and the average per capita non-food expenditure of households whose per capita total expenditure is close to the food poverty line. The survey did not cover fully the districts in the war-affected northern and eastern provinces.

⁸ Using the widely employed UNDP definition of average income less than one US dollar a day as the poverty line, 6.6 percent of the population in Sri Lanka was in poverty in 1995. But when the threshold value was increased to two US dollar per day, about 45 percent of the population was in poverty. This shows that relatively a small proportion of the population in the country lives in abject poverty, but a large proportion lives at the edge of poverty.

Between 1991-1992 and 2006/2007, all three districts in the western province (Colombo, Kalutara and Gampaha) have experienced the largest reduction in poverty. In the Colombo district, the ratio declined from 16 percent in 1991/1992 to 5.4 percent by 2006/2007. The districts like Nuwara Eliya and Kegalle saw an increase in poverty from 1991/1992 to 2006/2007. In such districts as Kandy, Matale, Nuwara Eliya and Kegalle, the reported poverty rate in 2006/2007 was higher than that of the national rate of 15.2 percent (Table 1.12).

There are many factors affecting skewed distribution of poverty in Sri Lanka. Firstly, the majority of the poor in Sri Lanka are concentrated in environmentally and physically marginal geographic pockets. Secondly, most rural villages typically lack or have access only to meagre economic, physical resources and social and economic infrastructure facilities. Especially, the interior rural areas in the country lack high mobility roads with efficient transport facilities, access to good quality education, healthcare, electricity, safe drinking water, assured irrigation. Such areas are also linked inadequately to growing markets and economic centres. Thirdly, it is possible that socially and politically marginal like the special castes and ethnic groups reside in underdeveloped areas due to extreme competition they face in accessing productive assets such as land, irrigation water and employment. Finally, socially marginal groups lack a voice in the matters affecting them like in policy decisions.

Table 1.12: Poverty head count ratio by district

District	Survey Period			
	1990-91	1995-96	2002	2006/07
National*	26.1	28.8	22.7	15.2
Colombo	16	12	6	5.4
Gampaha	15	14	11	8.7
Kalutara	32	29	20	13.0
Kandy	36	37	25	17.0
Matale	29	42	30	18.9
Nuwara Eliya	20	32	23	33.8
Galle	30	32	26	13.7
Matara	29	35	27	14.7
Hambantota	32	31	32	12.7
Kurunegala	27	26	25	10.7
Puttalam	22	31	31	10.9
Anuradhapura	24	27	20	15.4
Polonnaruwa	24	20	24	13.1
Badulla	31	41	37	14.9
Moneragala	34	56	37	12.7
Ratnapura	31	46	34	23.7
Kegalle	31	36	32	33.2

* Excluding the war affected areas in the north and east

Source: *Vidyaratne DBPS and Nigamuni WJ (2006) and Department of Census and Statistics, 2008*

War-affected north and east can be considered a special case. Data to assess the poverty situation in the two provinces are lacking. An earlier estimate suggested that from 25 to 55 percent of those residing in the two provinces in 2002 were in poverty (Government of Sri Lanka, 2002). Poverty levels in some interior pockets in uncleared areas or the areas (before May 2009) that had

been controlled by the LTTE in the northern and eastern provinces have been estimated to exceed 60 percent. Besides the heavy casualties on human lives, the war has damaged severely the physical, economic and social infrastructure and provision of normal services in the two provinces. Other contributory factors affecting poverty in the two provinces include low educational attainment, poor access to healthcare and nutrition and limited access to resources and employment opportunities due to uncertainty, social prejudices and exploitation by middlemen. The coastal areas in the two provinces were also affected to a great extent by the tsunami on 26 December 2004, this adding to already existing poverty problem. A major effort in the two provinces for poverty reduction is needed within which the potential for rapid agriculture and livestock development should be taken into account.

Areas in the northern and eastern provinces where the war took place have been freed from the LTTE by now and are ready for resettlement, reconstruction and rehabilitation. Initial breakthrough towards economic growth in these areas has to be accompanied by repair of infrastructure, concentrated efforts on crop and livestock farming and fishery. There is also much potential in the east to catch up with tourism.

1.6.2 Agrarian poverty

It was noted in section 1.2.3 (structural transformation of the economy) that the contribution of agriculture to GDP has declined over the years. In more recent years, agriculture's contribution to GDP declined rapidly – from 23 percent in 1995 to 19.9 percent in 2000 and further to 11.7 percent by 2007 with a slight increase in 2008. Livestock has an even smaller share (0.87 percent in 2008) in the national GDP. Decline in the share of agriculture is not necessarily a result of the decline in growth of production as absolute production has grown over the years. However, its relative contribution to GDP has reduced as the relative contribution of other sectors has grown and low growth in productivity.

Along with declining share of the national income from agriculture, the share of the household income from farming has reduced progressively from the time of independence. HIES of 2006/2007 revealed that the share of agricultural income of the average monthly household income was only 12.1 percent while wages/salaries constituted 35.8 percent. The share of agricultural income ranged from 3.6 percent in the most urbanised and industrialised Colombo district to 41 percent in the mostly rural district of Moneragala. Further more, the World Bank (2003) study revealed that about one-fourth of the total rural households' income came from agriculture of which income from casual agricultural wages was 5.5 percent (Table 1.13). In contrast, the survey found that 56.4 percent of income of households came from non-farm incomes. Of non-farm incomes too, salaries contributed to 37 percent of which 20.2 percent came from the public sector employment. Samurdhi being the government implemented income transfer programme contributed 3.6 percent and private transfers accounted for 5.6 percent of households' income. Thus, the importance of agriculture in rural households has drastically diminished over the years.

Table 1.13: Average percentage share of different sources of income in total rural household income 1999-2000

Source of income	Percentage
Agricultural	23.3
Farm	17.8
Casual Agricultural Wages	5.5
Non – farm	56.4
Casual Non -agricultural wages	20.2
Public Salaries	21.3
Private Salaries	16.7
Sale of farm products *	0.9
Transfer	9.1
<i>Samurdhi</i>	3.6
Farm subsidies	0.1
Remittances	5.6
Other	5.6
Fisheries	0.6
Estate	1.3
Total	100.0

Note: * Consists of sale of forest products and processed food

Source: World Bank, 2003, *Sri Lanka Integrated Survey 1999 -2000*

Sri Lanka adopts a threefold classification of sectors as rural, urban and estate and poverty incidence in Sri Lanka has varied widely between sectors, space and over time (Table 1.14). Those located in the rural and estate sectors account for 80 percent and 5.3 percent of the population respectively. Poverty rate was the highest in the estate sector (30 percent in 2002 and 32 percent in 2006/2007). Data in Table 1.14 also show that poverty incidence in the estate sector increased from 20.5 percent in 1990/91 to 38.4 percent in 1995/96 and then declined to 30.0 percent by 2002 and increased again to 32 percent by 2006/2007. In contrast, in the urban sector, poverty was 7.9 percent in 2002 and 6.7 percent in 2006/2007. Similarly, poverty in the rural sector increased slightly from 29.4 percent in 1990/91 to 30.9 percent in 1995/96 and then reduced to 24.7 percent by 2002 while reducing significantly to 15.7 percent by 2006/2007. The data clearly indicate a tendency for rapid reduction in the urban and rural poverty level over the last five years. However, the poverty incidence in the estate sector has increased. Because about 80 percent of the population are located in the rural sector and about 16 percent of them are in poverty, Sri Lanka's poverty is yet a rural phenomenon.

Table 1.14: Poverty headcount ratio by sector (percent)

Sector	Survey Period			
	1990/91	1995/96	2002	2006/2007
National	26.1	28.8	22.7	15.2
Urban	16.3	14.0	7.9	6.7
Rural	29.4	30.9	24.7	15.7
Estate	20.5	38.4	30.0	32

Source: Department of Census and Statistics, *Household Income and Expenditure Surveys of 1990/91, 1995/96, 2002, 2006/2007*

As could be expected, the poor in Sri Lanka in general are those lacking productive assets, tradable skills, physically or mentally disabled etc. The rural poor include the landless hired-labourers or tenant farmers with little income from the non-farm sector. Even when the poor are engaged in farming, they are likely to operate uneconomic paddy holdings or produce other food crops (OFCs) in highlands under rainfed conditions. The poor generally tend to lack skills that are in demand in the labour market. The estate workers, casual labourers, individuals in the fishery, and livestock, self-employed individuals and urban workers in the tradable as well as non-tradable sectors are amongst the groups. A close relation between the rural poverty and the employment in agriculture is readily apparent. About 40 percent of those in agriculture and related pursuits were estimated to be in poverty by the turn of the century (Asian Development Bank, 2001). The World Bank (2007) study on poverty assessment revealed that compared with 16 percent of non-agricultural households in poverty; nearly 24 percent of rural agricultural households were in poverty. The above study also found that rural households that earn a higher proportion of their total income from non-farm employment were wealthier than those who earned a higher proportion of their total income from agriculture.

The World Bank Report (2007) also revealed a linkage between provincial agricultural GDPs and poverty. The study found that the share of agricultural income in predominantly rural provinces was higher. The data in Table 1.15 show that though 56.4 percent of the total household income comes from non-farm sources while this rate varied from 73.8 percent in the western province to 32.9 percent and in the Uva province. In the Uva and Sabaragamuwa provinces, agriculture contributed 49.9 and 34.2 percent of the total household income respectively. Amongst the nine provinces with poverty data available, above two provinces were found to be the poorest. In contrast, for the western province in which the poverty rate is the lowest and with a rapidly declining trend of poverty over the decade, the share of agricultural income to the total household income was only 7.6 percent while non-farm income was 73.8 percent. This implicate that a province is poorer when its dependence on agriculture is higher. Salaries are a major source of non-farm income while a significant portion of income is also coming from non-agricultural wages too. Only 23.3 percent of households' income comes from agriculture. Direct transfers compose of around 10 percent and *Samurdhi* (social transfer programme of the government) is only a fraction of it.

Table 1.15: Average percentage share of different sources of income in total rural household income by province, 1999-2000

Sector	Average Percentage Share of Rural Household Incomes by Source and Province								
	<i>Western</i>	Central	Southern	North Eastern	North Western	North Central	Uva	Sabara-gamuwa	All
Agricultural	7.6	21.8	26.0	38.7	17.9	33.9	49.9	34.2	23.3
Farm	6.5	13.8	20.8	29.0	10.5	26.4	41.4	29.4	17.8
Casual Ag. wages	1.1	8.0	5.2	9.6	7.3	7.5	8.5	4.9	5.5
Non – farm	73.8	53.7	54.9	41.6	60.7	41.8	32.9	45.8	56.4
Casual Non agri. wages	21.6	21.6	25.4	11.8	24.3	11.6	10.8	21.7	20.2
Public Salaries	21.9	26.9	13.8	23.6	22.8	23.4	23.3	17.9	21.3
Private Salaries	29.0	13.3	13.8	8.7	13.9	5.5	10.5	14.7	16.7
Sale of farm products	1.2	1.1	0.9	0.6	1.2	0.2	0.4	0.8	0.9
Transfer	9.1	14.2	9.0	5.9	8.5	9.6	8.8	9.7	9.1
<i>Samurdhi</i>	1.9	5.3	3.7	2.3	4.7	6.9	6.8	4.3	3.6
Farm subsidies	0.0	0.2	0.0	0.1	0.1	0.0	0.1	0.1	0.1

Source: World Bank, 2003, *Sri Lanka Integrated Survey 1999 -2000*

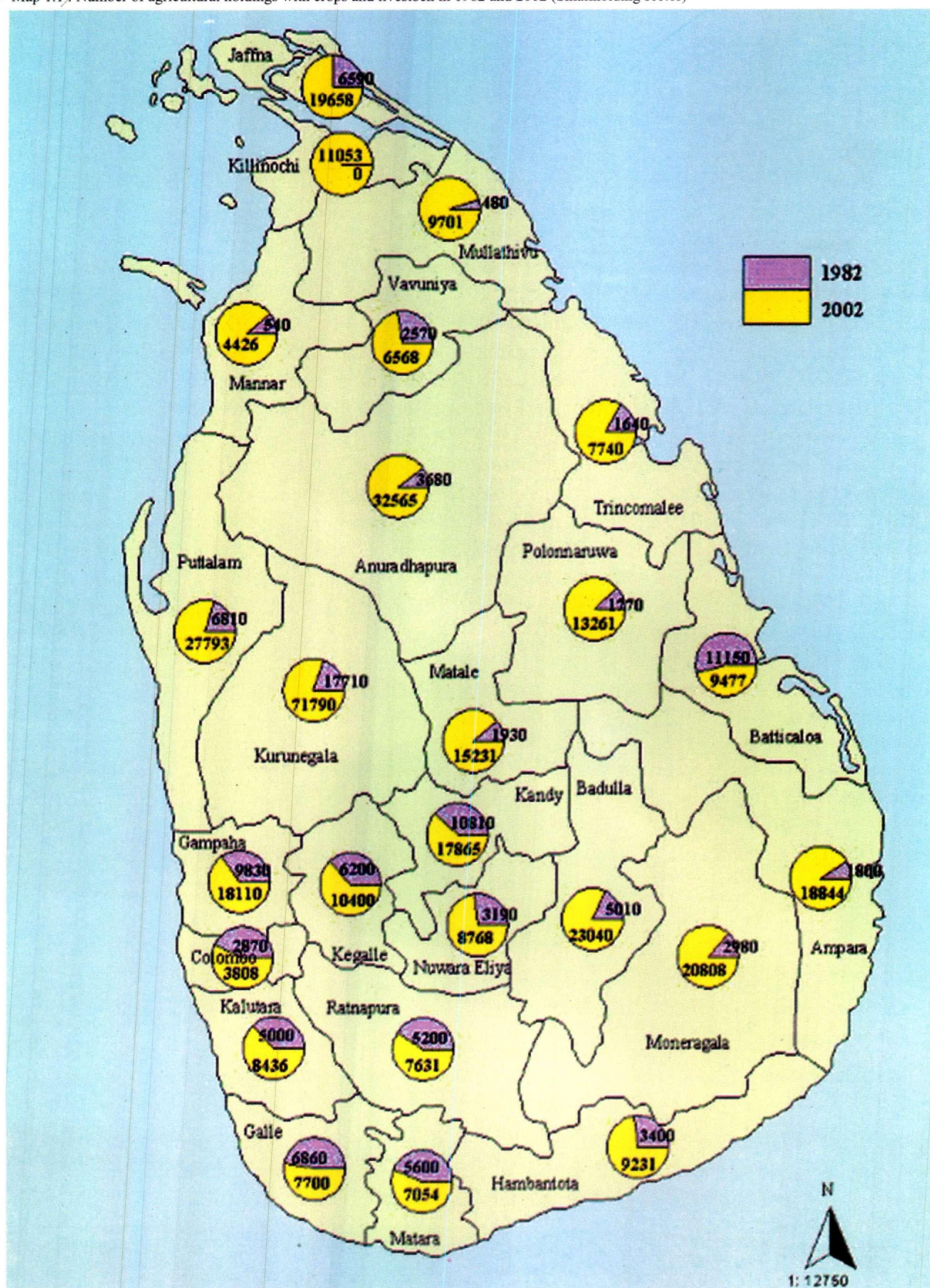
In the poorest province of Uva, the share of agricultural GDP was 53 percent, while 34.3 percent of the agricultural households located within it were found to be poor while only 16.9 percent of non-agricultural households were in poverty. In contrast, only 3 percent of the provincial GDP of the western province came from agriculture, while 15 percent of the households engaged in agriculture within it were found to be poor. Of those engaged in other activities in the western province only 9 percent were poor.

1.6. 3 Linkages of agrarian and rural poverty

Given the observed connection between rural poverty and agrarian poverty, any attempt at rural development and agrarian poverty necessitates understanding of emerging conditions in SFS and sorting out what factors are associated with agrarian poverty. An attempt is made in the following section to identify likely factors associated with poverty in SFS and emerging conditions in it.

In general the rural and agrarian poverty is a multidimensional phenomenon caused by many different factors. There are many factors that are likely to contribute to the poverty in those engaged in agriculture in Sri Lanka. A major one is sluggish growth of agriculture in the recent past. The growth rate of the agricultural GDP declined from 2.8 percent during the 1980s to 1.6 percent during the 1990s and to 0.9 percent from 2002 to 2004. This was in spite of the fact that national GDP grew annually by about 5 percent since the 1990s. This is in spite of the fact that total resources used in agriculture remains high. For instance, agriculture uses 30 percent of the workforce, 30 percent

Map 1.1.: Number of agricultural holdings with crops and livestock in 1982 and 2002 (Smallholding sector)



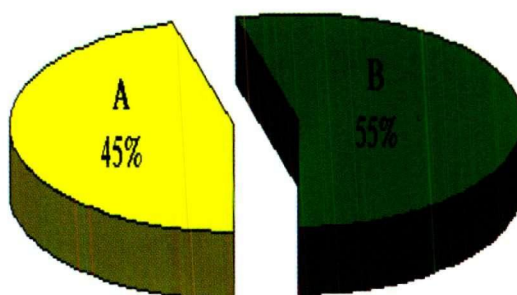
Source : Census of Agriculture, Department of Census and Statistics Prepared by Agriculture Policy & Project Evaluation Division HARTI

of the landmass and about 80 percent of irrigation water sources. The contribution of agriculture to GDP in 2006 and 2007 were marked at 7.0 percent (257,147 million rupees) and 7.3 percent (265,870 million rupees) respectively due mainly to government's response to face the impending food crises accompanied with shortfall in production at the global level. Besides the low agricultural productivity, there are many factors that can be attributed to poor performance of agriculture. These include uneconomic holdings operated by the farmers, farming of low value crops and agricultural infrastructure. Relevance of each of the above factors in understanding agrarian poverty is briefly examined below.

Comparison of the information available in the Agricultural Censuses of 1982 and 2002 shows a significant tendency towards fragmentation of land holdings. The number of holdings reported in the census of 1982 was 1.8 million. By 2002, there were 3.3 million holdings (map 1.1). Increased number of holdings without adding up new land to the existing extent implicate that there has been trend towards a decreasing the size of land holdings in SFS. This has implications for effective transformation of SFS in terms of diversification and increasing productivity.

It is highly likely that the structural distribution of land holdings in SFS influences diversification of production and earning an adequate income to maintain a family. For instance, Agricultural Census of 2002 found 3.3 million agricultural holdings in the country and revealed that 45 percent of those had less than 40 perches (Figure 1.1). The agriculture produce of such smallholdings was stated to be used mainly for home consumption. Around 55 percent of the land was above 40 perches in extent and such lands were said to be used mainly for agricultural production for sale.

Figure 1.1: Distribution of agricultural holdings in the smallholding sector in 2002

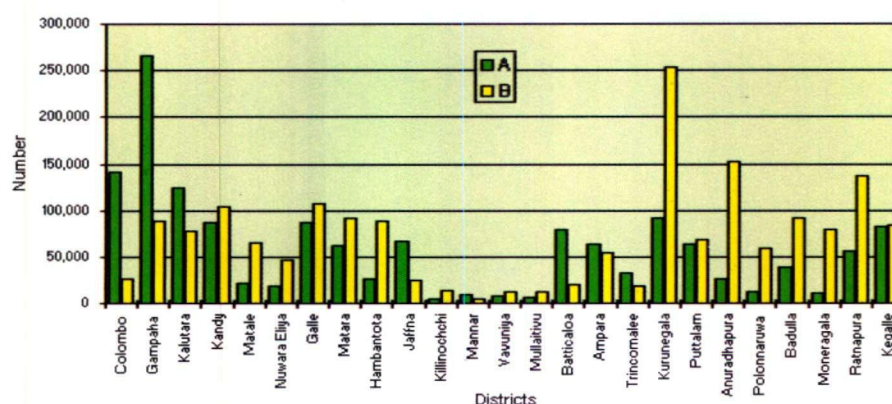


A. Holdings reporting extent less than or equal to 40 perches of land with agricultural produce mainly for home consumption

B. Holdings reporting extent more than 40 perches of land or producing agricultural output mainly for sale purposes

Source: Census of Agriculture 2002, Department of Census and Statistics

Figure 1.2: Distribution of agricultural holdings in the smallholding sector by district in 2002



- A. Holdings reporting extent less than or equal to 40 perches of land with agricultural produce mainly for home consumption
- B. Holdings reporting extent more than 40 perches of land or producing agricultural output mainly for sale

Source: Census of Agriculture 2002, Department of Census and Statistics

The size class distribution of land varies across districts. The data in figure 1.2 show that in such districts as Colombo, Gampaha, Kalutara, Jaffna, Batticaloa, Ampara etc had the majority of holdings under 40 perches whilst many districts like Kandy, Galle, Puttalam, and Kegalle had nearly equal amounts of holdings less than and over 40 perches. Only a few districts such as Galle, Matara, Hambantota, Kurunegala Anuradhapura, Polonnaruwa, Badulla, Moneragala and Ratnapura had the majority of holdings over 40 purchases. The difference is that those operate holdings less than 40 perches can produce mainly for home consumption. The data show that fragmentation of land is high in the wet zone which comprises one-third of the country's landmass. Districts that experienced the most land fragmentation were Colombo, Gampaha, Kalutara, Kegalle, Galle, and Matara. A similar pattern was also reported in the dry zone districts such as Jaffna, Batticaloa, and Ampara. There is an observed relation between the land size operated and the poverty. Findings of the Sri Lanka Integrated Survey 1999-2000 by the World Bank (2003) provided evidence of connection between poverty and land size operated as is depicted in Table 1.16. The data show that in terms of expenditure quintiles, the poorest owned and cultivated the smallest extent of land. On the other hand, the smallholder land operators had the highest cropping intensity of all groups. This implicates land use intensification alone cannot overcome land tenure debilities. Besides the size of operational holdings, there are many tenure debilities affecting SFS and graduating out of poverty by those engaged in farming.

Table 1.16: Land owned (in hectares) and operated by expenditure quintiles

	Poorest	Second	Third	Fourth	Richest	Total
Land owned	0.46	0.47	0.53	0.55	0.86	0.56
Net cultivated area	0.58	0.62	0.75	0.84	1.09	0.77
Gross cultivated area	0.84	0.86	0.99	0.98	1.19	0.96
Cropping Intensity	1.45	1.39	1.32	1.17	1.09	1.25

Source: World Bank, 2003, *Sri Lanka Integrated Survey, 1999 – 2000*

There also can be a connection between cropping pattern and farm household income. The mainstay of SFS is paddy cultivation and it is a low value crop as far as the income generated per unit of land is concerned. Paddy farmers typically operate smallholdings of land with the average unit of land around 2 acres. Given the relatively low incomes accrued to paddy farming, sufficient incomes to sustain a family cannot be generated from uneconomic holdings when a large sector of paddy farmers operates. For instance, when the imputed value for family labour is included, growing paddy in both the *Yala* and *Maha* seasons has been found to incur significant losses to the farmers (Table 1.17). The data also show that in comparison to paddy-paddy farming system in both seasons, a mixture of paddy and other food crops can result in sufficient incomes to maintain a rural family. In spite of this fact, crop diversification on paddy lands is limited due to cultural and social preference for cultivating paddy by farmers and marketing problems associated with other cash crops, especially the perishable crops like vegetables and yams. The low income earned from paddy prevailed until recently when paddy prices escalated.

Table 1.17: Estimated net income for different cropping patterns (Rupees /Ac/Year)

Cropping Pattern	Total Cost (Including imputed cost of family labour)	Net Income (Including imputed cost of family labour)	Net Income (Excluding imputed cost of family labour)
Paddy-Paddy	23,077	-1,541	8,501
Paddy-Other Food Crops	39,340	10,271	19,665
Paddy-Vegetables	45,826	20,410	37,736
Potato-Potato	94,699	150,520	183,611
Vegetable-Vegetable	31,775	5,545	21,063

Note: Based on Department of Agriculture costs of production

Source: *Ranaweera N F C, Samarathunga P A and Hafi A A B (1998)*

Poverty in the agrarian sector also has been variously attributed to many other factors. These include insufficient technology adoption and lack of innovation and crop diversification by analysts. By implication, such analysis holds the responsibility of emerging agrarian distress on smallholder land operators themselves. In turn, the farmers blame the ineptness of the government in addressing the situation they are in and the wrong policies.

The agricultural production in SFS is also affected by limited post harvest processing and value addition, lack of access to investment finance. Disruption of agricultural markets due to the armed conflict that prevailed in the north and east before May 2009 also influenced sluggish growth in the agricultural production. The significant extent of land has been abandoned by farmers in the north and east due to security reasons.



1.7 Nutrition

In spite of the rapid reduction in mortality rates of infants and children under five years, high incidence of malnutrition continues to prevail amongst the preschool children.⁹ Energy-protein under-nutrition, iron deficiency anaemia, iodine deficiency disorders and vitamin A deficiency are the primary nutrition-related problems in Sri Lanka. However, like in many other developing countries under-nutrition in Sri Lanka does not result in the high level of infant and child mortality. This is due to a combination of factors such as comparatively high basic educational level of mothers and relatively widely spread basic health services. Information on obese children in Sri Lanka is scarce and probably the number is still much lower compared to under-nutrition.

It has also been found that 17 percent of children in Sri Lanka are born with low birth weight, with the prevalence of low birth weight – the highest in the estate sector. Maternal nutrition and health problems during pregnancy too are found to be high. Compared to the acceptable minimum of 9.5 kg, the average weight gain during pregnancy is reported to be 7.5 kg. Of among pregnant women, 36 percent are found to be anaemic. Poor maternal nutrition and health during pregnancy is mainly due to inadequate diet (e.g. low in energy, protein, micronutrients etc), infections and inadequate rest. A social factor contributing to maternal nutrition problem has been the food taboos and beliefs that prevent certain nutritious foods from being consumed.

The data in Table 1.18 show that people's calories, protein and fat requirements come mainly from grain and vegetable sources. In other words, contribution of animal based food in Sri Lankans' diets is still minute. Therefore, diversifying nutrition base of the people's diet is a need in which expanding livestock production largely can fulfil.

⁹ However, available data indicate a declining trend in under-nutrition amongst the children. For instance, between 1993 and 2000, the prevalence of stunting (heights for age) declined from a high of 23.8 percent to 13.5 percent, the prevalence of wasting (weight for height) from 15.5 to 14 percent and underweight (weight for age) from 37.7 to 29.4 percent. The percentage of children born with low birth weight (an indicator of maternal nutrition) has also reduced from 19.7 to 16.6 percent.

Table 1.18: Per capita availability of calories, proteins and fat from vegetable and animal sources
1985 - 2005

Year	Calories per day			Proteins (G/day)			Fats (G/day)		
	Total	Vegetable	Animal	Total	Vegetable	Animal	Total	Vegetable	Animal
1985	2,517.5	2,396.6	120.8	55.0	43.3	11.8	58.0	51.7	6.3
1986	2,376.8	2,266.7	110.1	52.1	40.8	11.3	52.1	46.5	5.5
1987	2,267.4	2,133.9	133.5	51.4	38.3	13.1	49.2	42.4	6.8
1988	2,326.1	2,199.8	126.3	52.6	40.2	12.4	48.6	42.8	5.7
1989	2,248.4	2,118.1	130.3	52.2	40.0	12.2	51.4	44.6	6.8
1990	2,292.0	2,159.5	132.6	54.3	41.0	13.4	51.1	44.4	6.8
1991	2,213.9	2,075.7	138.2	53.0	39.2	13.8	49.5	42.6	6.9
1992	2,169.0	2,028.5	140.5	52.0	37.7	14.4	39.5	32.4	7.1
1993	2,139.1	1,990.3	148.8	53.2	36.9	16.3	39.0	31.9	7.1
1994	2,314.4	2,170.9	143.5	56.1	41.0	15.1	43.2	36.3	6.9
1995	2,259.8	2,108.8	151.0	56.5	40.8	15.7	43.0	35.6	7.4
1996	2,183.4	2,035.3	148.1	54.3	38.9	15.4	42.0	34.7	7.3
1997	2,209.0	2,056.0	153.0	54.6	38.1	16.5	41.0	33.6	7.4
1998	2,249.6	2,088.8	160.8	54.8	37.5	17.3	43.6	35.8	7.8
1999	2,332.2	2,175.2	157.0	57.2	41.2	16.0	43.2	35.5	7.7
2000	2,318.5	2,159.7	158.8	56.7	38.6	18.1	46.0	38.6	7.4
2001	2,391.6	2,234.3	157.3	59.4	41.4	18.0	46.6	39.4	7.2
2002	2331.1	2170	161.1	58.4	40.1	18.3	42.8	35.5	7.3
2003	2328	2165.5	162.5	58.6	40.5	18.1	42.7	35.3	7.4
2004	2253.5	2102.6	150.9	56.9	39.7	17.2	41.3	34.5	6.8
2005	2363.4	2221	142.4	58.6	43.1	15.5	42.6	36.0	6.6

Source: Department of Census and Statistics. Food Balance Sheet (various issues)

1.8 Role of Livestock in Poverty Reduction Strategies

The role that livestock development can play in general in poverty reduction is examined in greater detail in chapter two. It is estimated that approximately one-quarter of the global poor, of whom 2.8 billion live on less than two US dollars a day, are livestock keepers. This is in spite of the fact that livestock can provide a steady stream of food and revenue, help to raise whole farm productivity, improve rural nutrition and living conditions. Livestock is often the only livelihood option available to the landless as it allows the exploitation of common-property resources for earning a livelihood. In addition, livestock is often the only means of asset accumulation and risk diversification that can prevent the poor in marginal areas slipping into abject poverty. There is thus a strong argument for ensuring that the development of the smallholder livestock sector is an

effective means of reducing rural and agrarian poverty as is examined in more detail in chapter two by Dhanawardana Gamage.

In spite of many poorer rural dwellers who depend on livestock to a considerable extent, a significant amount lives in poverty. Literature review reveals that livestock has hardly been the focus of rural development and poverty reduction strategies. Even though the role of agriculture is widely acknowledged in rural development and poverty reduction strategies, less prominence for the livestock sector is given in poverty reduction strategies.

Roger, B, Chapman R and Slaymaker, T (2003), note no single country gives full recognition to the role of livestock and develops adequate strategies for exploiting its potential for poverty alleviation. It is noted that even in pastoral countries like Niger or Tajikistan where livestock is the mainstay of the subsistence of the majority of the population; livestock in poverty reduction strategies has been given low priority. It is also reported that some countries such as Guinea-Bissau and Sierra Leone have completely ignored the livestock sector in PRSP. The countries that give some emphasis to livestock in the PRSP include Mozambique and Mauritania, which stress the importance of livestock in their PRSPs.

By reviewing the role assigned to livestock in Poverty Reduction Strategy Papers (PRSPs), Roger, Chapman and Slaymaker (2003), arrive at some broad conclusions as follows:

- i. Livestock is generally under-represented in the PRSP process and in output documents.
- ii. Instead, greater attention is given to commercial operations than to the livestock species and structures relevant to the poor.
- iii. The format of the PRSP does not provide a realistic picture of the situation of poor livestock producers despite the apparent participatory and consultative nature of the process adopted in preparing those.
- iv. Recommendations in PRSPs are usually central and top-down suggesting that the local opinion may be sought but is usually not incorporated into final documents. Procedure does not lead to any increased representation of livestock in PRSPs.
- v. The broad sectoral priorities outlined in the majority of PRSPs appear largely inadequate in the specific socio-economic context of the country in question.
- vi. Recommendations regarding livestock are extremely general.

1.9 Practical Need for Development of Small-scale Livestock Production

In order to identify the practical needs for fresh efforts towards development of the livestock sector, major findings in the present chapter are summarised below.

- i. During sixty years after independence, Sri Lanka's economy saw a transformation from traditional agricultural based rural economy with sustainable lifestyles to a more diversified economy through expansion of the industrial and service sectors.
- ii. In the late 1970s, efforts were made to move away from total dependence on agriculture in order to solve the problem of slow growth in GDP, growing problems of unemployment and poverty. Policy reforms starting from 1977 has been instrumental in structural transformation of the economy. However, the benefits of transformation have been largely concentrated in the western province. Therefore, the present government has recognised the need for more

balanced development.

- iii. Successive governments have made significant investment on irrigation and social and economic infrastructures to settle people in the hitherto thinly populated dry zone. This resulted in expanding the area under paddy and other food crops cultivation followed by attainment of near self-sufficiency in rice and growth in production of other food crops.
- iv. Productivity growth in the crop sector, both in plantation and domestic crops sub-sectors have been low and the contribution of agriculture to GDP has declined significantly over the years.
- v. Although the contribution of agriculture to the country's total GDP has declined considerably as other sectors expanded, the role of the agriculture sector remains important for rural poverty reduction. Nearly 80 percent of the population reside in rural areas and a sizable portion of them depends directly or indirectly on agriculture as a source of livelihood. World Bank study (2003) showed that about half the rural households and about 40 percent of the expenditure quintiles were dependent on agriculture for income. Income from agriculture was critical for some provinces like Uva and Sabaragamuwa that have higher poverty rate.
- vi. The rural areas in Sri Lanka remain repository of poverty and estate sector has the highest reported incidence of poverty. The north and east that have been brought under government control likely to have very high incidence of poverty and human and social deprivation.
- vii. In terms of land and water resources devoted and labour force engaged, the mainstay in SFS is paddy cultivation and from a smallholding of land that the farmers typically cultivate cannot provide sufficient incomes to sustain a family of four persons.
- viii. Dependency on non-farm employment by those engaged in agriculture is increasing, a factor attributable to low income from farming and increasing opportunities for non-farm employment in rural areas.
- ix. In addition to engagement in non-farm employment, many of the poorer agricultural households also depend on transfers from family members employed in the armed forces, private security organisations, and the garment industry and from those employed abroad as migrant workers. Such dependency shows the need for expanding or diversifying smallholder agriculture enterprise to make the system relatively more sustainable.
- x. The share of non-farm income in households engaged in agriculture is higher than income from agriculture. For instance, Sri Lanka Integrated Survey 1999–2000 by the World Bank (2003) revealed that nearly 52 percent of the average income of the rural households came from non-agricultural wages and self-employment in non-farm enterprises. The relative importance of non-farm income was higher for paddy farmers. This is likely due to relatively low income from paddy farming and relatively less time to be engaged in paddy cultivation than growing other crops. The issue here is that the farmers devote or can devote less time on agricultural production and increase the productivity. If the farmers are in a position to integrate crop farming with livestock farming they are in a position to devote more time on-farm enterprise, obtain complementary and higher incomes and reap benefits from livestock as considered in chapter two.
- xi. The share of employment in the agricultural sector has progressively declined over the years. The rate of employment in agriculture declined from 55.5 percent in 1990 to 44.1

percent in 1995 and by 2005 agriculture employed 7,105,322 persons representing 32.2 percent of the total workforce. This was largely due to the poor performance of the export-crop sub-sector. The difficulties in the export-crop sub-sector have not been compensated by the domestic food crops sub-sector or SFS because the latter failed to realise its full potential for creating more new employment opportunities.

- xii. On the other hand, many thousands of people still depend on agriculture for a living making it still a main source of livelihood in rural areas and the major source of income for many households¹⁰. In SFS, women are employed in large numbers as unpaid family workers, while men are largely engaged as own-account workers.
- xiii. As regards the plantation sector, waged employment opportunities on estates have been reduced over time. Persons employed on plantation estates were around 542,000 in the early 1980s. However, the number has reduced progressively to 278,357 (Fontgalland, 2003).
- xiv. Agriculture labour force tends to flow out of agriculture due to low income from farming, making this a major problem to be addressed. A sizeable portion of those engaged in agriculture is employed in public sector services such as education, health, transportation, public administration etc. On the other hand many work as casual labourers, petty traders, own account workers etc.
- xv. Associated with above fact (xiv) is increasing incidence of part-time farming. Especially paddy farmers tend to engage in other economic activities to complement agricultural income or as a way deficit financing of agricultural income. Paddy farming necessitates additional sources of income to support a family while also providing time to engage in other activities as the paddy farmers have relatively free time to do so compared to the farmers growing other cash crops.
- xvi. Due to the large gap between agricultural and non agricultural incomes, members of farming families seeking better income opportunities leave agriculture. Mobility of labour from agriculture to other sectors (i.e. from agriculture employment to non-farm employment) has resulted in the reduction of labour for agriculture. This employment shift is partly due to the expanding economy. However, labour mobility from agriculture will inevitably continue to affect the labour availability in the agricultural sector. This calls for making agriculture more attractive in terms of opportunities for increasing income. Means to do this is through crop diversification and diversifying the farm enterprise.
- xvii. Conventional agriculture in Sri Lanka – farming of smallholdings – has failed to attract young people. Incomes from agriculture, especially incomes from paddy farming, are relatively low in comparison to what one can earn from engaging in the non-farm sector employment. Under these circumstances, younger groups (especially those who have had a minimum level of secondary education) seem reluctant to take up agriculture, especially paddy farming. There is a potential to retract the youth agriculture through development of modern livestock farming.
- xviii. The estate workforce seeking employment outside the plantation is increasing. For instance, an estimated 274,000 workers have left the sector during 1980-2003 (ADB 2007). It is found that youth from estates resort to low-salaried, unsecured, informal, non-agricultural wage as a livelihood within and outside the plantation sector. Complementary income on the

¹⁰ One estimate suggests that nearly 58 percent of the rural population in Sri Lanka depend on agriculture, at least partially, for their livelihood.

estate such as livestock farming can provide solution to this issue in a significant way.

- xix. A major obstacle in SFS is the excessive land fragmentation and farmers having to depend on uneconomic landholdings for crop production. Excepting for cattle and buffalo, other species of livestock need little land to run a household level livestock enterprise like poultry.
- xx. The majority of rural people live in the wet zone which has only 30 percent of the total land available. Due to population pressure on land, the majority of the wet zone farmers cultivate uneconomic holdings. In the wet zone areas, soil erosion and fragmentation resulting from sub-division of existing holdings have created severe problems for crop production and productivity increases. Integration of crop farming with livestock can benefit agricultural land operators in the wet zone immensely.
- xxi. Existing evidence elsewhere indicate that increase in income from livestock in rural areas reduces income inequality. Livestock farming as practised in Sri Lanka too favours achieving equity objectives of development in rural areas. For instance, the bulk of the livestock population in Sri Lanka is owned by marginal and smallholder farmers: 71 percent of cattle, 63 percent of buffalo, 66 percent of small ruminants, 70 percent of pigs and 74 percent of poultry. This implies that marginal and small landholders derive a considerable portion of their income from livestock.
- xxii. Due to the large numbers of current and potential producers, the smallholder dairy production shows significant potential for increasing the national dairy production.
- xxiii. Inequality has implications for rapid reduction of poverty. Poverty reduction has been slow due to widening inequalities among income groups and across regions, and also because growth is concentrated in a single province. More inclusive economic growth will require easing specific constraints affecting particular sectors, regions, and groups. A major constraint in this regard is the access to infrastructure to improve opportunities for the poor and other marginal sector of the population living in lagging sectors and regions.
- xxiv. As the authors contributing to this volume show, the country is heavily dependent on imports of livestock products. Especially the milk and meat imports have become a heavy burden on government budget.
- xxv. There is a significant incidence of under-nutrition in the country. Amongst the undernourished, large numbers are contained in rural and estate sectors. Under-nutrition is expected to be high in the north and east.

Thus, given the existing conditions in the rural cum agrarian sector and emerging scenario both in the SFS and the estate sector, the need for development of smallholder livestock production is clear. This is not only to enhance incomes of the smallholder farmers so that a significant portion of them graduate out of poverty, but also to reduce such debilitating phenomenon like part-time farming. Following factors stress the need for diversification of agriculture production in the country and to enhance household level income.

Analysis in foregoing sections shows the practical need for diversification of farm household enterprise and enhancement of household income for reducing the incidence of agrarian poverty. In this regard, the development of the smallholder livestock is a potential strategy. This is for a number of reasons as follows:

- i. A major advantage of smallholder livestock production is the variety of ways it can support the livelihood strategies of the poor. Dhanawardana Gamage in chapter two in this book shows the potential the livestock has for reducing rural poverty and malnutrition. As analysis show, the role played by livestock in poverty reduction revolve around generating livelihoods, enhancing disposable assets, contributing to food and nutritional security, providing draught power, transport and manure and serving traditional social functions. The analysis in chapter two by Dhanawardana Gamage shows that livestock is an indispensable part of the livelihood systems of many poor rural and urban population in developing countries, that it can play a crucial role in farming systems and that it can decrease the vulnerability of households. Livestock in Sri Lanka fulfils most of the functions noted above, but the degree to which this occurs is not sufficient in terms of the potential this sector has. About three-fourth of the Sri Lanka's population lives in rural areas, and more than one-fourth of it falls below the poverty line. Poverty is largely prevalent among the landless, marginal and small farm households. The livestock sector also has considerable potential to contribute towards rural employment creation and diversification of household economies. However, government policies regarding smallholder agriculture have placed heavy emphasis on the crops sector, especially on the paddy sub-sector.
- ii. As the smallholder farmers also integrate livestock on their farms, concerted policy efforts could be adopted to develop the smallholder livestock sector to overcome the difficulties in SFS. For this, there is a need for enhancing the livestock production and marketing by assisting the smallholder farmers to adopt commercial livestock, in particular dairying and poultry. The growth in the smallholder livestock sector will reduce the poverty in SFS while fulfilling the government objective of developing the rural sector and attainment of more equal growth.
- iii. It was already noted that in spite of the Sri Lanka's achievements in human development indicators, its people suffer from under-nutrition significantly. Though this could be due to various reasons like dietary/feeding habits, cultural influence etc and people's nutritional conditions are also significantly influenced by the type of foods available for consumption. In comparison to developed countries, animal based foods in the Sri Lankan food basket are fewer.

1.10 Chapters in this Book

The present chapter written by Dhanawardana Gamage is to serve as the preamble to this book. It outlines and discusses the objectives of the book, ecological and policy context of agricultural and rural development and state of the agrarian and livestock sectors and the linkages between them. It also introduces the focus and the contents of the remaining chapters which this section does.

The chapter two written by Dhanawardana Gamage examines the inter-phase between poverty and livestock. The chapter which is based largely on existing literature examines the connection of the poverty with livestock. It is found that livestock fulfils multiple functions in agrarian and pastoral communities whilst the majority of smallholder livestock farmers, including the pastoralists are in poverty. The observed situation is in spite of the promise the livestock in general has in enhancing the livelihoods and nutrition of the rural people who constitute the largest

percentage in less developed countries. The author briefly examines the limitation of livestock in poverty reduction in the global setting. After the general review of inter-phase between livestock and poverty, the author discusses the state of the livestock sector in Sri Lanka and potential it has in reducing poverty.

The chapter two is followed by four chapters that analyse and draw implications for selected sub-sectors of the livestock sector in the country. There are four chapters dealing with the livestock sub-sectors: poultry, dairy, buffalo and swine production respectively. In addition, the authors contributing to chapter four and seven also discuss the state of the goat sub-sector with sufficient details.

Most chapters provide an account of the historical setting, trajectories – each of the sub-sectors has followed in evolving into the present situation and its contribution to the economy. The chapters also examine the statutory support systems and major drawbacks observed in those as well as experience in other countries to enlighten the reader of different approaches and ensued outcomes. Most authors show the prevalence or even the dominance of smallholder livestock farming and are cognizant of issues at the grass-roots level. The major issues highlighted are issues related to availability of stocks and breeding system, inadequate feeding and productivity of animals, healthcare, hygiene, extension, marketing etc. These chapters that deal with policy and strategic issues at the national as well as the technical, managerial and marketing issues at the grass-roots level are useful for formulating policies and preparing strategies for each of the sub-sector of the livestock sector in Sri Lanka. The chapter seven in this volume largely focuses on the role the livestock development can play in enhancing food security in the country and the improvement of the nutrition of the population. Each chapter accompanies a section on conclusion and recommendations. Most of the above technical and policy analyses are provided by professionals engaged in the development of livestock in Sri Lanka.

The chapter three jointly written by DVS de S Gamage and SP Gunaratne – deals exclusively with the situation in the poultry sub-sector in Sri Lanka. By examining the experience in Asia and Africa, the authors argue that table eggs come from small flocks. They also show that the poultry industry has developed into a major industry from one of backyard production system few decades ago. However, a major share of eggs yet comes from semi-intensive and backyard systems. The authors show that mediation of large business in the sector has been most instrumental in the growth of the sector into a modern livestock industry and big business has also integrated small producers vertically through out-grower schemes or contracting systems. They find the prices of poultry products have increased along with feed prices.

Chapter four written by ADN Chandrasiri examines and analyses the state of the dairy sector in the country. As a precursor to discussion, he compares per capita milk consumption of Pakistan (180 kg), India (72 kg) and Nepal (40 kg) and Sri Lanka (33 kg). On the other hand, countries compared have low per capita income than Sri Lanka showing that problem is likely to be the availability of milk and food habits in Sri Lanka. This shows the ample opportunities in the country to increase the production and consumption of dairy products. The author shows that there is no significant change in cattle population whilst the buffalo population has decreased by more than 50 percent during the past 50 years. Further, he notes a significant decrease of goat population. On the other hand, the average daily milk production per cow did not change during the same period. The author attributes this to the lack of proper selection and culling programmes at the grass-roots

level.

It is indicated that more than 40 percent of the cattle, buffalo and goat population in Sri Lanka is concentrated in the dry zone and the second highest population is found in the dry intermediate zone. The author shows that during the past eight years, the islandwide annual milk production has gradually increased by about 11.6 percent. Cow milk production has increased at an overall rate of 12.6 percent while the buffalo milk production has increased only by an overall rate of 6.7 percent. On the other hand, the demand for milk and milk products is gradually increasing by around 5 percent annually. The author reflecting on the emerging scenario reveals that the present production and collection of milk is not sufficient at all – to meet the growing demand and the imports will continue to increase. He shows that the expenditure on milk foods as a percentage of the total expenditure on food has increased from 2.4 percent in 1980 to 9.3 percent in 2006.

Amongst the concluding remarks in the chapter include the need for efficient utilisation of the potential natural feed resources available in the country and re-orientation of the feeding practices to achieve a higher level of efficiency. However, the author finds that with high yielding cows the milk production falls short of the actual production level of the animals maintained on pastures alone. Although supplementary concentrated feeding would increase the milk production, such a feeding practice would be uneconomical due to high cost, inadequacy and poor quality of the concentrated feeds available at present. Lack of sufficient quantities of legumes in most of the pasture lands is another serious problem that the author observes. Even, on the large-scale commercially oriented cattle, buffalo or goat farms, well-established legume-pasture combination is lacking.

Chapter five jointly written by DHA Subasinghe, BMAO Perera and PGA Pushpakumara, examines and analyses the state of buffalo (*Bubalus bubalis*) sub-sector. They show that the buffalo population in Sri Lanka has shown negative growth over the past three decades and the current population is around 319,000. They observe that this is in spite of the fact that buffalo being a domestic ruminant that has been used as a multi-purpose animal in Sri Lanka since historic times, and is ideally suitable for dairy and draught purposes of the rural smallholder farmer even under present conditions. Buffalo also have the ability to survive in stressful environments, feed on poor quality forages and provide milk rich in butterfat and proteins, apart from draught power and manure for crop agriculture.

Suitable land available for buffalo production has decreased over time with that of the buffalo population. Thus the reduction in buffalo population is a matter of concern regarding rural poverty reduction, improvement of nutrition as well as smallholder crops production. In this regard, the authors recommend introducing simple and new technologies in nutrition, breeding and management to the smallholder farmers to enable them to use more intensive systems of buffalo production. This requires programmes promoting farmer participation in technology generation and transfer to promote integrated farming systems that use buffalo as a multi-purpose animal. The authors also recommend improving existing stocks by use of exotic river type breeds like Murrah, Surti, Nili-Ravi etc.

Use of buffalo as draught animals has declined over the years. The authors quoting existing studies have shown that only about 40 percent of the buffalo farmers milked their cows, and of this only 14 percent milked them throughout the year, while the others did so only for short periods of about 2-3 months after calving. The buffalo farmers of the Batticaloa, Hambantota, Ampara,

Ratnapura, Matara and Kalutara districts regularly milked their cows. Over 50 percent of the farmers who milked their buffalo made curd, as it gave higher returns than the sale of liquid milk and also improved the period of preservation in good condition. This shows the prospects for buffalo farming for curd production. There is also the need for improving the productivity of animals. The authors put the average lactation yield of indigenous buffalo cow around 1.5 litres a day. However, they show that crossbreeding indigenous Lanka buffalo with specialised exotic dairy breeds such as the Murrah has shown great promise in increasing its milk production potential.

Quoting on existing examples, the authors show that buffalo have the ability to grow faster than cattle and are more efficient converters of feed to meat. On the other hand, contrary to general belief, there is no difference between the meat of the male and that of the female. However, the meat of the female has higher fat content and lower water content. Similarly, the authors argue out the common belief that “buffalo meat is hard” and indicate that buffalo meat is as palatable as cattle meat. Finally, they indicate that prejudice against buffalo meat is not justified in view of its positive features with regard to the nutritional value and tenderness.

The authors also note that though both the state and the private sector agencies are involved in livestock and milk production in Sri Lanka, there is very little collaboration and coordination as to the activities implemented by them. They further observe that the primary objectives and functions of these agencies need to be reviewed and reforms must be introduced to support the smallholder farmers, and long-term development programmes need to be implemented in order to ensure improvements in the livestock sector that are sustainable with the available local resources.

Chapter six jointly written by SP Gunaratne, ADN Chandrasiri and Shadana Gajanayake, provides analysis of emerging conditions and existing state of the pig (swine) production in Sri Lanka. The authors note that the pig production has evolved into an intensive smallholder production system from a backyard pig rearing system. However, the total estimated pig population of Sri Lanka has decreased over time recording 79,295 heads in 2004 with a pig to human ratio of 1:240. The world pig population is about 921 million of which about 60 percent is in Asian countries. Unlike other sub-sectors of the livestock, swine farming is concentrated in the western-coastal area, popularly known as “pig belt” with about 70 percent of the pig population being concentrated along the coastal area from Puttalam to Kalutara.

Natural breeding is the most common breeding method in swine production. The Landrace, Large white and Duroc are the exotic breeds available on farms and present swine population consists of these three exotic breeds, their crosses and indigenous pigs. The authors support the idea that pig farming is less dependent on land and Sri Lanka is relatively free from many swine diseases showing the advantage of this sector.

In spite of the promise, especially to increase meat production, the swine sector has been given lesser attention by both the people and the government. According to the authors, in the “National Livestock Development Policy and Strategies formulated in 2006, the government has placed less emphasis on the meat sub-sector including swine production. These strategies also has not clearly identified the private sector role in meat production. High cost of feed, quality and availability of breeding materials, marketing and inadequate extension services are the important constraints identified in the swine industry. Reviving farmer organisations is important to establish links, provide services and supply inputs to the swine farmers.

The annual production of pig meat in Sri Lanka has been estimated at 1053 metric tons, which is about 1.5 percent of the total meat production in the country. The outcome of the existing situation has been the low per capita availability of pig meat (about 110 g) in Sri Lanka with the swine sub-sector contributing less than one percent to livestock GDP. The per capita consumption of pork also is the lowest compared to beef, mutton and chicken. Per capita availability of pork estimated at 110g/person/year in Sri Lanka compared to certain Asian countries like China (24 kg) Malaysia (15 kg) and Philippines (12 kg) is low. According to world statistics, pork was the most eaten meat in the world in 2000 (about 91.5 million tons compared to 70.4 million tons of chicken). The majority of pig farms adopt sub-optimal management practices, with swill-feeding to reduce feed cost.

The chapter seven jointly written by Thakshala Seresinhe and K K Pathirana examines the extent to which the livestock sector can contribute to food security in the country and nutrition improvement of the population. From the point of view of the two authors, the diet of the people in Sri Lanka largely comes from a small number of staple foods and therefore animal products are of great importance in preventing malnutrition; as they are concentrated sources of limited essential amino acids in vegetable protein of basal diets.

The authors by analysing the existing state of the livestock sector as a whole support the livestock production to improve the availability of livestock food product at national level and save the escalating import cost of such products. For instance, the authors show that even though the total meat production in Sri Lanka has increased by more than fivefold over the past few decades, milk production has not shown substantial growth and imports of powdered milk have drastically increased. The authors show that volume of powdered milk imports has grown 4 percent per annum over a period of ten years. Though the local production meets somewhat the increasing demand for meat and eggs, the situation with regard to milk is bleak. On the other hand, the consumption levels of livestock products in the country are much below than that in many other countries.

Accounts provided by the authors also show how livestock development can improve food security and nutrition conditions at the farm household level. For instance, livestock can add to food security and nutrition at the smallholder farmer level by increasing employment opportunities and income. This is especially because 50 percent of livestock – especially the ruminant population – come from smallholder land operators.

Animal products are primarily a source of protein and essential amino acid, but when they are a major constituent of the human diet they also contribute a significant proportion of total calories. The authors argue that the increase in livestock production can add to food security and nutrition of the poor smallholder farmers by enhancing their direct access to livestock food products. They are also of the view that increased production will keep prices of the livestock products down and improve low income groups' access to them as livestock products are subject to price-and income-elasticity ensued by lower prices inducing increased demand, total production and farm household income.

The chapter eight written by Dhanawardana Gamage summarises the challenges the small-scale livestock farming faces and the major thrust areas to be considered in livestock development in the rural setting of Sri Lanka. It starts with constraints imposed by the government policy and

examines more practical problems like breeding, maintaining stocks other constraints like access to capital by smallholder livestock farmers. Other major constraints examined by the author in this chapter include labour, land and feeding material availability and management systems adhered to by the farmers. After examining the major challenges, the author moves on to delineate what could be considered as the major thrust areas for focusing policies and strategies to develop the smallholder livestock sector. The author elaborates the importance of fine tuning the support systems; education, research and extension and importance of putting in place a practical system of marketing.

The present chapter written by Dhanawardana Gamage is to serve as the introduction to this book. It outlines and discusses the objectives of the book, ecological and policy context of agricultural and rural development and the state of the agrarian and the livestock sectors and introduces the content of remaining chapters with pertinent findings. Issues and challenges in the rural and agrarian sectors are discussed in chapters four and five respectively.

The chapter two written by Dhanawardana Gamage deals inter-phase between poverty and livestock based on existing literature.

1.11 Conclusions and Recommendations

Conclusions and recommendations in this chapter are more general yet pertinent aspects of findings in this book. Policy recommendations are also provided in chapter eight by way of discussing thrust areas. Practical and technical conclusions and recommendations are provided by each author in respective chapters separately.

Current (*Mahinda Chinthana*) policy of the government on agriculture focuses on strategies to transform subsistence agriculture to commercially oriented and highly productive sector, increasing value addition and maintaining food security and raising incomes of small farmers. Current policy also stresses the need for reducing regional disparities in growth and reducing poverty. The livestock development programmes should recognise the above objectives and prepare practical programmes to develop the livestock sector.

With many thousands of small-scale producers involved in the livestock production, farm animals show the potential for rural development and poverty reduction amongst small-scale farmers as well as contributing to reduction in rural-urban disparities. However, there are many factors hindering the performance of the small-scale livestock production in the island. As to the Department of National Planning (2002), the major factors hindering the performance of the sector include the output-pricing regimes which does not relate to the increase in prices of the main feed inputs, lack of efficient and streamlined institutional arrangements for milk and milk products, and improvement of integrated livestock management support services.

Besides the above constraints, there are many production constraints affecting the small-scale livestock production systems. These include lack of suitable breeds as well as lack of capital to acquire animals by those interested. For instance, the authors show that most available animal stocks like cattle, buffalo, swine and goats are generally of poor quality for increasing productivity. Other factors affecting small-scale dairy, buffalo and swine production include inadequate feed base, high costs of bought-in feeds and poor management practices adopted by farmers. In addition, farmers are having difficulties in coping with and adjusting to labour demand in the small-scale livestock

enterprises are reported. Small-scale livestock producers also face problems with constraints in produce sales, especially due to the fact that they are being compelled to depend on local market niches and narrow product bases. Most of the above problems are discussed in detail by the authors contributing to this volume.

However, marketing aspects of the production need more attention as economic growth among poor livestock keepers will depend on their level of access to markets. It is noted by the authors that the existing marketing system consists of local market niches and externally organised market avenues. For instance, based on local milk demand dairy farmers sell part or whole of the milk produced to local consumers. Demand for locally produced milk is significant with demand outstripping supply throughout a large part of the dry season and drastically reduced demand during the rainy season. Due to this reason, a glut of supplies on the local market occurs. Relatively large-scale companies purchase milk through collection centres, process and deliver. Organised market has been the source of expansion of the small-scale dairy and poultry sectors. However, major constraints of providing an organised system of marketing are the dispersed producer community and an equally dispersed rural market. To overcome the problem associated with dispersal of producers, there needs a better understanding of the areas where livestock development can most efficiently contribute to the reduction of poverty through the most efficient application of the limited resources. *Kiri gammana* or milk village programme attempts to address this issue. Second, the lack of targeting the poor in livestock development and in decision-making processes must be remedied. Third, new forms of organisation and participation of poor in service delivery related to livestock farming need to be addressed.

The increasing scarcity of land and water has wide implications in terms of the prioritisation of livestock production systems in various locations and among poorer groups. Therefore, development of production and farming systems that rely on fodder production or use of alternative resources should be taken into consideration.

Women play an important role in livestock keeping, and experiences show that in the provision of livestock services and the design of livestock development programmes, a female targeted approach can improve the overall impact in terms of poverty reduction. Efforts to secure women's access to and control of productive and natural resources such as land, livestock and credit are strengthening women's influence and social empowerment.

For more effective pro-poor livestock development, the following are required:

- i. An understanding of areas containing the groups and production systems with the most potential for livestock development.
- ii. In-depth assessment of the impact of livestock services on poverty reduction.
- iii. Development of tools for monitoring of livestock impacts on poor.
- iv. Development of a common framework for pro-poor project design and implementation.
- v. Collection and sharing of the lessons learned.

All contributors to this volume have discussed the inadequacies in the public sector involvement in the direct delivery of services to small-scale farmers. Existing situation regarding extension reveals that there are multiple agencies involved in extension at multiple levels making the whole extension system very complex. On the other hand, the private sector too can play an important role in the provision of livestock services as is practised in the poultry sub-sector. The public sector

can concentrate on regulation, quality control and development of market assistance schemes, as conventional veterinary services are not economically viable in marginal areas. Community animal-health worker systems implemented in many countries represent an example of such systems. Preventive medicine and vaccine systems can be used in a community setting for the benefit of the poor livestock keepers.

Producer organisations that are truly owned and controlled by the producers have the potential to empower themselves and facilitate the delivery of services that respond to their needs and meet required quality standards. Small-scale producers can be organised and empowered to gain from efforts to organise and work together to identify their needs, consolidate demand and achieve economies of scale in service delivery.

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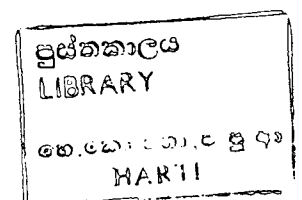
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Chapter **2**

**LIVESTOCK FOR
RURAL DEVELOPMENT AND
POVERTY REDUCTION**

Dhanawardana Gamage



2.1 Introduction

This chapter is an attempt to review and assess the extent to which the smallholder livestock – a form of production and livelihood in rural areas, particularly by the small-scale crop farmers – can help reduce rural and agrarian poverty. The term livestock is used to denote a range of animals like cattle, goat, sheep, pig, horse, camel, yak, poultry etc raised by people as production or livelihood entities and draught power. Livestock is raised in different scales applying diverse technologies and under different management systems. As a sub-sector of agriculture, it offers greater potential for rural development and poverty reduction, particularly in Asian and African countries that are still struggling from the grip of abject poverty.

Since time immemorial, livestock has been a vital source of livelihood of the people; even before the dichotomy between the rural and urban economies. It is still practised in pastoral communities in countries like Bhutan, Laos and Nepal etc. An estimated 600 million small farmers and herders are currently engaged in raising and managing livestock all over the world.

In some countries, livestock has been a major source of business transaction and industrial raw material. There are many forward and backward linkages livestock has for manufacturing and service industries. The major forward linkages include supply of livestock products for processing, value addition, and distribution, marketing etc. The backward linkages include the provision of extension services, breeding, medicinal and feeding material and items for construction of cattle and poultry sheds etc.

In addition to its significant contribution to national, rural and provincial economies, livestock plays an important role in nutritional improvement, rural development and agrarian poverty reduction. Also at a time, prices of chemical fertilisers are on the increase, the role livestock can play – in nourishing soils with animal droppings for crop productivity improvement – is vast and economically significant. The most indisputable advantage livestock has – is the ability of the domesticated animals to convert marginal resources like the pasture, fodder, agricultural and industrial residues and household waste into food that is consumable by humans.

Aquaculture is a related pursuit of humans involving the husbandry of aquatic plants and organisms ranging from the propagation of aquatic organisms under human control to the manipulation of at least one stage of an aquatic organism's life. Aquaculture as an economic activity too can generate additional employment and income in rural areas. However, both livestock and aquaculture activities have not received due attention, particularly in the formulation of strategies for rural and agrarian poverty at home and abroad, in spite of the fact that they are integral parts of the rural households' economies of developing countries.

The principal argument for development of the smallholder livestock sector in the South Asian region comes from the need felt for increasing rural incomes, nutrition and diversifying the sources of income of small-scale farmers. Despite the immense economic and social benefits that can be generated both at farm and national levels, livestock production has fallen short of expectations in terms of the accomplishment of the production objectives as well as the rural and agrarian development objectives. Therefore, many factors that commiserate over the need for developing the small-scale livestock sector are also discussed in this study.

The reasons for using livestock for rural development and poverty reduction in Sri Lanka are clear. A major one is the high incidence of rural and agrarian poverty in the country. The rural poverty is largely associated with sluggish growth in agriculture and lack of diversification of the rural economy. On the other hand, much of the growth that has occurred in the country over the past three decades has been largely confined to the most urbanised and industrialised western province. One of the major issues of development in Sri Lanka, – therefore, is the growing inequality between the western province and the rest of eight provinces. Poor social and economic infrastructures in the rural provinces inhibit the attraction of private capital investment. The growth in the non-farm sector in rural provinces is largely limited to small enterprises that employ only a handful of individuals per firm.

Agrarian poverty is a multifaceted problem as is rural poverty. The major factors contributing to the observed high incidence of poverty of those linked with agriculture in Sri Lanka include slow down, if not, an impasse in productivity growth, lack of diversification, land tenure issues and marketing problems. There have been many efforts by the government agencies to assist the diversification of the agricultural production system in the smallholder farming sector which have been partly successful. In certain localised areas, the farmers have opted to cultivate cash crops ensued by increasing income. The efforts towards development of the non-farm sector in rural provinces have been ineffective to a large extent due to many structural impediments. Much of the efforts made by the government as well as the non-governmental organisations in rural areas have been towards small-scale enterprise development. However, they suffer due to poor management, lack of application of appropriate technologies, lack of raw material and limited market niches for products with little contribution to increasing rural household income. The livestock sector in Sri Lanka is a traditional component of the rural sector and is closely integrated with the smallholder farming sector. Therefore, it was logical to see how this sector could be developed to overcome diversification of income in rural areas and reducing agrarian poverty.

2.2 A Brief Review of the Literature

2.2.1 Role of livestock in widespread poverty reduction

The potential for promoting livestock as a means of rural development and poverty reduction – in the rural economic sector – is greater. Many see that growing human population coupled with increasing urbanisation, economic growth, rising per capita incomes, changing patterns of food consumption with increasing demand for livestock products as significant aspects of such potential. It is a common experience that when peoples' income increases, their demand for livestock products too increases; as they tend to consume less grain-based foods and relatively larger portions of livestock based products like milk, eggs and meat. These changes in dietary habits are not confined to urban areas but are also widespread amongst the rural population too. The observed shift in consumption pattern is suggestive of the potential the livestock sector has for contributing to the agricultural gross domestic product (AGDP), national gross domestic product (NGDP), growth in the national economy, rural development and poverty alleviation.

Further, the recent rise of world market prices of livestock products in an environment of trade liberalisation opens up new markets and opportunities for developing countries except for two major constraints. Firstly, are the standards of the products in conformity with standards of quality, safety and hygiene? Processing, handling and marketing of livestock products – as an industry in most developing countries – are in an embryonic stage and have new challenges – in terms of standards which the developing countries have to face – if they are to meet the growing demand of the western markets. Exporters to western markets face stringent quality control and import procedures which are tough for small-scale livestock producers to comply with. Secondly, the non-tariff barriers are constraints faced by developing countries' livestock sector on the world market.

Livestock development in countries like Sri Lanka also faces additional constraints in terms of growth at an extensive margin due to the limitation of land available to develop pasture. Population pressure on land in Sri Lanka is immense and the land tenure debilities prevent supply of land for large-scale livestock farms. Therefore, the majority of livestock keepers in developing countries have to produce small-scale and target production for local and domestic markets. This calls for livestock development as an import substitution industry in the short run.

On the other hand, the way in which the production, processing and marketing are carried out and the marketing networks developed have a profound impact on the growth and the demand for any commodity. This should be out of sight in developing a strategy for livestock development. For instance, the ways in which the livestock products are sourced such as encouraging new models of sourcing out production – is important for rapid growth in the sector. Sourcing out production that occurs through contract farming improves the production, processing and marketing by lengthening supply chains, separating food production from the consumption and prompting consumer demand, while maintaining higher quality, hygiene and safety. This has occurred in the poultry sector in Sri Lanka over the past two to three decades with the involvement of the private sector.

Outsourcing production or contract farming means the vertical integration of small producers via market mechanism to large business. The vertical integration process provides opportunities as well as threats to small-scale livestock producers. The small-scale producer is benefited by easy access to inputs, all or part of technical knowledge needed – specifically on quality and disease

control methods – and most importantly a guaranteed market. A major threat to small producer in contract farming system is that a significant portion of the surplus he/she produced on the farm could be squeezed out. This could happen when purchasing inputs and selling outputs.

Expansion of outsourcing production is possibly a threat to micro-scale producers. They are likely to be pushed out of business when they have to compete with the relatively large-scale producers who realise the economies of scale and produce at a cheaper cost. Therefore, it is not entirely clear what opportunities are left for employment generation and poverty reduction within the new systems of production like outsourcing except for rapid growth in production like the case of Sri Lanka. This presents new challenges for institutions like the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) of Sri Lanka which has the mandate for policy research on rural and agrarian development and to monitor development scenario in the field in relation to the changing context.

2.2.2 Multiple role of livestock farming

Literature provides ample examples and descriptive accounts of multiple functions livestock fulfils in the case of small-scale farmers. By and large the objective of rearing animals by the smallholder farmers is as a source of income from the sales of milk, eggs, meat, wool, hides/leather, and honey. It has been noted that 40 percent of the districts in Kenya, livestock represents more than a quarter of total household income (Thornton *et al.*, 2002:75). Similarly, livestock is a significant source of cash income in rural provinces in Nepal. For the isolated mountain communities in Nepal, livestock is found to be amongst the few items exchanged for cash constituting nearly half of the total farm cash income (Maltsoglou and Taniguchi, 2004: 24-25).

Livestock has the potential of improving food availability and nutrition of the poor who are usually located in marginal environments. This is by converting inedible biomass and household waste into nutritional product that also have a high value in the market. Livestock contributes from 9 to 14 percent of direct consumption needs of the households' world over. Products such as meat and milk are concentrated sources of high-quality protein and certain vitamins and minerals. Meat, milk and eggs reduce the inadequacies in largely cereal-based diets of the poor in developing countries. Livestock can improve the nutrition of some of the most vulnerable groups, including women and children (IFAD, 2004:19-20). When children consume even modest amounts, livestock products have the ability to improve physical and cerebral development and health.

Livestock has the capacity to provide livelihoods under meagre resource conditions. This is through integration of cattle, buffalo and goat with crops. In such integrated systems, the farmers use crop residues as animal feed whilst the animals are used as draught power as well as for meat and egg production. Smallholder livestock farmers use crop residues; pasture from the common property resources as well as from the land they farm in combination with commercially sold feeding supplements. For this, livestock is a resource efficient and reprocessing system of production.

Another important aspect of the resource advantage of livestock is that it can produce a range of livelihoods with meagre land resources as is the case in most developing countries. Integration of the crop production with that of the livestock production have been developed – in countries faced with scarcity of land like India, Indonesia, and China, Sri Lanka, Viet Nam etc – as a coping strategy to deal with land scarcity and maximise land use. Egan (1999) shows that India's integrated

dairy production is concentrated in highly populated areas. Thus, integrated crop-livestock farming systems practised in the smallholder sector is also useful for increasing productivity and income from meagre resources like land in highly populous countries to increase the availability of consumables. India, for example, is one of the largest milk producers and consumers in the world while small-scale dairying has appreciably helped her to increase dairy products. Another major resource the animals provide in small-scale integrated farming systems is organic manure. The animals like cattle, buffalo, horse and donkey are also used as draught power in such systems¹¹.

Besides working as production entities and sources of livelihood, domesticated animals provide a critical reserve against financial shocks resulting from multiple contingencies like ill-health, crop failures, funerals, thefts and other such risks. For pastoralists, livestock is the most important tangible asset they own. Many of the small-scale cattle, buffalo and goat farmers maintain their animals as a form of capital, saving and quick source of cash. In fact, livestock ownership is the only form of saving and capital stocks available to women in many situations. Cash is obtained not only through sales of animals, but also through sale of by-products like manure. Thus, livestock can function as a crucial source of financial capital for the rural poor and other vulnerable groups. When the poor have access to markets, livestock serves as a source of collateral giving households other forms of capital and opening pathways for further income diversification (IFAD, 2004:3).

In addition to being a method of saving; source of food, income, draught power and manure; livestock serves many other functions for small-scale livestock keepers. For example, as a social capital system that operates in poorer regions. The poorest in many societies are often provided with livestock to start rearing for milk, dung for fuel and as draught power by relatively well-to-do livestock owners (Shackleton *et al.*, 2000:53). Livestock as loans and gifts enhances the family and community ties. Livestock in certain cultures plays a central role in cultural traditions such as weddings and funerals.

Besides being an aspect of social capital, livestock serves as a means of social relations, exchange and positioning of families in rural communities. In rural communities, economic standing and prestige of a family is often measured by the kind and the number of livestock it owns. Ownership of livestock adds to the social positioning of women as the animals ensue a source of income for them. Women often keep livestock and get most of the revenue from production. Existing experience also entails that livestock generally contributes to a sizeable portion of the income controlled by women (Thornton *et al.*, 2002; Heffernan 2003; Delgado *et al.*, 1999). Thus from a gender perspective too, small-scale livestock development could become a major strategy for empowering poor rural women.

¹¹ Though the performance of individual countries varies, a major feature of the livestock production in South Asia is integration of crop production systems with that of livestock production systems. When practising in an integrated manner, as the small-scale livestock producers do, domestic animals perform a much beneficial function in crop production over the foods for consumption and material for industrial production. In this respect, the South Asian model of cattle farming differs from that of large-scale, input and capital intensive western mono-cultural model that is guided by meat and/or milk production. In contrast, livestock farming in South Asia is multicultural, integrated with crop production systems and undertaken by many farmers with relatively fewer animal heads. Therefore, small-scale livestock in South Asia has more benefits than large-scale livestock farming in the West. This tradition has to be preserved for sustainable crop production.

There is a connection between the poor and the smallholder livestock farming. Livestock contributes to be the livelihoods of more than two-third of the world's rural poor and to a significant minority of the peri-urban poor. Livestock production is often the only livelihood option available to the landless as they allow the exploitation of common-property resources for private gains. Some poor also raise few animals as supplementary source of livelihood. Thus, when one discusses about the poor practising livestock, it may range from herding as pastoralists to small mixed farmers who use livestock for traction, manure for organic fertiliser and fuel, meat, milk and fibber. In addition, livestock is often the only means of asset accumulation and risk diversification by the poor. Livestock often helps them falling into abject poverty.

The poorest of the poor often do not have livestock, but if they can acquire animals, their livestock can help start them along a pathway out of poverty. This is revealed by instances recorded in the existing literature. For instance, in a study of household poverty dynamics in twenty communities in Kenya, researchers found that more than 40 percent of families that escaped poverty did so by diversifying their farm income, primarily by acquiring livestock (Kristjanson *et al.*, 2004:12).

In a general sense, livestock can provide the poor rural dwellers a variety of goods and benefits already discussed above with little cost as most domesticated animals feed themselves on grass, crop residues like straw, kitchen and other household leftovers. In some cases, livestock is the only material asset that the poor can accumulate, and even the landless can do so by using communal feed resources, waste products and purchased feeds. For the poorest of the poor, livestock can, in some situations, be the first step along the pathway out of poverty.

The multiple functions attributed to livestock show that the existing small-scale livestock farming, especially that of cattle and buffalo farming, in the South Asian region is closure to 'alternative' agricultural production approaches. It has been the focus of dialogue since the 1990s in the West in general and the United States in particular. Integrated farming systems are relatively ecologically more sustainable as they are based on low input systems and useful in circulating nutrients with high efficiency¹². Dairy industries based on high cow turnover rates, high veterinary and metabolic enhancing chemical inputs, and concentration of waste in more developed countries appear to be less sustainable. Being an integral part of the agricultural economy, livestock would improve the sustainability of the crop sector through provision of organic manure and draught power as inputs.

However, livestock is an overlooked element in rural development and poverty reduction strategies. Therefore, one would assume that right kind of livestock services can help the small-scale livestock keepers who struggle to run more efficient businesses to graduate out of poverty. Most important spheres of services that can be extended to them would include veterinary care, breeding technologies and access to financial services and markets. Most small-scale livestock keepers are located in remote areas and constrained by lack of good road access and transport facilities. To be effective, livestock services should address the reality that most rural poor people lack such as access to vital resources like land, water, markets, credit, health services and education. The livestock development strategies also should address such issues as the lack of good breeding stocks, feeding materials and associated problems of low productivity.

¹² Incidentally, the system too can cause accumulation of few toxic products in any one area.

2.2.3 Limitation of livestock in reducing poverty

In spite of many good things associated with livestock, the demand for animal products such as milk and meat continually rising and potential to combat poverty, a great majority of small-scale livestock keepers tend to be poor. For instance, of the estimated 600 million small farmers and herders in rural areas around the world manage about one billion heads of livestock, about 95 percent of them are deemed to be poor (Delgado *et al.*, 1999; IFAD, 2004:9.10; Thornaton *et al.*, 2002). Besides showing the importance of livestock to the poor, the numbers show the limitation of livestock for poverty reduction.

The observed relation between poverty and livestock is due to many factors. Firstly, a large sector of the livestock keepers such as migrant herders is from the poverty stricken areas of poor countries in Africa and Asia. Secondly, of the estimated 600 million poor people engaged in livestock, 150 million people are landless and have to depend on others for land or pastoral practice. Thirdly, livestock keepers are tending to be located in environmentally and physical marginal areas. Thus, they adopt livestock as the last resort in making a livelihood without which they will have little survival opportunities. Fourthly, intrinsically livestock rearing is a risky venture, particularly for the small-scale farmers. Risk can even lead them into a vicious cycle of poverty. Risks involved are of many types including natural factors like the harsh environmental conditions and vagaries of weather, losses caused by diseases due to lack of knowledge and proper veterinary care and damages caused by predators (IFAD, 2004:14). Finally, small-scale dairy producers in developing countries are located largely in remote areas with poor infrastructure facilities, service support and markets. Therefore, they face enormous problems in receiving adequate prices to meet production costs.

2.3 The State of the Livestock Sector in Sri Lanka

2.3.1 Trends in livestock population

Authors contributing to this text describe the trends in growth of livestock population in the country and those interested in details of the trajectories of growth are requested to pursue the relevant sections of those chapters. Information given by Chandrasiri and others (in chapter four) on livestock population indicates that the cattle population has slightly increased whilst the buffalo, goat and sheep population have decreased during the past fifty years. According to information provided by Thakshala Seresinhe and KK Pathirana (in chapter seven), excepting the duck, which is only about thousand heads altogether, cattle, buffalo, pig, sheep and goat had minus growth rates during the period between 1992 and 2002. Studies indicate that the pig population remained almost static during the past two decades. Analysis provided by DHA Subasinghe, BMAO Perera and PGA Pushpakumara on buffalo sub-sector (in chapter five) notes that there are estimated 319,000 buffalo population currently in Sri Lanka of which 198,000 are females. According to him, buffalo account for about 20 percent of the total large ruminant population in the country.

Above information shows that, besides the poultry sub-sector that has seen a rapid growth during the past two decades, in all other sub-sectors of livestock has experienced declining numbers of animals in spite of the fact that the market demand for livestock products has been rising along with the growing population and increasing income. Reduced growth in the sector has

meant increased prices keeping low income groups out of consumption or significantly reduced consumption patterns. Religious reasons and the fear of increasing cholesterol in the blood serum due to high fat content in red meat also reduces the demand for non-poultry meat. Increased private sector involvement and changes in consumer preferences for the poultry meat – in particular over beef and pork meat – explain the growth in demand and supply of poultry meat in the country during the past two decades or so. The private sector has been instrumental in setting up capital intensive breeder farms, hatcheries, feed mills, and processing units. The major output from the poultry sector comes from large poultry farms.

2.3.2 Spatial distribution of livestock population

It is clear that livestock is kept in almost all physical environments like in the wet and dry zone areas, high and low altitudes, peri urban fringes as well as in the remote and marginal areas in rural provinces. However, the small-scale cattle, buffalo and goat farmers tend to concentrate in specific ecological niches. The data show that most of the cattle, buffalo and goat are kept by farmers in the dry and dry intermediate zones of Sri Lanka¹³. The coastal parts of the western province and north-western province referred to as ‘pig belt’ are well-known for piggery¹⁴. However in the past two decades, farm subsidies and especially other support services from the government sector has been gradually withdrawn.

2.3.3 Livestock in the national economy

Sri Lankan society has been predominantly agrarian. However, the country is moving towards industrialisation with heavy concentration on garment manufacturing, food, and beverage sub-sectors. With the structural transformation of the economy and due to the sluggish growth in agricultural productivity over two decades, the share of agriculture in the national GDP has gradually declined. Contribution of the agriculture sector (i.e. crops, livestock and fishery) to GDP has declined from 28 to 16.8 percent by 2006 and to 11.7 percent by 2007. In 2008, agriculture grew slightly at a higher rate. The contribution of livestock to the agriculture GDP has increased marginally from 5.6 percent in 1975 to 6.5 percent in 2006 (Central Bank Annual Report, 2005)¹⁵.

The Sri Lankan economy recorded 7.0 percent growth during the third quarter of the year 2007. In considering the agriculture sector, paddy production has shown a decrease indicating a rate of 4.1 percent. The political situation in the east also contributed to a general slowing of crops and livestock production for the third quarter of 2007. However, the real value of livestock production went up by 6.5 percent, while poultry production went up by 5.6 percent and milk production went up by 4.2 percent during the period. Country’s GDP grew by 6.5 percent in the first quarter in 2008 and was expected a six percent growth rate for the year.

13 Little over two-third of the cattle, buffalo and goats are in the dry zone.

14 About 70 percent of the swine population in the country is concentrated along the coastal belt from the Puttalam to Kalutara districts. Among the districts, Gampaha and Kurunegala have the highest pig population.

15 In 1975, the contribution of the agriculture sector to GDP was 28 percent and the contribution of the livestock sector to GDP was 5.6 percent. In 1996, the contribution of the agriculture sector to GDP was 18.4 percent and the contribution of the livestock sector to GDP was 6 percent. But in 2006, the contribution of the agriculture sector to GDP was 16.8 percent and the contribution of the livestock sector to GDP was 6.5 percent (Central Bank Annual Report, 2006).

2.3.3.1 Imports and exports of livestock products

Over the past decades, the total meat production in Sri Lanka has increased by more than fivefold though milk production has not shown substantial growth (Seresinhe and Pathirana, in chapter seven). While poultry meat production has grown by about 5 percent per annum, the volume of milk imports has grown 4 percent per annum over ten years. In 2000, the value of imports of powdered milk reached nine billion rupees making milk foods becoming the main items of livestock product imports. The unprecedented increase in prices of imported milk in the world market has affected the country's import budget.

Sri Lanka also imports hides and skins. In this regard, Sri Lanka's experience is different from the neighbouring countries. For instance, India's domestic supplies meet almost the entire milk demand and imports of hides and skins have reduced along with the growth of the cattle industry. In contrast to imports, livestock products contribute little to export incomes. Increased livestock production can reduce import dependence of Sri Lanka on many livestock products. In addition, the increase in growth would also reduce import dependence and increase exports.

2.3.3.2 Consumption of livestock products

In spite of the fact that Sri Lanka's social indicators have been favourable in terms of her per capita income level, the majority of the population suffer from a range of nutrition related health impairments. Lack of intake of nutrient-rich foods could be considered a major factor for the prevalence of malnutrition and under-nutrition rates in Sri Lanka. Diet of the Sri Lankans – as in other parts of South Asia – is cereal based and animal based food can enrich the diets through adding up protein and other vital nutrients.

Sri Lanka's consumption per capita of livestock products is low in terms of the international averages. For instance, the country's milk product consumption per capita has been about 40 kg per annum as against 130 kg consumed per person per year in developed countries. However, the rate of consumption of milk products per annum has been increased from 15.3 kg in 1995 to 36.0 by 2000 and to 40.03 by 2005. Sri Lanka's per capita consumption of egg, poultry meat, beef, mutton and pork is low as against the average per capita consumption in developed countries. For instance in 2005, per capita consumption of eggs were 56; poultry meat was 4.5 kg, beef 1.4 kg, mutton 0.036 kg and pork 0.6 kg as against 356 eggs, 23.8 kg of poultry meat, 22.7 kg of beef, 6.5 kg of mutton, 28.6 kg of pork in developed countries. When overall values are considered, a Sri Lanka's per capita consumption of meat is 6.4 kg as against 81.6 kg in developed countries in 2005. Egg and poultry meat consumption is expected to further increase over the years as the broiler meat is being promoted by the poultry industry and has become acceptable socially. Fish is a close competitor to poultry and eggs though supply has been affected due to warring conditions in the north and escalating oil prices affecting mechanised boat use and land transportation.

2.3.3.3 Employment in livestock

Dairying is labour intensive at farm level. The small-scale dairy production systems as practised in Sri Lanka have a sizeable labour component. The small-scale producers use labour for milking, collecting pasture and looking after animals. However, few full-time dairy farmers are reported in the country. The rest of them are part-time farmers who are mainly engaged in other

agricultural activities. Their primary occupation is not dairying.

Most of the small-scale livestock farmers rely on family labour whilst the medium and relatively large farmers are engaged in hired labour for managing livestock. Buffalo, goat, swine and poultry – as backyard systems are important sources of part-time work and a livelihood. Such employment is particularly important for landless women and children. Expansion of the livestock sector benefits such marginal and vulnerable groups like the landless labourers. Livestock can augment income and employment opportunities for small-scale land operators.

The total male and female agriculture operators of all age groups are 1.46 and 0.29 million respectively (Department of Census, 2002). In terms of principal activity status, livestock employs only a small portion of the rural workforce. However, the estimates reveal that labour typically amounts to over 40 percent of total costs in smallholder systems. Therefore, the potential of livestock to augment income and employment opportunities for small-scale land operators is significant.

2.4 Potential of Small-Scale Livestock Production Systems

Sri Lanka's agriculture sector is defined to include crops, livestock, fishery and forestry for accounting purposes. Crop sub-sector is usually dichotomised into two main sub-sectors as the plantation and non-plantation. The plantation sector constitutes relatively large holdings planted with, tea, rubber and coconut. These are managed as plantation estates, use waged labour in production and produces are largely exported. In contrast, the non-plantation sector is characterised by many thousands of farmers growing food crops mainly for the domestic market though about two-fifth of tea and a significant share of rubber and coconut is produced on smallholdings. Present analysis focuses on the smallholder farming sector and small-scale livestock farming which are practised – in most of the cases – in an integrated manner.

In terms official classification, farmers operating land holdings less than 20 acres come under the smallholder farming sector (SFS) in Sri Lanka. By defining a smallholding as holdings below 20 acres, Census of Agriculture in 2002 recorded that there were 3,252,954 holdings of which only 6,577 (2 percent) were holdings larger than 8.09 hectares or 20 acres. Of the total of 3,252,954 holdings, 1,462,904 (45 percent) were holdings of less than 0.10 hectare or 1/4 acre. The distribution of land holdings further showed that approximately 1,783,473 (55 percent) of the holdings were between 0.10 and 8.09 hectares or between 1/4 and 20 acres. According to Ministry of Livestock Development sources, approximately 90 percent of the smallholdings are less than 2 hectares in extent and 33 percent of those contain livestock.

Census of Agriculture in 2002 defines "livestock operator" as any person who is responsible for the management of the livestock. The above source further indicates that the livestock operator carry out the activities related to livestock with the assistance of others (hired labourer or any other person). Livestock may be owned, obtained on "*Ande*" (rent) or lease or any other form of arrangements. They may or may not own land holdings. Small-scale livestock operator for the purpose of this paper is defined as those rearing one or more animals for production of goods or services for own consumption or sale. When the above definition is adopted, the majority of smallholder farmers too can be classified as small-scale livestock farmers as they cultivate crops and raise animals in an integrated manner. Chandrasiri (in chapter four) notes that there is no

information on the actual size of the small-scale dairy herds in the country. He is of the opinion that an assumption of herd strength of approximately 1-12 heads of cattle or buffalo or from 2 to 80 heads of goats that can be easily reared on a 20-acre land with other mixed crops would be reasonable. Such small-scale dairy farmer would be able to supply approximately 1-20 litres of milk a day.

Livestock production is an important component of many household economies of the SFS in particular and rural economy in general. Approximately, 80 percent of cattle and 47 percent of buffalo are with the smallholder farmers. Similarly, some 65 percent of goat and sheep population and 53.2 percent of swine population in 2002 was in the smallholder livestock sector compared to 48 percent and 31.8 percent respectively in 1992. The data show the share of the poultry population kept by small poultry farmers remains unchanged, though the structure of the industry has changed substantially. The figures are indicative of the potential for the development of the smallholder livestock sector. However, data used by many authors to this volume indicate that the size of the livestock population has been reduced over the years.

One of the major issues that could be raised in relation to the low numbers of goats and swine is, whether economics of raising these animals are right in Sri Lanka. If the economics are right or the two sub-sectors are profitable, one would contemplate that more private interests have to be drawn to these sub-sectors. There needs some in-depth studies clarifying such matters. For instance, besides religious taboos against killing animals, there is no particular religious, social or health value in the country against eating goat meat though such values prevail over cattle and swine meat. For this or other reasons there have been no special beef breeds available in Sri Lanka whilst the beef comes as a by-product of the dairy industry.

2.5 Livestock for Reducing Rural Poverty

Poverty in Sri Lanka is largely a rural phenomenon with over 80 percent of the poor living in rural areas. Incidence of rural poverty was estimated around 23 percent in 2002. Prevalence of poverty amongst the landless, marginal and smallholder farmers is high. Around 40 percent of the households engaged in farming and related pursuits were in poverty by the turn of this century. Given the poverty level in the SFS, one way of addressing it is targeted smallholder livestock development.

The figures regarding rural and agrarian poverty show the compelling need to diversify and raise the incomes of the rural dwellers and agrarian population if the rural and agrarian poverty to be contained and to be reduced. As already noted, Sri Lanka's livestock is largely concentrated amongst the small-scale producers who are mostly located in remote areas of the poorer provinces. The increasing demand and recuperating prices for livestock products can provide real opportunities for the small-scale livestock producers as well, if they have the access to infrastructure and improved breeding stocks, technologies, management capabilities and the markets.

There are many factors pointing to the importance of adopting smallholder livestock farming as a strategy for reducing rural and agrarian poverty. On the basis of the discussion so far in this chapter, following are the major factors considered.

- I. Findings of the literature reviewed show many benefits of crop farming along with livestock in an integrated manner, such as provision of foods, and while increasing assets, savings. These readily disposable sources of income are important in reducing vulnerability of being poor and entrapped in a vicious cycle of poverty.
- II. Increasing fuel price place heavy pressure on poorer farmers in their ability to use mechanised draught power and use of inorganic fertiliser. Livestock can reduce their production cost by providing animal draught power as well as organic manure.¹⁶
- III. Continuing increase in livestock products in the international market – which the country depends heavily on – by importing – provides a renewed logic for attempts at increasing livestock products. Particularly, the demand for poultry products and milk products has increased in the recent past. On the other hand, the prices of livestock products, particularly for milk products have been increased in the recent past due mainly to shortfall in production and rapid rise of prices in the international market. There is a logical necessity for the country to reduce the import budget of livestock products, given the scarcity of foreign income the country is facing. A win-win strategy would be if such objectives could be achieved largely through small-scale livestock sector productivity improvements.
- IV. When rationalised, the smallholder livestock sector has the potential for improving farm household income, increasing the availability of protein and increasing the national dairy production. Therefore, it appears that the livestock sector has considerable potential to contribute towards alleviation of problems of unemployment and poverty in the rural provinces, especially – unemployment and poverty amongst smallholder farmers.

However, despite the importance of livestock at the household, provincial and national economy levels, the sector has not reaped its full potential. An illustrative example in this regard would be dairying in Sri Lanka. There are many reasons for underperformance of the sector. At the policy level, most development interventions have had a bias towards the small-scale crop sector though with some good reasons like reducing food deficit. Due to the above reason, efforts made to improve sub-sectors of livestock like dairy industry have been minimal. Due to this fact, marginal and small-scale livestock operators derive a small portion of their income from this activity.

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¹⁶ The author has the personal view that the drudgeries involving agricultural production could be greatly reduced by increased use of mechanical draught power. Then one has to assess the emerging situation and pros and cons. There is little doubt as to the benefits of increasing use of organic fertiliser which the animals can provide readily with their manure.

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Chapter **3**

**SMALLHOLDER
POULTRY
PRODUCTION**

*DVS de S GAMAGE
&
SP GUNARATNE*

3.1. Introduction

To achieve the millennium development goals – there is a need to control the rate of poverty reduction, and reach the poorest segment of the population. In this exercise, an increasing recognition the international development community has given to the role of the smallholder poultry sector as a source of livelihood support for the poor. Its ability to improve the nutritional standard of the poorest and to promote empowerment of women - is gathering momentum (Dolberg, 2004). Prospects of marketing free-range products have increased due to improved market access (Conroy, *et al.*, 2005). The outcome is the increase in market orientation even among smallholder poultry enterprises. This has posed challenges and opportunities to both smallholder and commercial poultry sectors to compete with each other. Rapid change in the poultry sector during the past two-to-three decades is - the effect caused by this situation. This could be observed especially in the developing countries of Asia, where rapid economic growth and urbanisation are taking place. Fast development of the poultry sector into large-scale industrial and vertically integrated poultry production units has become the model for Asian countries. These developments may have had an impact on the small-scale operations due to competition for market space and, the idea given to the public by governments that these small units can be reservoirs of disease, especially in the wake of HPAI outbreak – completely ignoring their contribution towards income and nutrition support for poor households (Wijewantha, *et al.*, 2007).

This may have been exaggerated (Branckaert 2006, Rushton *et al.*, 2005, Otte 2006, Otte *et al.*, 2007) and can have a serious implication for supporting the livelihoods of the poor people. This chapter on smallholder poultry sector is therefore, – to examine the evidence on viability in the wake of expanding large-scale production systems with substantial economies of scale, well-organised and integrated supply chains and the ability to respond to various types of risk.

This chapter is based primarily on the documented literature. Although there is a moderate amount of literature now available on smallholder poultry production internationally, there is ‘very little’ written on Sri Lanka. There is absolutely a dearth of field-based evidence on aspects of on-

going structural changes in the global, regional and Sri Lankan contexts. Therefore, this is an attempt to give a broad characterisation of the stakeholders of the smallholder commercial poultry production with a brief analysis of its importance in comparison with different countries.

3.2 Poultry Development in Other Countries

The success of the smallholder poultry production in poverty alleviation, reduction in malnutrition, etc, stimulated FAO to initiate the International Network for Family Poultry Development (INFPD), – to disseminate and share knowledge and experience in family poultry development among scientists and poultry workers. This network regularly issues electronic newsletters and conducts conferences, seminars and training programmes. FAO was also successful in getting the World's Poultry Science Association (WPSA) to recognise family poultry as an important component in poultry production. As a result, WPSA allowed INFED to conduct parallel scientific sessions during their congress meetings. The first series of programmes commenced in 2000 at WPSA congress held in Montreal, Canada and is continuing thereafter in all congresses. According to the proceedings of the last WPSA congress held in July 2008 in Australia, many family poultry development activities are seen in Africa compared to other regions.

Small poultry or family poultry production is no longer new to many Asian countries. Some countries had even gone to the extent of developing specialised breeds of chickens for family poultry system. Few examples are Giri Raja in India, Fyomi in Bangladesh and Kanfun chicken in Malaysia/Indonesia. With the development of these breeds, housing and other management practices were also developed to suit the specific needs. Most of these systems used simple and traditional technologies with little or no external inputs. For example, they use brooding hen, sand bath or kerosene incubator for hatching of eggs.

3.2.1 Bangladesh

Although the poultry production has evolved into a large-scale intensive commercial production system in many countries, smallholder or backyard village systems still continue. In fact, the majority of table eggs in Asia and Africa still come from small flocks. Smallholder poultry farming has given multi-faceted (i.e. social and economic) benefits. Therefore, many countries adopt poultry as a means of poverty reduction. One such example is the "Bangladesh Poultry Model" (Policy and Planning Unit, Ministry of Fisheries and Livestock, Bangladesh). This model has been extensively tried in Bangladesh for several years and is now becoming popular in many Asian and African countries. Bangladesh model has proved to be an efficient and successful tool for income and job generation and poverty reduction among landless farmers, distressed women and jobless youth. The close interaction of the different components in this model is the key to its success. Following elements are included in the model; model breeders, mini hatcheries, chicken rearers, poultry workers, feed sellers, egg collectors and supportive services such as micro-credit.

3.2.2 India

In India, there is an instance where the private sector can create a viable business model, build rural market acumen and door step delivery mechanisms by anticipating on the traditional know-how of women rearing backyard poultry leading to enhancing incomes, assets, prestige and contribution to overall livelihood development of the poor.

Despite the potential offered by the backyard poultry production in reaching out to the poorest, there has been little government support for backyard poultry production in India as in Sri Lanka. It was recently that the Governments of India and Sri Lanka have become sensitive to the potential offered by the backyard poultry and have begun to promote it through various schemes, such as – in Sri Lanka – Hadabima Authority, Mahaweli Authority, Samurdhi Authority and the Department of Animal Production and Health.

Similarly, the growing realisation could be observed among the private sector players in India of the 'business potential' offered by this sector, which is contrary to Sri Lanka, where the private sector is yet to understand that there is a business potential in backyard poultry. Hence, this has opened up new possibilities of nurturing synergistic partnerships between public, private and civil society organisations in India with the common objective of enhancing poor people's livelihoods.

Such private sector promoted backyard poultry in India is by Keggfarms Private Ltd. They introduced a bird known as 'Kuroiler', which is a dual purpose type with higher productivity than indigenous birds. They sell over 14 million Kuroilers annually.

3.3 Smallholder Poultry Production Systems

There are two distinct poultry production systems: smallholder, small-scale, or family poultry; and the large-scale commercial poultry. Also, there are many intermediate stages in between. The large-scale commercial poultry production is highly dependent on external inputs and thus vulnerable to local and international market forces. It is a business carried out purely on profit. The smallholder poultry keeping has many objectives. It is principally a family-based activity with minimum external inputs. It helps to uplift social, economic, nutritional and employment standard of the family. They have little impact on environment and are highly integrated to the crop-livestock system for sustainability. Therefore, many countries in the developing world adopt smallholder poultry programmes as a tool for poverty alleviation, reduction of malnutrition and women empowerment. Many successful smallholder poultry programmes are presently implemented in Asian and African countries. Today, the "Bangladesh Model" is one of the successful smallholder poultry programmes. It is adopted in many developing countries. There are several terms used to describe smallholder poultry production today. Some of them are: family poultry; rural poultry; backyard poultry; village poultry; village chicken; scavenging village chicken; extensively reared chicken; free-range chicken (poultry); local chicken (poultry); traditional poultry, etc. Although there are minor differences, all these terms describe characteristics of the smallholder poultry production.

The changes in the poultry production system could be observed from the classifications done during different periods. Prior to 2000, there was a classification published in Sri Lanka Livestock Policy Review (1992), by Brown and Copeland Company, New Zealand, in the following table, where the production systems are divided into three main divisions, as backyard, semi-intensive and intensive.

Table 3.1: Distribution of poultry farmers on the scale of operation and market share

System		Size	Percentage of Farmers	Market Share	
Intensive				Meat (%)	Egg (%)
	Large-scale	> 5000 birds	5	65	40
	Medium-scale	1000 – 5000	10		
	Small-scale	100 – 1000	35		
Semi-intensive		50 – 100	35	30	60
Backyard		10-25	15	5	

Source: Sri Lanka Livestock Policy Review (1992), Brown and Copeland Company, New Zealand

In this classification, 50 percent of the broiler and layer operators supply 65 percent of chicken meat through broiler and spent chicken, whereas, the major share of eggs comes from the semi-intensive and backyard systems. Thus, the rapid changes that occur have clearly differentiated two production systems known as the formal sector or “organised-commercial poultry sector” and the informal sector or smallholder poultry production sector. This classification has been derived from the FAO classification. It is based on the level of integration of operation, marketing system and bio-security (Table 3.2). This chapter is confined to the discussion of the informal sector. Even though it is mentioned as a character bio-security level, this should be corrected as bio-security measures adopted by the operators. The bird density in the formal sector is very high compared to the informal sector; this could be a security risk too. Further, the movement of production cycles is higher than the informal sector. The risk of disease-carrying bird movement can be the same in both cases.

Table 3.2: Poultry production systems in Sri Lanka

	Formal Poultry Sector		Informal Poultry Sector	
	Organised Commercial		Smallholder	
	Integrated	Semi / non-integrated Large/ Medium	Small-scale commercial	Family Poultry
Type of bird	Broiler	Broiler / Layer	Broiler / Layer	Indigenous / crossbred
Type of operation	Out-grower	Individual	Individual	Homestead
Flock size	>2000 to 25000	>1000 to 25000	<1000	10-25
Management system	Intensive	Intensive	Intensive / Semi-intensive	Free range / Semi-intensive
Bio-security level	Moderate to high	Moderate to low	Low	Low to minimal

Source: Wijewantha et al., (2007)

The organised-commercial poultry sector has been playing the lead role in making poultry industry the fastest growing segment within the country's agriculture sector. Its contribution to the livestock sector has been significant; however other sectors both ruminant and swine have been stagnant. Poultry has been the driving force behind the livestock segment of the agriculture sector in terms of the contribution to GDP. National annual consumption is 1.8 million eggs and 60

million broilers. The poultry industry today, is – to a great extent – a private sector business with a few companies dominating the industry output. Even though, the estimates of income elasticity for broiler chicken and eggs indicate strong growth in the urban consumption, whereas the growth in the rural and estate consumption is lagging behind. As such, the sector growth does not contribute to the reduction of malnutrition, which is a millennium development target. Hence, the role of the informal sector in enhancing the nutritional standard of the very low income agricultural workforce in the rural and estate sectors can be considered an important factor for food security. Further, its ability to empower unemployed and underemployed rural and estate women is another factor that contributes to human development. In addition to these factors, its ability to prevent physical debility, – due to the consumption of eggs produced, – can contribute directly to poverty alleviation. A reduction in the number of people engaged in family poultry keeping has also been observed over the past three decades, while a marked reduction in the indigenous chicken population has been identified as a major issue.

3.3.1 Global outlook and its impact on Sri Lanka

With increasing importance of poultry as a source of protein, new breeding techniques together with nutritional innovations have made the egg and meat production more systematic. This is very important to countries like Sri Lanka with limited agricultural resources and also with a very high demand for finished products. Demand for animal products is rising especially in Asia and Africa. It is estimated that the global demand will increase by 85 percent for poultry meat, 80 percent for beef, 45 percent for pork, and 130 million litres of milk by 2015. The meat consumption in the developing world has been growing at the rate of 6 percent per annum during the period from 1997 to 2006.

China and India will be the major population growth centres during this period. With development, there is a fast growth in demand for animal products in the two countries. The Chinese meat consumption, which was 3.8 kg in 1961, grew to 54.9 kg by 2004, this is a staggering 1345 percent increase, or 30.6 percent increase per annum. The population in both China and India will touch 1.5 billion by 2020. The annual GDP growth rate during the period 1997-2006 in China has been 10 percent whereas, in India it was 4 percent and it is expected to increase to 8 percent during the next couple of years. This will not only increase the demand for energy and animal products, but in 2030 China and India are expected to account for 70 percent of the global oil demand. The two countries plan to meet the demand to a certain extent, by producing bio-fuels. They will be compelled to import large quantities of corn, soya bean and other cereals to produce bio-fuels. China wants to increase bio-fuel production by fourfold, 3.6 billion litres in 2002 to 15 billion litres in 2020, or 9 percent of its gasoline demand. India plans to increase sugarcane cultivation by 16 percent to produce bio-fuels. In addition to this, India is preparing legislation to support cultivation of *Jatropha*. This will have an impact on land and water – as bio-fuels will add pressure on land and water. Major corn exporters such as USA and EU too plan to increase the production of bio-fuels using corn. USA and EU target for 2020 is to utilise 500 million tons of corn to produce 55 billion gallons of renewable fuels.

Sri Lanka is amongst the developing countries that import most of their food and feed ingredients. She is thus subject to pressure from this global change. This could be shown in Table 3.3.

Table 3.3: Imports of essential food items and price increase

Imports to Sri Lanka			Price changes of essential food items from July 2005 to 2 nd week September 2007	
Protein sources		Amount	Protein sources	Increase (%)
	Milk	85%	Milk foods	26.1
	Lentils	Substantial amounts - 60%	Pulses or lentils	57.7
Energy sources		Amount	Energy sources	Increase (%)
	Wheat	100%	Wheat flour – 25% of staple	88.8
	Sugar	80%	Sugar	31.8
	Rice	Minimal amounts	Rice – 75% of staple	49.5
			Bread	80.3
	Potato	30 %	Potato	22.0
			Coconut	42.9
			Coconut oil	66.1

Source: Derived from data based on Department of Census and Statistics (2007) by DVS de S Gamage

The price increases in food during 2007 have been unprecedented compared to the past five decades. The situation aggravated further with the increase of oil price and the utilisation of human food grains for bio-fuels. Hence, increase in local production of essential foodstuffs is needed. In the case of commercial poultry production, it is difficult due to increase in the price of feed ingredients as shown in Table 3.4.

Table 3.4: Imports of feed ingredients and price increase

Imports to Sri Lanka			Price changes of feed ingredients from September 2006 to September 2007	
Protein sources		Amount (%)	Protein sources	Increase (%)
	Soya	100	Soya	35.6
	Fish meal	90	Fish meal	13.9
Energy sources			Energy sources	Increase (%)
	Maize	85	Maize	46.7
	Oil	90	Oil	40.0

Source: Derived from Market information (2007) by DVS de S Gamage

According to Table 3.4, the increase in prices during the period in review too has been unprecedented compared to the past five decades; however it may not be conducive to the growth of the poultry sector in Sri Lanka. The price of feed per ton too had increased by 15.5 percent from January to September 2007 causing a severe shortage of eggs and chicken as well as other essential foodstuffs.

3.4 Socio-economic Aspects of Poultry Farming

Although the number of protein-deficient households decreased from 41.7 percent in 1969-70 to 28.6 percent in 1990-91, the average annual drop is only 0.624 percent. In other words, around 6 million of the population are protein deficient. About 5.1 million of them are in the rural areas – of which 0.5 million are children below the age of four (Household Income and Expenditure Survey 1990/91). It is said that those who have high income and rearing poultry – consume more eggs (Jayawardana and Bandara 1992) – than those who have low income and do not have poultry. Therefore, the rural poor not rearing chicken may not consume the per capita availability of eggs.

Of the labour force of eight million, only 36 percent are women. This indicates that unemployment is more prevalent among women, particularly the rural women who form the majority of the unemployed. Most of them produce food or other items and barter for other goods. Their production is almost a no-input production system. They utilise the money for family welfare and their role in the improvement of family nutrition cannot be ignored. Illiteracy, early marriage (below 18 years), multiple and close child bearing and rearing, immobility, lack of opportunities and economic dependence – compel the rural women to take employment on the periphery of their homes. Further, arable land in hectares per capita has fallen from 0.06 in 1979-81 to 0.05 in 1994-95. Therefore, backyard poultry keeping will not only improve the nutritional standard of the rural poor; it will also provide some support towards empowerment of rural women.

3.5 Eggs in Human Diet

Eggs contribute significantly to the body's nutrient needs during rapid growth. It is therefore an excellent food for children, teenagers and youth. Its high nutrient content, low caloric value and easy digestibility add value to many therapeutic diets for adults. Most bland diets and the first light or soft diet following surgery or other illness usually include eggs. They help patients regain good health and maintain it. Eggs are valuable and readily acceptable to older people, whose caloric needs are lower and sometimes who have difficulty in chewing food.

Table 3.5: Comparison of the food value of egg with other essential foods

	Eggs	Milk	Fish	Beans	Wheat flour
Digestibility	97.0	96.9	85.0	72.8	90.9
Biological value	93.7	84.5	76.0	58.0	65.7
Net Protein utilisation	93.5	81.6	79.5	38.4	40.3
Protein efficiency ratio	3.9	2.1	3.5	1.5	1.5
Chemical score	100.0	60.0	70.0	34.0	44.0

Source: *Egg in Nutrition and Health* (1994) K Nageswara Rao, Central Poultry Training Institute – Hessarghatta, Bangalore, India

The egg has high quality proteins compared to other foods. The quality of the protein-contained food can be determined by its biological value (BV), net protein utilisation (NPU), protein efficiency ratio (PER) and chemical score (CS) (FAO, 1970). As far as nutrient principles are concerned, an egg is the cheapest source of animal protein. Further, longer shelf life, 'easy

and quick' to prepare are – some of the advantages. An-egg-a-day is unlikely to impact the risk of coronary heart disease or stroke among healthy people, according to an article of the April 21st issue of the *Journal of American Medical Association* (JAMA: 1999; 281: 1387-1394 see www.jama.com). Eggs are also considered a protective food for humans because they provide better support for mothers and the better start in life for the young, speed up maturity and produce better development, produce high level of adult vigour, extend the average span of life. Therefore, the above information shows egg as a food that can be on par with rice, the staple food of Sri Lanka.

3.6 History of Poultry in Sri Lanka

Since ancient times, scavenging chicken system has been an integral part of the crop-livestock-based farming systems in the rural areas of Sri Lanka. Low input poultry products in the scavenging system take an important place in the rural economy. Backyard poultry production is predominantly an egg production system (Wickramaratne *et al.*, 1993, Wickramaratne, 1999) and they have a genetic potential for meat production too (Gamage *et al.*, 2005). Village chicken population in Sri Lanka is recorded as 1.16 million according to Census of Agriculture 2002. DAPH has identified the family poultry sector, as a crucial area to support in view of its importance to reducing malnutrition of children, physical debility of adults, and of women empowerment, and in the conservation of indigenous chicken.

In the early 1950s, chicken meat had been a luxury food item in Sri Lanka, while eggs were either imported or came from local indigenous birds. Production systems were basically backyard scavenging with no additional expenditure on feed. In 1955, the government launched a programme to upgrade the industry. Initially males of improved strains were distributed to farmers. Deep-litter system was also introduced. In the 1960s, parent birds were imported and until late 70s and early 80s pure breeds such as *White Leghorn*, *Rhode Island Red* were distributed to farmers for egg-production by the state-owned organisation - Central Poultry Research Station (CPRS), Karandagolla.

Figure 3.1: Black eco type chicken

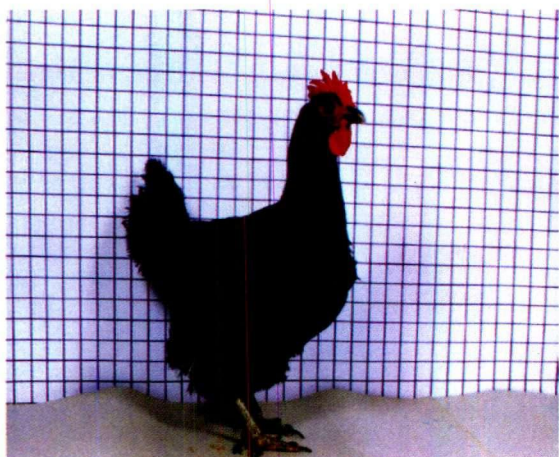
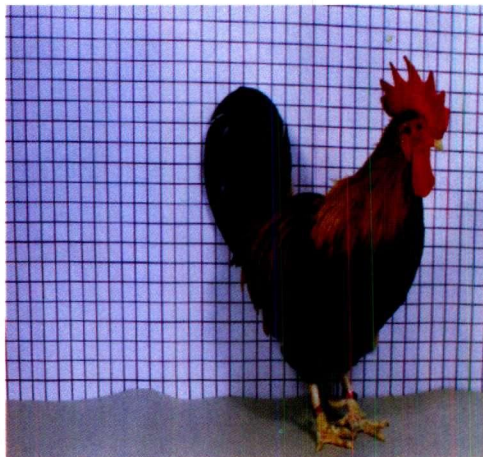


Figure 3.2: Orange tan eco type chicken



The expansion of the industry commenced in the 1970s due to active participation of the state and the private sector. It improved productivity in the existing poultry stocks with quality feed. Until the early 1980s, the bulk of compound poultry feed (around 90 percent) produced in the country – came from the state-owned Oils & Fats Corporation.

In the past, the government veterinary surgeons and their staff, employed by the Department of Agriculture, handled poultry health and extension work. The Department of Animal Production and Health (DAPH) was established in October 1978 and, from its head office located at Peradeniya, – centrally coordinated all extension and disease-control work. In the latter part of 1989, with the establishment of the provincial council system, the functions were devolved and handed over to provincial departments of animal production and health.

With increasing participation of the private sector, the industry showed a rapid progress particularly from 1990 onwards. The growth was more prominent in the broiler sector, but no remarkable growth was recorded in the layer sector. This could perhaps be due to high capital involvement, market uncertainty and not-so-growing consumer demand.

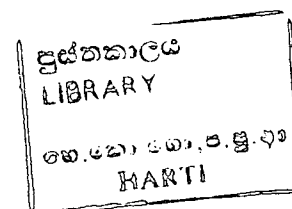
Until the 1980s most recorded poultry diseases in the country had been *Newcastle Disease (ND)*, *Fowl Pox (FP)*, *coccidiosis*, *intestinal parasitic infestations* and *deficiency syndromes*. The two viral diseases, ND and FP were successfully controlled by vaccination. These two vaccines were manufactured by the Veterinary Research Institute (VRI), Gannoruwa, and distributed to farmers free of charge, through the government veterinary network.

3.6.1 Government intervention

In Sri Lanka, the government involvement in the poultry sector from the pre-independence era to date has been changing with the transformation in the poultry segment within the agriculture sector. Since the early 1940s, attempts have been made from time to time, towards uplifting the family poultry keeping – one such being the introduction of improved males from breeds like Rhode Island Reds, White Leghorn, Light Sussex, Australorp, Cornish and Plymouth Rock, – to increase the number of eggs by crossbreeding the indigenous type of chicken. The latter may have brought limited success, as the first generation (F1) of these birds had a variable capacity to breed and brood. Nevertheless, the introduction triggered a situation to provoke some people to change over, keeping only the said breeds and their crosses under semi-intensive systems. This is an improvement from the scavenging system, as some external inputs were needed to sustain the new farming system.

3.6.2 Central Poultry Research Station (CPRS)

The government in view of increasing the locally produced eggs had to support the emerging system of poultry keeping. It established farms – not only to develop and supply high quality genetic material, – but also to develop, introduce new innovations through research, transfer of technology, training of government extension staff and to produce food in state farms. Therefore, to provide these multi-faceted activities Central Poultry Research Station (CPRS), Karandagolla, Kundasale was set up in May 1954. CPRS, (Ladefoged and Mahadevan, 1956), and the research farm of the Veterinary Research Institute (VRI), Gannoruwa, Peradeniya played a pivotal role in laying a solid foundation for a poultry sector that has been growing into a key industry since then. Over the past five decades, research on breeding improved strains, utilisation of local-feed ingredients in poultry rations, artificial insemination in poultry and incubation practices are some of the work CPRS has carried out.



3.6.3 Poultry breeding activities

Breeding activities pertaining to poultry were carried out under the able supervision of veterinary research officers (VROs). They were responsible for creating a two-way white egg strain – 250H3 and a two-way tinted egg strain in the mid 1960s. The latter was known as RhoWhite – a cross of Rhode Island Red male to a White Leghorn female, and was very popular during the transition period from semi-intensive to intensive deep litter management system introduced by CPRS. The 250H3 – a cross between two White Leghorn lines (Line A and B) became popular with those who took up commercial egg production as self-employment and it was on par with imported egg-laying strains. The smallholders played a major role in increasing the national egg production. By 1962, Sri Lanka stopped importing eggs from India. Further, a heavy-meat-type strain was produced by a cross between White Cornish and White Plymouth Rock and introduced to commercial meat producers. Sri Lanka started deviating from cockerels to specialised meat strains. CPRS started producing commercial day-old-chicks (DOCs) through parents developed from pure lines.

3.6.4 Poultry vaccine production

The vaccine production centre at VRI had introduced two vaccines, namely Newcastle Disease (Ranikhet) and Fowl Pox vaccines. The former was produced first in 1934 and the latter was in 1946. They helped control two most important diseases then. Ranikhet vaccine was out of production from 1996 to 2004 due to technical reasons. But, the production was re-started in 2004 with certain quality improvement. VRI made these vaccines freely available to farmers. With the entry of many imported vaccines to the market and becoming more popular among commercial poultry units, VRI-produced/local vaccines were confined to a few smallholder farmers. They used it because it was available in small quantity (i.e. Ranikhet in 200 dose vial) compared to imported vaccines, which were available with a minimum quantity of 500 doses.

In addition to above two vaccines, VRI commenced production of Fowl Cholera Vaccine in 2006. This vaccine is produced mainly on request of breeder farms.

3.6.5 Poultry genetic resource

Major portion of the poultry population in developing countries like Sri Lanka is the local breeds with genetic diversity. There is a need to utilise and conserve these types as they thrive well under the extensive management conditions with almost no inputs. Even though there is a possibility to improve these breeds but under the present context they cannot compete with commercial hybrids. Therefore, any breeding programme for local breeds should focus on specific attributes and have specific goals to suit the system.

The breeding goals for commercial hybrids were focused on feed efficiency, and this has resulted in a layer producing over 300 eggs per year and a broiler utilising 1.6-1.8 kg feed to produce 1 kg live weight, and can grow up to 2.5 kg in six weeks. These breeding populations were maintained by a dozen foundation stock breeders three decades ago has now fallen to three.

Table 3.6: Breeders and ownership since 1991

Breeders	1991 Location	1991 Ownership	2001 Ownership	2006 Ownership
Babcock	Ithaca, USA	Rhone/Merieux	Merial	Hendrix Genetics
Bovans	Ospel, NL	Hendrix	Hendrix/Nutreco	Hendrix Genetics
Dekalb	Dekalb, USA	Dekalb Genetics	Hendrix/Nutreco	Hendrix Genetics
Hisex	Boxmeer, NL	BP Nutrition	Hendrix/Nutreco	Hendrix Genetics
H & N	Redmond, USA	Lohmann	Erich Wesjohan	Erich Wesjohan
Hubbard	Walpole, USA	Merck	Merial	Grimaud freres
Hy-line	Des Moines, USA	Lohmann	Erich Wesjohan	Erich Wesjohan
ISA	Lyon, Fr	rhone/Merieux	Merial	Hendrix Genetics
Lohmann	Cuxhaven, GER	Lohmann	Erich Wesjohan	Erich Wesjohan
Shaver	Cambridge, CAN	Rhone/Merieux	Merial	Hendrix Genetics
Terra	Babolna, HUN	Babolna RT	Babolna RT	

Source: Albers and Van Sambeek (2002)

Currently, the handful of foundation stock breeders controls the genetic improvement of chicken in the world. They are located in cooler regions in the temperate zone, but their products reach all other climatic zones in the world. In this process the inputs and resources they utilise to create the specific environment to these hybrids can be very expensive to the developing world. Nevertheless there is no option but to provide this high resource utilising environment to achieve maximum potential from these birds. Therefore, commercial chicken rearing requires a substantial capital inputs to start.

This trend could be arrested through utilisation of specific genotypes, such as homozygote or heterozygote naked-neck or featherless birds, could be another option for hot climate. Other such traits could be incorporated to lessen the burden of high resource utilisation in rearing commercial chicken. These specific genotypes are now wiped out from the commercial foundation stock gene pools after decades of artificial selection, but these are with the local gene pool.

As the food production in the developing world is transforming from producer-driven to consumer-driven this utilisation of local breed genotypes in conventional breeding programmes will be useful. Especially, selection for fitness traits utilising these genotypes can reduce the utilisation of drugs and chemicals in producing food.

3.6.6 Commercial egg and meat layers

It must be shown that the selection process since 1925 has increased the number of eggs per hen from 170 to over 300 eggs per annum. This has not only increased the number of saleable eggs per hen housed, but also feed conversion efficiency as well as egg quality. Breeders were also

concerned over the persistency of lay to meet these standards. Due the genetic improvement, Sri Lankan broiler industry developed from predominantly smallholder operation to a large industry. The producer driven commercial broiler industry could be divided into two market sections.

First and the traditional form of market is the live weight-market. Most of the smallholder broiler producers fall into this segment. The producer purchases day-old-chicks from a parent operation, rears them to market weight and then sells to either the processors or to the wet-market¹⁷ through wholesaler collectors. In this situation the producer and the breeder are two independent profit centres. But traits needed for the producer to obtain profits are negatively correlated with traits needed for breeder profits.

Live broiler to processed broiler integration is the next segment, if most broiler chicks are sold. Even though there are two profit centres as in the first instance, the broiler integrator providing day-old-chicks to the producers for growing is concerned with the efficiency of the whole process from breeder traits to grower traits.

3.6.7 Poultry nutrition

The nutrition research on poultry at CPRS was primarily – to developing feeding programmes for newly evolved birds of the nutrition division of VRI. Their findings had laid the foundation for the commercial feed industry of Sri Lanka. They helped in developing rations for poultry at the first feed milling organisation, the state-owned Oils & Fats Corporation. Other organisations such as Moosajees, BCC and individuals too received technical support for feed manufacturing. The lack of adequate feedstuffs in Sri Lanka is widely recognised as the main constraint to increase the production of eggs and chicken meat.

There are over twenty locally available feed ingredients that have been evaluated and documented by researchers in Sri Lanka. This information has been available for over two decades to feed manufacturers but was not utilised as imported feed ingredients were available at a cheaper rate. Current economic and environmental crisis has now changed the scenario in Sri Lanka. There is a new breed of small- and medium-scale operators that have entered the feed manufacturing field previously dominated by three big players. This group has now started utilising these locally available feed ingredients to supplement expensive imported ingredients.

Maize is the main energy source for poultry and is the single ingredient imported in highest quantity for poultry feeding. The production in Sri Lanka was only a fraction of the requirement in the past, but with current non-availability of maize in the world market we were compelled to produce our own maize demand for the industry. The other main energy sources available are rice bran / rice polish, as well as broken rice and graded rice. The availability of broken rice is affected with the increase in the use of rubber-roller rice mills and the price is quite high, similar to maize.

¹⁷ The floors and surroundings are often routinely sprayed and washed with water – to the extent of flooring it at frequent intervals – which gave it the name ‘wet-market’. Generally the wet-markets combine butcher shops and fish markets and have facilities for the customer to select a live animal, and then either take it home or have it killed expertly and cleaned before their eyes.

3.6.8 Poultry extension activities

Efficient poultry extension activities of the government at that time helped popularise poultry farming. The livestock officer (poultry) and his group collectively with the well-organised extension network of livestock officers, agricultural instructors and the *Krushikarma Vyaptha Sevakas* (KVSs) attached to DAPH of the Department of Agriculture played a critical role in popularising poultry in urban, peri-urban, estate and rural sectors. Hence, today's poultry industry is built on the foundation laid by the government through VRI, CPRS and its network of extension staff.

3.6.9 Canadian International Development Agency (CIDA)

A special reference has to be made about the role of the Government of Canada through Canadian International Development Agency (CIDA) in supporting the poultry programme. CIDA support came in two stages (i.e. the period from the late 1960s to the early 1970s and from 1984 to 1989). During these two stages, the state farms were able to acquire modern equipment and technology. The private sector followed suit.

In the early 1980s, the government identified the need to strengthen the support services that cater to smallholder poultry sector. It was decided to go beyond the two-way crosses CPRS was producing then – to match the imported genetic stocks. This resulted in producing new pure lines to produce two three-way terminal crosses (white egg and brown egg) at CPRS.

3.6.10 Pure line breeding at CPRS

Central Poultry Research Station (CPRS) was able to successfully test the terminal crosses which were on par with several imported strains on-station. The birds were further tested on-station and on-farm in view of ascertaining their production potential. Their performance was found as good as any imported strains under locally managed conditions (Ganegoda, *et al.*, 1982). But CPRS was unable to penetrate the day-old chick market due to government policy changes as well as the strengthened marketing strategies of the private sector (Gamage *et al.*, 1991, Gamage *et al.*, 1992, Jayaruban, 1995).

3.6.11 Change of strategy in 90s

The government has changed its strategy for poultry sector. Earlier it had confined mainly to policy-making and statutory activities related to formal poultry sector. But, its policy on small-scale poultry production continued. This new change prompted CPRS – to change its strategy for poultry sector and identified it as a crucial area for support. As a result, the family poultry programme (FPP) under DAPH was initiated in 1996 in Minipe and Nagadeepa. A similar programme was later commenced in Muthurajawela of the western province.

It was decided in 1997 to discontinue the commercial pure line programme to support the commercial egg production sector and look into the possibility of supporting the family poultry or the backyard poultry or so-called scavenging poultry sector that has been ignored or overlooked for over five decades by the government, private sector and NGOs. Furthermore, information from the

poultry programme in Minipe / Nagadeepa showed that the commercial egg layers in the scavenging or backyard system or family poultry sector is not a feasible option to the indigenous chicken

3.7 Government Policy Path

The government role in the development of poultry should be hailed. Most policy decisions and development projects during early stages helped the industry transform into the present state. Before the 1950s, it was only a backyard poultry system. Part of the egg requirement was met by imports from India. The government supported poultry by providing farmers with hybrid cockerels initially and later crossbred day-old-chicks to improve the genetic potential of the local birds. Introduction of new breeds helped increase the egg production. With this new development, import of eggs from India also was stopped – to support the local production. During the next stage, the government commenced poultry research and established regional hatcheries. It also introduced small-scale intensive deep litter system. Since the importance of vaccines was strongly felt, *New castle* and *Fowl Fox* vaccines were introduced during this time. The two vaccines were very effective and were able to control diseases. Poultry feed production was also commenced in the 60s by establishing a feed mill at Seeduwa under the management of Oils & Fats Corporation.

The Department of Animal Production and Health was well equipped with necessary technical and laboratory services to back up the poultry sector. Therefore, farmers always sought advice and assistance from the government veterinary office and VRI. Poultry farming became more commercially-oriented operation, transforming from small-scale deep litter system to medium- and large-scale farms. At present, there are more advanced environment-control houses and also battery cages on many farms in Sri Lanka. The farms are equipped with latest technology and birds. Their performances are on par with any developed poultry industries in the world. This transformation is widely seen in the broiler sector, especially with the private sector entering in poultry farming from the early 80s to date. The changes affect the layer sector relatively less. There could be many reasons for the layer sector to respond differently, due to its frequently changing nature. Often the poultry farmers who had less access to credit – confined their operations to layer production.

With the private sector involvement, the government gradually withdrew from the poultry development activities and confined their role to statutory and regulatory functions. The government justified its new stand – as a measure – to look after the broiler sector needs, but it failed to understand the specific needs of the layer sector, which was lagging behind and of which the smallholders formed the majority. The government discontinued the vaccine production forcing smallholders to buy imported vaccines, which are expensive. Further, there were no small vaccine packs available and many farmers stopped vaccination. Whatever the reasons for suspension of the production of the local poultry vaccines, the small-scale farms faced the consequences.

Although the government attempted to support smallholder poultry production, by way of promoting self-employment programmes, *ad-hoc* mini-projects etc no major programmes as such implemented – to revive the small farmer. This situation became worse due to implementation of the Avian Influenza-control programme, where backyard poultry farming were subjected to some restrictions. DAPH had issued guidelines for backyard poultry farming and farmers had to strictly follow them. As a result, any significant development in the small poultry sector would not have been possible in the future.

3.8 Present State of the Industry

3.8.1 Evolution of the poultry industry

With continued support and intervention of the government, free-range poultry rearing system gradually evolved into a small-scale intensive system first and then to a highly organised commercial industry with improved efficiency. Along with the rapid expansion, several structural changes took place, where the scale of poultry farms changed from an average of 25 to 100 birds in the 1960s, 70s and early 80s to over 1000 birds. This change was inevitable due to profit margins of egg producers decreasing from the latter part of the 1980s.

While witnessing above changes, which transformed part of the poultry farming to a formal or commercial sector, many units in rural, estate and peri-urban areas continued to remain as backyard or free-range units. These units still supply around 15 to 30 percent of the table egg requirement of the country.

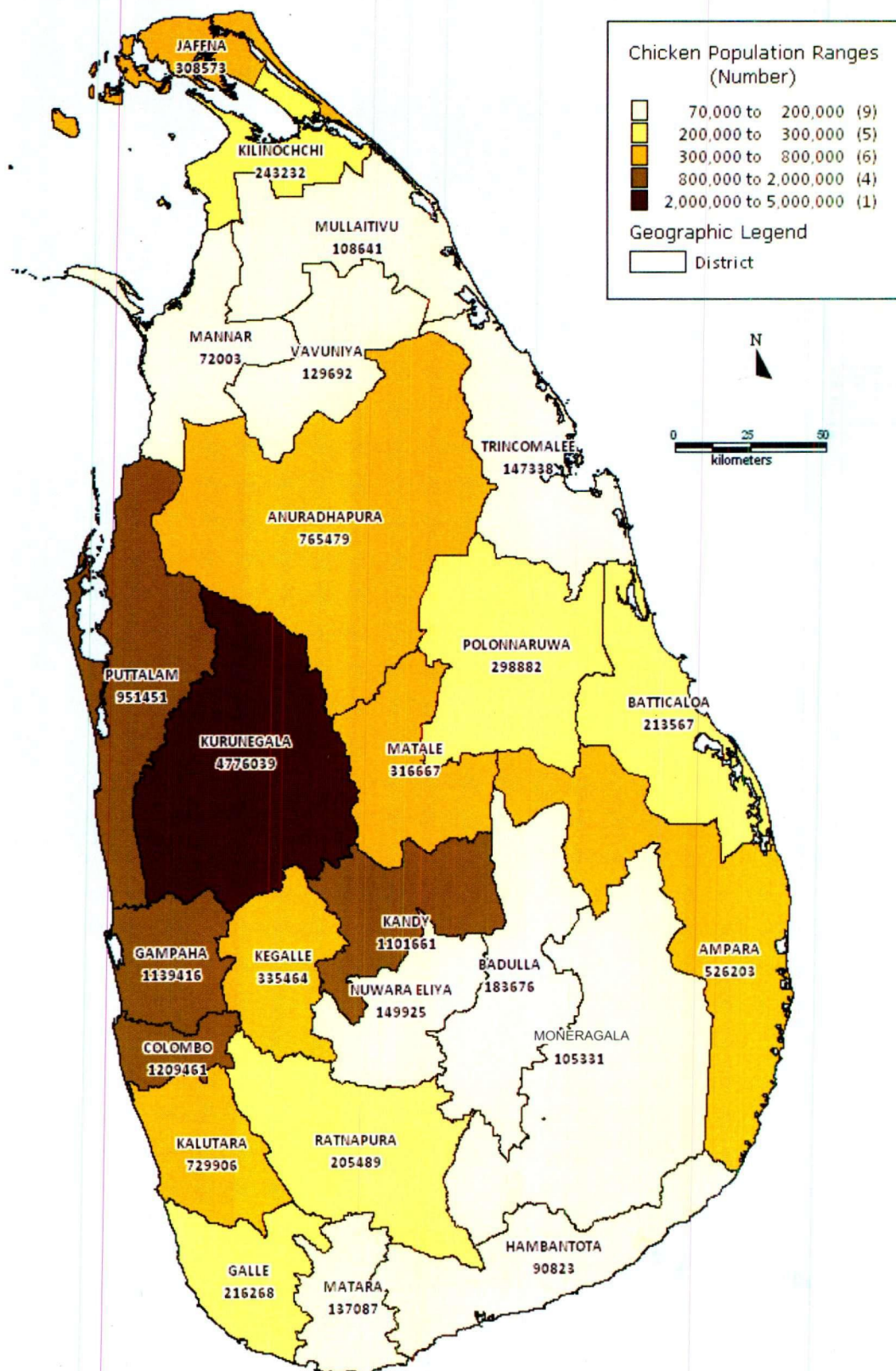
3.8.2 Private sector investments

In view of growing competitiveness, the small producer was compelled to increase the flock size. This change required more sophisticated inputs and a better management system. The producers needed better attention and support; therefore they were compelled to tie up with the large-scale private operators who could invest greater amount of investments on infrastructure, feed industry, processing as well as quality breeding stock. The private sector transformed an activity of backyard poultry rearing by women and children, into a major commercial industry over the past five decades.

3.8.3 Population and distribution

Total chicken population and annual DOC production from hatcheries are given in Table 3.7. The country's breeder and commercial poultry farms, feed manufacturing plants, processing establishments are mainly concentrated in western and north-western provinces - the area known as the 'poultry belt' (see Map 3.1). Poultry production is concentrated in these areas perhaps due to the increased levels of consumption, transport and marketing facilities and the availability of land in the north-western province and other resources conducive for poultry production.

Map 3.1 Distribution of poultry population in Sri Lanka - 2008



Data Source: Department of Census and Statistics, Sri Lanka
Map Produced by Databank Planning and Economics Division, DAPH

Table 3.7: Poultry population and annual estimates from 1970 to 2006

Year	Total chicken population (Mn)	DOC layers (Mn)	DOC broilers (Mn)	Year	Total chicken population	DOC layers (Mn)	DOC broilers (Mn)
1970	6.856	-	-	1989	8.833	3.12	13.1
1971	6.693	-	-	1990	8.250	3.70	14.5
1972	9.127	-	-	1991	8.261	4.20	15.6
1973	7.529	-	-	1992	8.852	3.80	18.8
1974	6.521	-	-	1993	9.261	4.60	25.2
1975	5.684	-	-	1994	9.466	3.70	32.4
1976	5.700	-	-	1995	9.573	5.80	37.9
1977	5.833	-	-	1996	9.137	3.30	38.5
1978	4.912	-	-	1997	9.253	5.60	40.8
1979	5.882	1.73	2.3	1998	9.566	4.50	47.2
1980	6.341	1.60	2.5	1999	9.922	4.40	48.9
1981	6.296	1.80	3.1	2000	10.622	4.90	59.7
1982	6.249	1.62	5.8	2001	10.655	5.96	63.7
1983	6.457	1.84	6.5	2002	11.564	5.72	64.7
1984	6.113	1.67	6.9	2003	11.774	7.20	67.1
1985	7.097	1.95	8.6	2004	11.041	6.50	69.7
1986	7.638	1.79	10.2	2005	11.636	6.70	73.7
1987	8.588	2.01	11.4	2006	13.117	6.30	73.4
1988	8.645	2.12	12.6				

Source: Department of Census and Statistics, Statistical Abstract, various issues

In general, a major portion of the broiler population is found on large-scale farms, where the layer population is found in smallholder units. Due the genetic improvement, Sri Lankan broiler industry developed from predominantly smallholder operation to a large industry. The producer driven commercial broiler industry could be divided into two market segments (*already discussed in 3.6.6 Commercial Egg and Meat Layers*).

3.8.4 Management and health

Both the state and the private sector provide disease diagnostic services. The government veterinary offices islandwide provide basic disease diagnostic services. In addition to diagnostic services veterinary investigation centres are located in Jaffna, Matara, Pannala, Polonnaruwa, Vavuniya and Welisara. They provide disease investigation services and certain laboratory examinations. VRI provides diagnostic, investigation, laboratory testing and confirmation services. Further, the Veterinary Hospital and the Veterinary Teaching Hospital of the Faculty of Veterinary Medicine and Animal Science located at Peradeniya too provide poultry diagnostic services. Currently, three private sector poultry establishments have their own well-established diagnostic laboratories and provide services to farmers. Increased imports in the form of inputs that are required by the industry and high intensification resulted in more poultry diseases to emerge during the recent past. Very virulent *Marek's disease* and *avian encephalomyelitis* reported in the country in the early 90s caused heavy economic losses. Infectious bursal disease (IBD) also broke out in

the late 1995 and spread in many areas in an epidemic form, affecting a large number of farms.

Infectious bursal disease and fowl typhoid are the two important diseases that are mostly prevalent at present. For commercial layers, vaccination against *Newcastle disease*, *Fowl pox* and *infectious bursal disease* is compulsory, whereas for broilers, *Newcastle* vaccine is given. Vaccines protect parent birds, and the vaccination schedules may vary depending on the location of breeder farms and disease situation in the area.

A monitoring programme on poultry breeding farms against *salmonella pullorum/gallinarum* was commenced by DAPH – to eliminate them at the breeder level. Antigen is currently produced at VRI and testing has been made compulsory for all breeding farms since 2002. Legislative support is necessary for further growth. The two Acts namely, Animal Diseases Act No 59 of 1992 and Animal Feeds Act No 15 of 1986 provide legislative back up service for the quality assurance of DOCs, chicken meat and chicken meat products, veterinary pharmaceuticals and biologicals, animal feeds and for the prevention and control of poultry diseases. The Director General of DAPH is authorised to implement provisions of these acts.

3.8.5 Meat production and marketing

Although, the government has taken the initial step towards integration of the meat market in the subcontinent, small-scale operators have not been allowed into the process. As a result, the number is reducing. The wet chicken market is improving – even though there have been government regulations to curtail it since the 1980s. The information on this enterprise has now been documented and available.

Traditionally, homestead processing of chicken was carried out to supply meat to the family or limited orders in rural areas. A traditional live bird or live chicken marketing system often starts with chicken raised in backyards or on small farms. Here, chicken is mixed with different types of other poultry, different species of birds, wild birds and other farm animals.

This tradition is still practised to a certain extent in rural areas but it is disappearing in urban areas due to restrictions. The live bird marketing system during the past century was practised in urban areas – mainly to meet the meat demand. Ismail, F and Perumal MCRM, (1999) states – the inauguration of Edinburgh market in Colombo, in 1873, “...which was predominantly a beef, mutton, chicken and pork market...”

Backyard or village birds were sold under this system. Live birds were collected by poultry managers or ‘*Kath Karayas*’ (pingo carriers) who were mainly concentrated in the Dandugama village in Ja Ela. Peliyagoda market, popularly known as *Pol Athu* Market had been the ‘hub’ of live bird sale. Buyers or wholesalers from Colombo and other suburbs came to Peliyagoda market to purchase village chicken. Live bird collectors in Dandugama sold the birds there.

The practice of collecting live indigenous chicken for consumer demand in urban areas has gradually reduced the population of indigenous birds. It created a shortage of chicken supplied to the urban market. To meet the demand, commercial broiler strains were introduced and the new production system replaced indigenous with finished broilers (Wijewantha *et al.*, 2006, Wijewantha *et al.*, 2007). The rapid increase in the demand for chicken meat required more than what the pingo carriers could transport. In time, the mode of transport too was changed by pingo carriers from

push cycle to motorcycle. At present live birds are mostly transported in open trucks from the main producing areas of the north- western and western provinces. The live bird markets are mostly concentrated in the western province. The main live bird market is now located at the Manning Market of the Colombo Municipality.

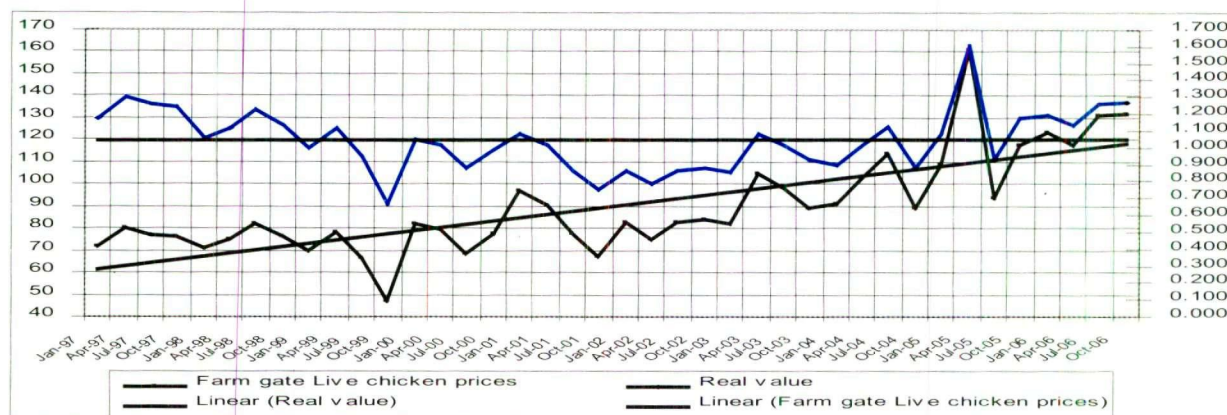
Live chicken or wet market is either a permanent or a temporary place where various species of animals such as poultry wild birds, fish and other small animals are brought alive in cages and sold either live or as meat. People often would buy fresh meat of animals slaughtered on the spot or buy a small number of live animals and slaughter at the backyard of the house (WHO, 2006). Consumers sometimes would like to have animals killed on the spot – to make sure that the meat is fresh and healthy.

The majority of the live bird market (LBM) owners are Muslims and the remainders are Catholics of the Ja Ela and Negombo areas. Purchasing live birds from the market is dependent on the scale of operation. More than three-fourth of the LBM owners meet their requirement from live bird traders who deliver them at doorstep. Others purchased direct from farms. Often the birds are transported in open trucks and delivered mostly in plastic crates, as it is easy to handle and clean. Live bird traders and large-scale buy back operators – based on the prevailing market price – determine prices. Live birds are in cages or pens until they are slaughtered. The majority of the LBM owners practise *halal* method of slaughtering. Often the bird skin is completely removed and de-feathering is done manually or by machine.

Live bird market is popular amongst the Muslims as well as the low income groups living in urban areas. This mode of marketing is very popular amongst these two groups of customers. Low income groups will purchase small amount of chicken meat depending on their purchasing power. In this case, the trader provides meat from 100 to 500 g. This system needs to be continued but the hygienic conditions should be improved.

Due to new technology, frozen food has become fashion for people in urban and rural areas over the past three decades. The market for frozen chicken has increased and turned the broiler sub-sector to a fast growing industry. Within the last three or four decades, Sri Lanka's poultry industry changed from a 100 percent backyard system to a broiler industry which accounts for 65 percent of the market share (AgEnt 1996). The broiler industry has shown an annual rapid growth of 10 percent in the recent past. The major components of the broiler industry are: the breeder feeder production; commercial broiler operation; processing; marketing; and other input suppliers. The breeder operations are of two major categories – as grandparent and parent farms. The large-scale processors producing poultry meat rely heavily on out-growers for their production and it operates as a contract between the out-growers and the entrepreneurs on buy back basis. The broiler buy back operations consist of a number of components of the supply chain such as supply of drugs and vaccines, feeds, DOCs, broiler rearing, processing and marketing. Under normal circumstances, the farmers manage to run 5 to 6 broiler growing cycles per year. In Sri Lanka, the standard rearing period for broilers is 42 days and the buy back operators collect broilers from the farmers who have been contracted to supply. In general, they are expected to return at least 95 percent of finished broilers, out of the total number of DOCs they receive. The contract farmers are paid on the basis of the live weight of the birds return. The buy back operator fixes the prices. At the time of payment the money spent on the inputs are deducted from the payments due to contract farmer.

Figure 3.3: Comparison of farm gate live chicken prices from 1997 to 2006



Source: Derived from market information by DVS de S Gamage (2007)

Table 3.8: Categorisation of buy back system (BBS) on number of contract farmers

Category	BBS & No of Contract farmers	No of BBS	Percentage of farmers
Up to 100 contract farmers	BBS 1-60, BBS 5-100	2	4.95
101-300 contract farmers	BBS 2-220, BBS 3-150, BBS 8-300	3	20.75
301-500 contract farmers	BBS 4-500, BBS 6-400, BBS 9-400, BBS 10-500	4	55.72
Over 500 contract farmers	BBS 7-600	1	18.58
Total		10	100.00

Source: Wijewantha et al., 2005

Though the sector has a highly evolved and integrated production and marketing system, there is still another informal poultry production and marketing system with significant contribution. While the formal sector runs grandparent farms, parent stock farms and imported chicks to supply to the demand, besides their other functions like buy back system, feed manufacturing, processing, other supportive services and marketing – the informal sector maintains the backyard/ extensive or semi-extensive small-scale poultry industry.

3.8.5.1 Day-old-chick production

There were forty poultry (broiler and layer) breeding farms and hatcheries producing day-old-chicks (DOCs) in 2003. In the broiler sector, three large-scale farms contributed to about 52 percent of DOC production in 2003, whereas in the layer industry, 82 percent of the total layer chick output in 2003 came from four large-scale breeding farms.

Nearly 62 percent of the requirement of the broiler parent stocks is currently imported while the balance – which is supplied by the broiler grandparent farm – belongs to a large-scale company. All layer parent stock requirements are imported at present. Imports are currently allowed from eight countries.

Presently around sixty-five million broiler chicks and six million layer chicks are produced annually and this can meet the existing demand. However, during the recent past, there have been instances of market saturation of DOCs that, in turn led to a sharp decline of prices from time to time. As a result, during the period from 1995 to 2003 some of the small-scale breeding farms and hatcheries were forced to close down their operations.

Currently there are a few state-owned poultry breeding farms. The National Livestock Development Board (NLDB) owns three medium-scale breeding farms namely, Karandagolla, Marawila and Miriswatte. Respective provincial departments of animal production and health manage five small-scale breeding farms, Achchuveli, Batticaloe, Kekanadura, Trincomalee and Vavunia. The total contribution of the DOC production in the country from these state-owned breeding farms was 2.8 percent in the broiler sector and 5.2 percent in the layer sector in 2003.

3.8.6 Supply of poultry feeds

The total requirement of the compound poultry feed is manufactured locally. Three large-scale feed manufacturing plants currently supply around 70 percent of the total compound feed requirement. Though the country has all natural resources that are needed to produce raw materials (ie maize, soya bean meal, fish meal), over 90 percent of the requirement is still imported.

Due to high cost of production and fluctuating farm gate prices of eggs in the recent past, there is an increasing trend for self-mixing of layer feed. Presently, there are over 300 self-mixers in the major poultry processing areas of the north-western province. Raw materials for small-scale feed mixing are purchased from the wholesale markets located at Wolfendhal Street, Colombo.

3.7.7 Meat processing and marketing

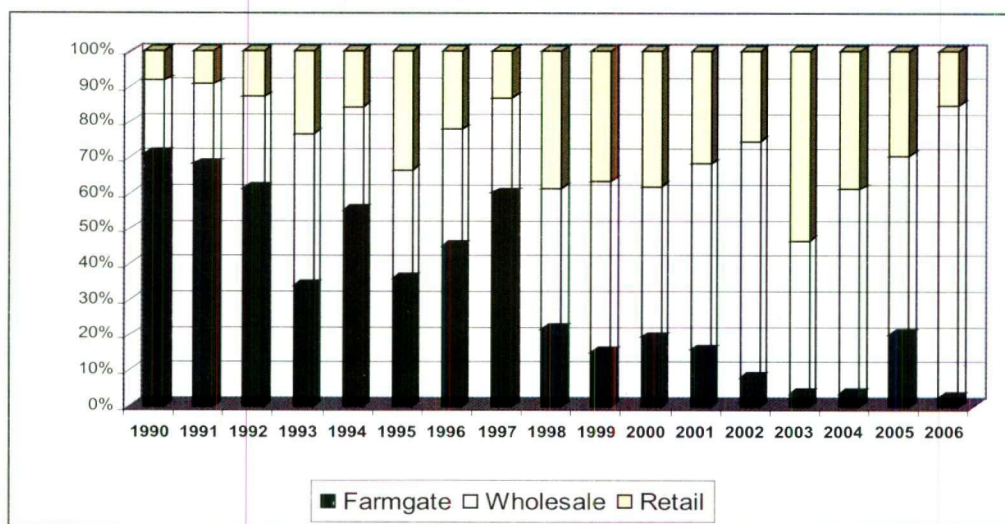
The meat-processing sector has shown a remarkable progress over the past years in order to meet changing consumer demands. Around 65 percent of chicken meat is currently produced in the country using modern technology. Branded chicken products are introduced into the market with quality certification. At present, there are 15 large- and medium-scale chicken meat processing establishments and, the annual chicken meat production in 2003 was around 80,000 metric tons. Two large-scale meat-processing establishments have already been registered with DAPH for export of chicken meat and obtained certification under Hazard Analysis and Critical Control Points (HACCP) system from the Sri Lanka Standards Institute (SLSI). The product quality certification – 'SLS' mark has been awarded to two companies.

3.8.9 Egg production and marketing

There is no well-organised out-grower system for egg marketing. In the major egg producing areas of the north-western province, small- and medium-scale feed mixers sell their feed, collect eggs from farms and supply to the Colombo wholesale market. The feed mixers are engaged in the input supply as well. In addition to this system, there are local egg collectors or so-called middlemen who collect and supply eggs mainly to the Colombo wholesale market. In other areas of the country individual farms have to look after their own market sources.

Price determination: Unlike the broiler sector, there are no cold storage facilities and value addition for table eggs. Therefore, eggs produced by layer farms have to be sold within the shelf life period of eggs; the period is normally two weeks. Presently the wholesale egg marketers in Colombo decide the weekly egg prices based on the supply and demand. Compared to chicken meat, price fluctuation of table eggs within a year is considerably high. Egg production and marketing systems are unorganised and have affected the growth. There have been some studies on the egg market and production efficiencies.

Figure 3.4: Percentage share of profit margins of producers, wholesalers and retailers



Source: Derived from market information by DVS de S Gamage

3.8.10 Poultry production and environment

The environmental impact of the backyard poultry or mixed extensive systems is marginal because of the limited waste concentration and the reliance on feed grain and food and crop residue. The formal and informal commercial poultry sector can have a marked impact on the environment due to its growth in production scale and geographical concentration, utilisation of feed grains and water, as well as transport costs for manure disposal. Poultry production is associated with a variety of pollutants, including oxygen demanding substances, ammonia, solids, nutrients (specifically nitrogen and phosphorous), and pathogens. Trace elements, antibiotics, pesticides, hormones, and odour and other airborne emissions. Their impact on surface water, groundwater, air/atmosphere and soil has to be ascertained. Other indirect impacts include ecosystem destruction and biodiversity erosion associated with the expansion of feed crop production into natural habitats and the overexploitation of non-renewable resources for feed production.

Compared to other livestock species, poultry however performs well from an environmental perspective. Indeed, a substantial comparative advantage that poultry has over other animal sectors relates to its efficiency in feed conversion. Feed conversion ratio represents a major contribution to the profitability of the industry in terms of reduced feed inputs as well as waste output. With cattle in feedlots, it takes roughly seven kilograms of grain to produce one kilogram gain in live weight. For pork, the figure is close to four kilograms to produce a weight gain kilogram, for poultry it is just over two, and for herbivorous species of farmed fish, such as carp, tilapia, and catfish, it is less than two. Another comparative advantage lays in the low water content and high nutrient

content of poultry manure. It is thus often handled with more care than manure from other species – particularly pig – as recycling is generally economically profitable. Potential technologies that exist – can lead to substantial reductions in environmental impacts.

3.8.11 Further processing and value addition

Eggs from village chicken flocks generally fetch premium price in the market. This is an advantage for brown eggs from small flocks, even produced under intensive system. At the same time there are farmers producing specialised eggs called 'designer' eggs. There are a few farmers producing organic eggs. Some farms produce eggs with high selenium, omega-3-fatty acids, etc. It has been found that village chicken eggs contain carotenoids pigments of high concentration that add/give an appetising colour to egg yolk and also serve as the precursor to vitamin A (Gunaratne *et al.*, 1993). This finding is in keeping with the common experience that eggs from village birds have a darker yolk, and are generally more appetising. The cholesterol content in commercial egg, or farm egg was higher than in village eggs. Further investigations reveal that the higher content of cholesterol in commercial eggs was due to larger and heavier yolk. In fact, there is marked difference – as far as cholesterol concentration in egg yolk is concerned – between village and farm eggs.

3.8.12 Imports and exports

Almost 80 percent of inputs (parent and grandparent chicks, feed raw materials, pharmaceuticals, chemicals, vaccines, equipment, utensils) required by the industry are presently being imported. Commercial poultry is not allowed to import due to the risk of exotic poultry diseases. Import of parent and grandparent birds is allowed only for registered poultry breeding farms. At present imports of chicken meat and chicken meat products are low and represent less than two percent of the domestic production. They are imported by the value-added industries and BoI companies as specialised products. Though the export volumes of chicken meat and eggs are not very significant at present, there is an increasing demand for our value-added products particularly from neighbouring countries.

3.9 Research and Investigation

The Veterinary Research Institute (VRI) in Gannoruwa, is the principal body carrying out research pertaining to the poultry sector. Faculties of Veterinary Medicine and Agriculture are also to some extent carrying out research. The government funds most of these research programmes.

3.9.1 Pure lines developed at CPRS

The Central Poultry Research Station (CPRS) has been maintaining egg and meat pure lines since the 1960s. Initially two White LegHorn (WLH), WLH-A and WLH-B, and one Rhode Island Red (RIR) pure lines were maintained. They were continuously pedigree bred till the late 1970s. This was then discontinued; this has resulted in steady drop in their production levels. Hence, the demand for the crosses produced by these pure lines shifted to imported commercial layer and

broiler strains. This resulted in a renewed bid to capture the local market through better commercial crosses. Therefore, to address this issue new pure lines were developed in 1988. Ten unrelated white egg and twelve unrelated brown egg lines were developed. After a series of partial and complete diallelic tests, three high ranking pure lines from each type were selected. They were mated as shown below to obtain the terminal three way crosses.

White egg commercial cross

Sire line	Dam line
L2	N3 X L1
L2	N3L1
L2.N3L1	

Brown egg commercial cross

Sire line	Dam line
M	P7 X P8
M	P7P8
M.P7P8	

These were then tested on-station (Jeyaruban *et al.*, 1996) and on-farm (Gamage *et al.*, 1997) and found to be as good as any imported strain. These birds were mainly given to smallholder commercial sector.

DAPH started intervening initially through research projects and later development programmes. In addition to this, Sri Lanka being a signatory to the Convention on Biological diversity, initiated a sustainable conservation programme with a research component to characterise indigenous chicken at the CPRS, Karandagolla, Kundasale.

3.9.2 Family poultry programmes

The initial Family Poultry Programme (FPP) started in 1997 in the Minipe-Nagadeepa area where commercial egg layers have been distributed instead of the indigenous type birds. (Gamage and Panawela, 2001).

The observations of the study indicate the need to produce a comparatively high yielding indigenous bird from these families and to support the family poultry sector whilst conserving indigenous chicken. Some observations are as follows:

Firstly, two-third of these families were unable to maintain this specialised egg strain successfully. This is owing to the reason that these households were incapable of offering supplementary feed in addition to scavenging. For this reason it is understood that it will not be helpful to permit such strains to enter this farming system.

Secondly, much higher egg consumption was observed in these families than others who did not rear chicken. An individual in these families consumed from sixty-five to ninety-five eggs annually. This was much higher than the national figure of fifty eggs per annum per person. However in the project area the egg consumption of families not rearing chicken was less than ten eggs per person per annum.

Thirdly, the dependency of the housewife of these families, on the male member, results from the reason that the majority of rural women are unemployed or burdened with children. Empowerment was observed to a certain degree during this project as an income was derived from

excess eggs marketed by the housewife. The average income calculated was 693.33 rupees per month (US\$1 = LKR 70 (1997)). It was observed that they used all the money for the family welfare. So family poultry keeping allows women more time with their families and money for family welfare.

Fourthly, severe scarcity of indigenous chicken ecotypes was observed in the Minipe-Nagadeepa project area. This is true to almost all rural areas in Sri Lanka.

Finally, the most important factor is the low egg production of indigenous chicken ecotypes not being acceptable to the farmers under the present context. It was observed that these birds lay only sixty eggs annually.

Therefore, the above reasons could fully justify a project to breed and the development of indigenous chicken ecotypes that could perform better than the currently available indigenous chicken under the same farming system with same amount of inputs. Consequently a research project proposal was developed in year 1999. This following project was funded by DAPH and started in 2000.

3.9.3 On-farm study

- Improving production potential of village chickens by introducing a dual purpose bird in the crop based Mahaweli settlement (System C *Girandurukotte*)

The F1 cross of an improved commercial layer sire strain and the indigenous female was studied. These birds were restricted to the homestead compound. Hence, their feed resource base is limited to this area. They were supplemented by kitchen refuse and agriculture by-products available in the area. It was found that due to proper attention the survivability has improved. Their age at sexual maturity was between six to seven months. Egg production per month was between thirteen – nineteen and averaging on sixteen. Egg consumption was three eggs per person per week. Due to poor broodiness the F1 or 50 percent of indigenous birds prevent producing replacements. Hence further increase in indigenous blood for this cross is recommended, or a combination of indigenous, F1 and B1 could be recommended to this system.

3.9.4 On-station study

- Evaluation of free range poultry production under coconut to improve the productivity of coconut plantations - in collaboration with the Coconut Research Institute, Lunuwila. (Samarajweewa and Gamage 2004).

Coconut (*Cocos nucifera*) utilises only 25 percent of the land area and 40-45 percent of the intended light. Therefore this experiment was conducted with the objective of integrating free-range poultry under coconut to improve productivity. Two populations, with 50 percent (150) and 75 percent (175) indigenous blood levels were compared with a locally developed commercial egg strain (CPRS Brown). Month-old chicks were divided into three replicates (25 birds each) and assigned at random into enclosures. Growth rates and hen housed egg production were significantly different ($P < 0.05$) with CPRS brown showing the highest growth rate and egg production followed by 150 and 175. No brooding was observed in CPRS Brown birds, whereas 150 was low-moderate

and moderate-high brooding in 175. CPRS Brown seemed to be a suitable strain for its higher productivity to integrate with coconut, but their inability to brood affects the sustainability of this production system. There was a positive balance of nitrogen and phosphorous while potassium was in negative balance. The study showed the total nitrogen and phosphorus requirement (nut production- 90 nuts/year/palm) were provided through the integration of poultry, and their levels were higher than in the control plots i.e. standard estate practice. Even though, the phosphorus content in integrated plots were excessively higher; CPRS with higher production levels showed less accumulation. Biological activity of soil in plots integrated with poultry was higher. Results indicated that only K needed to be supplemented. This in fact saved 70 percent cost of fertiliser per hectare of coconut by integration with poultry.

This study places due emphasis on conservation and sustainable development of indigenous poultry birds and the biological base of the birds. These birds have the capability of recycling and help stabilise the biological equilibrium.

3.9.5 Developments of the project

During the past decade the Central Poultry Research Station (CPRS), Karandagolla, Kundasale through provincial DAPH, Samurdhi, Hadabima and various NGOs have been distributing upgraded indigenous chicken that could produce around 150 eggs annually by scavenging and with minimum inputs. Each family is provided with two males and ten females. This system has a limited impact on the rural agriculture sector, as the number of indigenous chicks supplied is very small due to capacity limitations at CPRS. It is time to change the CPRS strategy in view of a larger impact.

Therefore, it was decided to develop indigenous chicken multiplying units which could supply large numbers of indigenous chicken to the family poultry sector. These units were being set up at Kotadeniyawa, Undugoda, Kakunadora, Seepukulama, Bibile and Boraland. In the future, more units will be developed in the eastern and north-western provinces (Gamage, 2005).

Supply of Parents up to 31st October 2007

North and east provinces – Trincomalee, Vavunia and Jaffna,	300 males and 2000 females
Sabaragamuwa province – Undugoda,	15 males and 100 females
Western province - Kotadeniyawa,	25 males and 150 females
North-central province – Seepukulama,	20 males and 100 females
Uva province – Boraland and Bibile	45 males and 250 females
Southern province – Kakanadora	40 males and 200 females

Source: Therathasan, 2007

Progress achieved from this project since its inception in year 2000:

- This is the first attempt to conserve indigenous farm animal genetic resources in Sri Lanka.
- DAPH has a large population of indigenous chicken.
- Phenotypic and genotypic characterisation of scavenging poultry strains and determination of phylogenetic relationship among these strains. (Gamage and Sinnathamby (2003), Gamage and

Sureshkumar (2003), Gamage and Sri Karan (2003) and Sinnathamby and Gamage (2004) and Niroshan *et al.*, (2004)).

- Evaluate and compare productivity of identified scavenging poultry strains.
- At the same time a digital photograph of those birds was taken and stored in a computer for further investigation.
- Blood sample from each bird was collected for genomic analysis.
Genomic DNA was isolated from blood samples by using commercially available genomic DNA isolation reagent, DNAzol™. Those isolated DNA has been preserved for analysis and comparison.
- Testing and development of a group of chicken containing 50 percent indigenous and 50 percent CPRS brown, known as (150) and a group of chicken containing 75 percent indigenous and 25 percent CPRS brown, known as (175). Scavenging chicken group – 150 was tested initially The 150 could produce around 150 eggs (110 to 170) and 175 – 110 eggs (90 to 140) annually by scavenging and with minimum inputs.

A further study on 150 and 175 was carried out with the original CPRS brown under smallholder plantation management.

General findings:

- It was observed that the primary caretakers of scavenging poultry are women and some times children.
- Due to land limitations as well as other limitations the flocks are mostly five to fifteen with two to eight adult layers.
- They are allowed to scavenge around for their food and mostly kitchen refuse is also fed, and there are no other inputs incurred.
- These eggs are consumed by the family members (25 percent), some are sold to neighbours, and others are exchanged for other food items at the village boutique. The transaction is handled by women, thus giving them a reasonable economic independence.
- It is known that high income groups and those rearing poultry consume more eggs than the low income groups and those who do not have poultry. Therefore, the rural poor not rearing chicken may not consume the per capita availability of forty-eight eggs.
- The eggs produced by the scavenging chicken are mostly consumed by very low income groups who are mostly below the poverty line.
- The population of indigenous poultry found in the scavenging poultry sector is seen to be reducing or being replaced by exotic strains or their crosses that require high resources.
- The composition of scavenging population consists of 65 percent of indigenous birds, 30 percent indigenous and commercial crossbreds, and 5 percent of commercial types. The crossbreds are of varying levels. But due to the inability to breed the crosses, over 50 percent commercials get eliminated naturally. This happens to the commercial types introduced to this system.
- Their productivity varies according to the ability of the bird to survive and adapt to this system. Generally the productivity is high under any feed resource base. However, crossbreds having some exotic blood will respond to any feed inputs.
- The pure indigenous birds do not require any support, for they can survive and produce under this system. Their daily production could be estimated to around 1.5 eggs and 2 eggs per week respectively.
- Those having more of exotic blood may produce three to four eggs/week but extra feed has to be offered. This may not be possible in very low income homesteads.

- The exotic birds under this system may produce five eggs provided they are offered extra feed. Furthermore they are not sustainable as they may not brood and hatch the next generation, and also have the ability to protect the next generation.
- After the early 1950s, this sector has been neglected by the government, but it has survived. This may not be so in future unless the state intervenes and supports.
- Badly in need of some form of disease control for Raniket and Fowl Pox.
- The family poultry sector has the potential to improve food security of the country, whilst contributing to poverty alleviation and human development.
- The other salient point is that the family poultry sector is a self-sustaining industry that requires no outside intervention for longer periods unlike the commercial poultry sector. But periodic boosts could be given to make this a major impact industry in the country as far as family nutrition is concerned.

3.10 Farming and Production Systems

Farming and production systems are mostly mixed farming where crops and livestock (both poultry and ruminants) are integrated on the same farm, is the character of smallholder production. Poultry found in the low-input scavenging system are mostly indigenous types, but it is the formal commercial system that dominates the poultry production.

– Family poultry sector

The family poultry sector comprises of mostly poor households with minimal assets and marginal livelihoods. These groups include mostly the landless, marginal and small-holder farmers. It has been documented that this is the entry point to begin the manner of asset accumulation to climb the poverty ladder (Todd, 1999). This could be shown in Figure 3.5.

Figure 3.5: Illustration of family poultry as an entry point

Assets of Livestock							
				Milch cow			
			Bullock				
		Cow					
Poultry							
Landless							
	House	Share crop	Land lease	Land			
Years of Borrowing							

Source: Todd, 1999

3.11 Poultry Production

In Sri Lanka, the term 'poultry production' generally used to cover 'chicken production' as other types of poultry rearing are less significant. However, there are some farmers keeping other types of poultry or miscellaneous poultry. According to Wickramaratne *et al.*, (2000), there are some farmers engaged in miscellaneous poultry in the western and north-western provinces. About 90 percent of them maintain flocks of village chicken. The flock size of all species varies widely. The rearing of turkey, duck and quail is – for meat purpose while the rearing of geese and guinea fowl is – for ornamental purpose. The importance of geese and guinea fowl has been well identified by the farmers who have coconut holdings – as an efficient low cost weed controller. There was a special demand for quill of guinea fowl to be used as fishing fly in the fishing rod. There is a big demand for quality breeding materials, as the present stock is highly inbred. Immediate requirement to promote turkey and duck has been stressed in most studies on poultry industry. But, large-scale commercial production has not been recommended due to poor marketing facilities.

3.12 Egg Production and Marketing

3.12.1 National livestock development policy and strategies -2006

The National Livestock Development Policy and Strategies 2006, explains the government role and the directions for livestock sector development. While recognising the importance of the poultry sub-sector as the best solution for the ever-increasing demand for meat, the government expects the development to continue with active participation of the private sector. The role of the public sector in poultry is principally a regulatory function for management of animal disease and assurance of quality of the production and the produce.

3.12.2 Regulatory functions

Legislative support is necessary for any industry to its further growth. The two Acts namely, Animal Diseases Act No 59 of 1992 and Animal Feeds Act No 15 of 1986 provide legislative back-up service for the quality assurance of DOCs, chicken meat and chicken meat products, veterinary pharmaceuticals and biologicals, animal feeds and for the prevention and control of poultry diseases. These acts are being implemented by DAPH and its Director General who is authorised to implement their provisions.

3.12.3 Industrial monitoring- policy planning

At present, the Ministry of Agriculture and Livestock Development is responsible for livestock (poultry) development in Sri Lanka. Policy decisions are taken by the ministry for further development of the industry, by consulting industry stakeholders and DAPH.

Industry monitoring is part of the responsibilities of DAPH. A mechanism has been developed to collect data, maintain a database on the industry, collate and disseminate relevant information to industry stakeholders and state institutions. Forecast reports, annual reviews, other special reports are also produced by DAPH periodically, which are used to plan and develop policy for the poultry industry.

3.13 Role of Poultry Associations

All Island Poultry Association: Formed in 1996, it comprises members from all levels of the industry. The association deals mainly with farmer's interests and represents their problems to policy makers. It is also involved in improving technical know-how of farmers.

World's Poultry Science Association- Sri Lanka Branch: This was formed in 1998, as an affiliated branch of the world body. The main objective of this association is advancement of poultry science in the country by organising seminars, training programmes and arranging study visits of foreign industry personnel.

3.14 Shortcomings of the Poultry Industry

- Sri Lankan formal poultry industry is excessively dependent on imported inputs such as feed, equipment and pharmaceuticals.
- Inefficient utilisation of imported inputs.
- Indiscriminate utilisation of drugs and pharmaceuticals.
- Increase in the cost of production due to high prices of imported and local inputs.
- Improper market price determination.
- Poor marketing practices.
- Producers not sensitive enough to market requirements.
- Producers not understood the Genotype X Environment interaction of high quality imported layers and broilers.
- Interventions with low inputs to the system have not been utilised properly.
- Poor awareness of policy makers of the importance of the informal family poultry sector on nutrition, poverty alleviation and empowerment of rural poor.

3.15 Conclusions and Proposals for Future Development

The poultry industry has today come to a standstill due to crises of world raw material and energy. It has a direct bearing on the smallholder poultry sector. Most farmers have suspended their operations due to losses. If this situation continues for a long time Sri Lanka will lose most of its smallholders. The poultry production in Sri Lanka is confined mainly to chicken rearing and other poultry like ducks, turkeys, quails, guinea fowls etc. are not reared in any significant numbers. A few years ago, DAPH introduced a programme – to support miscellaneous poultry production. A stock of breeding ducks and a few breeding turkeys were imported, but the programme did not continue.

Chicken rearing was, in early days mainly for eggs and meat, and came from culled layer birds. Poultry meat was then a luxury item. With the introduction of broilers in the 1980s, poultry meat became cheaper and today it is the number one meat contributing to the meat per capita consumption. Introduction of broiler birds not only made the poultry meat popular, but also separate layer production and broiler production into two clear sectors within the industry. The private sector involvement in the broiler sector was the main reason for the rapid expansion. Therefore, today a few large-scale producers or those operating buy back systems (contract growing) dominate the broiler sector. Smallholder contribution is little or not at all in the broiler sector.

The government involvement through statutory and regulatory support is sufficient for this sector to grow at an annual rate of about 5 percent over the past few years and more than 10 percent in the 90s. As the layer sector still remained largely with smallholders, policy decisions to support development and services are essential. It seems that the government has failed to some extent in this respect. Perhaps the government has not yet recognised the different scenarios taken place in the layer and broiler sectors, or it may not have heeded the voice of the private sector. Under these circumstances, the layer sector suffered badly and the progress in the past years was static.

Whatever the causes for ups and downs, today the two sub-sectors need different policy and development approaches for further improvement. Broiler industry – being commercialised – employs all modern technology needs to look for local inputs to reduce the cost of production. The cost of production of chicken is very much higher in Sri Lanka, compared to many countries in the world and particularly the countries in the region. If the present ban on import of chicken, due to Avian influenza is removed, there will be cheaper meat in the local market and local broiler production will collapse in no time.

The feed cost is the main factor contributing to the high cost of production as Sri Lanka imports more than 70 percent of raw materials required for broiler feeds. Maize and soya bean are the most important raw materials. Until recently, there was no proper programme for production of these materials locally, possibly due to lack of coordination between institutions involved with livestock production and crop production. Due to the new programme of maize cultivation introduced by the agriculture sector with direct involvement of the presidential task force, the situation is changing and the supply of maize for animal feeds production has doubled accordingly. Maize cultivation brings a very good income to farmers. If this trend continues, Sri Lanka will become self-sufficient in maize in a few years. However, active participation of the livestock sector should require to correcting some of the shortcomings in the programmes.

Post-harvest technologies, storage and quality of the maize had to be given priority with improved production. Parallel to maize production, soya bean production also has to be started, as it is equally important for sustainable animal feed production. If these two raw materials are available locally, the cost of production of chicken could be minimised and more competitive at the export market. Our poultry industry is well equipped with all modern technology – to prepare poultry meat – for export market compared to other countries in the region. As Sri Lanka is also free from many zoonotic diseases like “bird flue”, we should exploit this competitive advantage.

The recommendations for the layer sub-sector need to consider differently as layer production is still with the smallholder. At least, one-third of the table egg requirement today comes from village flocks, where average flock size is less than fifteen birds. The balance of two-third comes from large numbers of small intensive flocks and a few medium and very few large-scale farms. The smallholders still require government support in terms of disease control and other extension services. There is no single production model, which can be recommended for all regions in the country, except the Bangladesh Model. The latter with modifications may be tried in some areas, particularly in more backward areas as a means of poverty alleviation and self-employment. Social and economic standards in many parts of the country, is above the limits of the countries that have been successful with the Bangladesh Model.

Layer production in many developed countries has adopted intensive battery systems. But, they are now gradually making use of less intensive but modified cages due to pressure groups for animal welfare. European Union has developed a cage for their member countries, which is said to be more comfortable to birds. There are “welfare eggs” in many markets for a premium price and the demand is increasing steadily. The farms in Britain are required to get the RSPCA (Royal Society for Prevention of Cruelty to Animals) certification to produce welfare eggs. Similar trend can be observed in other countries too. Organic egg is another addition to this new range of products for the niche market. In Sri Lanka, there may be/are one or two farms producing organic eggs. The ‘designer egg’ concept is also becoming popular in many countries and similar trends can be seen in Sri Lanka as well. Today, there are farms that produce eggs enriched with Selenium, Omega-3-fatty acids etc. Sri Lanka smallholder layer sector has the capacity to explore these new avenues not only for the local market but also for the expanding export market. Technology used to produce ‘designer eggs’ is available and smallholder poultry producers can easily adopt most of them.

Eggs are also now used as a medium of treatment for some diseases and ailments. There is no argument that egg protein is the best protein in terms of its nutritional value to prevent nutritional deficiencies in all age groups. It is a medium of treating many chronic illnesses, especially in children. In Thailand, iodised egg is a substitute to iodised salts. Nutraceuticals concept tried widely is in experimental stage.

It is clear that the future of the layer industry will depend on the direction of today. There is potential for implementation of smallholder models in certain areas for poverty reduction and self-employment. At the same time, there is vast potential for production of specialised eggs for local and export market. Policy decisions and support services are essential to achieve these ends.

Family poultry sector (FPS) takes an important place in the Sri Lankan rural economy. The DAPH’s role is not only to assist the commercial sector but also to support the FPS to increase its contribution to 30 percent. The nutritious egg and chicken meat produced contributes to the enhancement of the family nutrition and income. Furthermore, malnutrition amongst the children in low income groups could be avoided. In addition to this, extra nutrition could reduce the so-called physical debility of adult agricultural workforce. Physical debility amongst adults could reduce the work output resulting in low production that contributes to poverty, as well as low growth in the agriculture sector. Furthermore, it is a source of income to unemployed rural women.

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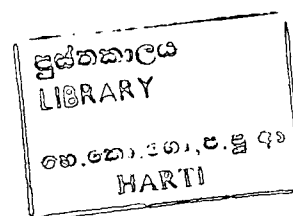
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Chapter 4

**SMALLHOLDER
DAIRY SECTOR**

ADN Chandrasiri



4.1 History of Dairy Industry in Sri Lanka

Compared to many milk producing countries in the world including India and Pakistan, the ancient Sri Lankans did not practise the pastoral farming system. Maintenance of large-scale dairy herds and use of large grazing lands were not normal practices. Therefore, the Sri Lankans were not traditional milk consumers. However, the ancient kings maintained royal dairies to get milk and milk products known as "*Pasgorasa*" for consumption. It is believed that the famous "White cattle" in the eastern province originated from these royal herds. Curdled milk was popularly known as curd especially in the southern region. It had been a practice to serve an additional shallow plate to put curd during lunch or dinner. Eating curd with rice is still a tradition in the southern region. Even today, curd with honey is a delicacy in the Sri Lankan diet.

Systematic dairying came into existence in Sri Lanka during colonial times. British superintendents who owned estate plantations in the up-country imported European breeds of dairy cattle for production of fresh milk for their consumption. The male calves born to these animals were given to the estate labourers who reared them and used for upgrading their cattle. The resulting generation had higher milk production and was very popular among the local dairy men. A synthetic population was gradually evolved by inter-se mating among these animals. As the ancestors of these animals had been shipped from the Cape of Good Hope in South Africa, the new synthetic breed was named "Cape" cattle. Unfortunately, there had not been a proper selection and breeding programme to maintain this valuable breed of dairy cattle. After establishment of the artificial insemination and natural breeding programmes using exotic bulls, gradual genetic deterioration of Cape cattle started. Presently, this breed is considered an extinct species.

Purely due to involvement of the Europeans and the estate workers, the up-country area fast developed into a milk-shed area. The government's involvement in dairy cattle breeding began with the establishment of Karagoda-Uyangoda and Polonnaruwa farms in 1935 and Ridiyagama farm in 1936 (Bandaranayaka, 1970). The first up-country farm was established in 1941 at Bopathalawa and later at Ambewela. The main objective of these farms was to supply quality breeding animals

to the dairy farmers. Subsequently, the state interest was diverted to other dry zone areas like Thamankaduwa, where a large extent of natural grazing lands available, were converted to the main milk producing areas in the 1950s. Several large-scale cattle farms with zebu and zebu crosses were also established in these areas to provide breeding stocks to the public. Around 30,000 cattle and buffalo were reared in Thamankaduwa complex (Asoka, 2008). Subsequently, cattle, buffalo and goat have been imported into the country and were maintained on the government farms as nucleus stock.

During the 1970s, there were 21 farms engaged in breeding cattle, buffalo and goat in the country. These farms were able to fulfil the national requirement of breeding animals. All these farms were handed to the Department of Animal Production and Health (DAPH), when it was created in 1978. These farms were handed over to the National Livestock Development Board (NLDB) during the early 90s. DAPH still maintains two large-scale goat breeding farms at Imbulandanda in Matale and at Thelahera, in Nikaweratiya. All other government owned livestock farms are now managed by NLDB.

The Mahaweli Authority of Sri Lanka (MASL) which was established under the Mahaweli Development Programme was also involved in the activities of dairy development. MASL established a few livestock farms. However, none of them exist today. Under the Accelerated Mahaweli Development Programme, most of the dry zone lands were utilised to grow cash crops neglecting the dairy sector, except in the Girandurukotte area (System C) where grazing lands were made available and milk marketing facilities were established.

4.2 World Milk Production

World milk production presently is around 676 million metric tons per annum (FAO, 2005/06). Europe and North America produce the most. But India is the world's highest milk producer with 80 million mt per annum. All the leading milk producers, except Australia and New Zealand produce milk for domestic consumption. Per capita consumption of milk in developed countries is approximately 244 kg, whereas in developing countries it is around 64 kg (FAO). In Sri Lanka, the per capita milk consumption is very much below this level and it is approximately 33 kg. Per capita milk consumption in some of the countries in the region is shown below.

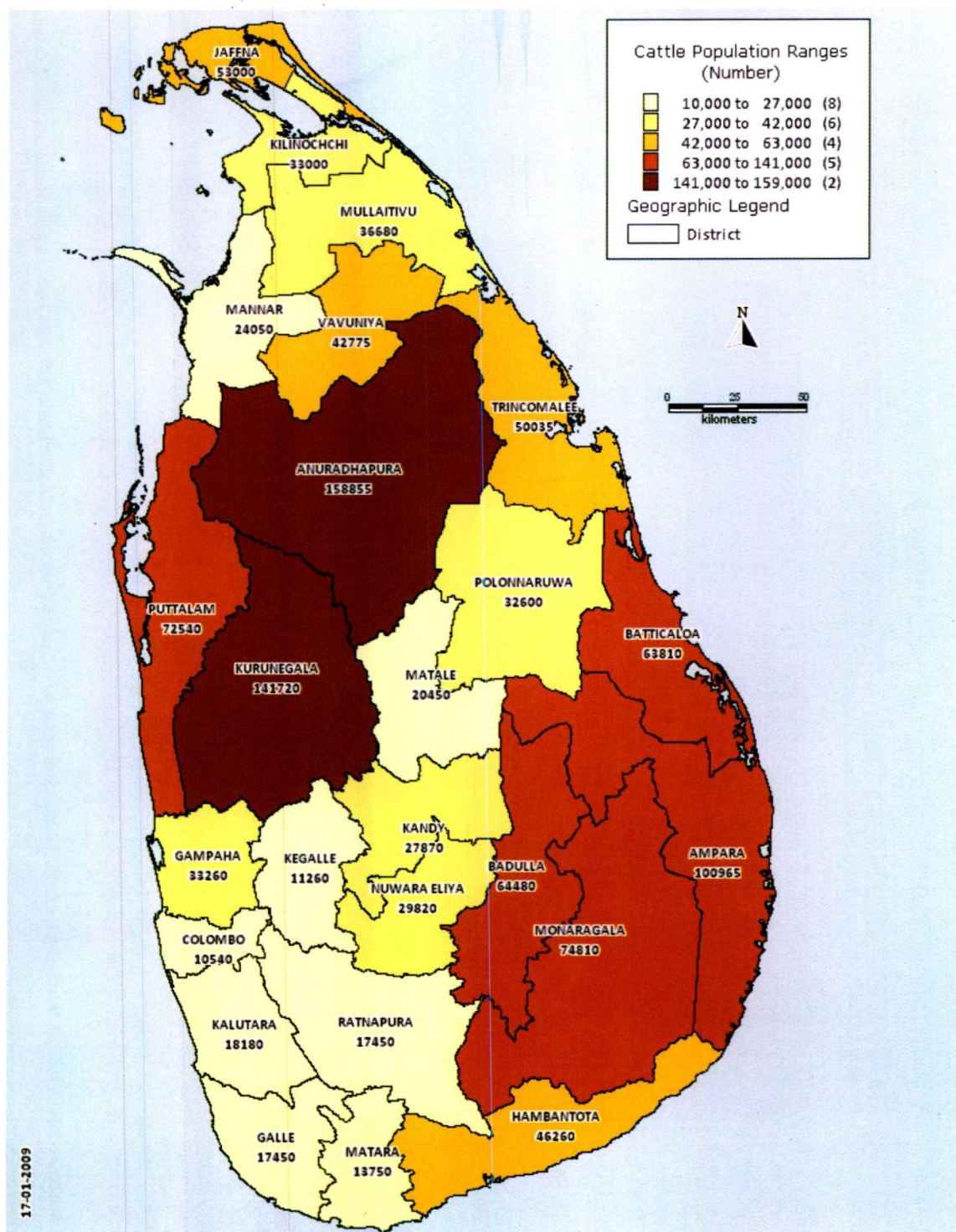
India	72 kg
Nepal	40 kg
Pakistan	180 kg

If ranked according to the present level of milk consumption, Sri Lanka could be identified as one of the lowest in the world. Due to the global economic crisis and increased food prices, the dairy industry in developed countries is badly affected. The prices of milk and milk products will continue to increase. As a result, exports will be limited and very expensive.

4.3 Present Position of Sri Lanka

The Sri Lankan society is predominantly agrarian. Although the country is moving towards industrialisation, the agricultural sector is still prominent and contributes a greater share to the national economy. During the past three decades, the government has been gradually withdrawing farm subsidies and especially other support services resulting in a decline in the employment in

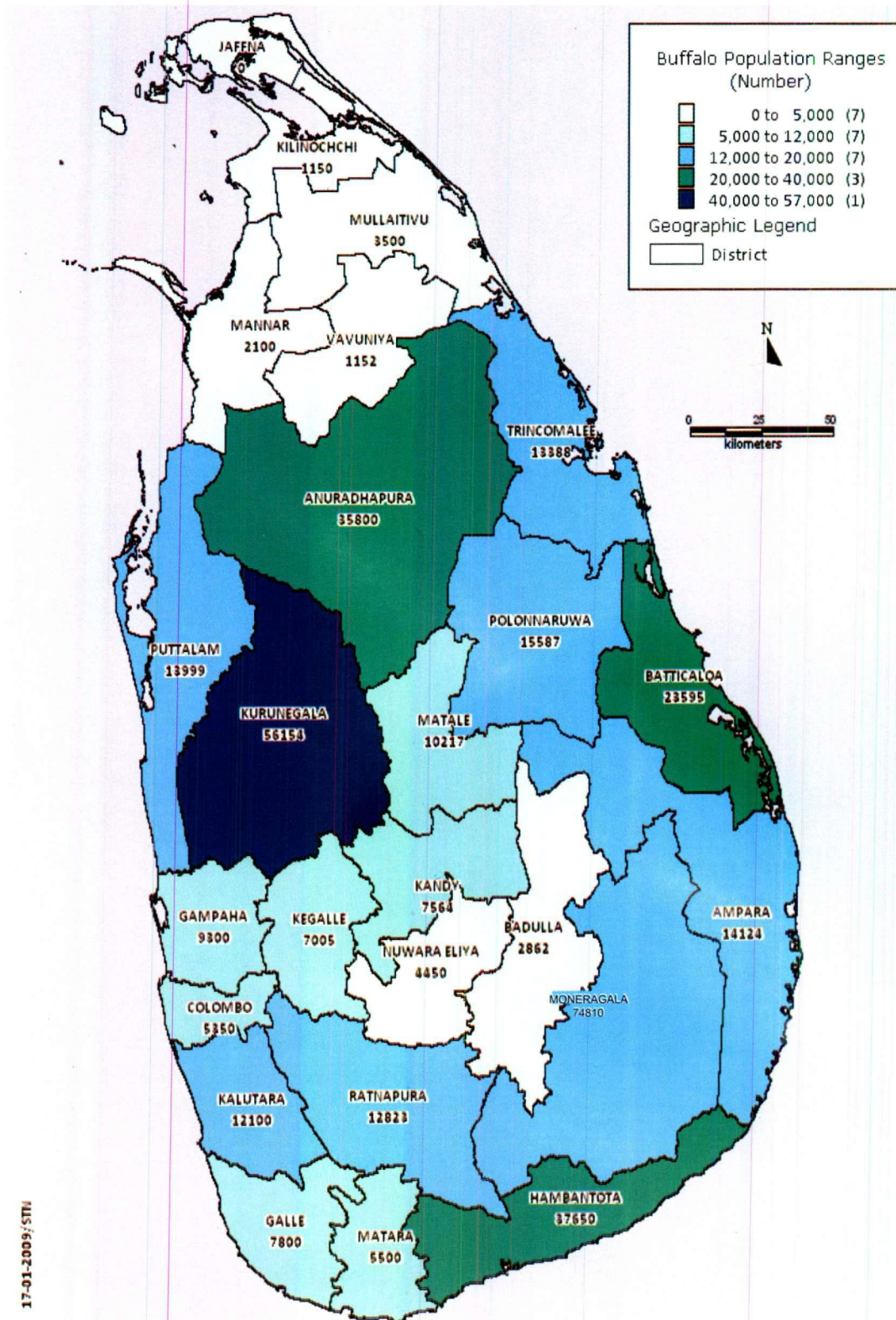
Map 4.1 : Distribution of cattle population by districts - 2008



Data Source: Department of Census and Statistics, Sri Lanka

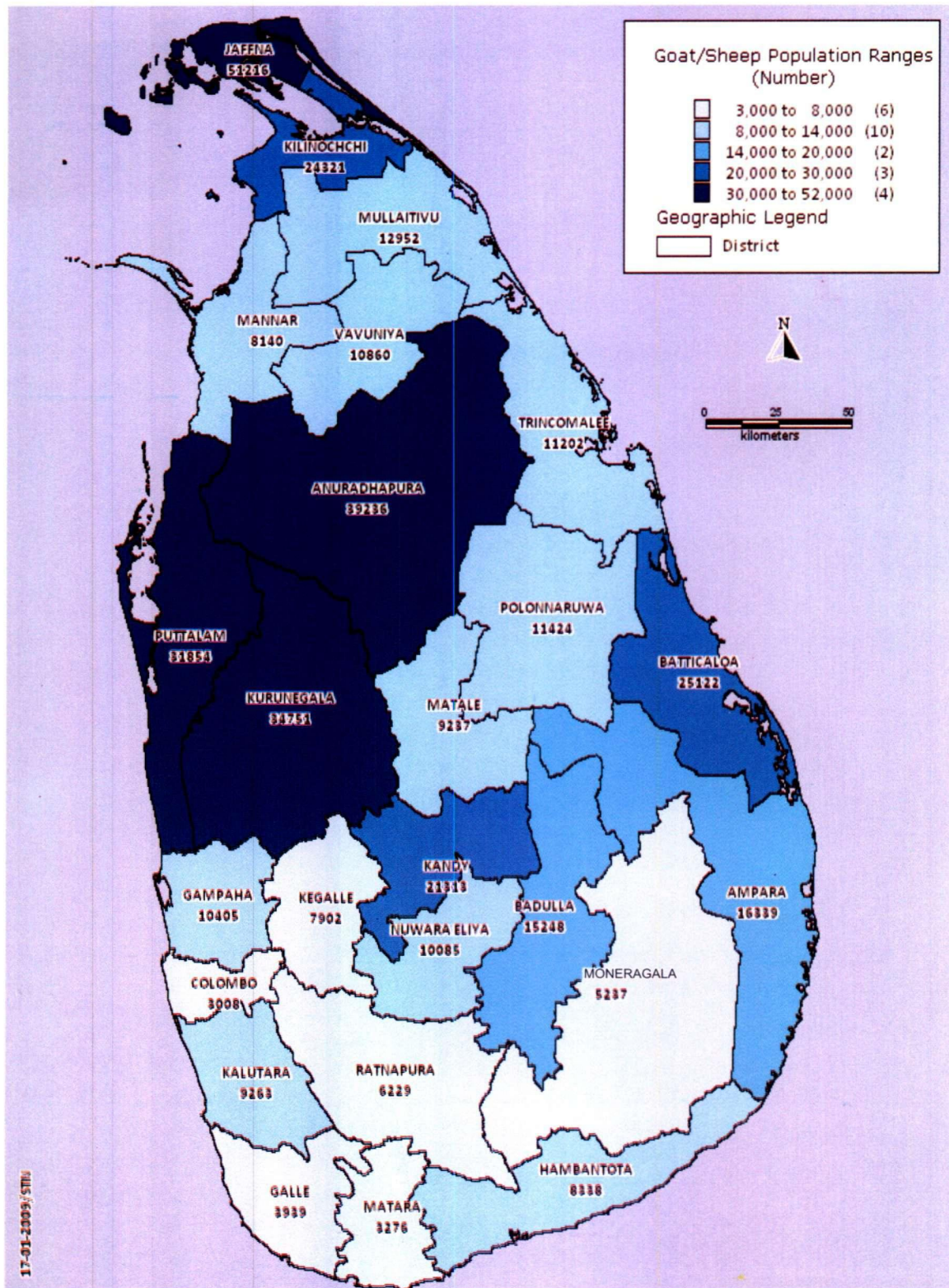
Map Produced by Databank Planning and Economics Division of DAPH

Map 4.2 : Distribution of buffalo population by districts - 2008



Data Source: Department of Census and Statistics, Sri Lanka
Map Produced by Databank Planning and Economics Division of DAPH

Map 4.3 : Distribution of goat/sheep population by districts - 2008



Data Source: Department of Census and Statistics, Sri Lanka
Map Produced by Databank Planning and Economics Division of DAPH

agriculture and its share of output. Therefore, its contribution to total GDP has been decreasing gradually. Table 4.1 shows how its contribution has declined over a period of three decades between 1975 and 2006.

Table 4.1: Contribution of the agriculture and livestock sector to national GDP

Year	Agriculture (%)	Livestock (%)
1975	28.0	5.6
1996	18.4	6.0
2006	16.8	6.5

Source: Anon 1996 & Central Bank 2006

This indicates that the country's national policy is moving towards industrialisation at the expense of food production. However, the contribution of livestock to GDP has increased from 5.6 (1975) to 6.5 percent (2006).

Although the statistics are not available, there are very few full-time dairy farmers in Sri Lanka. The rest of dairy farmers are part-time farmers who are mainly involved in other agricultural activities. Their primary occupation is not dairying (Abeywansa 2003a).

The dairy sector in Sri Lanka is important, not because it provides only employment to the rural poor but also fresh and processed milk products to the nation. Locally produced milk and milk products can be still considered one of the cheapest animal protein sources available in Sri Lanka.

There are three main categories in the Sri Lankan dairy sector: cattle; buffalo; and goat. This chapter generally deals with all the categories and special emphasis has been made in places where necessary. The government has strongly recommended the necessity of identifying the dairy development as a national responsibility and develop it as a prosperity-aimed and food security-based development programme at national level (National Programme for Dairy Development in Sri Lanka, 2005-2010).

Information on livestock population indicates that there is no significant change in cattle population during the past several decades. The buffalo population has decreased by more than 50 percent and the goat population has also decreased during the past 50 years (Table 4.2).

Table 4.2: Livestock population

Year	Cattle	Buffalo	Goat
1954*	1,277,310	706,644	563,912
1959*	1,486,009	780,784	487,365
1995**	1,704,100	763,900	591,100
2002**	1,510,400	642,600	453,100
2007***	1,222,990	318,920	405,800

Source: * Statistical Abstracts (1960), ** Sri Lanka Livestock Statistics (2002), *** Data Bank (2007), DAPH

More than 40 percent of the cattle, buffalo and goats are found in the dry zone of Sri Lanka and the second highest population is found in the dry intermediate zone (Table 4.3).

Table 4.3: Livestock population in the top two agro-ecological zones

Agro ecological zone	Cattle	Buffalo	Goat
Dry zone	706,800 (46.8%)	267,500 (41.6%)	202,400 (44.8%)
Dry intermediate zone	394,900 (26.1%)	225,800 (35.1%)	115,300 (25.5%)

Note: The values within parenthesis indicate the percentage of the total population

Source: *Sri Lanka Livestock Statistics (2002), Ministry of Agriculture and Livestock*

The dry zone consists of the Ampara, Anuradhapura, Kilinochchi, Baticaloa, Mannar, Mulativu, Polonnaruwa, Trincomalee, Vavuniya and Jaffna districts and Mahaweli H zone. The intermediate zone consists of the Hambantota, Kurunegala, Puttalam and Moneragala districts.

According to the definition given in the Census of Agriculture 2002, the smallholder sector covers all the holdings below 20 acres in extent. More than 96 percent of cattle, 98 percent of buffalo and 92 percent of goats are in the smallholder sector. There is therefore, a great potential for the development of the dairy industry among the smallholder farming community. Livestock population in the smallholder sector (only the top two districts recording the highest and second highest population) is shown in Table 4.4.

Table 4.4: Livestock population in the smallholder sector in the top two districts

District	Cattle	Buffalo	Goat
Kurunegala	167,297 (15.6%)	66,451 (24.0%)	n.a
Anuradhapura	144,019 (13.5%)	3623 (12.2%)	35417 (10.8%)
Jaffna	n.a.	n.a.	65,736 (20%)

Note: Figures in the parenthesis indicate the percentage of the total population)

Source: *Sri Lanka Livestock Statistics (2002), Ministry of Agriculture and Livestock*

The smallholder farms with the highest number of cattle (29.1 percent) and buffalo (36.2 percent) are in the Kurunegala and Anuradhapura districts (Map 4.1 & 4.2). The smallholder farms with the highest number of goats are in the Anuradhapura (10.8 percent) and Jaffna districts [(20 percent) see Map 4.3]. This information is useful for planning development programmes for the smallholder livestock sector. Although the smallholder sector has a large cattle and buffalo population at present, the productivity of the animals is low. The number of milch cows and their production in the smallholder sector is shown in Table 4.5.

Table 4.5: Number of milch cows and their production in the smallholder sector

Year	No of milch cows	% of the total population	Total production/day (lit.)	Avg. production /day/cow (lit)
1972	316,000	19.5	339,442.5	1.1
1982	423,000	24.9	641,377.5	1.5
1992	626,000	39.0	646,293.3	1.0
2002	648,000	42.9	738,423.3	1.1

Source: Based on Sri Lanka Livestock (2002), Smallholder Sector

The milch cow population in Sri Lanka in 2002 was 70.4 percent of the total population (Sri Lanka Livestock Statistics, 2002). However, the percentage of milch cows in the smallholder sector in the same year was 42.9 percent. This is an indication of the poor efficiency in milk production of the smallholder sector. The percentage of milch cows in the smallholder sector has gradually increased (from 19.5 to 42.9 percent) during the past three decades. But, the average daily milk production per cow did not change during the same period. This could be due to lack of proper selection and culling programmes at the grass-roots level.

As far as buffalo are concerned, the situation is very much similar to cattle. The number of milch buffalo and their production in the smallholder sector is shown in Table 4.6.

Table 4.6: Number of milch buffalo and their production in the smallholder sector

Year	No of milch cows	% of the total population	Total production/day (lit.)	Avg. production /day/cow (lit)
1972	98,000	13.1	11,614.5	1.2
1982	133,000	15.1	193,200.0	1.5
1992	277,000	30.9	236,926.7	0.9
2002	221,000	34.4	230,316.7	1.0

Source: Based on Sri Lanka Livestock Statistics - Smallholder Sector, 2002

In 2002, the percentage of milch buffalo in Sri Lanka was 57.9 (Sri Lanka Livestock Statistics, 2002). The percentage of milch buffalo in the smallholder sector was very much below the national figure (34.4 percent). This is again an indication of poor efficiency in the dairy buffalo production. Although the percentage of milch buffalo cows has increased from 13.1 to 34.4 percent, the average daily milk production per buffalo cow has not increased significantly for the past three decades. This is an indication of a serious management problem at the field level. This is a matter to be considered in any buffalo development programme.

During the past eight years, the islandwide annual milk production has gradually increased (approximately by 11.6 percent). Cow milk production has increased at an overall rate of 12.6 percent while the buffalo milk production has increased only by an overall rate of 6.7 percent as shown in Table 4.7.

Table 4.7: Annual milk production and collection in Sri Lanka (000' MT)

Year	Cow milk	Buffalo milk	Total milk production	Milk collection (formal)	% Collection
2000	151	30	181	93	51.4
2001	153	30	183	102	55.7
2002	153	30	183	92	50.3
2003	157	30	187	88	47.1
2004	160	31	191	99	51.8
2005	162	31	193	100	51.8
2006	165	32	197	109	55.3
2007	170	32	202	114	56.4

Source: Census and Statistics, 2007

Contribution of buffalo to national milk production is approximately 16 percent. Compared to the other countries in the region this is the lowest. In India, Pakistan and Nepal, the proportion of buffalo milk production is 57, 77 and 70 percent respectively (Sivali, 2008). Buffalo have big potential in the Sri Lankan dairy industry which is not fully utilised. The smallholder farms in the Anuradhapura and Kurunegala districts own 36 percent of the buffalo population. The promotion of dairy buffalo production in these districts will certainly increase the contribution to the national milk production and also help the smallholder farmers increase their income level.

According to Census and Statistics (2007), the per capita availability of milk has increased by 11 percent from 2000 to 2007. During the past seven years, the milk collection has increased by 22.6 percent (Table 4.7). On an average, only 52.5 percent of the total milk production has been collected through the formal milk collecting channels. The informal milk market is estimated at approximately 45 percent of the total production (Sivali, 2008). The rest of the milk produced (2.5 percent or approximately 5,050 metric tons of milk/year) in Sri Lanka is not collected by any organisation. In many rural areas, there is no milk collecting facility available and in some areas, only the morning milk is collected. This is a serious economic loss to the rural producers as well as to the nation.

The milk sold to the informal market is mainly consumed as fresh milk by people in urban and rural sectors. Therefore, these informal market channels should not be disturbed. Instead, they should also be promoted along with the formal milk market channels. The central province records the highest in milk collection (34.4 percent of the total collection), while the north-central province records the second highest (21 percent of the total collection). Table 4.8 indicates the milk collection in the central and north-central provinces.

Table 4.8: Milk collection in central and north central provinces

Province	Collecting agents	Districts	Amount collected (lit.)	% of the total collection
Central	MILCO NESTLE Co-op societies	Kandy Matale Nuwara Eliya	35,799,300	34.4
North-central	MILCO NESTLE Co-op societies	Anuradhapura Polonnaruwa	21,874,988	21

Source: *Sri Lanka Livestock Statistics, 2002, Ministry of Agriculture and Livestock*.

4.4 Milk Consumption Pattern

In Sri Lanka, the demand for milk and milk products is gradually increasing at around 5 percent annually (ANZDEC, 2007). It is very clear that the present production and collection of milk is not sufficient at all to meet the growing demand. If this situation is not addressed the imports will continue to increase. The expenditure on milk foods as a percentage of the total expenditure on food has increased from 2.4 percent in 1980 to 9.3 percent in 2006. But, the consumption of fresh milk shows a declining trend. The national average monthly household fresh milk consumption in 1980/81 was approximately 2.6 litres. In 2006/07, the national average monthly household fresh milk consumption was approximately 0.4 litre. Powdered milk is the major milk product consumed by Sri Lankans. Per capita consumption of powdered milk has increased from 1.59 kg in 1980 to 3.63 kg in 2006. Unfortunately, the production of powdered milk in the country was insufficient to meet the demand. In 2006, the local production was able to meet only 18.7 percent of the national demand. The country therefore, has to depend largely on imported powdered milk.

The value of milk and milk products imported to Sri Lanka during 2007 was approximately 19 billion rupees. Past records indicate that the quantity of imported milk and milk products has decreased gradually while the price has increased fourfold during the period 1990-2000. The consumption of milk in 2006 was 90 ml/person/day whereas the recommendation is 180 ml/person/day. Therefore, importation has had no significant impact on the per capita availability of milk (Chandrasiri *et al.*, 2003a). However, during the last two decades, particularly after the open economy in 1977, the imports have owned the major share in the dairy market (Table 4.9).

Table 4.9: Percentage share of the local production in the dairy sector

Year	Local production (%)	Imports (%)
1982	66	34
2002	43	57
2006	20	80

Source: *Sri Lanka Livestock Statistics, 1982, 2002, 2006, DAPH*

The above table indicates a rapid reduction in the local milk production during the past two decades. In 1982, the local milk production was 66 percent of the requirement, while the imports

were only 34 percent. In 2002, the local milk production had dropped to 43 percent, while the imports had increased to 57 percent. In 2006, local production was only 20 percent of the requirement and the rest was imported. The gap between the local milk production and the imports is widening. The recent developments in the dairy sector have failed to keep pace with the increasing demand for milk.

One of the surveys carried out in 2003 in the Galaha veterinary range – once the highest milk producing area in the Kandy district has shown very alarming results. During the period of 2001-2003 on an average farm the number of cows became reduced from 16 to 2 and, the amount of milk supplied too was reduced accordingly from the maximum of 60 to 12 litres per day (Kothalawala, 2004). This fact alone is a classical example of the fate of the dairy industry in most of the principal milk producing areas.

Recently, the cost of a metric ton of imported powdered milk was increased from 1800 to 5000 dollars and further increase is expected. As a consequence of this price hike, retail price of powdered milk was also increased. Price increase of 400 g packet during 2007 and 2008 is shown below.

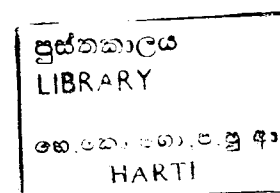
Table 4.10: Change of price of 400 g powdered milk in 2007 and 2008

Product	2007 (LKR)		2008 (LKR)		Overall price increase as %
	Jan	June	Jan	Dec	
Lakspray	154	180	26	260	68.8
Nespray	175	180	195	260	48.5
Anchor	164	180	275	260	58.5
Highland	140	160	255	230	64.3

Source: Derived from DAPH data base by ADN Chandrasiri, 2009

Within a year, the price of 400 g packet of powdered milk increased by 48-68 percent. With increased prices, one expected the consumers to turn to fresh milk which is cheaper. But, this did not happen. Instead, the consumers looked for cheaper brands of powdered milk. Under these circumstances, the future of powdered milk consumption will continue.

In order to avoid supply shortage and protect the consumers, the government imposed a very low tariff (5 percent) on imported powdered milk. Though the reduction of duty on importing powdered milk was bad news for Sri Lankan milk producers, the price increase was a good opportunity for them to establish a stable position in the local market. If the price differed greatly between the imported and the locally made powdered milk, the local products would be favoured mostly. Unfortunately, it did not become a reality. Instead, the price of the locally produced powdered milk (Highland) too increased parallel to imported brands of powdered milk. As there were no taxes on imports involved in the locally produced powdered milk, this price increase was attributed to other reasons which will not be discussed here. If we are to promote locally produced milk and milk products, they should be made available at affordable prices.



4.5 Dairy Production Systems

4.5.1 Cattle and buffalo

Cattle and buffalo represent the major part of livestock population in Sri Lanka. According to climatic factors and resource distribution, the systems of rearing of these two animals vary widely. The predominant cattle and buffalo production systems are listed below.

1. Plantation crop-based dairy cattle farming system (Estate system)
2. Kandyan home garden system in the mid-country (Mid-country smallholder system)
3. Coconut-based cattle and buffalo farming system (Coconut triangle system)
4. Northern and southern dry zone extensive system
5. Off-farm income-based peri-urban dairy farming system
6. Smallholder buffalo system
7. Vegetable-based intensive dairy farming system (Jaffna peninsula system)
8. Irrigated rice-based system

For detailed information of predominant milk production systems practised in Sri Lanka please refer to Chandrasiri (2004).

4.5.2 Goat

According to the resource base in different areas of the country, there are three goat farming systems (Chandrasiri 2004).

1. Rainfed highland crop-based goat farming system (Extensive)
2. Crop-based goat farming system (Semi intensive)
3. Intensive goat farming system (Estate system)

Figure 4.1: Extensive management system of local goats



4.6 Dairy Management Systems

Depending on the availability of the resources, the cattle, buffalo and goat farming can be broadly categorised into three management systems: intensive; semi-intensive; and extensive management.

4.6.1 Intensive Management System

Mainly the pure or crossbreeds of European type animals are kept indoors and provided with cut grass. They are supplemented by concentrated feeds and mineral mixtures. The majority of farmers depend on formulated concentrates available in the market, while a few farmers provide self-mixed concentrated feeds to their animals. The most common self-mixed concentrated mixture is the rice bran and coconut *poonac*. Common salt and di-calcium phosphate are the most common mineral sources used by farmers. By-products from mills such as broken rice, dhal, omi, beer pulp are also used depending on the availability. The average production level of an intensively managed herd is 15 lit/cow/day. The most common breeding method for cattle is AI while the buffalo and goat are either artificially or naturally bred.

4.6.2 Semi-intensive Management System

Animals are sent out for grazing or tethered during day time. For tethered animals, changing the tying position 2-3 times is the normal practice and the animals are usually given water in a bucket. In the evening, animals are brought back and the concentrated and mineral mixtures are given. Some animals are provided with cut grass or tree fodder during night. Most of the animals are provided with sheds during night. Very often the animals are milked twice. The average milk production is 8-10 lit/cow/day. Calves are also sent with the mothers if they are not milked in the afternoon. The majority of them are crosses of Temperate (Friesian/ Jersey or Ayrshire) and Zebu (Sahiwal) types.

Figure 4.2: Sahiwal cows



Figure 4.3: Sahiwal Jersey cow



4.6.3 Extensive Management System

This is a low input management system. Normally, they are large herds. The animals are released to crown land, tank beds or scrublands for grazing and driven them back in the evening. Very often animals are not fed with concentrates or minerals. They are not provided with shelter at night. Some times, the animals are milked once a day or not milked at all. The average milk production is 2-3 lit/cow/day. Most of them are either Lankan or Zebu types.

Figure 4.4: Extensive management system of cattle



4.7 Projected Future of the Dairy Sector

The human population growth and the increased per capita income can be considered the two main causes for the increased demand for livestock products including milk and milk products. Sri Lankan economy is characterised by an increasing GDP per capita. In 1998, the per capita income was 804. In 2006, it was increased to 1,355 (Central Bank Annual Report of Sri Lanka 2006). With increased income levels of the people, the food habits too have changed and, as a result the demand for animal food has gradually increased. In the past, the income growth per capita was relatively low averaging 2 percent per annum. However, since 1990, the economic growth has averaged between 4-5 percent annually. Based on the expenditure elasticity for milk and milk products developed by Ibrahim *et al.*, (2003), the overall expenditure elasticity for milk products is 1.17 which is relatively elastic since it is greater than 1. This suggests that increasing household income by 1 percent, would lead to more than 1 percent increase in expenditure on dairy products. Rural expenditure elasticity was higher than urban elasticity (1.31 and 0.83 respectively) Ibrahim *et al.*, (2003). Higher elasticity level in the rural sector can be due to lower income levels of the rural community. Therefore, with a satisfied economic growth (4 percent or more/ year), the demand for liquid milk and other milk products will also be increased both in the urban and rural sectors. Milk as an essential food item the demand will increase for a while and then remains constant afterwards. At 4 percent growth rate of GDP, the demand for milk and milk products in 2010 will increase to 1.4 million mt. This is slightly over 100 percent compared to the demand in 1997 which was 698,000 metric tons. This will be a golden opportunity for local milk producers to increase their production and sales.

It has been proposed to launch an aggressive promotional campaign to popularise consumption of fresh milk (National Programme, 2005-2010). It would be the best solution to improve the dairy industry in Sri Lanka. It has to be done carefully by maintaining both the hygienic and nutritional quality of milk. At the same time, it should reach the consumer in an acceptable form at an affordable price (Jorgen and Lusato, 2007). When people do not cultivate the habit of fresh milk drinking the question raised is whether it is worth spending money on promotional programmes. More propaganda and time is needed to instil it in them.

If the people prefer to consume powdered milk, it should be made available at an affordable price rather than forcing them to consume fresh milk. Therefore, making investments on improving the quality of locally produced powdered milk at the MILCO factory of Ambewela would be more meaningful.

There is another aspect of the consumption of fresh milk. It is considered a sign of poverty in certain countries. Processed or value-added milk and milk products are expensive and poor people cannot afford it. Due to poverty, more Kenyans consume raw milk (<http://www.cityfarmer>). Kenya produces 3.078 billions of litres of milk annually, of which only 200 millions of litres are processed. Due to ineffective marketing systems for milk and other dairy products by the government, many unofficial milk marketing outlets have been established by dairy farmers to cater to the increased demand. In Kenya, consumer preference for raw milk over processed milk is almost 100 percent even in the areas far from farming districts.

Knowledge about the strengths, weaknesses, opportunities and threats of the present small-scale dairy industry in Sri Lanka is of great importance to implementation of a sustainable

development programme.

4.8 Strengths of the Present Small-scale Dairy Industry

Availability of a large number of animals of different genotypes and a large number of farmers engaged in the smallholder dairy production system can be considered the biggest strength of this sector. Slight increase in milk production will have a significant effect on the production of national level. Although the animals are of low genetic merit, the large number of animals and people in the smallholder sector represent a huge potential for increasing the total production of milk and generating employment (Jorgen and Lusato, 2007). The large population of animals with higher genetic variation can be used as the base population for good breeding. The non-descript and indigenous types of cattle, buffalo and goat available can be conserved (In-situ and/or Ex-situ) and utilised for sustainable breed improvement programme. These indigenous types of animals possess some important characters, which can be incorporated into a programme of breed improvement. Heat resistance, resistance to common parasites, resistance to economically important major diseases, ability to thrive well under poor quality roughages, ability to walk long distance to find food are some of the important characters. In addition, these animals act as live banks for smallholder farmers. There is a niche market for these animals. When the cattle keepers are in urgent need of money, it is a common practice to sell a few animals. Due to a large number of farmers involved in the small-scale dairy sector, they can form farmer-based organisations. They too can provide a good base for participatory action research programmes and other development programmes. Small-scale dairy enterprises are very important when one considers their number and contribution to the economic development of the country.

4.9 Weaknesses of the Present System

At present, nearly 125,000 artificial inseminations are carried out annually and approximately 20,000 female calves are born each year. As there is no proper animal registration system and proper market place for these crossbred progeny, the most in the surplus end up in slaughterhouses. This may be one of the reasons for severe shortage of quality bred animals.

Many of smallholder dairy farmers operate individually and they are not organised properly. Therefore, they are not influential and unable to find solutions jointly to their problems. These fragmented and voiceless smallholder farmers have been handicapped by bargaining power (National Programme, 2005-2010). This is different from the poultry producers in Sri Lanka where they have organised themselves islandwide under the umbrella of "The All Island Poultry Association".

Low level of education among the smallholder farming community can be considered one of the weaknesses. The majority of cattle farmers are not educated well. In the western province, 80 percent of the household heads who rear cattle have only primary education (Abeyratne *et al.*, 2003). Due to this reason, they have poor or little knowledge about the scientific aspects of the management systems they practise. However, the experience some of them have inherited from their ancestors cannot be underestimated. Farmer education has a significant impact on solving many of the field level problems efficiently (Chandrasiri *et al.*, 2003b). Updating the technical knowledge of the extension staff is a prerequisite of the farmer education programme.

Lack of scale investors can also be considered an inherent structural weakness of the dairy sector. Irrespective of the scale of production, the maintenance of proper records is essential in any type of commercial livestock enterprises. Unfortunately, many dairy farmers do not maintain records as such on animals or farm activities. Lack of a permanent animal-ID system is a serious drawback. Animal-ID system is requirement for herd-fertility management and AI follow-up activities.

Lack of proper marketing system is also another constraint on the small-scale dairy farmers in many rural areas. In many potential areas, evening milk is not collected causing a serious economic loss to the farmer. The farmers lose approximately 40 percent of their income by not selling evening milk.

Although the dairy farming has been practised for many decades in Sri Lanka, there is no freely available different types of concentrate feeds for different types of animals; especially, calf meal and calf starter in the market. Younger calves, stud bulls and milking cows are fed with the same type of dairy ration.

Although the role of middlemen is required in the market chain – where sales and marketing are concerned, their involvement in the dairy sector activities has created many problems to dairy farmers and consumers. Middlemen mainly collect milk, and distribute animal feeds. Exploitation of farmers by middlemen is another serious issue noticed in many places. The farm gate milk price is one of the classical examples for this. Farmers get very little or some times nothing when collecting agencies increase the farm gate price. Very often the increased amount is grabbed by the middlemen involved.

Sri Lanka being a tropical country with very high plant biodiversity, a large feed resource base for cattle, buffalo and goat is available throughout the year. In Sri Lanka, 12,000 square kilometres out of the total land area of 65,610 square kilometres are under grasslands (natural or established). Unfortunately, this feed resource base is not efficiently utilised in the dairy sector. Most animals in smallholder operations are underfed. Hence, the productivity of these herds is low, thus leading to a serious economic loss.

Recent studies have identified that inadequate farm gate price, payment not based on the quality of milk, low keeping quality of milk, inefficiency of the milk collecting system, unavailability of good quality roughages, higher price of cattle feed, scarcity of good quality breeding cows, reduction of grazing lands are the major problems related to the dairy industry (Chandrasiri *et al.*, 2003a). Absence of meaningful income from dairying is one of the main reasons of abandoning dairy industry and lack of involvement of youths (National Programme 2005-2010). Frequent rejection of milk is one of the main reasons for preventing many dairy farmers to supply the milk to formal market channels. Longer storage time without refrigeration can be considered major reason for rejections at the collecting points. A study carried out in Kandy has shown that milk could be kept only for two hours at 27 degrees centigrade without deterioration of quality (Kodikara, 1987).

As milk contains approximately 87 percent of water and all the nutrients required for bacterial growth, it is highly perishable. Therefore, more attention has to be given to the public health aspect of the milk production, collection, storage and distribution.

4.10 Opportunities of the Smallholder Dairy Sector

Small-scale dairying requires low capital. This is a good opportunity in any type of business enterprise. Although not utilised properly, availability of a good natural feed resource base is a great opportunity. Many cattle in semi-urban and rural areas feed on highway and railway side grasses. The number of farmers who cultivate small plots of improved grasses and fodder in their own lands are also gradually increasing. In addition to the feed resources mentioned above, quite a lot of agricultural by-products (rice bran, rice polish, paddy straw, coconut *poonac*, jak seeds) and industrial wastes (canary waste, beer pulp, sugarcane tops and sugar mill wastes, molasses, warehouse wastes) can also be used as animal feeds. Compared to other countries in the region, incidences of the most common cattle, buffalo and goat diseases are low in Sri Lanka. Due to DAPH's efficient programmes of disease prevention and control, all fatal diseases of livestock are presently under control in Sri Lanka. Another opportunity of the small-scale dairying in Sri Lanka is the possibility of giving up the dairy farming easily. As the initial expenditure and use of machinery and other expensive equipment are low, the farmers can easily give up dairying if they have any problem. Gradually increasing demands for animal products and increasing consumption levels can also be considered opportunities in the dairy sector. Although the present AI coverage is very low, there is a great potential for promoting AI service. The latter is the most reliable and efficient method of breeding to upgrade local animals.

4.11 Threats of the Small-scale Dairy Sector

To rear cattle, buffalo and goat, a large area of land is required for grazing. Pasture and fodder available in private lands, crown lands, scrublands, tank beds, and paddy fields are the other common source of roughages. Many dairy farmers depend on roadside grass, while others use poor quality roughages available on large estates belonging to others. There is a trend in decreasing availability of land for livestock due to rapid development programmes and housing schemes etc. Increasing degradability of land is another problem which affects pastures and fodder production. Due to emerging zoonotic diseases and problems associated with environmental pollution, the farmers in urban areas have been asked either to close down or shift their farms to other places. Non-availability of quality breeding animals is another major problem to the livestock farmers. Non-availability of family labour/ hired labour generally, affects the small-scale dairy farmers. The younger generation prefers white collar jobs and they are not willing to take over farming from parents. Many livestock operations are economically not viable due to high feed and other costs. Up to recent times, the AI service was very popular in the Kandy and Nuwara Eliya districts. The latest information indicates that the targets and achievements of the AI service in the Kandy district have decreased by 9.2 percent (Kotalawala, 2004). The main reason for this drop could be due to reduction of the number of cows. Another reason may be the loss of faith in AI service. High price of concentrate feeds and low price of farm gate milk are the most common problems of the dairy farmers. Theft of cattle and buffalo is another major problem they have (Abeywansa, 2003b).

There had been many development programmes (both local and foreign funded) in the past to support the small-scale farmers. Table 4.11 below provides information related to projects.

Table 4.11: Past development projects to support small-scale farmers

	Project	Donor Agency	Duration
1.	Sri Lanka/Asian Development Bank (SL/ADB) Livestock Development Project	ADB	1983-1991
2.	Sri Lanka German Goat Development Project	FRG(GTZ)	1982-1990
3.	Sri Lanka Netherlands Livestock Development Project	Netherlands Government	1986-1991
4.	Sri Lanka CIDA Poultry Development Project	Canadian Government	1984-1990
5.	Livestock Planning Project	FRG(GTZ)	1983-1992
6.	Agriculture Rehabilitation Project	ADB/FRG	1989-1992
7.	Sri Lanka Agriculture Research Project	World Bank	1987-1996
8.	Smallholder Integrated Livestock Extension Project (SILEP)	FRG (GTZ)	1992-1994
9.	Artificial Insemination Incentive Scheme	Sri Lankan Government	1992-1994
10.	Heifer Calf Rearing Scheme	Sri Lankan Government	1992-1994
11.	Minipe/Nagadeepa Irrigation Rehabilitation Project	OECD of Japan	1990-1995
12.	Livestock Disease Control Programme	Sri Lankan Government	1992
13.	Sri Lanka Asian Development Bank Livestock	ADB	1992

Above information indicates that the government has implemented many development programmes in the past to promote the dairy industry in Sri Lanka. However, the impact of most of these development programmes on the end-users is not very satisfactory. The lack of a proper follow-up programme after completion of the project is a serious drawback of all these projects. Although there are no reports available on the follow-up activities of the projects, it seems that few numbers of small-scale dairy farmers were able to get targeted benefits of the projects. The author is of the opinion that the project planners, implementing agencies and the beneficiaries should collectively take the responsibility for successes and failures of the projects, which have been implemented so far.

4.12 Government Policies and Programmes

There are many policies and programmes for the development of the dairy sector. The main strategy for the development of dairy industry in Sri Lanka was the establishment of the National Milk Board in 1957 to facilitate milk collection, processing and marketing. Prior to liberalisation of the economy, the import of dairy products to Sri Lanka was relatively small and promotion of powdered milk was also not very aggressive. But this situation completely changed after the open economy of 1977 (Daniel, 2008). Free flow of powdered milk into the country changed the

composition of domestic milk market. Before trade liberalisation, the share of percentage of the local production in the dairy sector was 63 percent and this pattern rapidly started to change. Change in the share of percentage of the domestic milk production after the 1970s is shown in Table 4.9.

Sri Lanka Oil & Fats Corporation, which was established in the early 60s, was the leading animal feed manufacturer in Sri Lanka. Local feed ingredients such as rubber seeds and coconut residues were used to produce animal feeds. However, after closure of the Oil & Fats Corporation in 1992, large-scale utilisation of locally available feed ingredients for animal feeds was stopped and the manufacturers had to depend mainly on imported feed ingredients.

Establishment of DAPH in 1978 was a turning point. Prior to this, the animal production and health division functioned under the Department of Agriculture. At present, the Central DAPH and the provincial departments of animal production and health with their veterinary and field extension staff are the primary organisations responsible for dairy development in Sri Lanka.

Another important policy decision taken by the government was the banning of slaughter of female cattle and buffalo in 1987, to avoid decrease in the national herd. But, it did not serve the purpose. The Animals Act No 29 of 1958 was amended several times and the recent amendment was in 2008 to avoid illicit transport and slaughter of female cattle and buffalo. The penalty for slaughtering of female cattle or buffalo has been further increased to 50,000 rupees and/or a term of three-year imprisonment.

The government has implemented cattle insurance scheme, pasture subsidy scheme and several credit programmes to encourage dairy farming. However, the available information indicates that the utilisation of credit under above schemes has been very low and the impact was minimal. The latest credit scheme was introduced in 2008 by the Central Bank of Sri Lanka under which loans are given up to 300 million rupees at a low rate of interest.

Since 1990s, several tax concessions for capital goods for dairy production have been effective. Similarly, value-added tax (VAT) on locally manufactured dairy products was removed in 2008 (Daniel, 2008). In addition, a cess on imported powdered milk was increased from 5 LKR/kg to 15 LKR/kg in 2008.

The government has provided funds for special programmes such as artificial insemination (AI), heifer calf rearing (HCR), livestock breeding project (LBP), disease control and prevention programme, livestock research programme, dairy village programme, liquid milk promotion programme and formation of breeder associations. The AI programme implemented more than 70 years ago, has not shown a significant improvement in genetic upgrading of cattle, buffalo and goats (Present AI coverage is 20 percent). The HCR programme commenced in 2008 was one of the most popular development programmes among smallholder dairy farmers. Unfortunately this programme had to be discontinued later, due to lack of funds

The present pricing of raw milk depends on the solid non fat (SNF) content and the fat percentage of the milk. The government-owned MILCO determines the price with the concurrence of the minister responsible for livestock development. The actual cost of production of milk has never been taken into consideration and thus the producers do not get a fair price for the milk produced.

At present, there are many laws and legislations pertaining to the dairy sector in Sri Lanka. It is regarded as a priority area for public sector investment in livestock development. According to National Livestock Development Policy and Strategies (2006), the government policy for dairy sub-sector can be summarised as:

- a. Promotion of liquid milk market;
- b. Invest on genetic upgrading of native stocks of cattle, buffalo and goat;
- c. Facilitate transformation of the present subsistence level of dairy production into a viable commercially oriented activity;
- d. Provide an environment conducive for the dairy industry through appropriate import and fiscal policies;
- e. Allowing market forces to govern the pricing mechanism of milk;
- f. Facilitating medium- and large-scale dairy enterprises; and
- g. Facilitating of the participation of dairy farmers and processors in the value chain of dairy products.

The government policy on agriculture is enhancing the income and living conditions of farmers through increasing productivity and other improvements, while ensuring food security in the country and availability of safe food products to consumers (Central Bank Annual Report, 2006).

The imported milk and milk products have already captured the elite market in Sri Lanka adversely affecting the local milk market. The government will revise the value-added tax in favour of the domestic dairy industry to protect dairy farmers against unhealthy competition of imported milk products (National Programme 2005-2010). However, this alone will not be effective unless an efficient quality control measures are imposed on the local products. In addition, there should be an efficient network of milk collecting, processing and distribution of the local milk and milk products throughout the country. There should be a balance between the government controlled measures and the availability of local milk in the market. If not mere imposition of taxes on imported milk and milk products alone will not protect the dairy industry. If we are to promote consumption of liquid milk, the milk should be freely available at an affordable price. During recent price increase of imported powdered milk, there was a severe shortage of locally produced powdered milk in the local market. If a local product of quality powdered milk was available at an affordable price, then the consumers would have changed to that brand without hesitation. In the absence of such a product, consumers had no alternative but the imported powdered milk.

Value addition is considered another effective method of increasing the income of the farmer. In order to provide technical expertise and training facilities on value addition, it has been proposed to establish the National Dairy Technology Institute (National Programme 2005-2010).

The farmer empowerment programme commenced in 2005, was aimed at establishing 3,000 farmer managed societies (National Programme 2005-2010). The objective was to ensure active farmer participation in all the aspects of the production-marketing chain.

The government will also recognise the smallholder dairy farmers as the most important stakeholder in the domestic dairy industry. But, the long-term policy should be to creatively transition from dispersed smallholder production to more concentrated, commercially oriented and controlled

production systems. This has happened in the poultry sector, where most of the smallholders have become medium-scale commercial entrepreneurs.

Another government programme is to promote medium-scale investors in production, processing and marketing aspects while safeguarding the interests of the small-scale dairy farmers (National Programme 2005-2010). The small-scale dairy farmers have an important role to play at the initial stage. If the productivity of the individual farm units are improved the smallholder dairy sector will be the ideal system to achieve the government objective of 50 percent self-sufficiency in milk by 2015.

In order to reduce the cost of production, an animal feed resources development programme has been proposed (National Programme 2005-2010). This includes establishment and management of 5,000 acres of natural *Gunea A* grass and 3,000 acres of natural grasslands, cultivation of 4,000 acres of improved fodder, planting and management of 28 million fodder trees, annual utilisation of 90,000 metric tons of crop residues, establishment of 12 medium-scale animal feed mills, three factories for production of mineral blocks and three factories for oil extraction.

The government will make necessary legal documents to safeguard long-term interest of the dairy industry by ensuring strict reservation of state livestock farms for the purpose of breeding cattle, buffalo and goat (National Programme 2005-2010). Joint ventures between the government and other parties interested to fulfil this objective would be more effective than allowing the government organisation only to maintain these farms. The severe demand for quality breeding stock in the country could have been met easily if these farms were managed properly. Already, the Ministry of Livestock Development has been approached with several project proposals for joint ventures with National Livestock Development Board (NLDB).

In addition, a special animal breeding programme was proposed to overcome the scarcity of quality breeding animals (National Programme 2005-2010). It was initiated in view of production of 30,000 upgraded heifer calves annually through the artificial insemination. However, the sustainability of this programme depends on the continuous availability of funds from the government.

NLDB to produce 6,000 upgraded heifer calves and promote private sector breeding farms to produce 10,000 heifer calves annually, are the other important objectives of this programme.

Animal breeding policy guideline which is in operation at present has been formulated by taking the management systems prevailing in different agro-climatic regions into consideration. Simplicity of the breeding strategy and reducing the number of breeds were among other aspects considered, when preparing the breeding policy guidelines. The breeding objectives, policies, and strategies for cattle, buffalo and goat under different management systems are shown in Table 4.12. For detailed information, the National Breeding Policy of 1994 can be referred to.

Table 4.12: Breeding objective, policy and strategy for cattle, buffalo and goat under different systems

Type of animal	Breeding objective	Breeding policy	Breeding strategy	
			Intensive management	Extensive management
Cattle	To produce a dairy type animal	Grading up using exotic type of cattle	Continuous upgrading using temperate breeds.	Grading up to 50% exotic level using temperate breeds.
	To produce a dairy dominated dual purpose (dairy/draught) animal		Grading up to 50% exotic level using temperate breeds.	Grading up to 100% level using Zebu breed.
Buffalo	Produce a dual purpose (draught/ dairy) buffalo	Grading up using exotic breeds of buffalo	Grading up to pure exotic level using recommended breeds.	Grading up to 50% exotic level using recommended breeds.
Goat	Produce a dairy type goat	Grading up to recommended exotic level	Continuous upgrading using recommended exotic breeds.	
	Produce a dual purpose (milk and meat) goat		Grading up to pure exotic level using recommended breeds	Grading up to 50% exotic level using recommended breeds

Source: Adapted from the National Breeding Policy Guidelines for Livestock (1994)

The government has developed a strategy for disease control in the dairy sector (National Programme 2005-2010). It will strengthen the disease surveillance systems and disease diagnostic facilities already available. Specific disease control programmes against Mastitis, Haemorrhagic Septicaemia (HS), Foot and Mouth Disease (FMD), Black Quarter (BQ) and Brucellosis will be conducted.

4.13 What to be done?

The current state of the dairy industry shows that the policies adopted so far have not been able to make any significant impact on the dairy sector (Daniel, 2008). As the majority of the dairy farmers belong to the smallholder sector, new small-producer-friendly approaches are needed to change the status quo.

As far as increased milk production is concerned, the number of animals, genetic make-up of animals and their productivity are very important. These three components have to be given equal priority in order to achieve self-sufficiency in milk. It is of no use having a large number of animals with low production. If the main objective is milk production, the efficiency is much more important than the number of animals on a farm. The maximum number of animals on a farm should be determined on the basis of available feed resource base to avoid underfeeding them. Therefore, maintaining a balance between the number of animals and available feed resource base is a very important management tool.

There are five main aspects to consider in an efficient dairy production system. The genetic improvement programme coupled with a better feeding, healthcare, marketing and efficient extension service would be ideal for our system. All these five aspects are equally important. Any improvement of one or two aspects without paying due consideration to others, will not give the desired results. This was one of the main reasons for the failure in many development programmes in the past. Importance of each aspect is described below.

4.13.1 Breeding

The national coverage of artificial insemination (AI) in Sri Lanka is approximately 18 percent of the total breedable cow population. The AI service in buffalo and goat is negligible. AI performance of cattle, buffalo and goats during the past four years is given in Table 4.13.

Table 4.13: Performance of AI in cattle, buffalo and goat

Year	Cattle	Buffalo	Goat
2004	131459	1431	2765
2005	142220	2677	3149
2006	152876	3412	2995
2007	157200	3046	4207

Source: Division of Animal Breeding, DAPH

During the past four years, cattle AI has been increased by only 19.6 percent while buffalo AIs has been increased by 112.8 percent. Low rate of increase in cattle AI has to be investigated. Compared to cattle, management of buffalo is easier and buffalo milk can be sold at a higher price. Therefore, the demand for improved buffalo is high. This may be the reason for higher rate of increase in buffalo AIs. The rate of increase in goat AI is 52.2 percent. As there is a niche market for goat meat and milk, the demand for improved animals has gone up and as a result, goat AI has gone up. However, there is a vast potential for improvement of AI service in cattle, buffalo and goat.

Although 82 percent of breedable cow population is still served by the stud bulls, the majority of these bulls are not selected properly, thus not contributing to higher milk production. Only few hundreds of selected bull calves are issued for natural breeding annually. Under such situation, improvement in milk production cannot be expected at the field level.

The AI service which has been carried out in Sri Lanka for more than 70 years has produced thousands of crossbred cattle and buffalo throughout the country. But the coverage is low. These animals are well adapted to the local environment and management conditions. However, it is very unfortunate to note that, still there is no systematic approach to utilise these valuable germplasm into a national level breeding programme.

Rather than a complicated breeding and selection programme, initially an open nucleus breeding programme with very simple selection process (mass selection) will be more effective and sustainable in the long run (Chandrasiri *et al.*, 2005). This will facilitate incorporation of superior genetics both from the nucleus and field level farm units. Milk recording programme to identify the high yielding cows and breeding them artificially using progeny tested semen of desired breeds of bulls will be the first step. Once, the calves are born; the male calves should be selected and brought

to a bull calf rearing station where the growth is closely monitored. The selected young bulls will be sent to a performance testing station for final selection. Semen from the selected test bulls will be used in progeny testing programme. The “none- selected” but quality bulls can be used for natural breeding programme. It should be coupled with an efficient castration programme of non-descript bulls in the area. Castration and natural mating should be planned well according to the availability of quality bulls. Otherwise, the farmers will neither get the service of a quality bull nor the service of the non-descript bull.

Every action has to be made for the promotion of the AI service and, with the improvement of AI the natural mating can be withdrawn gradually. Another important factor to be considered is the continuous supply of either good stud service or AI service to the farmers. An animal graded up for several generations can be degraded by 50 percent just by a single crossing to a non-descript stray bull. Unfortunately, this is what we see in most of smallholder farm units. Maintenance of good reproductive performance in cattle and buffalo requires constant attention, accurate herd records, and adequate knowledge of proper management practices and intelligent use of veterinary service to minimise reproductive failures (Jainudeen, 1969).

An effective dairy herd breeding programme should begin with the calf at birth and continue until the end of its productive life. An efficient calf rearing programme has to be implemented to look after the new-born progeny as these animals are the replacement stock in the dairy units. The period from two weeks to six months of the life of calf represents the period of highest mortality. It is important that the heifers be bred on time. They should be bred according to the weight and body condition rather than the age. When these superior young stocks are added to the herd, the non-productive and old cows can be gradually removed from the herd. Then only, one will be able to expect a significant improvement in milk production. Unless, such an efficient and systematic breeding, selection and culling programme is implemented, it is unlikely to achieve the target of becoming self-sufficiency in milk.

The farm gate price of milk is not the main factor of determination of the profitability of the dairy enterprise. It is the efficiency of the production or the productivity of the animals which is more important than the farm gate milk price. Poor productivity of animals is the biggest problem in the Sri Lankan dairy sector, at present. Shorter age at first calving (AFC) and longer calving interval (CI) can be considered the key factors which affect the economic dairy production.

Available information indicates that management of young stocks is neglected very badly on both smallholder and large-scale dairy farms. Particularly, the growth rates of these young stocks are very poor and therefore, the age at first conception and the age at first calving (AFC) are unusually extended causing a serious economic loss to the dairy farmers. Recent study has revealed that the AFC of the Jerseys and Friesians in two large-scale up country farms was 43 and 38 m respectively (Weerasinghe *et al.*, 2007). In the western province, the AFC and calving interval (CI) for cattle was 37.6 ± 37.7 m. and 16.8 ± 4.7 m respectively and for buffalo, the AFC and CI was 45.0 ± 10.1 m and 17.9 ± 7.4 respectively (Abeyratne *et al.*, 2003). The AFC and CI were 4.03 years and 602 days respectively for the crossbred cattle at Karagoda –Uyangoda farm (Ranasinghe *et al.*, 1986). It has been estimated that a farmer is losing nearly 100,000 rupees from an average cow (producing 10 lit/day) by not achieving the standard AFC of 24 m. These losses are due to loss of a calf, subsequent lactation and the losses due to managing a non-productive animal for more than a year.

Maintaining an annual CI is the other most important management tool of dairy cattle breeding. In order to achieve this, the calving-to-conception period (open period) has to be limited to three months. In goat to achieve an optimum kidding interval of 8 m (three kiddings in two years) the kidding-to-conception period should be limited to three months. Proper feeding of early lactating cow/ she-goat, proper heat detection and breeding at correct time are the key points to achieve this target.

Compared to an average production of milk which is 10 litres per day, a farmer is losing another 100,000 rupees by missing a single calving during her economic lifespan. The losses are due to: the loss of calf; loss of milk; and maintenance cost of an unproductive cow (Chandrasiri, 2001). After calving, a normal cow will take approximately 20-25 days to return to her normal oestrus cycle. After this period, detection at least three times a day (early morning, evening and late in the night) is a must to catch the cow in oestrus. In order to achieve the annual CI, the cow should be bred at the second oestrus after calving (approximately 45 days after calving). Time of breeding (AI or Natural) is also very important for a successful conception. If the animals are detected for oestrus in the morning they should be bred in the evening and if the animals are detected for oestrus in the evening they should be bred on the following day morning. This is known as the "AM/PM rule" and it is a very important management tool to follow by the dairy farmers. Maintenance of good herd fertility is the key factor of the economic milk production. Pregnancy diagnosis after two months of breeding can also be considered an important routine management practice. One of the most important services a veterinarian can render a cattle owner is to make an early pregnancy diagnosis. The idea of pregnancy diagnosis should be to confirm the non-pregnancy. This is the only way to reduce the economic losses due to longer CI. But, unfortunately many field veterinarians do not provide this valuable service to the farmers. According to 2007 figures, only 24 percent of the artificially bred cattle are diagnosed for pregnancy and approximately 25 percent of calving are recorded (Division of Animal Breeding, DAPH). AI follow-up activity is very important aspect and if this is not done properly, we cannot expect much from the AI service.

4.13.2 Feeding

Grass is the most predominant and the most widespread single plant in Sri Lanka which can be fed to cattle, buffalo and goat. There are many grass species in natural grasslands, which can be easily fed to the cattle and buffalo. They are listed below.

Table 4.14: Indigenous grass species in natural grasslands

Location	Type of grass	Local name
Found every where	<i>Cynoden dactylon</i>	Heen atora,
	<i>Axonopus compressus</i>	Narrow leaf carpet grass
	<i>Panicum repens</i>	Atora
Low elevation	<i>Brachiria distachia</i>	
	<i>Paspalum dilatatum</i>	
	<i>Digitarium marginata</i>	
	<i>Setaria barbetum</i>	
Hill country patanas	<i>Chrysopogen zeylanicius</i>	
	<i>Combepogan cenfertiflous</i>	

Source: Silva, 1970

Among those *Panicum repens* (Aora) is the most nutritious indigenous type of grass. The crude protein content in *Panicum repens* is 15 percent and the energy level is also high (Silva 1970). It is found everywhere and difficult to eradicate due to a deeply penetrating root system. Perhaps aora can be considered the most suitable grass for natural pasture lands. In addition to grass species listed above, there are many varieties of local tree fodder which can be used to feed the animals.

In addition to indigenous fodder and pasture varieties, there are some widely spread exotic grass varieties too. *Brachiaria* species and *Panicum maximum* are two such varieties. If properly utilised, up to an average of 5 litres of milk per day can be produced from these grasses and fodders alone. At Mahailuppallama, in the dry zone of Sri Lanka Sithamparanathan (1966) has envisaged realising 4.5 gallons of milk per acre per day using mixture of *Trifolium* species. Unfortunately, this "milk from grass" concept has been completely forgotten by most dairy farmers and they think that feeding concentrates are a must to produce milk. Therefore, the feed cost has become an important component in the dairy cattle husbandry. The main cause of poor productivity of the cattle, buffalo and goat is under feeding. Most of cattle and buffalo in large-scale and smallholder farms are underfed due to lack of grazing time and poor quality of the roughages fed. Realising this, the government has decided to allocate funds for communal grassland development. In the mean time, the research sector, especially the state and university sector have made efforts to identify the existing grassland resources, relevant institutional structure, and socio-economic background of the associated farmers in selected grassland systems. These current developments can be considered the foundation for the development of natural pasture and fodder resources in Sri Lanka in an efficient manner in livestock management.

However, in high yielding cows the milk production falls short of the actual production level of the animals maintained on pastures alone. Although supplementary concentrated feeding would increase the milk production, such a feeding practice would be uneconomical due to high cost, inadequacy and poor quality of the concentrated feeds available at present. Lack of sufficient quantities of legumes in most of the pasture lands is another serious problem in Sri Lanka. Even, in the large-scale commercially oriented cattle, buffalo or goat farms, well-established legume-pasture combination is lacking.

Figure 4.5: Improved pasture



Further expansion of the dairy industry should be coupled with efficient utilisation of the potential natural feed resources available in the country. It will also be necessary to re-orientate the feeding practices with the objective of achieving a higher level of efficiency of feed utilisation (Siriwardene, 1970). The efficiency of milk production is presently measured in terms of the amount produced by the cow. But, for the economy of land utilisation, the better system would be the amount of milk produced per unit of land.

Demand for organic foods is increasing in the world and therefore, organic farming is becoming more popular. In future, the demand for milk and meat produced from the animals grazed on natural forages will be very high. The dairy producers in developing countries will have a better market for such products.

The only practical and the most reliable method to judge the level of feeding under field condition is to assess the body condition score (BCS) of animals (SAREC/NARESA, 1998). Research has shown that there is a strong correlation between the BCS and the fertility of cows. Hence, the maintenance of appropriate BCS of animals will automatically improve the productivity. When the animals are properly fed, the reproductive efficiency will improve and the annual calving interval could be maintained. Therefore, the farmers will be able to have the maximum number of calving and lactation from the animals during their productive lifespan.

Many dairy farmers do not feed cows usually at night. Milk production can be improved by night feeding with sufficient quantity of water. A study (Wickramaratne *et al.*, 2005) has indicated that the cows fed at night with paddy straw and UMMB have shown an increased lactation length with a 33 percent increased lactation yield, very clear heat signs and reduced the calving-to-conception period. Average cost-benefit ratio has also increased from 0.48 to 1.14. Farmers should be encouraged in night feeding to compensate the reduced grazing period and reduced dry matter intake. If there are some edible feedstuffs left in the feed trough on the following morning that is the best indication of adequate feeding of the cow during night. Paddy straw and UMMB could be

largely used for this purpose as large quantities of paddy straws are available in Sri Lanka. In the 2006-2007 *Maha* and *Yala* seasons, the total paddy straw yield was approximately 3.15 million metric tons.

As far as a dairy cattle feeding is concerned, feeding of calves and post-partum cows are of utmost importance. Calves should be properly fed to gain required body weight fast and attain sexual maturity earlier. They also should conceive early and give birth to the first calf at the age of 24 months. Following guidelines (Table 4.15) will be useful in the assessment of the efficiency of calf feeding system adopted by individual farmers.

Table 4.15: Percentage of mature body weight during different stages of life of cattle

Stage of life	% of mature body weight
Birth	7
Weaning	15
1st oestrus	60
1 st conception	75
1 calving	85
2 nd calving	100

Source: Derived from DAPH data by ADN Chandrasiri, 2009

Good calf management starts during the last two months of pregnancy of the mother. In order to obtain a calf with standard birth weight, drying off the cow two months before calving and proper feeding during dry period is a must. During the last two months of the gestation, rapid growth of the foetus is taking place and the nutrient requirement of the foetus is at the maximum. Drying off the cow will facilitate fast growth of the foetus and improves the body reserves of the mother. Damaged udder tissue will also get repaired during the resting period and the cow will be ready for the next 305 day lactation period.

Proper calf feeding is needed to achieve the required body weight shown above. According to Ranasinghe *et al.*, (1986), the prolonged AFC in the crossbred cattle (4.03 y) at the Karagoda-Uyangoda livestock farm may be attributed to stunted growth during early stages due to lack of sufficient milk to calves. These facts indicate that a proper calf rearing is a prerequisite in the dairy cattle husbandry. Table 4.16 shows a feeding regime for calves to achieve the recommended body weight gain.

Table 4.16: Feeding regime for calves

Age (m)	Milk/d (l)	Calf starter feed/d (g)	Dry grass/d (kg)	Calf meal/d (kg)	Fresh grass/d (kg)	Concentrated feed for adults/d (kg)
Birth- 2 d	Colostrum ad-libitum					
2d -1m	2.5	30	0.5	-	-	-
1-2m	2.0	200	5.0	-	-	-
2-3m	0.75	350	20.0	-	-	-
3-4m	-	450	13.5	-	-	-
4-6m	-	-	-	1.0	10% of the body weight	-
6-9m	-	-	-	2.0		-
9-12m	-	-	-	2.5		-
12-15m	-	-	-	-		1.0
15-18m	-	-	-	-		1.0

Source: Derived from DAPH data by ADN Chandrasiri, 2009

In addition to proper feeding of calves, special attention should also be made to the feeding aspect of adults too. Heifer management, milking cow management and dry cow management are equally important aspects. From birth to first calving is the non-productive period of a dairy animal. Therefore, the farmers very often neglect them without proper feeding as income does not derive from them. However, this is the fast growing period in which more attention should be given to the feeding aspect. Hence, this is the most expensive part of dairy animal management.

When feeding adult cows under conventional feeding systems, a considerable amount of roughages (approximately 30 percent) is wasted. In order to avoid the wastage, the grass can be chopped before feeding. The other advantage of chopping the grass before feeding is the increased feed intake which facilitates efficient digestion. If the quantity of grass is small chopping can be done manually. Machine operated chaff cutters are available for large-scale use.

4.13.3 Healthcare

There are many aspects of healthcare in cattle, buffalo and goat. Among the communicable contagious diseases, Haemorrhagic Septicaemia (HS) is a bacterial disease in cattle and buffalo. Sri Lanka has been able to control through this deadly disease locally produced vaccine. Foot and Mouth Disease (FMD) is a viral disease which affects all three breeds. This disease is also controlled by routine vaccination. Black Quarter (BQ) is another deadly disease among young stocks which has successfully controlled by a locally produced vaccine.

In Sri Lanka, one of the biggest constraints on profitable animal husbandry is parasitism (Weilgama, 1981). Helminthiasis, Piroplasmosis and tick infestations are three important parasitic conditions that affect cattle, buffalo and goat. They cause damage by way of loss in condition, poor production and even deaths. All these three conditions can be successfully controlled by proper management.

Calf mortality is another serious loss to the dairy farmers. Calves that died before 6 months of age were analysed by Subasinghe (1981) and the overall calf mortality rates in cattle and buffalo farms were 17.8 and 22.2 percent respectively. The prenatal mortality rates on the same farms were 7.3 and 11.3 percent respectively. The main causes of calf mortality were worm infestation; general debility; navel ill; and pneumonia, and which can be easily controlled through improved management, farmer training and extension programmes.

Among economically important diseases prevalent in Sri Lanka, Brucellosis can be considered the number one disease. Brucellosis is a bacterial disease which causes abortion in cattle, buffalo and goat. In 1986, the incidence of brucellosis in private herds of cattle in the country has been reported as 0.6 percent (Peiris *et al.*, 1986). The incidences of the disease in the eastern, north- central, north-western and southern provinces were 9.7, 6.5, 5.6 and 4.4 percent respectively. The economic loss due to brucellosis in 2005 has been estimated as 141 million rupees (Gajanayaka *et al.*, 2000). The losses are due to loss of calves (5 million rupees or 4 percent), loss of milk (27 million rupees or 19 percent) and loss of subsequent fertility (109 million rupees or 77 percent) of the affected animals. This loss is equivalent to 2.4 percent of the contribution to the livestock sector GDP in 1994. Although this disease is not very common in buffalo and goat, reports available indicate that it is gradually spreading among cattle. This disease can be controlled by culling affected animals or by vaccination. The estimated annual cost of an eradication programme is 41 million rupees. (Gajanayaka *et al.*, 2000), and hence the benefit cost ratio of a brucellosis control programme is 3.4:1. The most effective method of control of the disease is the prompt cull of affected animals. But, unfortunately there is no such an effective programme at present in Sri Lanka to eradicate such an economically important cattle reproductive disease. Even on state farms, where infection rate is high one is forced by circumstances to maintain reactor herds for purpose of economy although it is a short-sighted policy (Kumaraswami, 1971). Although Brucellosis is one of the most difficult diseases to eradicate, certain countries such as the Scandinavian countries, Denmark, Sweden and Norway by their aggressive and bold policies have completely eradicated the disease and have affected great savings to their national economy. Why Sri Lanka cannot implement such an efficiently brucellosis-controlling programme is a question still left unanswered by the authorities concerned?

Mastitis or inflammation of the udder is also an economically important disease in cattle, buffalo and goat. The losses due to mastitis include the decline of milk yield milk composition, shortening the productive period of the affected cow, and increased a cost of drugs and herd replacement (Wanasinghe, 1971). According to estimates in 1971, the economic losses of mastitis due to the reduction of milk yield alone has been estimated as 4.3 million rupees per year. If the losses due to other components were also taken into account, the total loss would have been higher. Survey of the incidence of mastitis conducted in 1977 revealed that 70 percent of the cows in the sample were positive for mastitis and about 50 percent of the cows on small farms were affected (Wanasinghe, 1981).

Good hygiene and cowmanship can easily control this disease (Whittlestone, 1970). Clean cow, clean cow sheds, clean hands and proper milking techniques provide the basis for an effectively mastitis-controlling programme. Efficient extension service to educate farmers would be sufficient to control the disease and save the losses.

4.13.4 Marketing

Cost of milk production involves many factors. Lands, buildings, animals, feeds, labour, and veterinary costs are the main components. In 1999, the ratio of farm gate milk price and labour cost was 1:13 in Sri Lanka whereas in India it was 1:4. In 2003, the ratio of the price-labour cost of milk in Sri Lanka has increased to 1:20. This is a very good indication of uneconomical milk production in Sri Lanka.

Cost of milk production (COP) varies according to management systems. In a recent study in the Kandy district, the highest COP was recorded in Nawalapitiya (32.40 rupees/litre) and the lowest COP was recorded in Hasalaka (23.72 rupees/litre). The average COP including labour was 30.55 rupees per litre with the minimum of 9.31 rupees and the maximum of 57.54 rupees (Livestock 2008). This wide variation is due to the management systems prevailing in the respective areas. Generally, the present farm-gate milk price seems to be insufficient. During 1994 and 2008, the fresh milk price has been increased by 275 percent and during the same period, the price of locally produced powdered milk (Highland) has been increased by 338 percent, while the price of imported powdered milk (Anchor) has been increased by 328 percent (Table 4.17).

Table 4.17: Change of market prices of milk and some milk products during 1994 and 2007

Item	1994	1997	2000	2007	2008	% increase
Fresh milk (LKR / L)	8.00	15.00	20.00	25.00	30.00	275
Powdered milk (400g) Highland (LKR/400g pack)	52.50	67.50	84.00	180.00	230.00	338
Anchor (LKR/400g pack)	60.75	84.00	103.00	190.00	260.00	328

Source: Derived from DAPH data by ADN Chandrasiri, 2009

Strategies to expand the network of milk collection in rural areas and establishing regional level milk processing units can be effective policy instruments of the government to achieve the objective of 50 percent self-sufficiency in milk by 2015.

In Sri Lanka, the milk collection in most of the rural areas is not satisfactory. In some areas, milk is collected in the morning only, and in most areas there are no collecting facilities at all. It has been estimated that the farmers lose approximately 35-40 percent of their income by not being able to sell their evening milk. Frequent rejection of milk at the collecting points is also another problem to producers.

The most effective way of delivering milk from rural producers to the market is collecting fresh milk and cooling. Establishment of village level collecting points with chilling facilities and medium-scale milk processing units catered by a group of farmers in a community will be an ideal set-up for our situation. This will reduce both unnecessary delays and cost of transport and losses due to rejection of milk. This invariably causes a better farmer income.

However, such operations have to be carefully identified and implemented. Gradual scaling up with improved market is necessary rather than establishing large-scale operation haphazardly.

Well-managed producer organisations can have strong links between the producer and the market. There are many examples of establishing large-scale milk plants in anticipation of rapid growth in milk supply but never materialised. Small- and medium-scale dairy processing is a profitable business opportunity for local entrepreneurs. As the demand is gradually increasing, these processors do not have market problems and they even offer farmers a higher price for raw milk than the leading companies. In the north-western province, one such organisation has paid 47 rupees for a litre of buffalo milk. (Developing Dairy Sector, 2007).

Recent trend in the involvement of large-scale dairy processing companies on milk collection and processing is a good sign. Large companies such as Cargills Quality Dairy and Nestle are now reviving their dairy development programmes to assist local farmers to meet the rising demand (Developing Dairy Sector, 2007). It has been found that large-scale processors provide various services to their milk suppliers. It even seems that the support which farmers receive from the large-scale dairy companies and other input suppliers often exceeds the services and support they receive from the government extension service (Developing Dairy Sector, 2007). However, the competition amongst some large companies has become not only a threat to themselves but to farmers as well. In such a situation, the government involvement would be necessary to safeguard the dairy producers.

Promotion of value-added milk products is another aspect of increasing the farmer income. However, this has to be done very carefully. With value addition, the quality should be given due consideration, as poor quality can cause serious health hazards to consumers. Milk can be converted into a range of products, which are universally popular. There are several types of processed milk products available in Sri Lanka.

Standardised cow and buffalo milk	Low fat milk
Skimmed milk	Pasteurised milk
Sterilised milk	Ultra heat treated (UHT) milk
Flavoured milk	Evaporated milk
Full cream condensed milk	Powdered milk
Yoghurt	Curd
Butter	Butter milk, butter oil and ghee
Dairy cream	Cheese
Ice cream	Milk toffee

Among value-added milk products, pasteurised and sterilised milk, curd, yoghurt, ice cream and milk toffee are common in Sri Lanka. In addition, butter and cheese making can also be promoted at the farmer level. Initially, these products should aim at the local consumer market and with the experience of the farmers the product can be further improved and commercialised.

Following suggestions are made to increase farmer income without increasing the present farm gate price of milk.

1. Establish evening milk collection in potential areas. Initially chilling centres of 500-litre capacity can be established and milk can be transported every other day. However, this arrangement will depend on the quality of the milk collected from the farmers. It is expected to increase the farmer income by 60 percent.

2. All the collecting centres must be equipped with modern fat testing equipment and establishment of individual milk testing system to avoid adulteration of milk. Monthly incentive of 1000 rupees could be paid to these collecting centres until recovery of the cost of milk testing equipment. It is expected to increase the farmer income by 40 percent.

3. Implement a quality (low bacterial count) based milk payment system. This will facilitate clean milk production.

4. Direct incentives to the farmers who supply milk to the formal milk market. Incentive will be based on the quantity of milk supplied as shown below.

30-75 lit/month	LKR 1.00/lit
76-150 lit/month	LKR 1.50/lit
151-200 lit/month	LKR 2.00/lit
201-350 lit/month	LKR 2.50/lit
351-500 lit/month	LKR 3.00/lit
>500 lit/month	LKR 1500/m

It is expected to increase the farmer income by 7-20 percent depending on the quantity of milk supplied. Funds for this kind of incentives can be obtained from the cess imposed on imported powdered milk.

4.13.5 Extension and management

In order to make the dairy enterprises economically viable, the entrepreneurial skills of the small-scale farmers have to be improved. As most of the farmers do not inherit these skills, this could be done only through effective extension programmes. Most of the modern technologies and new research findings have not yet reached the farmers in many areas. Therefore, the field extension service should be established well in the small-scale dairy sector. As far as transfer of technology is concerned there is a big gap between the technical expertise and the farmers, thus indicating a serious inefficiency in the extension linkage. Farmer education is a key factor to overcome field level problems. Participatory approach research programmes can be considered one of the effective methods to take the research findings and other extension methodologies to the end user. Farmer empowerment programmes such as farmer managed dairy societies can also be successfully utilised to carry out the extension programmes.

The modern dairymen cannot operate successfully without proper records of herds. The activities of farms should be relatively easy to monitor and maintain throughout. Otherwise the animals will soon get neglected. In any kind of livestock enterprise, animal identification and record-keeping are of paramount importance to intelligent breeding. However, it is very unfortunate to note that most of the dairy farmers irrespective of their scale of production do not pay attention to these important aspects effectively. Date of breeding, sire number, date of calving, difficulties at calving, retained placenta and other reproductive problems etc are important information for breeding. Availability of good records helps the veterinarian to investigate into the problem of infertility in a dairy herd (Jainudeen, 1969).

Fast development of the poultry sector is mainly due medium-scale entrepreneurs, especially under the so-called "buy back system" which is very popular at present. As smallholder dairy farmers

do not have all the resources and expertise needed, they are not competent enough to get involved in all the aspects of dairy farming. "Every one does everything" concept should not be encouraged; instead specialised farmer groups should be promoted. For example, those who have knowledge and facility to make cattle feed – should get involved in the feed manufacturing process only. In addition to compound feeds, they can get involved in selling bales of hay, UMMB, paddy straw and even fresh pasture and fodder for needy farmers. Similarly, the farmers who are interested in cattle, buffalo and goat breeding should get involved in producing pregnant heifers and cows. They also can produce quality bull calves for natural breeding. This will be a solution for lack of quality breeding stocks. The farmers who have expertise on value-added milk products should get involved in that business. Those who have marketing facility to provide dairy equipment, machinery and other implements required for the industry should do only that. The new concept of "one-farmer-one-activity" should be promoted, at least among leading farmer groups identified. This kind of approach will be a turning point in the dairy sector business.

4.14 Summary

There are a few key elements in marketable milk production. It is through efficient reproduction that a cow can fulfil her potential milking ability (Jainudeen, 1969). Therefore, breeding aspect can be considered one of the most important elements. Accelerated AI promotion programme to cover at least 50 percent of the breedable cow population is a must. New strategies like open nucleus breeding system to incorporate the superior genetics available in the field into the national level breeding programme should also be implemented. There should be a system to replace the non-descript mediocre stud bulls with selected quality bulls for natural breeding. These bulls can be even given free of charge to rural farmers to upgrade their stocks.

Attention should also be made to the feeding and the management of the young stock. It should be remembered that the genetic component of milk production is only 20 percent and the balance depends on the non genetic factors such as feeding, management and the environment. These aspects should also be at the optimum level for the animals to perform better.

A right farm gate price for milk based on the actual cost of production and incentives for producing quality milk will prevent smallholder producers leaving the dairy sector. It will also encourage the younger generation to enter the sector.

Farmer education and training are also equally important and the farmers should be properly trained in all important aspects of animal husbandry. Proper animal registration system is essential to safeguard the AI born male and female calves. Farmers should also possess entrepreneurial skills.

As the land available for dairying is gradually diminishing, management and proper utilisation of available land resources is highly needed. Establishment of pasture-legume combination in grasslands should be made essential. Milk collection should be commenced in the rural areas where, at present it is not organised. In order to improve the collection network, the infrastructure facilities such as roads, water and electricity should be made available in the rural areas. Promoting farmer organisations like All Island Dairy Association (AIDA) would make the dairy producers united, stronger and influential.

In order to overcome the severe shortage of quality breeding stocks, private partnership arrangements with state-owned NLDB farms should be encouraged. Implementation of an appropriate system to register the AI born calves and provision of market avenues for selling and buying the breeding stocks will prevent illicit slaughter of these valuable animals.

Policy intervention is also needed to promote more medium- and large-scale commercial dairies while supporting the smallholder sector. The Anuradhapura and Kurunegala districts can be considered the key areas for promoting buffalo production within the smallholder sector.

Based on the factors discussed above, following aspects can be considered vital for a small-scale farmer to produce milk in excess by converting his dispersed, unproductive and inefficient farm unit to more concentrated, commercially-oriented, controlled production system.

1. Night feeding of the animals with chopped grass and fodder, paddy straw and UMMB
2. Maintain the appropriate BCS during different stages of production
3. Proper calf feeding and management programme
4. Achieve early age at first calving and shorter calving at intervals
5. Follow appropriate breeding, selection and culling programme
6. Follow clean milk production procedures and invest on value-added milk products

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Chapter **5**

**LANKA WATER BUFFALO:
ITS IMPORTANCE TO
DAIRY INDUSTRY**

*DHA Subasinghe
BMAO Perera
&
PGA Pushpakumara*

5.1 Introduction

5.1.1. Importance of the buffalo in Sri Lankan agriculture

Agriculture is the livelihood of around 31 percent of the economically active population in Sri Lanka and in the majority of cases this comprises rural mixed farming on small-holdings, with crops and livestock performing complementary roles (Annual Report of the Central Bank, Sri Lanka, 2007). The main types of livestock that are reared by such farmers are cattle, buffalo, goats, pigs and poultry. Of them, cattle and buffalo are the species that provide the most diverse and important outputs that are of economic benefit to smallholder farmers, which include milk, meat, draught power and manure.

The rearing of buffalo is preferred by farmers in some regions of the country due to their ability to utilise low quality forage, survive under harsh environmental conditions and provide economically important products with the minimum of external inputs. The milk of the buffalo, due to its higher content of fat and solids-non-fat (SNF), is particularly favoured for making value-added products such as curd and ghee. The animals also serve as capital and savings and are considered a part of the family assets in some farming communities.

The buffalo population in the country during the 1970s and 1980s was estimated to be around 800,000. However, the last islandwide census of agriculture conducted in 2002 showed a total buffalo population of 282,000, indicating a drastic decline. The current population is estimated to be 319,000 (Department of Animal Production and Health, 2007: www.daph.gov.lk/statistics.php). Over 90 percent of them are of the indigenous variety, known as 'Lanka buffalo', among smallholder farmers. They are used predominantly for farm power in the cultivation of rice, but in some areas they have traditionally been milked, particularly in the south-east (Ruhuna), which is famous for buffalo curd. Lanka buffalo are located mainly in the low-country wet and dry zones and in the mid-country. In the dry zone, they were traditionally managed as large herds on a free grazing system (extensive system) in the past, with grazing on natural pastures in scrub forest,

common lands and fallow rice fields. This system has now been replaced in some areas with a tethered grazing system (semi-intensive system) due to pressure on land availability caused by expanding human population and irrigated settlement schemes. In the wet zone, the herds are small and managed semi-intensively with limited grazing, as seen in the coconut triangle where tethered grazing is practised.

Improved exotic breeds of river type buffalo such as the Murrah, Surti and Nili-Ravi have been imported on many occasions during the past five decades, mainly from India and Pakistan. These were originally confined to state farms, but some of the progeny were regularly sold to the private sector, particularly to smallholder farmers, in order to promote cross-breeding of the indigenous buffalo with the imported breeds. The main objective of such breeding programmes was to upgrade the milk potential of the Lanka buffalo, while retaining its draught ability. This has resulted in a small but increasing population of cross-bred buffalo, which are usually managed more intensively than the indigenous animals for milk production.

A few specialised small- to medium-scale buffalo dairy farms also exist, particularly in the peri-urban areas around Colombo and other cities. These are based on intensive management systems, with feeding on cut fodder (zero grazing) and concentrates. With the recent increases in the retail price of milk and milk products and the resultant increase in the farm gate price paid for milk, many smallholder farmers have switched to the rearing of cross-bred, and even pure-bred, buffalo as a source of additional income. The increasing demand for buffalo curd from the cities also adds value to the milk and makes milk production from buffalo more profitable than from cattle.

Currently, the total milk production in the country from cattle and buffalo, including the collection by the organised milk collection network, the informal milk markets and home consumption, is estimated to be around 202 million litres per year (www.daph.gov.lk/statistics.php), to which the Lanka buffalo contribute about 32 million litres (16 percent). The overall contribution of animal draught power (DAP) in agriculture is considered to be around 36 percent, of which the Lanka buffaloes contribution is over 70 percent comes from the buffalo.

It is clear from the foregoing that the buffalo is an important livestock species that contributes to both food security and poverty alleviation in the context of smallholder farming that is prevalent in most parts of Sri Lanka.

5.1.2 Previous publications and objectives of this chapter

The buffalo production systems, their contribution to rural economy and the potential for their improved utilisation through application of modern technologies have been comprehensively documented in the books *"The Sri Lanka Water Buffalo"* (Eds. Perera *et al.*, 1989), *"Role of the Buffalo in Rural Development in Asia"* (Eds. Perera *et al.*, 1996), and *"Water Buffalo: Improved Utilisation through New Technologies"* (Eds. Subasinghe *et al.*, 1998). Information on all aspects of buffalo production and health and practical advice for field level professionals is contained in the books *"Cattle and Buffalo Farming: Handbook for Veterinarians"* (Eds. Abeygunawardena & Siriwardena, 1999), *"Water Buffalo in Asia IV – Diseases of the Buffalo"* (Eds. De Alwis *et al.*, 1999), *"Water Buffalo Research in Sri Lanka – Compendium of Research Information"* (Eds. Siriwardena *et al.*, 1999), *"Water Buffalo in Asia I – Nutrition in the Buffalo"* (Eds. Ibrahim *et al.*, 2001). A global perspective on the role of the buffalo in different countries is contained in the chapter on buffalo

by Perera *et al.*, (2005) in the book “*Livestock and Wealth Creation - Improving the Husbandry of Animals Kept by Poor People in Developing Countries*” (Eds. Owen *et al.*, 2005).

Therefore, this chapter will not attempt a comprehensive coverage of all aspects of buffalo production and health. It commences with an examination of historical and traditional aspects of buffalo keeping in Sri Lanka, which are not adequately documented in accessible form. The chapter then briefly reviews some of the unique biological aspects of the buffalo, identifies some of the constraints faced by smallholder farmers, and proceeds to describe a successful technology generation and transfer programme that was implemented in several areas of the country. The concluding sections examine the current policy issues and the needs for change to promote improved utilisation of the buffalo in the smallholder sector for rural and national development.

The material presented is based on previously published research papers and reviews, monographs, reports and web-sites of relevant ministries, institutions and departments, as well as personal observations of the authors.

5.2. Historical Aspects of Buffalo Production and Management

5.2.1. Classification of buffalo and the status of Lankan buffalo

Domestic water buffalo (*Bubalus bubalis*) belongs to the order *Artiodactyla* (even toed ungulates) and to the sub-order *Ruminantia* (animals with complex stomachs). They are included in the family *Bovidae* (other families comprise deer, giraffe and camel) and in the tribe *Bovini* (other tribes being goat, sheep and antelope). The *Bovini* in turn comprise three groups viz: *Bovina* (cattle), *Bubalina* (Asian buffalo) and *Syncerina* (African buffalo). The group *Bubalina* has only one genus *Bubalus*, and *Bubalus bubalis* is the only domesticated species under this genus. MacGregor in 1938 classified water buffalo into two main types, namely “river type” and “swamp type”, depending on their phenotypic characters and behaviour. Buffalo in the India-Pakistan sub-continent were classified as river type due to their origin around river basins and their preference to clear running water for wallowing. They include the specialised dairy breeds which have subsequently spread to the countries in the Mediterranean region, South America and Europe (e.g. breeds such as Murrah, Surti, Nili-Ravi, Kundi etc.). The classical working or draught buffalo of South-East Asia were classified as swamp type due to their habitat in swampy areas and their preference for wallowing in stagnant pools of mud. The indigenous Lanka buffalo was previously considered as belonging to the swamp type, but the cytogenetic studies conducted in 1970 refuted this view.

Cytogenetic studies conducted on the two types of buffalo have shown that the river type has 50 chromosomes, while the swamp type has 48 chromosomes. These two types can be interbred and their progeny are fertile (Perera *et al.*, 1989). Although the Lanka buffalo was originally classified as swamp type based on its phenotypic characters and habits, it has been found to have 50 chromosomes (Bongso *et al.*, 1977; 1978), and should therefore be classified as a river type based on its genotype. Some basic differences in the characteristics of river and swamp buffalo are given in Table 5.1 (Perera *et al.*, 2005).

Table 5.1: Characteristics of river and swamp buffalo

Parameter	River Buffalo	Swamp Buffalo
Percentage of world population	70	30
Wallowing habits	Running water (rivers)	Stagnant water (swamps)
Number of chromosomes	50	48
Main uses	Milk and meat	Draught and meat
Body colour	Darker	Lighter
Body hair	More	Less
Chevrons on neck	Absent	Present
Horns	Curled, swept back from forehead	Sickle shaped, in line with forehead
“Bos” on forehead	Present	Absent
Growth rate (kg/day)	0.8-1.0	0.5-0.7
Weight at puberty (kg)	250-350	200-300
Adult weight (kg):		
Male	450-750	400-600
Female	400-650	350-450
Milk production:		
Litres/day	5 to 15	1-3
Litres/lactation	1,500-4,500	200-750
Lactation length (months)	9-10	5-8
Fat content of milk (%)	6-10	6-10

Source: Perera *et al.*, 2005

In addition to the domesticated Lanka buffalo, a limited population of “wild” buffalo also exist, and are now confined to remote forest areas. They are larger than Lanka buffalo, but smaller than the Indian wild buffalo (*Bubalus arnee*; Deraniyagala, 1953). Deraniyagala (1959) considered the Sri Lanka wild buffalo as a separate sub-species and named it as *Bubalus bubalis migona*. A good specimen of a well-preserved head of a Sri Lanka wild buffalo fitting Deraniyagala’s description is exhibited at the Colombo National Museum as exhibit number 783. Some domesticated Lanka buffalo have moved into the wild habitat and become “feral”. In some locations, these feral animals have interbred with wild buffalo, and it is now difficult to distinguish between truly wild and feral buffalo.

Although it has been postulated that the Lanka buffalo is a descendant of those that were introduced in the 6th century BC by the immigrants from North India (Vijaya and his ancestors) (Perera *et al.*, 1989), this view is disputed by subsequent archaeological discoveries. Fossil buffalo teeth were found in gem pits of the Ratnapura district at depths of 6-30 feet below the surface. Further evidence of fossil deposits has been found in the dry zone jungles, which clearly indicate that buffalo have been present in the country during pre-historic times. Therefore, it is more likely that the indigenous Lanka buffalo may have originated from the wild buffalo and have been domesticated by the early inhabitants of the island for their use.

5.2.2. Relationship of the buffalo to history and culture

The domestic water buffalo has been an integral component of the agrarian community in Sri Lanka for over 4,500 years. Use of the buffalo from the very early period has been documented in the ancient chronicles such as the *Mahavamsa* (Geiger, 1912; Geiger, 1960; Perera *et al.*, 1989), which indicates that large herds of buffalo existed in villages such as *Dwavamandala* and *Digavapiya* in the south-east of Sri Lanka. The ancient Sinhalese used the term *Mi-gavaya* for the buffalo and *Ela-gavaya* for cattle. The term *Mi-gavaya* has been derived from *Mihi-gavaya*, which means an animal related to *Mihi katha* or land, a clear indication that the buffalo was used for land preparation in agricultural activities.

There is clear evidence in ancient chronicles and rock inscriptions to show that buffalo were offered to Buddhist temples. An 11th century AD rock inscription in Jaffna indicates that 15 buffalo were offered to a temple called *Velgam Vihara* by a Tamil national, to provide ghee to light the lamps in the *Viharaya* (Epigraphica Tamilica, 1971; Perera *et al.*, 2000). Epigraphical evidence at Galapatha Raja Maha Viharaya (near Bentota/Aluthgama) reveals that offerings had been made to the temple to seek protection for the buffalo and their herdsmen (Epigraphica Zeylonica, 1904). Inscriptions on a rock pillar at *Hevevissa Korale* in the Kurunegala district indicate the offering (*pooja*) of 400 buffalo to *Lankatilaka Vihara* in the Kandy district by an army commander by the name of Senadhilankara in the 14th century AD (Paranavithana, 1960(a). The king had also offered the services of herdsmen to the *Viharaya* to manage the herd of buffalo (Paranavithana, 1960 b).

It was a traditional custom during the time of Sinhala kings that when a temple or village owned a large herd of cattle or buffalo, the king provided the herdsmen to manage the herd. These herdsmen held a noble status and were honoured with respectable positions affiliated to their names such as *Pattividane* or *Nilamakkara*. In the royal palace, there was an official position called "*Pattividane Nilame*", who was the chief of the milkers (Herdsmen) and butter men (Perera, 1916). The owner of a large personal herd was called a *Gambaraya*. He was accepted as a member of the high society, not only for his wealth, but for his nobility. This term and the tradition were seen to be observed in certain areas of the Hambantota district by the senior author, some years back (1958). The cattle and buffalo that belonged to the *Vihara* were treated as Royal property and therefore not used in agriculture or any other work, except for the supply of milk and *Pasgorasa* to the *Viharaya* (Perera *et al.*, 2000). Even as late as the 16th century AD, cattle and buffalo rearing were considered a noble profession, and persons who owned and managed them were considered high class citizens in society.

5.2.3. Buffalo and its products in ancient times

Many Buddhist scholars such as Buddhagosa have written several texts in Pali on the management of cattle and buffalo. *Samantha Pasidika* is one such text which gives several guidelines under the discipline (*Vinaya*) on domestic cattle and buffalo management (Woods and Kosombi, 1928; Perera *et al.*, 2000).

Buffalo has traditionally been preferred over cattle for the provision of draught power in wetlands. They have been used from the initial stages of land preparation to the threshing of the harvested paddy (Perera *et al.*, 2000), as documented in the 13th century AD in publications such as *Pujawaliya* and *Saddharmarathanawaliya* (Siriweera, 1993). A notable traditional feature in the use

of draught or manpower in agriculture was the reciprocal arrangement among individual farmers which was known as *Kaiya*, which usually involved transaction in kind. When the land owner was unable to supply buffalo, he had to pay the yoke hire (*Viya-kuliya*) or give a portion of his crop share. Payment for buffalo hire in the 18th and 19th centuries was on a crop share basis which was usually about 1-2 bushels of paddy for ploughing an acre of land, payable at harvest. Such traditions are being practised even today in remote villages.

Buffalo, unlike cattle (oxen), do not appear to have been used for road transport. The oxen that were used to draw carts were called *Galgon* and the herd was termed *Galgon panthiya*. Goods were also transported on the back of cattle or buffalo, which were referred to as *Thawalam* or pack animals. Sometimes they were also referred to as *Gonigon* (Siriweera, 1982). In the early days, buffalo were used to trample and compact the soil on the irrigation bunds during the construction phase (Perera *et al.*, 2000). Other uses of buffalo for draught power include the mixing and seasoning of clay in the pottery and brick industries (Deraniyagala, 1959; Abeyratna, 1981), lifting of water from rivers and wells, and extraction of oil from coconut and gingili using the *Sekkuwa*. Some of these practices occur even today, in remote villages in the country.

In ancient times, buffalo have also been put to other uses such as for hunting other animal species, and to capture wild or feral buffalo for domestication (Tennent, 1861; Story, 1907). The skin of the buffalo was used for making canopies (*viyana*) and drums or tom-toms which were used in Buddhist temples for rituals and communication, as well as for making shields (*Paliha*) and leather vests (*Sam salta*) (Chulawansa, 1929). Buffalo horns were used to make tool handles, combs and various ornamental items. Buffalo bones and hair were used in spiritual activities and rituals associated with the threshing field (*Kamatha*). Buffalo dung and urine including crushed bones were used as organic manure for crops. In addition, urine was used as an important ingredient in traditional medicine (*Darmapradeepika*, 1927). There is also evidence in a text called *Magasalakunu* that buffalo were used as fighting animals (perhaps as a traditional sport) in the 15th century AD, and reference to a place called *Meegon aramba* in Kandy near the *Malwatu Viharaya* where traditionally *Pora meegon* or fighting buffalo were kept - the paddock (D'oyle, 1817). Deraniyagala (1959) has reported on the various phenotypic characters of the buffalo used for fighting, method of selection and training including the rules of the game. These buffalo fights were usually conducted during the paddy harvesting season.

In the pre-colonial period butter and ghee were the main commodities that were traded exclusively in Sri Lanka. Breeding buffalo for butter and ghee was a traditional practice, and it was also a requirement to pay part of the dues to the king in the form of butter and ghee, especially in Jaffna (de Silva, 1995; Premasundera and Abeygunawardena, 2000). In ancient Sri Lanka, *Pasgorasa*, which means five tastes of excellence, originated from the cow or buffalo milk and was considered a valuable food item in both royal and ordinary menus. *Pasgorasa* comprises milk (*Kiri*), curd (*Deekiri*), cream (*Yodhaya*), ghee (*Githel* or *Dunthel*) and butter (*Vendaru*) (Ariyapala, 1956). The widespread use of buffalo milk for domestic consumption as liquid milk, curd, ghee and butter continues to this day. The frequent invasion of Sri Lanka by South Indians in the 11th century AD caused considerable damage to irrigation systems and paddy cultivation, particularly in the dry zone. As a result, buffalo which provided the source of farm power also declined in numbers. The remaining animals moved into the jungles and became wild over a period of time. Paddy cultivation was also neglected during the period of European rule. The early colonisers were interested mainly in trade in the spices of the country, while the later rulers were interested

in developing the plantation economy based on cash crops such as coffee, tea, rubber and coconut. Eventually, most of the paddy lands became fallow and the buffalo population was considerably reduced over the years (Premasundera and Abeygunawardena, 2000).

5.3. Current Status of the Buffalo Industry

5.3.1. Buffalo production and management systems

Buffalo management systems in different parts of the country have largely been influenced by the climate, type of crops grown and cropping pattern, availability of grazing land, genetic make-up of the animals and the main production objectives (Abeygunawardena and Abeygunawardena, 1998b). The major production systems involving large ruminants (ie cattle and buffalo) can be classified as follows:

Dry Zone Traditional Village System: This is the most prevalent system, although it is becoming more difficult to sustain due to limitations of grazing land. The main genotypes are indigenous zebu cattle and buffalo, with some crosses with Indian breeds (Figure 5.1). They are kept on communal grazing lands, the management inputs are minimal (mainly labour for herding) and the primary income is from sales of meat and draught. Use for draught and sale of surplus animals are the main economic objectives. A limited quantity of milk is also extracted from some animals over a short lactation period, some of which are converted to curd and other products.

Figure 5.1: Indigenous and cross-bred buffalo in the dry zone under extensive management system



Dry Zone Irrigated Settlement System: In areas where land has been recently allocated for irrigated agriculture, cattle and buffalo farming has become more intensified. Small herds of animals with medium production levels are maintained under a combination of tethered grazing and stall-feeding with cut grasses, tree fodders, straw and some concentrates. Milk and draught are the primary products, while surplus animals are sold for draught and meat.

Intermediate Zone (Coconut Triangle) System: Here large extents of land are under perennial crops and livestock farming is based on a semi-intensive system. The herd sizes are small and the animals are grazed, either free or tethered, on natural pasture under coconut and other perennial crops. Milk and draught are the primary products while surplus animals are sold for draught and meat.

Wet Zone (Mid- and Up-Country) System: In this zone land is severely limited and therefore an intensive smallholder mixed crop-livestock production system is in existence. The animals are pure-bred or cross-bred European breeds of cattle and Indian breeds of buffalo maintained under zero-grazing for milk production. The inputs for feed, health control and artificial breeding are high. Although the productivity per unit is greater than that in other zones, the net returns are low.

Peri-urban System: This is seen especially in the areas around Colombo. It is a unique dairy production system that is not integrated with crops. High producing pure-bred European cattle and Indian buffalo are kept under total confinement and fed on cut fodder and concentrates that are purchased from outside. On some farms only milking animals are kept, with freshly calved animals being bought in and then sold after the lactation is completed. Thus breeding is done by farmers in other regions, who buy the dried-off cows. Although input costs are high, the income generated is sufficient for most of these farmers – to rely on dairying as their main source of income.

An extensive survey conducted in 1985 on Lanka buffalo kept by village farmers in 16 districts covering various agro-ecological zones of the country has documented the above systems and their production characteristics (De Silva 1984; *De Silva et al.*, 1985). The results showed that the overall average herd size was 22.5, ranging from 5.3 to 53.6 in different districts. The average herd composition was 17 percent of 0-1 year old, 13 percent of 1-2 year olds, 9 percent adult heifers, 33 percent cows, 15 percent castrated males and 13 percent entire males. Ninety two percent of the farmers used buffalo for draught power in land preparation (ploughing, puddling and leveling), while 82 percent used them for threshing the harvested paddy. Only 14 percent of the farmers used buffalo for milk production, in certain districts. The mean lactation yield was 1.5 litres /day and the lactation length was 150-180 days

A comparative study on the milk production and reproductive characters of Lanka buffalo and three exotic breeds (Surti, Murrah and Nili Ravi) maintained on state farms was done by Abeywansa & Abeygunawardena (1995) and the findings are summarised in Table 5.2.

Table 5. 2. Production and reproductive characters (mean $\pm$ SD) of exotic river buffalo and indigenous Lanka buffalo on state farms on Sri Lanka

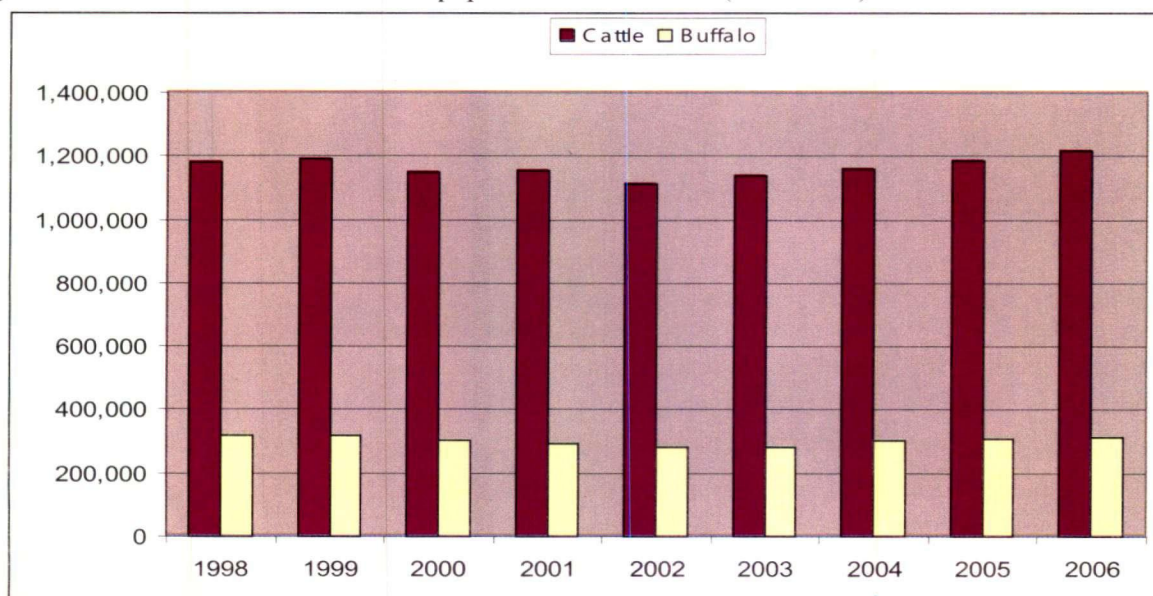
Parameter	Breed type of buffalo			
	Surti	Murrah	Nili Ravi	Lanka
Main calving season	Sept.- Jan	Sept.- Jan	Variable	Sept.- Jan
Age at 1 st calving (m)	51.8 $\pm$ 0.2	54.9 $\pm$ 7.9	52.1 $\pm$ 9.6	44.9 $\pm$ 5.1
Birth weight (kg)	27.1 $\pm$ 4.2	27.6 $\pm$ 2.7	30.1 $\pm$ 5.1	17.9 $\pm$ 2.8
Lactation length (days)	267.3 $\pm$ 74.9	386.6 $\pm$ 91.9	308.9 $\pm$ 97.3	110.5 $\pm$ 20.6
Lactation yield (L)	1003.0 $\pm$ 390.9	1052.1 $\pm$ 496.4	1760.9 $\pm$ 581.4	120.5 $\pm$ 35.6
Calving interval (d)	481.81 $\pm$ 157	509.8 $\pm$ 183.6	490.6 $\pm$ 126.0	506.8 $\pm$ 157.9
Calving to 1 st service (d)	149.32 $\pm$ 79.4	177.4 $\pm$ 83.2	136.9 $\pm$ 90.7	-

Source: Abeywansa and Abeygunawardena, 1995

5.3.2. Buffalo population, their growth and decline in comparison to cattle

The current (2007) population of buffalo in Sri Lanka is estimated to be approximately 319,000 (national livestock statistics). The change in estimated population sizes of cattle and buffalo over the past nine years is given in Figure 5.2. The data show that the population of both cattle and buffalo declined slightly from 1999 to 2003 and thereafter increased slightly. At present buffalo population account for about 20 percent of the total large ruminant population in the country. The distribution of the numbers of male and female buffalo among herds of different sizes is shown in Table 5.3.

Figure 5.2: Estimated cattle and buffalo population in Sri Lanka (1998-2006)



Source: Department of Census and Statistics (2006)

Table 5.3: Distribution of the numbers of male and female buffalo among herds of different sizes in 2002

No. of animals in the herd	No. of herds	Sex		Total
		Female	Male	
1 – 2	16,070	15,599	13,209	28,808
3 – 4	10,859	20,941	16,492	37,433
5 – 6	4,171	13,525	9,113	22,638
7 – 9	2,261	11,771	5,905	17,676
10 – 19	3,161	31,410	10,926	42,336
20 and above	3,268	104,782	27,781	132,563
Total	39,790	198,028	83,426	281,454

Source: Department of Census and Statistics (based on the Census of 2002)

Out of the total number of 198,000 female buffalo and 83,500 male buffalo, the numbers of improved genotypes (i.e. either pure-bred Indian and Pakistani breeds or cross-breeds of these with the indigenous variety) were approximately 20,000 females (10 percent) and 7,500 males (9 percent), with the remainder being Lanka buffalo. The current buffalo population in different provinces is given in Table 5.4.

Table 5.4 : The buffalo population in different provinces of Sri Lanka(2006)

Province	Buffalo population
Western	26,750
Central	24,800
Southern	50,950
Northern	9,000
Eastern	41,450
North Western	83,400
North Central	51,800
Uva	15,070
Sabaragamuwa	15,700
Total	318,920

Source: Department of Census and Statistics, 2006

The state farms operated by the National Livestock Development Board (NLDB) currently contain a total of 2,047 buffalo, of which 869 (42 percent) are cows. The main buffalo farms are located in the dry zone (Polonnaruwa and Ridiyagama) and the coconut triangle (Melsiripura, Marandawila and Nikaweratiya).

5.3.3. Milk production of the buffalo in comparison to cattle

The estimated annual national milk production from cattle and buffalo in the country and the amounts collected by the formal milk collection system (mainly milk processors in the state, cooperative and private sectors) are given in Table 5.5. The data show that buffalo contribute to about 16 percent of the national milk production at present. Overall, the milk collected by the formal collection system is about 55 percent of the national production.

Table 5.5: Annual milk production from cattle and buffalo and the amounts collected by the formal milk collection systems (mainly processors) over the past nine years

Year	Annual milk production (litres)		Total annual production (litres)	Total collected by processors (litres)
	Cattle	Buffalo		
1998	147,381,600	29,707,440	1,770,890,450	100,828,000
1999	149,686,800	30,196,800	179,883,600	108,863,000
2000	151,239,600	30,210,144	181,449,744	92,494
2001	152,764,800	30,262,800	183,027,600	102,245,000
2002	152,840,880	30,354,120	183,195,000	92,043,000
2003	156,546,000	30,258,000	186,804,000	88,003,000
2004	159,696,000	30,600,000	190,296,000	99,235,000
2005	161,816,400	30,925,200	192,741,600	100,185,000
2006	164,862,200	31,648,160	196,510,680	109,308,000

Source: Dept. of Census and Statistics, 2006

The total milk production from the buffalo cows on state farms of the NLDB is around 600,000 litres per year. The average production of a cow is 4.2 litres per day and the average lactation length is 286 days.

The unprecedented rise in the price of imported milk influenced by the prevailing world market trends, have increased the demand for local milk and curd in recent times. This has created a greater opportunity for buffalo farmers to get a good price for their milk and curd.

5.3.4. Contribution of draught animal power in rural agriculture and current trends

Surveys conducted by formerly Agrarian Research and Training Institute (ARTI) by *Ryan et al.*, (1981) and a national survey conducted by the Farm Mechanisation Research Centre (FMRC) of the Department of Agriculture showed that draught animal power (DAP) was used to cultivate about one-third of the cultivable land (Hulangamuwa, 1998). This situation remained throughout the 1990s with 50 percent of the land preparation being done with hand tools and animal power. In rice cultivation, buffalo is principally used for ploughing, harrowing and levelling the land before planting, and in post-harvest threshing (de-seeding) the paddy (Hulangamuwa, 1998). However, it is evident that the traditional role of the draught buffalo in paddy cultivation has been gradually eroded by tractor power during the past 30 years. This has resulted in a slow decline in the buffalo population of the country since the 1960s, as described in Section 5.3.2 above.

A large-scale survey in 16 districts representing all agro-ecological zones of the country (de Silva *et al.*, 1985) showed that 92 percent of the buffalo owners used animals for land preparation in agriculture. The time taken to plough an acre of land with a pair of buffalo ranged from 2 – 4 days. “Puddling” required twice as much time than ploughing. Overall, each buffalo was used for draught over a period of only 52 days per year.

5.4 Biological Aspects

5.4.1. Birth weight and growth rate of different breeds and crosses

Birth weight is generally determined by the breed of the animal and environmental factors that affect maternal nutrition and the resulting growth of the foetus. The influence of maternal nutrition on the foetal growth is great during the last trimester of pregnancy. Seasonal factors such as rain can influence maternal nutrition through forage quality and availability, while heat stress can have adverse effects through reduced feed intake by the cow.

A comparative study on birth weight of four buffalo breeds maintained on state farms (Abeywansa and Abeygunawardena, 1995) showed that the average weight of Lanka buffalo calves was around 18 kg, while that of Surti, Murrah and Nili-Ravi breeds ranged from 27 – 30 kg (Table 4.2). A study on Nili-Ravi calves born to imported dams recorded mean birth weights of 30.5 ± 4.5 kg in male calves and 28.6 ± 4.68 kg in female calves (Komori *et al.*, 1994).

Under dry zone conditions, the growth rate of Lanka buffalo calves was 0.39 kg/day, while that of the Murrah was 0.45 kg/d. However, in the mid-country, under better management and a less stressful environment, the mean daily weight gains in the Murrah were 0.51 kg/day (Tilakaratna, 1982). Similar findings were reported in the growth rate of Nili-Ravi calves born at the Nikaweratiya farm – off-dams imported from Pakistan, with 0.5 kg/day in males and 0.4 kg/day in females (Komori *et al.*, 1994).

5.4.2. Nutrition

Comprehensive reviews on the nutrition of water buffalo are available in recent publications by Ranjhan (1996 and 1998) and Ibrahim *et al.*, (2001). A brief overview is given below.

It is well known that the water buffalo has a unique ability to utilise poor quality forages more efficiently than cattle (Sebastian *et al.*, 1990), with 5 percent of higher digestibility of crude fibre and 4-5 percent of higher efficiency in the utilisation of metabolic energy for milk production (Mudgal, 1999). This is due to a combination of several factors such as higher intake of dry matter and longer duration of feed material retained in the digestive tract. The variety of micro-flora such as bacteria, protozoa and fungi present in the rumen of the buffalo is more favourable for the digestion of low quality fibrous feeds. Besides, the buffalo has the ability to utilise a variety of plant material available in the environment including reeds, floating grasses and aquatic weeds present in marshy lands (Perera *et al.*, 2005).

About 75 percent of the buffalo population in Sri Lanka depends on free grazing in lands under natural pasture and other herbage (Perera and Perera, 1996). With seasonal fluctuations in rainfall, the quality and quantity of available forage also fluctuates, and in times of short supply, the farmers feed them on poor quality crop residues like straw and agro-industrial by-products (AIBP). Thus, a major factor that affects the productivity of the buffalo is poor nutrition.

The potential for extensive grazing and fodder production in Sri Lanka has gradually diminished, with good pastures and arable lands are being used for crop production and human settlements. As a result, only marginal and poor quality lands are left for grazing and mixed

farming. Therefore, simple and new technologies in nutrition, breeding and management need to be introduced to the smallholder farmer, through active farmer participatory programmes in technology generation and transfer. Farmers who are used to rearing buffalo under traditional methods with minimal inputs do not readily accept innovations, especially when they call for extra time, money and labour. However, with proper approach and constant efforts it has been possible to convince farmers to accept newer technologies (Jayasuriya, 2000; Abeygunawardena *et al.*, 1996 & 1997; Perera *et al.*, 2005).

The feed resources that can be used in addition to natural grasses include fibrous crop residues such as rice straw, maize stover, and agro-industrial by-products (AIBP) such as molasses, rice bran, waste from fruit canneries, brewer's grain. Some non-conventional feeds like sugarcane tops and rubber seed meal are other low cost materials that can be used for feeding buffalo.

Studies conducted under a multidisciplinary programme (Abeygunawardena *et al.*, 1996; Abeygunawardena and Siriwardena, 1999) have shown that simple low cost feeding systems can be developed using locally available feed resources. The strategy used was to combine natural grasses, rice straw and legume tree fodder with urea-molasses multinutrient blocks (UMMB) for use by smallholder farmers keeping buffalo under an intensive management system (see Section 5.7).

5.4.3. Reproduction

Comprehensive reviews on the reproduction of water buffalo are available in publications by Perera (1998 and 1999) and Perera *et al.*, (2005). A brief overview is given below.

5.4.3.1. Reproduction in females

Buffalo heifers usually attain puberty when they reach about 55-60 percent of adult body weight, but the age at which this occurs can be highly variable, ranging from 16-46 months. This is influenced by genotype, nutrition, management, social environment, climate, year or season of birth and diseases. Under optimum conditions buffalo heifers can conceive as early as 16 months of age, but more commonly this occurs around 26-30 months. Although buffalo attain puberty later than cattle, they have a longer reproductive life, which compensates for the early disadvantage.

Reproductive characteristics of buffalo are summarised in Table 5.6. The external signs of oestrus are less obvious in buffalo than in cattle, with a major difference being that homosexual behaviour between females, which is common in cattle, is rarely seen in buffalo. The main behavioural signs are restlessness, bellowing and frequent voiding of small quantities of urine. Externally detectable physical changes include swelling of the vulva and reddening of the vestibular mucosa. Mucus secreted from the cervix during oestrus is less conspicuous than in cattle. In hot climates, the duration of heat may be shorter and the signs may be exhibited only during the night or early morning. The most appropriate time for breeding, whether by natural service or artificial insemination (AI), is during the latter part of the oestrus period. Thus, the AM/PM rule which is applied in cattle, where females detected in oestrus in the morning are bred in the afternoon of the same day and those detected in the afternoon or evening are bred the following day morning, also applies in buffalo.

Table 5.6: Summary of reproductive characteristics of buffalo

Parameter	Mean	Range
Age at puberty (months)	30	16-46
Weight at puberty (kg)	275	200-350
Length of oestrus cycle (days)	21	17-26
Length of oestrus (hr)	10	5-27
Time of ovulation: - After onset of oestrus (hr) - After end of oestrus (hr)	34 14	24-48 6-21
Length of gestation (days): - River type - Swamp type	310 330	300-320 320-340
Birth weight of calves (kg)	26	22-36
Involution of uterus (days)	30	25-35

Adapted from Perera et al., (2005)

The duration of gestation in the buffalo ranges from 300 to 330 days with a mean of about 310 days for river types and 320 days for swamp types (Perera and de Silva, 1985). The period of anoestrus or acyclicity after calving is longer in buffalo than in cattle under comparative management conditions and, under good conditions, ranges from 30-90 days. However, factors such as nutrition, suckling management and climate (which also influences nutrition through feed quality and availability) influence the duration of post-partum anoestrus. For example, Lanka buffalo raised under harsh conditions with free suckling by the calves commenced ovarian activity between 150-200 days after calving, whereas those that were raised under free-grazing conditions with abundant natural feed and suckling restricted to once a day resumed cyclicity by 30-60 days (Perera *et al.*, 1987).

Reproductive disorders such as pyometra, cystic ovaries and dystocia occur less frequently in buffalo than in cattle. However, cervico-vaginal prolapse is an important disease condition, observed particularly in late pregnancy and the immediate post-partum period in the Nili-Ravi breed. This seems to be associated with increase in peri-vaginal fat deposition together with excessive relaxation of ligaments and tissues around the birth canal, suggesting some hormonal involvement.

5.4.3.2. Reproduction in males and artificial insemination

Under good feeding and management, young buffalo bulls can be used for breeding from about 26-30 months of age, but sexual maturity or full potential is usually reached about one year later. Although they can reproduce throughout the year, seasonal changes are usually observed in libido and fertility which are related – to factors such as rain, which influence nutrition; and – to temperature and humidity, which influence testicular functions.

The procedures for collection, evaluation and preservation of buffalo semen for use in AI are similar to those in cattle, with the major difference being in the semen diluents, where Tris buffer, skim milk and coconut water are used more commonly as ingredients (Vale, 1994). The two main methods of preserving semen are the chilled form (+ 4 degrees centigrade) and the deep frozen form (-196 degrees centigrade). The former can be used for up to three days after processing, while the latter can be used for over 10 years.

At present, the number of AIs done on cattle and buffalo in the country are around 160,000 per year (Animal Breeding Division, DAPH). The actual number of buffalo are not readily available, but are likely to be less than 10 percent of the total. The majority of the inseminations are done with locally produced frozen semen. Some importations of frozen buffalo semen have been done over the past years (see Section 5.4.4).

AI using semen from improved breeds can be an effective method for rapid gains in milk production, particularly for poor farmers who own draught buffalo and wish to turn to dairying to increase their income. However, the major limitations are lack of awareness among farmers on the advantages of AI and inadequacies in infrastructure for efficient delivery of the service. Addressing these deficiencies will permit the benefits to percolate down to the poorer farmers.

A factor to be considered in cross-breeding is the difference in number of diploid chromosomes in swamp and river types (Table 5.1). The F1 generation will have a proportion of animals with an unbalanced karyotype of 49 chromosomes. Although this does not affect fertility in females, a proportion of males can have lower fertility and such programmes should include measures to detect and cull them. However, this does not pose a problem when crossing Lanka buffalo with Indian or Pakistani breeds, since they all have 50 chromosomes.

5.4.3.3. Reproductive efficiency

The buffalo has been traditionally regarded as a poor breeder with low reproductive efficiency, due to the frequent observation that it is characterised by late attainment of puberty and maturity, seasonality of calving, long post-partum anoestrus, poor expression of oestrus signs, low conception rates and long calving intervals (Perera, 1999). However, it is evident that the majority of farming systems – under which buffalo are raised, involving harsh environments, lack of year-round feed supply and minimal managerial inputs, – have adverse effects on fertility. Studies conducted under different farming systems in Sri Lanka (Perera *et al.*, 1987; Perera *et al.*, 1988) as well as in other countries (Usmani *et al.*, 1985 and 1990; Vale *et al.*, 1990) have shown that they can have good fertility if they are managed and fed properly so as to overcome such stresses.

Buffalo are capable of breeding throughout the year and are termed polyoestrus. However, in many farming systems a seasonal pattern of calving has been observed (Perera *et al.*, 1987). This is mainly due to the influence of climate and feed supply, which result in seasonal fluctuations in ovarian activity and conception, and therefore in calving. In some locations, where annual changes in rain determine the availability and quality of feed, ovarian activity commences some 2-3 months after the onset of rains, followed by conceptions that result in a peak calving season 10 months later.

Under optimum conditions, buffalo can achieve a first service conception rate (CR) of over 65 percent with natural service and 40-50 percent with AI. In well-managed herds, overall annual pregnancy rates of over 80 percent can be achieved, with a calving interval (CI) of 14-15 months. However, in many smallholder systems, particularly where females are also used for draught, the annual pregnancy rates are only around 50-60 percent with CI of 18-24 months. The results available from the NLDB show that buffalo managed on their farms have an average CI of around 16 months.

In modern dairy cattle production systems, the optimum CI is considered to be one year and, since the average gestation length in cattle is 280 days, cows must become pregnant by 85 days after calving. With the longer gestation length of 300-340 days in buffalo a one year CI is often impossible to achieve. Furthermore, although a short CI is desirable in purely dairy systems, it may not be so where draught power and other outputs are also important. Under conditions with limited and highly seasonal feed resources buffalo may calve only every other year. Attempts to reduce this interval could result in losses due to deaths of calves born during unfavourable seasons or to low survivability of the dam itself. Thus, the target for reproductive efficiency in each production system should be based on the optimum economic benefits that can be derived by poor farmers using their available resources in a sustainable manner.

5.4.3.4. Improving reproductive efficiency

Two major limitations that need to be addressed to improve buffalo fertility and thereby the economic benefits to smallholder farmers are poor oestrus detection and long postpartum anoestrus (Perera, 1999). Improving oestrus detection needs education and motivation of farmers, proper identification and records for individual animals and regular close observation for the occurrence of heat signs. Oestrus synchronisation is an alternative that could be applied in some farming systems. However, its use requires a full evaluation of the fertility status in order to select the most suitable hormonal protocol, and careful planning to ensure success.

Prevention of prolonged post-partum anoestrus is best tackled by providing farmers with information on how to manage, feed and breed their buffalo, in order to avoid deleterious effects of harsh climate, seasonal fluctuations in feed availability, parasites and diseases. Under smallholder systems, this demands a holistic approach from researchers and livestock support services; working closely with farmers to develop and transfer a package of appropriate technologies that are acceptable to them. The use of hormones and other therapeutic interventions to overcome anoestrus are unlikely to be successful unless these basic constraints are resolved.

5.4.4 Breeding

The national livestock development policy and strategy has recognised that cattle, buffalo and goat play an integral part in the rural agricultural economy, and has identified the dairy sub-sector as the priority area for public sector investment in livestock development. Upgrading of the native herd is considered a fundamental necessity for dairy cattle and buffalo development (Ministry of Livestock Development, 2006). This envisages preserving the traits of technical importance which have helped native livestock to thrive in hostile environments and low quality feed, while improving their productivity. A national breeding policy for cattle, buffalo, goat, sheep and pig has been formulated by the National Animal Breeding Committee in 1994 to ensure uniformity of

livestock breeding across the country (The National Breeding Policy for Livestock in Sri Lanka, 1994). The breeding objectives, policy and strategy for each livestock species in the various agro-climatic zones (hill country, mid-country, low-country wet, dry and coconut triangle zones and Jaffna peninsula) under intensive and extensive systems of management have been described. The general breeding strategy is to upgrade the existing livestock through cross-breeding using genetically superior breeds and thereby enhancing the production.

In buffalo breeding, the strategy is to produce dairy type buffalo by upgrading the local buffalo using pure exotic breeds such as the Murrah, Surti and Nili Ravi. The regions for this activity are identified as the mid-country and low-country, in the wet and dry zones as well as the coconut triangle, under both intensive and extensive management systems. In cases where draught power is required, the maintenance of 50 percent exotic blood levels is recommended. As the hill country is more suitable to keep dairy type cattle, buffalo breeding is not recommended in this zone.

Artificial insemination has been considered the preferred method of genetic upgrading of the native herd. However in areas where AI is not feasible, use of genetically superior stud bulls has been recommended for upgrading programmes. To achieve these objectives, the Department of Animal Production and Health has imported breeding buffalo and semen from India and Pakistan from time to time on several occasions, as shown in Table 5.7.

Table 5.7: Importations of live buffalo and semen to Sri Lanka

Year	Origin	Live animals				Semen	
		Breed	Male	Female	Total	Breed	Doses
1939	India	Murrah	-	-	124		
1942	India	Murrah	-	-	03		
1951	Pakistan	Murrah	-	-	42		
1969	India	Murrah	-	-	100		
1975	India	Surti	-	-	241		
1983	Pakistan	Nili Ravi	-	-	214		
1989	Pakistan	Nili Ravi	25	-	25		
1990/91	Pakistan	Nili Ravi	22	200	222		
1990	India					Murrah	500
1999	India					Murrah	2,000
2004	India					Murrah	3,000
2004	India					Murrah	2,280
2005	India					Murrah	720
2006	India					Nili Ravi	1,000

Source: Ministry of Livestock Development (2007); DAPH Annual Report (2007)

5.4.5. Potential for milk production

The milk production of Lanka buffalo was studied almost 50 years ago by Wijeratna (1962) in a herd of 100 buffalo cows purchased from farmers and maintained at the state livestock farm at Ridiyagama in the Hambantota district. The herd average for all lactations during an average lactation length of 248 ± 10 days was 79 ± 4 gallons (i.e. 380 ± 19 litres) after allowing the calf to suckle during milking. The dry period was 184 ± 12 days and the CI was 432 days. Thus, the overall average milk production after allowing for calf suckling was 1.5 litres/cow/day. It was concluded that the low production of the Lanka buffalo did not warrant selection of animals within the breed for herd improvement. Therefore, the alternative with greater promise to obtain enhanced milk yields was considered to be cross-breeding the indigenous buffalo with improved dairy breeds from the Indian subcontinent.

Subsequent studies (de Silva *et al.*, 1985, Perera *et al.*, 1989) have shown that only about 40 percent of the buffalo farmers milked their cows, and of this only 14 percent milked them throughout the year, while the others did so only for short periods of about 2-3 months after calving. The farmers who regularly milked their buffalo were largely confined to districts such as Batticaloa, Hambantota, Ampara, Ratnapura, Matara and Kalutara. The average lactation yield of indigenous buffalo was 1.5 litres/cow/day, similar to the findings of Wijeratne (1962), but the period of lactation tended to be shorter, ranging from 150-180 days. Over 50 percent of the farmers who milked their buffalo prepared curd, as it gave higher returns than the sale of liquid milk and also improved the period of preservation in good condition.

The above evaluation of milk production is clearly underestimated, since they do not account for the milk consumed by the suckling calf. A study using radioisotopes to measure body water turnover in suckled calves revealed that the daily intake of milk was around 12 percent of the body weight of the calf (Horadagoda *et al.*, 1994). Using this data the recalculated figure for the average total milk yield of the Lanka buffalo was 3.6 litres/cow/day.

Crossbreeding indigenous Lanka buffalo with specialised exotic dairy breeds such as the Murrah has shown great promise in increasing its milk production potential. Studies conducted by Jalatge (1982) and Jalatge *et al.*, (1989) on animals maintained at a state farm showed that the average milk yield per lactation was 355 litres in pure-bred Lanka buffalo and 1,317 litres in pure-bred Murrah buffalo. When Lanka buffalo cows were crossed with Murrah bulls, the yield of the F1 (50 percent Murrah) was 966 litres and that of the back-cross (75 percent Murrah) was 1,215 litres. Similar results were obtained by Tilakaratna and Jalatge (1983), confirming that there is a progressive increase in milk yield with increase in the level of Murrah blood.

A comparative study on the milk production and reproductive characters of Lanka buffalo and three exotic dairy breeds (Surti, Murrah and Nili Ravi) maintained on state farms (Table 5.2) showed that all three exotic breeds performed below the expected levels for the genotype in milk production and reproduction, and this was presumed to be due to poor feeding and management (Abeywansa and Abeygunawardena, 1995). Although Lanka buffalo was poor in milk production, it was superior to the exotic breeds in reproduction, with earlier sexual maturity and earlier first calving.

Lactation periods and lactation yields of different breeds of buffalo reported from various countries have been summarised by Hogburg *et al.*, (2007) and can be accessed at: (http://www.milkproduction.com/Library/Articles/Buffalo_Milk_Production_Chapter_5_M). In general, the milk yield per lactation of river types range from 1,000 to 2,000 kg, while those of swamp types range from 200 to 500 kg.

5.4.6 Potential for meat production

The buffalo has never been raised for meat in Sri Lanka. This is mainly due to the ban on the slaughter of buffalo, with the objective of conserving the declining buffalo population in the country and for use in draught. Moreover, Sri Lankan consumers have an aversion to buffalo meat for many reasons. However, butchers do slaughter them in illegal slaughter houses and sell the meat as beef from cattle. Despite the efforts taken by the government to conserve the buffalo population, recent census data show a serious decline (see Section 5.3.2).

Studies done in Sri Lanka on the potential of the Lanka and Murrah buffalo for the meat production (Tilakaratne *et al.*, 1976; Tilakaratne, 1982; Cyril and Jayaweera, 1996; Cyril and Siriwardena, 1998) show that there is great potential for raising surplus bull calves for meat under a low cost production system based on forages and crop residues in the dry zone and coconut triangle, and for fattening females that are undesirable for draught and milk. The gain in weight of indigenous Lanka buffalo (0.45 kg/d) and Murrah (0.39 kg/d) were superior to those of cattle (Friesian 0.15 kg/d, Red Sindhi 0.37 kg/d and Lanka cattle 0.30 kg/d) when managed under dry zone conditions. The two buffalo breeds were also superior to cattle in the total yield of lean meat (live weight x dressing percent) at comparable ages. In the mid-country, under better management and a less stressful environment, the mean daily weight gains were 0.51, 0.38 and 0.24 kg in Murrah buffalo, Sindhi and Friesian cattle, respectively. The buffalo were more efficient in the conversion of feed to body tissue, requiring only 11.0 kg DM/kg gain in weight compared to the two breeds of cattle (12.2 and 22.2 kg of DM/kg in Sindhi and Friesian, respectively). Buffalo also had a higher dressing percentage of 50.9 compared to 46.3 and 42.8 in Sindhi and Friesian, respectively. The tests conducted for tenderness of meat and taste panel scores for palatability revealed that buffalo meat compared favourably with cattle meat in eating quality (Tilakaratna, 1982).

Further, studies by Cyril and Jayaweera (1996) have led to the conclusions that: (a) buffalo have the ability to grow faster than cattle and are more efficient converters of feed to meat; (b) there is no difference between meat of males and females, except that meat from females has a higher fat content and lower water content; (c) the common belief that "buffalo meat is hard" is untrue and baseless; (d) buffalo meat is as palatable as cattle meat; and (e) prejudice against buffalo meat is not justified in view of its positive features with regard to the nutritional value and tenderness.

5.4.7. Diseases and their impact on productivity

A comprehensive account of the diseases of the water buffalo is given in the book "*Water Buffalo in Asia IV: Diseases of the Buffalo*" (de Alwis *et al.*, 1999). Diseases of the buffalo can be classified under five broad categories depending mainly on the causative agent, namely: parasitic; bacterial; viral; metabolic; and calf diseases. A brief overview of the important diseases is given below.

5.4.7.1. Parasitic diseases

Gastrointestinal (GI) parasites are one of the most important agents that cause economic losses by reducing the productivity of both cattle and buffalo. GI parasites include multi-cellular parasites such as nematodes and unicellular parasites (protozoa) such as coccidia. The most important GI parasite that affects young buffalo calves is *Toxocara vitulorum*, which is acquired primarily through the ingestion of milk containing infectious larvae from the dam. The larvae develop into adult parasites in the duodenum of the calf, causing clinical signs such as reduced food intake, diarrhoea leading to dehydration, weight loss, debilitation and ultimately to death. A single treatment of the calf at 10-16 days of age with the anthelmintic of choice, Pyrantel pamoate, is effective for eliminating the immature and mature parasites. This disease is important from a zoonotic aspect, because man can get the disease by eating undercooked liver (Roberts, 1990).

Liver flukes belong to the group Trematodes and usually inhabit the bile duct. The commonest flukes in cattle (*Faciola hepatica* and *F. gigantica*) have not been recorded in buffalo in Sri Lanka (Perera *et al.*, 1989). However, the conical fluke *Gigantthocotyle explanatum* occurs in the bile duct of buffalo in Sri Lanka, especially in the dry zone (Abeygunawardena *et al.*, 1996), but the clinical manifestations and economic effects have not been studied. *Schistosoma nasale* is another trematode parasite which develops in the veins of the nasal passage. Clinically the disease is characterised by the presence of thick mucous discharge from the nose. These parasites are transmitted by snails, and infect buffalo during wallowing or grazing around water holes.

Tapeworms (Cestodes) are parasites of the alimentary tract and associated ducts of animals. *Moniezia* is the common cestode found in buffalo (Perera *et al.*, 1989), with *M. benadeni* being the tape worm present in the small intestines of the buffalo calves. While mild infections may be sub-clinical, heavy infections can cause poor growth and ill-health in buffalo calves (Horadagoda, 1998a).

Coccidiosis is an intestinal protozoan disease which mainly affects buffalo calves up to one year of age. It is caused by the ingestion of infective oocysts of *Eimeria*. Clinical manifestations of coccidiosis are diarrhoea and dehydration, and in severe cases dysentery. Mild infections are self limiting, but severe infections can be fatal if untreated. Several species of *Eimeria* have been reported in buffalo in Sri Lanka (Bahirathan *et al.*, 1988/89; Bahirathan *et al.*, 1995).

Sarcosporidiosis is a condition caused by the protozoan parasite *Sarcocystis*. It produces spindle shaped cysts in the muscles of the limbs, myocardium and oesophagus that are visible to the naked eye. This infection is not very pathogenic but causes economic loss in the beef industry due to the need for rejection of affected parts of the carcass.

Buffalo are affected by blood parasites (*haemoparasites*), although to a lesser degree than cattle. Some of the protozoan diseases reported from buffalo are babesiosis, theileriosis and trypanosomosis (Weilgama *et al.*, 1989; Weilgama, 1999). Babesiosis is caused by a protozoan parasite that is transmitted by ticks and infects the red blood cells (*erythrocytes*). The two species that commonly cause disease in cattle (*Babesia bigemina* and *B. bovis*) have not been reported from buffalo in Sri Lanka. Thileriosis is also transmitted by ticks and the parasite infects lymphocytes, erythrocytes and tissue macrophages. Clinical symptoms are reduced appetite, fever, anaemia and enlarged lymph nodes. Two species, namely: *Theileria annulata* and *T. orientalis* have been

identified among buffalo in Sri Lanka. The disease can be prevented by tick control. Trypanasomosis is transmitted by biting flies, and the two species of parasite reported from buffalo in Sri Lanka are *Trypanosoma evansi* and *T. theileri*. In acute and per-acute cases buffalo may show convulsion, ataxia, blindness, frenzy and death. The drugs of choice for treatment of the disease are Diminazene aceturate (Berenil) and Isometamidine chloride (Samorin).

5.4.7.2 Bacterial diseases

The most important bacterial diseases in buffalo are Haemorrhagic Sepicaemia (HS), Black Quarter (BQ), mastitis, tuberculosis (TB), brucellosis and leptospirosis.

HS is an acute infectious disease of cattle and buffalo caused by *Pasteurella multocida* type B:2 and E:2. Buffalo are more susceptible to this disease than cattle and the most susceptible age is 6 months to 2 years (De Alwis & Vipulasiri, 1980; De Alwis *et al.*, 1986). Signs of the disease include severe depression, pyrexia, sub-mandibular swelling, laboured breathing and muco-purulent nasal secretions. Mortality is high, but animals that survive are immune and become carriers of the organism. Prevention of the disease is by annual vaccination. Treatment is effective only if the disease is detected very early and the drugs of choice are penicillin, ampicillin, cephalothin, enrofloxacin and oxytetracycline (Abeynayake *et al.*, 1993).

BQ is caused by *Clostridium chauvoei* which infects buffalo, cattle, sheep and goats. Affected animals show lameness with pronounced swelling of the upper parts of the affected limb, fever, loss of appetite and depression. The skin over the affected area becomes bluish-black and crepitation could be felt on palpation. Sick animals may die within 12 to 36 hours. Prevention is by annual vaccination.

Mastitis is inflammation of the mammary gland due to bacterial infection and is a major cause of economic losses in the dairy industry. The incidence of mastitis is generally less in buffalo than cattle, with studies in Sri Lanka recording rates of 43 percent and 66 percent in the two species, respectively (Wanasinghe, 1982). The main bacteria causing mastitis in buffalo are *Streptococcus agalactiae*, *Staphylococcus aureus* and *Corynebacterium spp.* (Mitra *et al.*, 1985). Infection can occur during lactation or the dry period and the disease can be clinical or sub-clinical. Prevention and control is based on the adoption of strict hygienic measures during milking and early detection of infection so that timely treatment can be done.

TB is an insidious bacterial disease that affects many species of mammals including cattle, buffalo, goat, man and even wild animals. The bacterium causing it is *Mycobacterium tuberculosis*, which causes development of tubercles in any part of the body. Humans contract the disease by drinking raw milk from infected cows or through aerosols. Pasteurisation, boiling or sterilising the milk kills the pathogens. The disease can take several forms; in the pulmonary form there is fluctuating temperature, dry and husky cough and gradual emaciation. In the intestinal form there is persistent diarrhoea. Treatment is of little value, and effective eradication is by testing and slaughtering of all animals that are positive for TB.

Brucellosis is a disease caused by *Brucella abortus* that affects primarily the reproductive system in buffalo and cattle. It is manifested by abortion, still births and infertility, and is also termed contagious abortion or Bang's disease. This disease is of zoonotic importance because it can

infect man, mainly by drinking unboiled milk of infected animals. Transmission between animals is through the ingestion of grass contaminated with infected foetal material and discharges that occur after abortion and through direct contact. Infected bulls also could transmit the disease to healthy cows during mating. It has been reported from several parts of the country (Perumalpillai & Kumaraswamy, 1957; Kumaraswamy, 1982; Peiris & Karunasena, 1989; De Alwis *et al.*, 1993). The incidence is 20-30 percent in some regions, while the overall incidence on a national basis was considered to be around 2 percent (Kumaraswamy, 1982). Brucellosis is a herd problem and basic hygienic measures need to be adopted to contain the disease within the premises and prevent human infection. Eradication of brucellosis requires a rigorous programme of testing and slaughter of all positive animals. Since this is not feasible for economic as well as social reasons in Sri Lanka, the strategy used is to control the disease by vaccination of calves at 4-8 months of age. The vaccine usually reduces the abortion rate, but a corresponding reduction in the level of infection cannot be achieved (Wijewardena, 1999).

Leptospirosis is caused by the *spirochete bacterium leptospira* which infects many animal species and man, and is of zoonotic importance. It causes nephritis, hemolytic anemia, jaundice, abortion and septicaemia (Radostits *et al.*, 1994). In buffalo, it can cause great economic loss from abortions, stillbirths, infertility, decreased milk production and even mortality. A study on the prevalence of leptospirosis in buffalo in 12 districts (Wijewardena *et al.*, 1996) showed an overall prevalence of 42 percent. For preventing the disease basic hygienic measures are important, together with elimination of rodents who are known to be carriers.

5.4.7.3. Viral diseases

The two important viral diseases of buffalo are foot-and-mouth disease (FMD) and rinderpest (RP). Both diseases are characterised by similar clinical signs such as high fever and severe oral lesions, but the dissimilarity is that RP is usually fatal, whereas FMD is rarely fatal in adult animals. Rinderpest has now been eradicated from Sri Lanka.

FMD affects all cloven footed animals including buffalo, and is of great economic importance due to its rapid spread to susceptible animals either through direct contact or through infected material. The virus belongs to the *Picornaviridae* family and has seven serotypes. Severity of the disease in buffalo varies between outbreaks, but is less than in cattle. It is speculated that wild buffalo inhabiting the jungles may be a reservoir of the virus (Fernando, 1982). The most effective strategy for prevention and control of the disease is the slaughter of all infected and in-contact animals, but this is impractical in most developing countries. Hence, in Sri Lanka bi-annual vaccination is done, together with control of the movement of animals from infected areas to disease free regions of the country through the implementation of legislature and procedures.

5.4.7.4. Metabolic diseases

When the physiological capability of an animal fails to meet the nutritional demand for its metabolic processes, which most commonly occurs during pregnancy and lactation, nutrients are drawn from the body reserves to maintain the essential body functions. Such a situation can create a metabolic imbalance resulting in disease related to production. Further information on these is available in Chapter 5 of the book "*Water Buffalo in Asia IV: Diseases of the Buffalo*" (Eds. de Alwis *et al.*, 1999).

5.4.7.5. Calf diseases

Calf diseases and mortality are a major causes of economic losses to buffalo farmers. Studies in Sri Lanka have shown an overall calf mortality of 22 percent, with most of the deaths occurring in those below one month of age and between the ages of 4-6 months (Subasinghe, 1981). Subsequent studies conducted on large state farms also showed a similar pattern of mortality in buffalo calves, with pre-natal mortality of 6 percent and post-natal mortality of 20 percent in a total of 6,500 pregnancies examined (Subasinghe, 1986). The common diseases and causes of mortality were navel ill, scours (diarrhoea), respiratory disease (pneumonia) and parasitic infections. The underlying causes are poor management, nutrition and lack of knowledge among farmers. The magnitude of the problem could be minimised by taking steps to overcome these limitations.

Navel ill is a common ailment of neonatal calves, especially in those raised under unhygienic environment and in the absence of adequate colostrums intake in the first two days of its life. Bacterial pathogens such as *Escherichia coli*, *Actinomyces pyogenes* and *Streptococcus spp.* become opportunistic invaders. Prompt and appropriate treatment is necessary to overcome this problem (de Alwis *et al.*, 1999).

Diarrhoea can be due to viral, bacterial or parasitic causes. Viruses such as rotavirus and corona virus act as primary infective agents in calf diarrhoea (Radostitis *et al.*, 1994). Diarrhoea associated with rotavirus in buffalo calves of the age group 1-150 days has been reported in Sri Lanka (Sunil Chandra & Mahalingam, 1994). The common bacterial causes are infections due to *E. coli* and *Salmonella spp.* The common causes of parasitic diarrhoea are the nematode *Toxocara vitulorum* and the intestinal protozoan *Coccidia spp.*

Calf pneumonia is one of the most important causes of mortality in buffalo calves (Bandaranayake, 1962; Subasinghe, 1981, Subasinghe, 1986). Aetiological agents can be viruses, bacteria or both. Viruses are considered to play the role of primary pathogens initially, while bacterial infection sets in as secondary invaders under the lowered body resistance in affected calves. Environmental factors such as adverse weather, ambient temperature, poor ventilation, overcrowding and poor management can precipitate respiratory disease (Horadagoda, 1999; Subasinghe, 1999). Improvement of housing and management practices can reduce the incidence of pneumonia to a great extent.

5.5 Product Technology

5.5.1. Milk composition and characteristics

Buffalo milk is used very much in the same way as cow milk except that it has a higher concentration of fat and total solids, which gives it a rich flavour. The chemical composition of milk from Lanka buffalo (Horadagoda, 1998; Horadagoda *et al.*, 1994) and a comparison of the major milk constituents with those of the human, cow and goat is given in Table 5.8. Additional information on the composition of buffalo milk from the world literature is available at the web-site: www.netnitco.net/users/djligda/wbfacts2.htm.

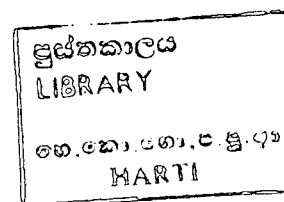


Table 5.8 : Comparison of the constituents of buffalo milk with that of other species

Constituent	Buffalo	Human	Cow	Goat
Fat (g/l)	75	38	37	41
Total proteins (g/l)	52	09	33	33
Casein (g/l)	44	2.5	28	25
Lactalbumin (g/l)	06	6.4	04	04
β -Lactoglobulin (g/l)	02	nil	03	02
Lactose (g/l)	43	70	44	43
Calcium (mg/l)	1560	297	1170	1300
Phosphate (mg/l)	1000	270	960	1060
Sodium (mg/l)	46	15	58	41
Iron (mg/l)	0.2	0.2	0.1	0.05
Energy (kcal/l)	100	69	67	76

Source: Horadagoda, 1998

Studies have shown that buffalo milk has the following comparative advantages over cow milk (www.indiadairy.com/info_buffalo_milk_vs.html):

- Higher in butterfat (nearly double that of cow milk) , but lower in cholesterol content (0.65 mg/g compared with 3.14 mg/g)
- Higher protein content and protein efficiency ratio (PER)
- Richer in important minerals such as calcium, iron and phosphorus
- Whey proteins are more resistant to heat denaturation
- Cheese from buffalo milk (e.g. Mozzarella cheese) has higher demand
- Presence of higher levels of bio-protective factors (e.g. immunoglobulins, lactoferins, lysozyme and lactoperoxidase) as well as bifidogenic factors render buffalo milk more suitable than cow milk for the preparation of a wide range of special dietary and health foods.

5.5.2. Milk products

5.5.2.1. Curd

Curdled buffalo milk, commonly called curd, has been a very popular product since ancient times, and is still largely based on a traditional cottage industry. It is usually prepared by inoculating boiled milk cooled down to about 40 degrees centigrade with a small quantity of starter culture, which is usually from the previous day's curd. The mixture is kept in a warm place and allowed to ferment (curdle) at room temperature for about 24 hours. Common bacteria involved in the starter cultures are *Lactobacillus acidophilus*, *L. bifidus* and *L. bulgaricus* (Horadagoda, 1998 b). Most of the buffalo milk produced in Sri Lanka is converted into curd because of its high economic advantage. At present prices, a farmer selling buffalo milk in liquid form would get about 35 rupees per litre, but when converted to curd the income would be around 120 rupees per litre. The additional costs are minimal in the rural areas, being mainly for the clay pot, since heating the milk is usually done with firewood.

Although curd is acclaimed as a quality product since ancient times, few scientific studies have been done on its quality. Pathirana *et al.*, (1996) surveyed 609 Grama Niladhari divisions in the Hambantota and Moneragala districts and recorded 1,968 curd producers who made on average

19,000 pots of curd per day. The warm climate in the area during most parts of the year helped the fermentation process of the milk, giving a product of firm consistency. However, curdling was found to be poor during rainy weather. Microbiological studies on the curd samples revealed the presence of the following organisms: *Coliforms* 31 percent, *E.coli* 6 percent and potentially pathogenic *Streptococcus spp.* 56 percent. Some yeasts and moulds were also seen, indicating poor keeping quality of the product. *Aspergillus flavus/parasiticus* was found in 31 percent of samples tested. The pH of the curd samples varied from 3.09 to 6.22, whereas the maximum recommended level of pH is 4.5. The starter cultures isolated from the curd samples were *L. fermentum*, *L. celobiosus* and *S. lactis*. The minimum inoculum required for satisfactory curdling was 0.5g of the previous day's curd (34×10^6 colony forming units). The extent of curdling was found satisfactory after 6-8 hours. The conclusion was that the quality of curd could be improved by introduction of processing and manufacturing procedures based on scientific principles.

5.5.2.2. Yoghurt

Although yoghurt is a common and popular fermented preparation of cow milk throughout the world, buffalo milk is less frequently used for its preparation. Buffalo milk is usually de-fatted to a standard level prior to the fermentation process, and the yoghurt is firmer in texture than that from cow milk. The organisms used as starter cultures for the fermentation are *L. bulgaricus* and *S. thermophilus* (Renaud, 1994).

5.5.2.3. Soured milk

This is an important component in the Indian diet and contains mainly clotted proteins (Horadagoda, 1998b). It is prepared by boiling the milk in an open pan and allowing it to cool down after which fresh lemon juice is added to curdle the milk. The curdled (sour) milk is collected after removing the water by straining it off through a piece of muslin. It is used in Bulgaria as an additive for soups, in desserts and as a breakfast food (Alexiev, 1998).

5.5.2.4. Cream

Buffalo milk is popularly used in the preparation of cream, because of its high butterfat content and white colour. It is an extract of milk which contains mainly fat and one-third of protein and lactose. Half cream has 12 percent butterfat, double cream has 18 percent and whipping cream has 35 percent. It is used widely in desserts, pastries and in confectionery. It is also used with tea and coffee particularly in restaurants and hotels (Horadagoda, 1998b).

5.5.2.5. Ghee

Buffalo ghee (locally known as *dun-thel*) is butterfat of milk dehydrated by slow heating, clarified while hot and allowed to solidify at room temperature. It has excellent keeping qualities when carefully prepared, with minimal loss of the vitamin A content of milk. Ghee prepared from separated cream has no pigment, and when solidified it has a white colour. It is used in traditional Sri Lankan homes as cooking oil, in the preparation of bread and cakes in bakeries and also for lighting oil lamps in religious rituals of Hindu and Buddhist culture.

5.5.2.6. Butter

The very high butterfat content of buffalo milk makes it particularly advantageous for the preparation of butter. Churning time of the buffalo cream is comparatively shorter than with cow milk cream. Butter made from buffalo milk is usually white in colour, unless colouring is purposely added. Buffalo butter is a popular product in India.

5.5.2.7. Cheese

Buffalo milk has not yet been used in the preparation of cheese in Sri Lanka; although cow milk is used for this purpose on a commercial scale by several manufacturing organisations such as the NLDB, MILCO, Kotmale Dairies and Ambewela Dairies. Buffalo cheese is popular in India and many other countries, with several types of soft and hard cheese being made. The most famous buffalo cheese in the world is the Italian “Mozzarella de Bufalo”. It is a fresh delicacy prepared under an old traditional technology dating back to the middle ages. Mozzarella cheese is soft and elastic, white in colour, with a light acidic pleasant taste. It has a short shelf life. In the supermarket, it is sold in brine and can be kept in the refrigerator for one week (Alexiev, 1998). Mozzarella is currently made in Italy and other Mediterranean countries as well as in some Latin American countries. The main demand is from the makers of Pizzas, where it is an essential ingredient.

5.5.2.8. Other products

Products such as condensed milk, powdered milk and baby foods are made from both cow and buffalo milk, often mixed together during the procedures of milk collection or processing.

5.5.3. Meat and meat products

Both swamp and river type buffalo are used as a source of meat in many countries. In most Asian countries they are often slaughtered at an advanced age after using them for draught and milk, and the meat is therefore, of poor quality. However, if they are raised under proper nutritional and management conditions and slaughtered at an early age (2-3 years) the quality of meat is comparable to that of cattle raised under similar conditions (see Section 5.4.5). Studies by Cyril and Jayaweera (1996) showed that the composition of buffalo meat is 75 percent water, 22 percent protein, 1-2 percent ash and 1 percent fat.

The procedures immediately prior to and during slaughter have important effects on meat quality. Animals should be rested prior to slaughter and proper accommodation (lairage) facilities for this purpose are usually provided in modern abattoirs. In Muslim countries, animals are slaughtered by bleeding them without stunning and by methods prescribed by their religious texts (Holy Quran). Throughout Asia Muslims have dominated this trade, and in Sri Lanka too the situation has been the same. In countries like Nepal and Philippines, the animals are pithed by a stab between the skull and cervical vertebrae and bled immediately. In Thailand, a captive bolt pistol is used to stun the animals prior to slaughter (FAO, 1977). In India, several modern abattoirs with world class sanitary and phyto-sanitary facilities have been established in a number of districts, and over 32 modern processing plants receive dressed carcasses from these abattoirs and process the meat for export (Ranjhan, 2000).

The situation in Sri Lanka, on the other hand, is that there are no modern abattoirs, and the two main municipal abattoirs in Colombo and Kandy have woefully inadequate facilities. In fact, often slaughtering in the country outside the municipalities is done under primitive conditions with no technical supervision. It is therefore, hardly surprising that the quality of beef is inferior, and the increasing trend for the population to refrain from eating beef is partly due to this factor, the other being religious considerations.

In any industry proper market outlets have to be ensured for the producer in order to be profitable and sustainable in the business. Similarly, if buffalo production is to be a triple purpose (dairy/draught/meat) industry, there should be satisfactory and close vertical integration of the producer and the processor, in the case of both milk and meat. A good example is the poultry industry in Sri Lanka, where there is a very close link between the producer and the processor. However, in the dairy industry these links are weak, while in the meat industry they are non-existent. Most often the Sri Lankan butchers and their agents exploit rural farmers and induce them to sell their surplus stock at unreasonably low prices.

The main processed products of meat in Sri Lanka are items such as sausages, meat balls and ham, which are aimed at the tourist market and higher end of the urban consumer society. These are based mainly on meat from cattle, pigs and poultry, and do not influence the market for buffalo meat.

5.6. Constraints Faced by Farmers

From a global perspective, constraints to sustainable livestock production by the resource poor farmers have been classed into three major categories (Heffernan *et al.*, 2005). These are fully applicable to the current situation that prevails in Sri Lanka, and are given below together with further observations of relevance:

- Procurement of animals: Generally poor farmers find it difficult to access capital and credit facilities to purchase the required breeding stock. In Sri Lanka, this is further aggravated by the lack of adequate numbers of good quality animals for purchase at present.
- Management: This means the ability to obtain animal health and production services, such as veterinary, breeding and advisory services. The rural areas of Sri Lanka are inadequately served in this respect, and there is an urgent need for expansion and strengthening the state and other agencies involved in livestock development and agriculture.
- Marketing: Non availability of reliable and steady markets for their products is a major constraint frequently faced by small farmers. Milk being a highly perishable product, has to reach the procurer and processor as soon as possible. In most parts of the country, milk collection is done only in the morning, and the farmers have no way of selling the evening milk. In this aspect too, relevant state agencies need to intervene to assist farmers to find sustainable markets initially, until strong farmer organisations with necessary skill and competence to carry out these functions are established.

Studies conducted specifically on the constraints faced by buffalo farmers in three different regions of Sri Lanka under the SAREC/NARESA Water Buffalo Research and Development Programme (see Section 5.7.2) revealed a wide range of constraints to improving the productivity

of smallholder livestock farmers. These constraints are still prevalent and some of them are common constraints faced by all dairy producers, while others are specific to buffalo farmers.

The common constraints faced by dairy farmers are as follows:

- Low farm gate price of milk, which is determined by government policy and the monopolistic practices of milk collection systems. This is further influenced by:
 - Lack of producer participation in collection and marketing, thereby resulting in monopolies and malpractices by the collectors and exploitation of the farmers;
 - Influx of high milk imports to the country (85 percent of the national requirement);
 - Powerful advertising campaigns by importers of milk products in order to sway consumer preference away from local milk products; and
 - Lack of milk collecting facilities in certain areas, and inadequacies even in some areas where they exist, with only morning milk being collected.
- Shortage of suitable breeding stock in the country. The factors influencing this are:
 - The state sector livestock farms of the NLDB are mandated to supply superior breeding stock to farmers, but they are able to meet only about 20 percent of the demand;
 - Inefficiencies in the animal distribution system from state farms;
 - Lack of organised livestock markets for farmers to sell and buy animals;
 - Limitations of the AI programme, with only 10-15 percent of breedable cows being served by AI, and only 2-5 percent of calvings attributable to AI; and
 - Lack of natural breeding (stud) services in areas where AI services are not available.
- High cost of feeding dairy animals. This is influenced by:
 - Seasonal fluctuations in ruminant feed resources resulting in scarcity;
 - High price of compounded feeds; and
 - Lack of knowledge on methods of low cost feed supplementation.
- Lack of an appropriate long-term government policy and sustained support to improve local milk production and progressively reduce imports. This is due to:
 - Inadequate government support for livestock extension services in management, health, breeding and product technology;
 - High cost of veterinary services and drugs;
 - Lack of follow-up programmes implemented by the line ministry and the Department of Animal Production and Health (DAPH) and to continue the livestock development programmes that were initiated and funded by international grants and loans; and
 - Lack of credit facilities, tax rebates, insurance schemes and other incentives to encourage small- and medium- scale private enterprises in dairy production.

The main specific constraints faced by buffalo farmers were as follows:

- Decreasing availability of land and water resources for keeping buffalo. This problem is most acute in previous low land-use areas that are now brought under irrigated settlement schemes;
- Lack of knowledge among farmers on intensive systems of buffalo production and their integration with crop production for mutual benefits;

- Lack of knowledge and support mechanisms for small-scale production and marketing of value-added dairy products from buffalo milk; and
- Failure of the government to recognise the multipurpose potential of the buffalo for milk, meat and draught, and implement suitable long-term development programmes.

5.7. Improvement of Buffalo Productivity under Small-farm Conditions

5.7.1. Research, technology generation and transfer

During the past few decades, considerable amounts of funds (both local and foreign) have been spent on agriculture and livestock research. However, it is believed that the impact of this research on the farming system and the rural community has been low due to the following reasons:

- Research projects were focused mainly on problems of fundamental and academic nature, were designed based on the priorities and perceptions of the researchers, and were usually laboratory oriented;
- Most scientists had little or no direct contact with the farming community, and therefore had little knowledge about the farming environment and the farmers' needs and aspirations; and
- Such projects failed to generate and transfer appropriate technologies that were applicable for solving the farmers' problems and could be adopted and sustained using the resources available to rural smallholder farmers.

It was therefore realised that in order to understand the multifaceted problems of the farmers, a multi-disciplinary approach was required. Furthermore, active participation of the farmers in the process of problem definition, adaptive research and in the generation and transfer of appropriate technologies was essential. This has led to the approach known as farming systems research (FSR), which involves methods such as rapid rural appraisal (RRA), participatory rural appraisal (PRA) and farmer participatory research (FPR). The FSR approach is based on the premise that technology generation appropriate for smallholder rural farmers requires prior knowledge of farm constraints and priorities and that feed-back loops must be in place between the end-users and researchers throughout the process of technology generation and transfer.

With regard to buffalo farming in Sri Lanka, studies conducted during the 1980s aimed at understanding the production systems under which buffalo were raised, their current reproductive and productive performance and the major limitations to improvement supported the contention that the buffalo could play an important role in rural development through supplementary income generation in smallholder crop-livestock farms (Perera *et al.*, 1984; de Silva *et al.*, 1985). This resulted in the first national workshop on buffalo production, which was held in 1980 under the sponsorship of the Swedish Agency for Research Cooperation (SAREC), and provided Sri Lankan scientists an opportunity to present the research information available up to that time, identify gaps that existed in the knowledge base, and make recommendations on research needs and priorities. As an outcome of the workshop, SAREC agreed to provide financial assistance for a coordinated and multidisciplinary research programme and the Natural Resources, Energy and Science Authority of Sri Lanka (NARESA, currently the National Science Foundation) undertook the responsibility of coordination and administration of the programme.

5.7.2. SAREC/NARESA Water Buffalo Research and Development Programme

The broad objectives of the programme were: (a) generation of baseline information on management and uses, nutrition, reproduction, diseases, products and product development and socio-economics, to identify constraints and opportunities for sustainable buffalo farming; (b) development of new technologies and management packages through on-station and on-farm research to overcome identified constraints; and: (c) dissemination of information on appropriate new technologies to wider groups of farmers. The programme commenced in 1984 and was undertaken in three successive phases, extending over a 15-year period.

5.7.2.1. Phase I (1984-1988): Baseline information generation and constraint identification

During this phase, twelve research projects were conducted and the findings that were published in journals, books and conference proceedings are cited in the appropriate foregoing sections. A synthesis of the important findings that subsequently led to the generation of an appropriate technology package is given below:

- Buffalo continue to be an integral component of the rural farming systems and are used by smallholder farmers primarily for draught, and to a lesser extent for milk and meat. Buffalo and cattle farming is an important supplementary income generating activity, with milk providing regular cash income unlike crop production which is seasonal.
- In many areas buffalo are managed with minimum inputs and fed on natural pasture and other vegetation in scrublands. Surplus animals are sold for meat and about one-third of the country's meat supply is derived from buffalo. Such sales also cushion the risk associated with crop failures and help to enhance capital assets.
- This valuable rural industry is under pressure due to diminishing communal grazing lands, and the extensive system of management needs to be changed towards more intensified operations, with a change in the type of animal from a draught type to a multipurpose type able to produce milk in addition to meat and draught power, utilising crop residues such as rice straw available in the villages.
- Buffalo are able to utilise pasture and fodder resources which are not generally preferred by cattle and have an advantage in their ability to digest coarse forages.
- Dairy buffalo need more nutrients for milk production and the feed deficiencies arising under smallholder management conditions due to the seasonal pattern of rainfall can be overcome by supplementation with low cost urea-molasses-mineral (UMM) multinutrient feed formulations.
- Buffalo usually need to wallow in order to dissipate body heat during the hottest part of the day, but sprinkling water on them during this period is a satisfactory alternative to wallowing.
- Buffalo cows usually have a long period of sexual inactivity after calving, particularly if the calf is allowed to suckle freely. Restricting the suckling to once or twice a day, and keeping calves and dams separated at other times, allows sexual activity to resume earlier and therefore improves their reproductive efficiency.
- Buffalo are affected by specific gastro-intestinal parasites, viruses and bacteria. The high calf mortality that occurs due to the parasite *Toxocara vitulorum* can be overcome by strategic worming at the age of two weeks, using a cheap and commonly available anthelmintic drug. The major bacterial and viral diseases can be prevented by timely vaccination.

5.7.2.2. Phase II (1989-1994): Farming systems approach to technology generation

The FSR model used included the following sequence of farmer-oriented steps: (a) selection of target group of farmers; (b) diagnosis of constraints and defining of goals of the farming system; (c) on-station and on-farm research to develop appropriate technologies with feed-back loops for continuous refinement; and (d) lateral dissemination of farmer approved results to wider groups of beneficiaries.

The findings from PRAs with buffalo farmers in different farming systems of the country were used together with scientific results from on-station research to develop a model for "Smallholder Intensively Managed Buffalo Units" (SIMBU) to carry out on-farm studies. This model was designed on the firm understanding that rural farming households had: (a) surplus labour, which has very little alternative uses; (b) access to supplies of green fodder, tree fodders and crop residues such as rice straw; (c) a practical need for greater integration of crop and livestock farming (i.e. crops providing crop residues as animal feed; animals providing draught power for land preparation and threshing as well as dung for enriching soil fertility); and (d) a need for a source of supplementary income, particularly of a regular nature, to avert the risk of getting into the agricultural debt cycle.

Following rigorous on-station experimentation, the SIMBU model units were replicated on 9 smallholder farms in the Mahaweli System H. During the next three years, the feeding and management systems were further refined and adapted. The main features of the SIMBU model were:

- Appropriate low cost housing providing adequate ventilation, hygienic floors, feed and water troughs, and storage space in the loft for crop residues
- Maintaining 2-3 adult buffalo cows and their calves (either pure Indian dairy breeds or their crosses with Lanka buffalo) yielding 4-10 litres of milk per day
- Feeding based on grass and tree fodder as the basal diet; leguminous trees grown as alleys or on perimeter fence; full utilisation of rice straw in conjunction with UMM supplements
- Sprinkling of water as an alternative to wallowing, to reduce heat stress
- Improved reproduction through heat detection, timing of service (AI or natural, depending on availability) and timely pregnancy diagnosis
- Restricted suckling, twice a day at milking time only, to permit early resumption of sexual cycles in the dam after calving
- Improved healthcare package for calves to reduce mortality, increase growth rate and advance the age at first calving; deworming at 12-16 days after birth to control *Toxocara vitulorum* infection; appropriate vaccination programme
- Body Condition Scoring system using a 1-5 scale, as an aid for matching feeding to the reproductive status and productivity of each animal
- Hygienic milk production and value addition by conversion to curd and other products
- Recycling of animal and crop wastes to provide mutual benefits to crop and livestock production
- Maintenance of simple farm records and their use in decision making

The model units operated by buffalo farmers proved that dairy buffalo yielding 4-5 litres of milk can be maintained on a low cost UMM supplemented diet, and the reduction in feed costs compared to conventional compounded feed supplements was 75 percent. Each unit provided a

regular income of 100 to 200 rupees per day to smallholders (at the prices prevailing in 1994 for milk and curd), which was sufficient to meet the day-to-day needs of the family. The nutritional status of the family improved and the asset base of the farmer grew with time as the herd size increased through reproduction.

5.7.2.3. Phase III (1995-1998): Information dissemination and technology transfer

The final step in the FSR approach, that of lateral dissemination of the farmer approved appropriate technologies to a wider group of beneficiaries, was done during this phase. It was undertaken by scientists from the University of Peradeniya, in collaboration with state, para-state, co-operative and private agencies in the livestock sector. The activities included popularisation of intensive buffalo rearing through documentation and creating public awareness of the benefits. They included the following:

- **Field Projects:** Demonstration farms were established in villages of Mahaweli Systems C and H, and the coconut triangle to demonstrate the applicability and effectiveness of the new technologies. Selected farmers were provided assistance and technical advice to upgrade their holdings to the status of the SIMBU model, as demonstration training locations for other farmers
- **UMMB Manufacture:** Three manufacturing units were been established on state farms. Dairy co-operatives and the private sector were provided technical know-how to venture into this field
- **Documentation Centre:** Established at the library of the Institute for Continuing Education in Animal Production and Health (ICE/APH), to serve as a depository and resource base for future research and development on buffalo production
- **Publications:** A series of publications were prepared, including a book for scientists and students, a compendium of research information, a handbook for extension workers, and information leaflets for farmers
- **Public Awareness Programme:** Done through linkages with on-going agricultural programs on television and radio, to highlight the potential of the buffalo and to popularise buffalo farming as well as the production and consumption of wholesome buffalo products
- **Continuing Education Programmes:** Implemented in collaboration with the ICE/APH, the provincial directorates of Animal Production and Health and milk producer co-operatives in selected areas. The objectives were to update the knowledge and skills of farmers, extension workers, field officers and administrators in appropriate technologies.

Regular monitoring and review of progress and terminal impact assessment conducted by SAREC has shown that this programme is one of their most successful over the past several decades. It has demonstrated that the FSR approach can be used for developing appropriate technologies to overcome constraints faced by rural farmers. It has also demonstrated that this approach will enable scientists to contribute more effectively toward attainment of national goals of sustainable economic development.

5.8. Legal and Policy Issues Affecting the Industry

5.8.1. Legislation relating to disease control and slaughter of buffalo

The three main legislative enactments that have a bearing on cattle and buffalo development in Sri Lanka are the Animal Diseases Act No 59 of 1992, the Animal Feed Act No 15 of 1986 and the Animals Act No 46 of 1988. Implementation of these Acts has been vested with the Director General of DAPH.

The Animal Diseases Act governs the import, export, quarantine and movement of livestock and poultry, as well as animal disease control. The Veterinary Drug Control Authority (VDCA) has been established in accordance with section 32 of Animal Diseases Act for the following purposes: (a) control of import, export, manufacture, sale and use of veterinary pharmaceuticals and biologicals; (b) promotion of research and clinical trials; and (c) to ensure the effective and safe use of veterinary pharmaceuticals and biological products through pharmaco-vigilance.

The Animal Feed Act is to regularise the production, distribution and sale of animal feeds and to formulate regulations to supervise and control matter thereof. The line ministry and DAPH are expected to ensure the implementation of provisions under this act and make necessary amendments depending on situation of the industry at any given time. The Animals Act No 46 of 1988 governs breeding, slaughter and transport of animals.

With regard to buffalo farming, the major legal issue has been the banning of slaughter of buffalo and the lifting of the ban on several occasions by previous governments. The present situation is that there is a complete ban on the slaughter of all buffalo, by a Cabinet decision made at the end of 2005. It is understood that this will be included as an amendment to the regulations under the Animal Disease Act. This step is aimed at reversing the negative population growth of the buffalo in recent times and to stop the indiscriminate slaughter of buffalo in the country. However, clear provisions have to be made to dispose of animals that are unproductive or unfit for draught, as well as males that are surplus for breeding purposes after authorisation by a competent professional such as a veterinarian. If not, such animals become an economic burden on the farmer who has to incur costs for feeding and maintenance, with no economic return.

As outlined in Section 5.5.3, Sri Lanka lacks a well-organised and developed meat industry. The result is that the farmer does not get a fair price for his surplus stock, and the consumer does not get a quality product. A clear policy framework and operating mechanisms are necessary to ensure that the unproductive females and surplus males of both cattle and buffalo are fully utilised for the legitimate meat supply in the country. This would also encourage the private sector to venture into and improve the procurement, processing and marketing of meat and meat products.

5.8.2. Current government policies on support and development of buffalo production

The declared policy of the present government on livestock development (Source: Ministry of Livestock Development, National Livestock Development Policy and Strategies, 2006) states that the dairy sector will be given priority for public sector investment in livestock development.

The strategies for improving the dairy industry have been outlined in general terms, and a synthesis of these is presented below:

- Promotion and expansion of the liquid milk market
- Upgrading the native herd as a fundamental necessity for dairy development
- Encouraging the private sector to contribute to dairy production
- Increasing the role of the buffalo in the domestic dairy industry
- Facilitating the transformation of the present subsistence level dairy producers/farmers into commercially viable and sustainable activity
- Providing a conducive environment for the domestic dairy industry through policies on importation of dairy products and relevant fiscal matters
- Allowing market forces to govern the pricing mechanism of domestic milk
- Developing the medium- and large-scale private sector engaged in the dairy industry for long-term sustenance of the dairy industry
- Facilitating and empowering the dairy farmers and the processors in the value chain of the dairy products.

While these policy guidelines are laudable in terms of the government's intended objectives, the mechanisms for achieving them in terms of actual activities and inputs at the grass-roots level have not been elucidated. Nor is there any mention of the procedures for implementing and monitoring these programmes, or for evaluating their outcomes in terms of verifiable performance indicators.

The agencies coming under the ministry are the ones that have the responsibility for ensuring the implementation of these policy guidelines. These include the National Livestock Development Board (NLDB), Department of Animal Production and Health (DAPH) and Milk Industries Lanka Company (MILCO). The cooperation and support of the provincial ministers in-charge of the subject of livestock, provincial directorates of animal production and health, district secretaries, divisional secretaries and local government authorities would be necessary for the successful implementation of a long term livestock development plan. It must also be stressed that the support of the Ministry of Agriculture will also be necessary for the implementation of a meaningful draught animal programme alongside a dairy buffalo development programme.

The mandate for maintaining nucleus animal breeding farms and issuing superior breeding stock to private farmers now rests with NLDB, since the farms of DAPH were transferred to NLDB in 1991. However, the records on the actual numbers of breeding stock issued to farmers indicate that this has had a very limited impact on genetic improvement of cattle and buffalo for dairy production. For example, during 2006 the total buffalo population on NLDB farms was 2,000 and the number of animals issued to the public was 151. This can be attributed to various factors, including poor reproductive management of the breeding cows and high mortality in the calves born, resulting in the inability to even maintain herd numbers.

DAPH and the provincial directorates of livestock are the major government agencies responsible for animal disease control including preventive vaccination against infectious animal diseases. Provision of animal breeding, extension and veterinary services also rest on them. However, there are major deficiencies in fulfilling these functions to the satisfaction of the beneficiaries, who are the smallholder farmers. Since the devolution of field veterinary service functions to the

provincial administration in the early 1990s, there has been a break down in the close coordination of the activities between the centres (DAFH) and the provincial directorates. At the periphery, they tend to follow somewhat independent programmes influenced largely by the provincial ministers in charge of the subject of livestock. We believe that this is not a healthy situation. The national ministry in-charge of livestock development could coordinate all livestock related national policies and activities in the country with the fullest cooperation of the provinces. National, provincial and local resources and needs could be well taken into consideration through collective planning and monitoring. The Ministry of Livestock Development and DAFH has to provide the leadership and backup for such a national programme.

MILCO, the successor to the National Milk Board (NMB) is another institution that comes under the purview of the Ministry of Livestock Development. NMB was originally established under the Milk Board Act No 18 of 1964 for promoting milk production, procurement, processing and marketing of milk to consumers in the country at reasonable prices. MILCO continues to handle the activities which have been assigned to it at the commencement and has three processing plants located in Colombo, Digana and Ambewela producing a variety of products. The Ambewela factory is their only spray-dried powdered milk plant. With the passage of time, several private and cooperative sector processors started competing with MILCO to purchase the milk produced in the country. Of these, Nestle Lanka Limited (NLL) is one of the major organisations manufacturing milk products in Sri Lanka since 1980. NLL commenced their activities by taking over the management of the NMB condensed milk factory at Polonnaruwa. Thereafter, they built a plant in the Kurunegala district to produce full cream powdered milk. This plant produces several branded products such as "Nespray", "Nestomalt" and "Milo". There are three milk processing companies which have been established with BOI approval producing ultra heat treated (UHT) and pasteurised milk. They are: Lanka Dairies (Pvt) Ltd., a subsidiary of Lanka Milk Foods and Stassens Group producing "Daily Milk", Dairy Lanka (Pvt) Limited, a subsidiary of New Zealand Milk Products and Tropifruit, which produces UHT milk under the brand name "Rich Life". Lanka Milk Foods now produces UHT milk from milk produced at Ambewela and New Zealand farms. A few cooperative unions like the Coconut Triangle Milk Union and Polonnaruwa District Milk Producers' Co-operative Society also procure and process milk.

Another state agency that is involved with livestock development in the country is the Livestock Division of the Mahaweli Authority of Sri Lanka (MASL). This programme commenced in 1970 with the diversion of Mahaweli waters to the dry zone areas as a major irrigation and human settlement scheme. The original objective was to provide draught animals (cattle and buffalo) required by Mahaweli settlers, for which purpose several large farms were established for breeding these animals and the implementation was placed under a separate organisation called the Livestock Development Division of the MASL. In the 1980s, the programme was expanded to cover dairy cattle and buffalo breeding, milk collection, processing and marketing. These farms were located in Mahaweli Systems H, C, B and Udawalawe. Besides dairy cattle, some of these farms maintained exotic dairy buffalo of the Murrah and Nili Ravi breeds. The farms that maintained buffalo were Kalankuttiya (System H), Girandurukotte (System C) and Mutuwella (System B) and they performed the task of breeding and issue of exotic breeding stock to the settlers in the respective regions for dairy and draught. However, with the passage of time low priority was placed on the original objectives by successive authorities of MASL, which has resulted in the gradual decline in the quality of stock, their numbers and management. These national assets could be

revived if fresh inputs such as new germplasm, managerial expertise and the necessary finances are provided early. These animals could be used as nucleus herds to merge with the national livestock development programme, with the support of the Ministry of Agriculture and MASL. At present, MASL is involved with the collection, processing and marketing of several milk products produced at the Thambuttegama and Girandurukotte milk processing plants.

Besides the buffalo farms maintained by the NLDB and MASL there are a few private dairy buffalo farms in peri-urban areas like Nawala, Piliyandala, Homagama and Horana and in Dambulla, Hinguraggoda and Kurunegala. At present, they receive little support from state. They should be encouraged and supported through the state machinery to improve the quality and productivity of their animals and feeding systems.

It is also clear that there is very little collaboration and coordination of activities between the various agencies responsible for livestock development and support to private farmers. Thus, a radical change in the policies and activities of all governmental agencies involved in the various aspects of livestock development is necessary. The primary objectives and functions of these agencies need to be reviewed and refocused.

There have been many previous imports of live cattle and buffalo to Sri Lanka in the past, but these have not provided the expected impetus for dairy development. It is important to consolidate the contribution of the progeny of such superior imported stock on the breeding farms and to improve their management conditions, before resorting to further importations. Imported stock at any future date should be located in suitable nucleus farms with facilities for better nutrition, management and healthcare. Their offspring must be managed properly and evaluated using comprehensive recording of all production data, and then subject to stringent selection for use in future breeding programmes.

With respect to the specific aspects of buffalo production, it is evident that the policy guidelines give little attention to this sub-sector. The scientific literature from Sri Lanka as well as other countries proves that the buffalo could be developed successfully to meet the needs of smallholder farmers as a multipurpose ruminant for dairy/draught/meat production. The buffalo is able to adapt well to any of the environmental conditions prevalent in Sri Lanka, including the vast tracts of underutilised land in the dry zone of the country, and thrive on coarse fodder, crop residues and agro-industrial by-products.

A well-planned programme of upgrading the Lanka buffalo to the Indo-Pak river types through selective breeding in combination with improvement in nutrition and management will result in enhanced milk production, increased availability of animal draught for agriculture, and good quality meat from surplus males and culls. Therefore, the authors urge that the government's policy and development strategy should focus as much attention on the buffalo as on the dairy cow, and provide the thrust necessary to improve the quality and increase the number of productive buffalo in the country.

No mention has been made in the ministry's policy document on the development of draught power using buffalo. In the current context of escalating prices of fossil fuel and machinery, this is an opportune time to revive the use of draught animal power for rural agriculture, as was done for centuries past in Sri Lanka. This should be done by the Ministry of Livestock Development in

collaboration with the Ministry of Agriculture, which is responsible for crop production.

5.9. Conclusions and Recommendations

5.9.1. Why keep buffalo?

Buffalo are preferred over dairy cattle by many rural smallholder farmers in the dry and intermediate zones of Sri Lanka. The main reasons are; their ability to utilise poor quality forage, survive under harsh environments and provide milk rich in butterfat and protein; and also provide draught power and organic manure for crop agriculture. Buffalo curd is in high demand in the cities, particularly "Ruhunu curd", which has been traditionally reputed for its delicious flavour.

However, with increased land-use intensity for crop production and human settlements, only marginal and poor quality lands are left for grazing and mixed farming. Therefore, simple and new technologies in nutrition, breeding and management need to be introduced to the smallholder farmer, to enable them to use more intensive systems of buffalo production. This requires active farmer participatory programmes in technology generation and transfer to promote integrated farming systems that use buffalo as a multi-purpose animal.

5.9.2. Population trends, importations and upgrading

The buffalo population stood at 0.8 million in the 1980s, but the last agriculture census of 2002 showed a drastic decline to about 0.3 million. There is a need to arrest this decline by ensuring that the potential contribution of buffalo to the improvement of smallholder farm economies through milk, meat and draught is fully utilised.

Exotic river type breeds of buffalo (e.g. Murrah, Surti, Nili-Ravi) have been imported to Sri Lanka on several occasions in the past, to upgrade the indigenous buffalo and to increase milk production in the country. However, these have not provided the expected impetus for dairy development. It is important to consolidate the contribution of the progeny of such superior imported stock in the breeding farms by improving their management conditions, proper recording and evaluation of their productivity, and selection of the superior animals for future breeding programmes

5.9.3. Contribution to milk, meat and draught

The total annual milk production in the country in 2006 was 197 million litres of which buffalo milk contributed 32 million litres (16 percent). There is clear potential for increasing this contribution through appropriate policies and technologies, thus reducing the importation of dairy products.

The buffalo has not been raised for meat production in Sri Lanka, mainly due to the ban on slaughter. However, studies show that there is great potential for raising surplus bull calves for meat under a low cost production system based on forages and crop residues in the dry zone and coconut triangle, and for fattening females that are undesirable for draught and milk.

Draught animal power was used to cultivate about a third of the cultivable land in the

country in the past, but this was gradually eroded by the introduction of tractor power in the last few decades. The increasing cost of fossil fuel and maintenance of tractors has resulted in their use becoming prohibitively expensive, and there is now a resurgence of interest in renewable sources of farm power. The buffalo can be effectively used to fill this gap.

A major limitation to smallholder buffalo production becoming a profitable industry is the lack of suitable close vertical integration of the producer, processor and the market. This has to be ensured through appropriate policies, participation of all government and private stakeholders and collaboration between them.

5.9.4. Nutrition

Water buffalo have a unique ability to utilise poor quality forage more efficiently than cattle with higher digestibility of crude fibre and higher efficiency in utilising metabolic energy for milk production. Studies have shown that simple low cost feeding systems using locally available feeds such as natural grasses and rice straw with tree legumes (e.g. *Glyricidia* and *Leucaena*) in combination with UMMB can be used by small farmers for feeding dairy buffalo. There is a need to popularise and disseminate such methods widely.

5.9.5. Reproduction

The buffalo has been traditionally regarded as a poor breeder with low reproductive efficiency, characterised by late attainment of puberty and maturity, seasonality of calving, long post-partum anoestrus, poor expression of oestrous signs, low conception rates and long calving intervals. However, these are the result of the farming systems under which they are usually raised, involving harsh environments, lack of year-round feed supply and minimal managerial inputs. Studies have shown that they can have good fertility if they are managed and fed properly so as to overcome such stresses. Also, buffalo have a longer reproductive life than cattle, which compensates for other disadvantages.

There is a need to educate farmers on the appropriate methods of reproductive management of the buffalo and to inform field livestock professionals and extension workers on the application of modern biotechnologies for improving reproductive efficiency.

5.9.6. Breeding policy

A national breeding policy on cattle, buffalo, goats, sheep and pigs has been formulated in 1994 to ensure uniformity of livestock breeding across the country. In buffalo breeding, the strategy is to produce dairy type buffalo by upgrading the Lanka buffalo using pure exotic breeds such as the Murrah, Surti and Nili-Ravi. Action needs to be taken by DAPH and NLDB to ensure that this policy is implemented effectively, and the offspring evaluated and selected for use in further breeding. Although AI has been considered the preferred method of genetic upgrading, the use of genetically superior stud buffalo bulls should also be facilitated in areas where AI is not feasible.

5.9.7. Diseases

Although the buffalo is more resistant than cattle to many diseases, there are several diseases to which they are highly susceptible. The most important parasite that affects young calves is *Toxocara vitulorum*, which is transmitted from the dam. It can be effectively controlled by strategic worming between 10-16 days of age. The most important bacterial disease is HS, which is an acute infection caused by *Pasteurella multocida*. Regular vaccination is necessary to prevent this disease. Other bacterial diseases include mastitis, brucellosis and leptospirosis. Of the viral diseases that affect buffalo, FMD is the most important.

Calf diseases and calf mortality are major causes of economic losses to buffalo farmers, with up to 22 percent of calves dying before the age of 6 months. The common causes of mortality are navel-ill, diarrhoea, pneumonia and parasitic infections. These losses can be minimised by educating farmers on proper management, nutrition and prophylactic measures.

5.9.8. Constraints faced by the farmers

The main constraints faced by dairy farmers in general are: (a) shortage of quality breeding animals in the country; (b) poor access to capital and credit; (c) difficulties in obtaining animal production and health services and the high cost; (d) lack of reliable and steady market for their products and lack of producer participation in the value chain; (e) seasonal fluctuation in the availability of forages, high cost of compounded feeds and lack of knowledge in the use of low cost feed supplements; and (f) lack of long-term government policy and sustained support to improve dairy production in the country to progressively reduce milk imports and to substitute animal draught to reduce the fuel bill on mechanisation of agriculture.

The more specific constraints faced by buffalo farmers are: (a) diminishing availability of land and water resources for buffalo production; (b) lack of knowledge among farmers on intensive management of buffalo with crop/stock integration; (c) lack of efficient support mechanisms for small-scale production and marketing of value-added dairy products from buffalo milk; and (d) failure of the government to recognise the multipurpose potential of the buffalo for milk, meat and draught, and to implement long-term sustainable development programmes. A multi-disciplinary approach is therefore required, with active participation of all stakeholders including the farmers, to improve buffalo productivity under small-farm conditions.

5.9.9. The SAREC Buffalo Research and Development Programme

This programme was undertaken in three phases from 1984 to 1998 as follows: Phase I - Generation of baseline information and constraint identification; Phase II - Farming Systems Research (FSR) Approach in technology generation; Phase III - Information dissemination and technology transfer. Regular monitoring, progress review of the programme and terminal impact assessment conducted by SAREC has demonstrated that the FSR approach can be used for developing appropriate technologies to overcome constraints faced by rural farmers. It has also demonstrated that this approach will enable scientists to contribute more effectively toward attainment of national goals of sustainable economic development.

5.9.10. Government policies and support to buffalo production

The government has introduced a complete ban on the slaughter of all buffalo. While this is a laudable step to reverse the negative growth of the buffalo population, it imposes an economic burden on the farmers who have to maintain animals that are unfit for production and draught. Therefore, provision has to be made to allow such animals to be sent to the meat market under the authority of a competent officer nominated for the purpose. Sri Lanka lacks a well-organised meat industry, resulting in the farmer not getting a fair price for his surplus stock, and the consumer not getting a quality product at a reasonable price. A clear policy framework and operating mechanism are therefore necessary to ensure that the unproductive females and surplus males of both cattle and buffalo are fully utilised for the legitimate meat supply in the country. This would also encourage the private sector to venture into and improve the procurement, processing and marketing of meat and meat products.

The 'National Livestock Development Policy and Strategies' published by the Ministry of Livestock Development in 2006 states that the dairy sector will be given priority for public sector investment in livestock development. While these policy guidelines are laudable in terms of the government's intended objectives, the mechanisms for achieving them in terms of actual activities and inputs at the grass-roots level need to be elucidated and implemented.

The above policy guidelines give little specific attention to buffalo production. The scientific literature from Sri Lanka as well as other countries proves that the buffalo could be developed successfully to meet the needs of smallholder farmers as a multipurpose ruminant for dairy/draught/meat production. The buffalo is able to adapt well to any of the environmental conditions prevalent in Sri Lanka, including the vast tracts of underutilised land in the dry zone, and thrive on coarse fodder, crop residues and agro-industrial by-products.

There have been many previous imports of live cattle and buffalo to Sri Lanka in the past, but these have not provided the expected impetus for dairy development. It is important to consolidate the contribution of the progeny of such superior imported stock on the breeding farms and to improve their management. Therefore, any stock imported in future should be kept on suitable nucleus farms with facilities for better nutrition, management and healthcare. Their offspring must be managed properly and evaluated using comprehensive recording of all production data, and then subject to stringent selection for use in future breeding programmes.

A planned programme of upgrading the Lanka buffalo to the river types through selective breeding with better nutrition and management will result in enhanced milk production, increased availability of draught animals for agriculture and good quality meat from surplus male stock and culls. Therefore, the government's policy and development strategy should focus equal attention on the buffalo as on the dairy cow, and provide the thrust necessary to improve the quality and quantity of productive buffaloes in the country.

No mention has been made in the ministry's policy document on the development of draught power using buffalo. In the current context of ever increasing prices of fossil fuel and machinery in the world market, it is now an opportune time to revive the use of draught animal power for use in rural agriculture.

A large number of state and private sector agencies are involved with livestock and milk production in Sri Lanka. However, there is very little collaboration and coordination of activities among the various agencies. The primary objectives and functions of these agencies need to be reviewed and refocused to support the smallholder farmers, and long-term programmes implemented in order to ensure improvements in livestock production that are sustainable with the available local resources.

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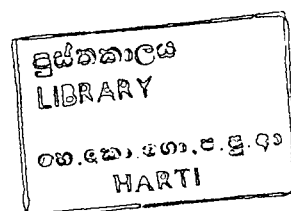
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Chapter 6

SMALLHOLDER PIG PRODUCTION

*SP Gunaratne
ADN Chandrasiri
&
Shadana Gajanayake*



6.1. Introduction

6.1.1 History of swine farming

Since ancient times Sri Lankans have been familiar with hunting and consuming pigs. This continues even today, in the rural parts of the country. Introduction of domestic pig rearing in Sri Lanka dates back to the 18th century when British planters brought pigs to supply their own pork demand. At the beginning, it was practised as a simple backyard system. With the overall development of livestock practices in the country, pig production system also was commercialised and the organised pig rearing systems were introduced. The development in the pig production of Sri Lanka was boosted with the introduction of exotic breeds of animals into the country. In the current perspective, pork is considered one of the potential sources of protein to meet the health ministry-recommended protein level in the diet of Sri Lankans. On the other hand, pig industry can provide employment opportunities for unemployed youth.

6.1.2 Swine production and farming systems

The classification of the Department of Census and Statistics for the purpose of data collection and census, divides agriculture holdings into two main groups, smallholder and estate sector, depending on the extend of land. Smallholder is defined on the basis of the holding size of the land area. Above 20 acre is defined as estate sector and below as smallholding. This classification although directly applies to crops, may not ideally fit into livestock farming. Many of the livestock units and farming practices are now becoming less dependent on land, especially mono-gastric animal production. They demand less land compared to earlier. However, these units, still depend largely on family inputs and contribute immensely to family nutrition and welfare. According to Wickramaratne *et al.*, (2000), the land use pattern of the pig farmers in the coastal belt suggest that most of them fall into the category of the smallholder. The land ownership varies from the landless to more than 8 acres. About 45 percent of the farmers surveyed have no highlands, while 80 percent of the farmers have no lowlands. This indicates that the majority of them are not traditional rice

farmers. Highest extent of land ownership is among highland crop farmers followed by livestock farmers. Farmers having less land area have the access to other types of land for their activities. Neighbours' land, government reservations, fallow paddy fields, cropland, reserved land for natural reservoirs, and other wastelands are among them. The majority of farmers have the access to their neighbour's land and reserved land for pig farming activities. However, there is no correlation ($r=0.32$) between land ownership and the number of pig units (a pig unit indicates the number of mature pigs). The above findings support the fact that pig farming is less dependent on land. They further may lead to the conclusion that the majority of pig farmers in the coastal region or 'pig-belt' in Sri Lanka fall into the category of the smallholder. Therefore pig farming in Sri Lanka can be justified as a smallholder farming system.

Pig farming in Sri Lanka has long been practised initially as backyard scavengers in the western coastal belt. According to Rajamahendran *et al.*, 1985 (Cited by Wickramaratne *et al.*, 2000), the ratio between backyard farms and commercial farms in 1985 was 1:1. The Sri Lanka-ADB livestock development project report, "an analysis of the pre project situation (1986)" describes three pig rearing systems, namely extensive, semi-intensive and intensive system. In the extensive system, pigs are let out to scavenge for their food and the pigs under this system generally belong to the indigenous type. This is a very primitive and unhygienic way of pig production causing nuisance to the neighbourhood. The pigs under this system do not receive any inputs from the farmer, but for the latter it offers a very practical way of converting waste into capital. The semi-intensive system is characterised by the provision of simple housing and small amount of bought-in feed in addition to the household and kitchen-waste the animals receive. Simple methods of disease and worm control are also practised. In instances where there is no housing provided, the pigs are tied to some fixed object with the help of a rope around the neck. Types of pigs mostly seen under this system are crosses between exotic and indigenous or pure indigenous. The third type of management found is the intensive system, where crossbred animals or improved breeds of pigs were kept permanently on properly constructed houses with cemented floors. Bought-in concentrates and swill are provided for them as feed, and regular healthcare programmes, systematic breeding and organised marketing are also generally seen under this system.

A limited survey carried out in the Colombo area has revealed that all pigs in the area are of exotic types with an average herd size of 36 (Ravindran *et al.*, 1995). According to above survey, the backyard system is becoming less popular due to scarcity of land and environmental problems.

Wickramaratne *et al.*, (2000), identified three pig farming systems and three production systems. The three farming systems identified, characterised and economically analysed are, crop-based, livestock-based and off-farm income-based. In crop-based system, farmer cultivates crops in addition to rearing pigs. The livestock-based system will have other livestock with the pigs. In the off-farm-based system, the farmer has a fulltime employment with regular income, in addition to pig keeping.

The dominant pig production systems under three farming systems can be grouped into three categories depending on the size of the unit. They are:

1. Commercial level pig production system;
2. Medium level pig production system; and
3. Small or subsistence level production system.

On the basis of the production system, the majority of the pig producers are smallholders (60 percent smallholders, 25 percent medium-scale and 15 percent large commercial farms).

Gajanayake (2004) also used a similar system for classification of farms in the western province depending on the scale of operation. In the breeder farm category, the farms with 1 to 5 sows are considered small-scale and 6 to 24 as medium-scale. Above 25 sows are considered large-scale. The majority of farms (65 percent) carry out breeding on a small-scale, whereas 8 percent of the farms are large-scale and the rest (27 percent) are medium-scale. In the fattening farm group, the majority of the farms (82 percent) in the province were small-scale (1 to 5 pigs). In the Kalutara district, 100 percent fattener farms were small-scale farms.

There are three main groups of pig farms in terms of the purpose.

1. Farms producing piglets (breeder farms)
2. Farms purchasing piglets and fattening them to market weight (fattener or finisher farms)
3. Farms producing piglets and fattening a limited number to market weight and selling rest of the piglets (mixed farms or farrow to finisher farms)

There were 5.6 percent, 32.24 percent and 61.5 percent farms under first, second and third categories respectively (Wickramaratne, *et al.*, 2000). According to Gajanayake (2004), fifty nine percent of the farms were engaged in breeder and fattener operation. Twenty six percent of the farms were exclusively for fattening and rest (14 percent) were only breeding. This suggests that the majority of pig farmers practise breeding and fattening to make their operations viable. This is not a very satisfactory situation with respect to bio-security and disease control as mixed farms got bigger risk of spreading diseases. It should be also noted that due to fluctuating demand for weaned piglings, the breeder farmers have no option, other than rearing their surplus piglings during periods of less demand. However, during early days (ADB, 1986), there were more breeder farms compared to mixed or fattener type. ADB report shows that there were 42.27, 21.45 and 36.28 percent breeder, fattener and mixed farms respectively.

6.1.3 Contribution to national economy

The contribution of agriculture and livestock production to national GDP in the past is given in Tables 6.1 and 6.2. The swine sub-sector contribution is negligible; hence it is not given any prominence in these tables. However, swine production provides a gainful of employment to a large number of people who are engaged in traditional farming as a source of livelihood.

According to DAPH, the contribution from poultry (including poultry feed), milk, beef and mutton and pig meat to the livestock GDP in 1998 has been 70, 11, 18, and 1 percent respectively. However, if the poultry feed component are excluded, the contribution from poultry, dairy, beef and mutton, and swine is 55, 33, 11, and 1 percent respectively (Abeyratne, 2007). The contribution from chicken meat and eggs is 34 and 21 percent respectively.

The data in Tables 6.1 and 6.2 can be analysed to show that the contribution from agriculture and livestock to national GDP is gradually declining, despite minor fluctuations in some years. However, the contribution from livestock to the agriculture GDP is marginally increasing during the past few years (Table 6.2).

Table 6.1: Livestock contribution to GDP

Year	Livestock contribution to Agriculture GDP		Livestock contribution to total GDP	
	%	LKR (millions)	%	LKR (millions)
1975	5.4	411	1.5	7,580
1980	5.7	1,024	1.5	19,900
1985	4.0	1,549	0.98	38,506
1990	4.36	3,195	1.0	72,788
1995	5.25	6,520	0.94	123,990
1998	6.44	11,311	1.12	175,562
1999	4.0	-	0.71	-
2000	4.1	13,332	0.71	200,964
2001	4.4	-	0.72	-
2002	4.4	15,245	-	237,282

Source: Abeyratne, AS, 2007

Table 6.2: Agriculture and livestock contribution to GDP

Year	Value of livestock Products	Value of agriculture GDP	Livestock contribution to agriculture GDP
	LKR (Million)	LKR (Million)	%
1998	10,825	175,478	6.2
1999	12,843	191,577	6.7
2000	13,332	200,964	6.6
2001	15,797	215,929	7.3
2002	15,981	233,615	6.8
2003	17,093	241,122	7.1
2004	21,318	262,271	8.1
2005	25,428	289,906	8.8
2006	29,829	333,114	9.0
2007	40,650	417,353	9.7

Source: Department of Census and Statistics

6.2 Present State of the Swine Production

6.2.1 Population and distribution

The world pig population is about 921 million. About 60 percent is in Asian countries. The total estimated pig population of Sri Lanka was 79,295 according to census of 2004. This gives a pig to human ratio of 1:240. About 70 percent of the population is concentrated along the coastal area from Puttalam to Kalutara. The particular region, referred to as the 'pig belt', includes the coastal areas of the western province and north-western provinces (see Map 6.1 for details). The north-western province carries the majority of the pig population (35-40 percent) followed by the western

province (30-35 percent) and north-central province (10-15 percent). Among the districts, Gampaha and Kurunegala have the highest pig populations. The pig population remained almost static during the past two decades (Table 6.3) and the districts of Gampaha, Puttalam and Kurunegala record the highest pig populations (Table 6.4)

Table 6.3: The trend of livestock populations in Sri Lanka

Livestock Species	1980	2000	2004	2005	2006	2007
Cattle	1,644,000	1,147,600	1,160,900	1,185,020	1,214,650	1,222,990
Buffalo	843,000	304,500	301,500	307,750	314,080	318,920
Goat	493,000	495,200	405,390	394,960	381,550	388,600
Sheep	28,000	11,200	11,480	10,290	13,620	16,480
Swine	71,000	70,800	79,290	85,020	92,210	94,210
Poultry	6,341,000	10,622,400	11,041,960	11,635,770	13,312,920	13,778,610

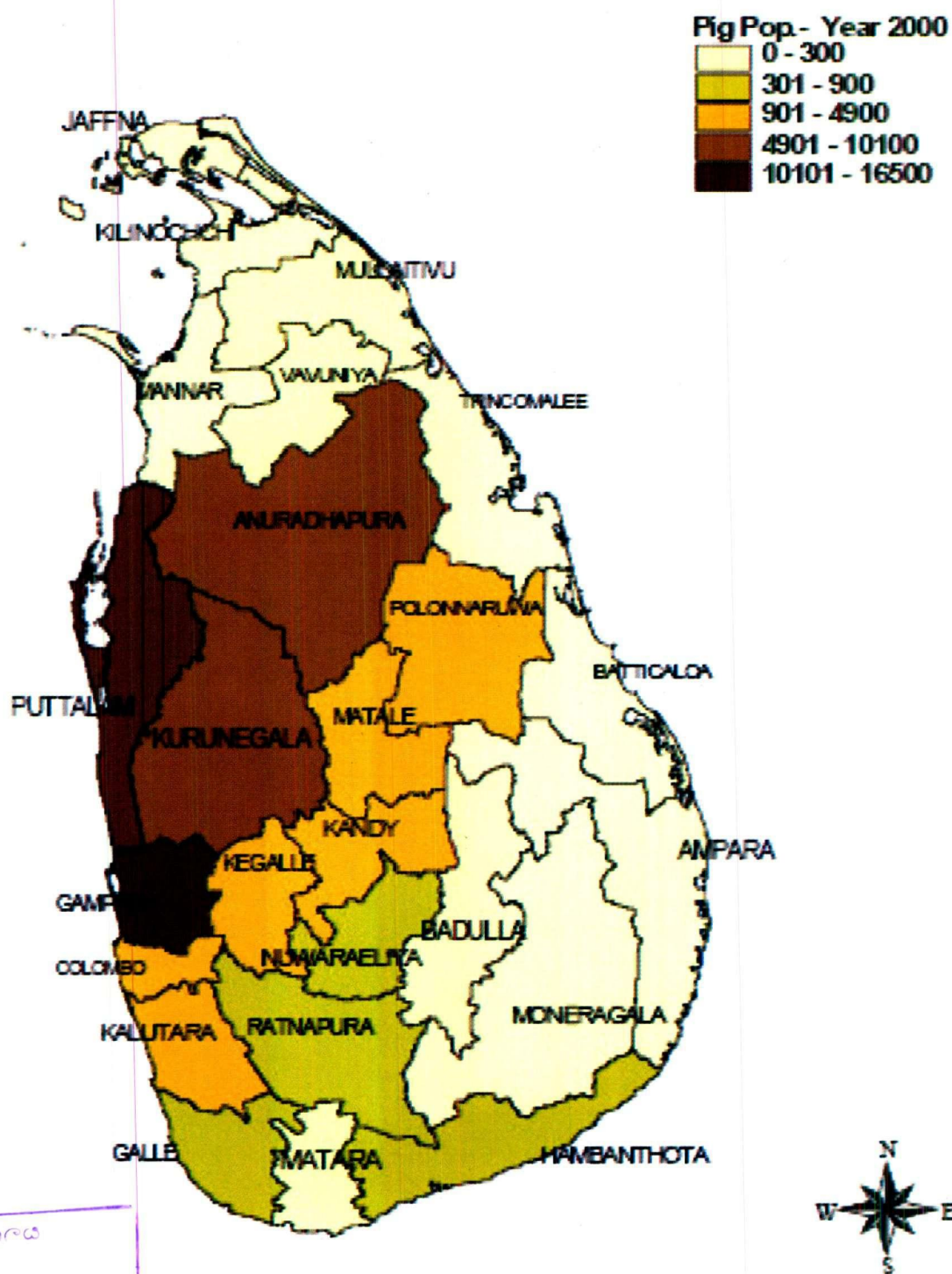
Source: Livestock Data (2000 to 2007), DAPH, Department of Census & Statistics, Ministry of Livestock

Table 6.4: Pig population and distribution in terms of district

District	2003	2004	2005	2006	2007
Colombo	3,700	4,000	3,660	3,430	3,770
Gampaha	15,140	15,970	17,000	22,717	22,800
Kalutara	1,270	4,800	3,440	3,365	3,800
Kandy	1,180	750	1,000	753	800
Matale	3,690	3,740	3,740	3,196	3,800
Nuwara Eliya	340	220	240	175	360
Galle	950	170	860	871	970
Matara	110	110	200	431	500
Hambantota	610	1,340	1,150	1,037	1,580
Jaffna	20	35	0	0	-
Killinochehi	0	0	0	0	-
Mannar	10	0	70	79	50
Vavuniya	100	0	310	211	80
Mulativu	0	0	0	0	-
Batticaloa	50	80	80	65	40
Ampara	330	530	350	645	560
Trincomalee	220	250	280	142	400
Kurunegala	10,990	11,370	15,390	15,557	15,080
Puttalam	19,050	20,830	22,620	25,635	26,100
Anuradhapura	5,840	7,230	7,500	7,543	7,210
Polonnaruwa	1,470	2,900	2,790	2,365	2,260
Badulla	610	740	610	1,095	1,040
Moneragala	280	730	830	801	950
Ratnapura	630	1,580	1,700	669	920
Kegalle	1,150	1,320	1,200	1,195	1,140
Total	67,740	79,295	85,020	91,977	94,210

Source: Department of Census and Statistics

Map 6.1: Distribution of pig population in Sri Lanka



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HARTI

Source: Division of Planning and Economics, Department of Animal Production and Health

6.2.2 Breeds

Exotic breeds like Land race, Large White, Duroc and their crosses are popular among Sri Lankan pig farmers. Indigenous pigs reared under backyard system are still found in certain parts of the country. Populationwise, the dominant pig breed is Large White (36 percent) followed by Land Race (33 percent) according to Wickramaratne *et al.*, (2000). However, according to Gajanayake (2005), in the western province, the number of pure breeds reported was very much less than above (Table 6.5). This difference in the reporting of breed distribution is expected, as only a few farms maintain records to trace origin of stocks. The majority of farms maintain breeding stocks as well as cross bred fattening pigs with no strict separation. Irregular introduction of exotic breeding materials with non-availability of artificial insemination facilities has resulted in many breeder units with inbred animals. Small-sized breeder farms, not having minimum critical numbers require maintaining as pure line too, contributed to this breed discrepancy. It is generally accepted that according to breeding principles, at least 100 sow units are required to maintain a pure line, and in Sri Lanka only one or two farms conform to the requirement. Therefore, confusion over breed composition is natural to prevail. Distribution of two main exotic pure breeds and their crosses in three districts in the western province is given below (Table 6.5).

Table 6.5: Distribution of swine breeds in the districts of the western province

Breed	Gampaha district	Colombo district	Kalutara district	Province
LR	5	2	8	5
LW x LR	35	44	32	37
LW	9	6	5	7
LWxLRxD	21	30	8	21
LWxLRxDxL	7	7	8	7
LWxLRxL	8	13	34	13
LWxDxL	0	0	3	0.4
LWxD	26	33	8	25
LWxL	10	15	39	16
LRXL	2	0	8	3
LRxD	5	0	0	3

Note: * LR-Landrace, LW-Large White, D- Duroc and L-Local pigs

Source: Gajanayake, S., 2005

The values given in Table are in terms of percentage. They are calculated on the basis of the number of responses of the total number of farmers.

These exotic breeds were introduced to Sri Lanka in as early as the 18th century when British planters brought animals for meat. But, the exotic breeds became popular only after 1965, when the Welisara pig-breeding farm commenced supplying breeding material to local producers. Since then, exotic breeds were imported in small numbers both by the government and private farmer from time to time. Considering the method of breeding, natural breeding is the main breeding method adopted, as artificial insemination is not popular among pig producers. However, there have been a few attempts to upgrade breeding stocks using imported semen of superior quality.

6. 2.3 Management and health

Only a few large-scale farms have near-ideal management practices. The majority of the producers (smallholders) have sub-optimal management practices with improper housing for the animals. Scientific feeding is rarely practised except by a few large-scale producers. Swill (refusals/wastes from various food-related products) is fed by most of the pig producers to cut down the cost. As already mentioned, mixed farms are the most common and an average herd composition of a farm is as follows:

Average herd composition of a pig farm;

Fatteners	10.78
Piglets	3.88
Replacement growers	1.61
Breeding boar	0.71
Sows	3.79 (1.56 pregnant)

Feeding and Nutrition

High feed cost is one of the main problems faced by the pig farmers in Sri Lanka. Pig has a well-developed large intestine; hence a wide range of materials including some fibre can be digested. Exploiting this advantage, the farmers use many low quality materials in pig feeding. The majority of fattener farms adopt swill feeding to reduce the cost of production. Being a tropical country with very mild climatic changes, Sri Lanka has a wide plant biodiversity and many of these non conventional plant materials can be effectively fed to pigs to get required weight gain. In fact, researchers in Sri Lanka have analysed the nutrient components of many of these feed ingredients and carried out many feeding experiments using them. However, the amount of research conducted on swine production is proportionately inadequate. The Bibliography on Animal Feeds and Nutrition Research in Sri Lanka (Gunaratne *et al.*, 2001) has listed most of the nutrition and feed related researches carried out in Sri Lanka with several publications related to swine feeding. Some of the non conventional feed materials found potential in pig feeding includes Colocasia yams (Ravindran, 1987), Kapok seed meal (Ganegoda and Siriwardena, 1978), arrack distillery spent wash (Ganegoda, 1983) and Eppawala rock phosphate (Ganegoda *et al.*, 1986). All these materials, if properly utilised will help to bring down the feed cost and the cost of production of pork.

Diseases and Health Problems in Swine

Sri Lanka is relatively free from many swine diseases. Nevertheless, a few diseases which are endemic affect the profitability. Wickramaratne *et al.*, (2000) reported the percentage of incidence of diseases as follows;

Diarrhoea	44.7
Swine fever	15.2
Parasitic infections	16.4
Foot and mouth disease	2.8
Respiratory diseases	16.6
Unknown	10.5

The Hog cholera or classical swine fever, which is the most important swine disease, was first reported in 1983 (Wanasinghe, 2008). The first outbreak was so severe that it had reduced swine population nearly to half. During the epidemic, swine fever was reported among the wild pigs and scavenging pigs. After the outbreak, the government commenced regular vaccination to cover a reasonable number of pigs, which kept the disease under control to some extent. Vaccine was given free of charge initially and provided at a reduced cost later. However, this support was withdrawn later and farmers had to buy their vaccine. This resulted in significantly reducing the vaccine coverage, making swine farms highly vulnerable to infection and outbreak. Originally, the outbreak of swine fever was traced back to the feeding of untreated swill from the airport. The spread of swine fever throughout the country was due to the feeding of swill in hotels which used processed pork products made of salvaged pigs (Wanasinghe, 2008). As a result of this experience it had become a common practice to treat (mainly heating) swill before feeding. Therefore, almost all farms today practise boiling, before feeding swill to pigs. Therefore, swill feeding has less influence on the spread of swine fever today and Wickramaratne, *et al.*, (2000) reported no correlation ($r=0.32$) between the swill feeding and the incidence of swine fever. However, importance of regular vaccination programme with state intervention to control this important disease should not be overlooked, due to high risk of infection and potential losses to the industry in case of an outbreak.

Japanese encephalitis (JE) is an arthropod-borne viral disease involving a vector and a vertebrate host. Pig is known to be an amplifier host and man may get infected accidentally. If large-scale pig breeding is promoted in Sri Lanka, it is necessary to adopt a strategy combining with the following measures so that pig breeding would not be blamed as a significant cause of JE outbreak in future. Pig vaccination could be used in well-controlled breeding areas. Semi-domestication of pigs needs to be discouraged. Where ever possible, the use of pig-pen protection and the spray-drying would help in reducing the viral transmission. Elimination of mosquito breeding at least around the pens should be attempted. Vaccination of farmers and other easily affected people could be accomplished. Establishing sentinel pigs to monitor virus activity would indicate how successful the other measures have been.

The diarrhoea caused by both infectious and non-infectious origins is the main health problem in pigs, resulting in the highest mortality among piglings. Although, about 80 percent of the animals are reared on concrete or cemented floors, still the incidence of diarrhoea is exceptionally high. Two common infections causing diarrhoea in piglings are coliform and campylobacter. Pig farmers rely heavily on antibiotics to control the incidence of diarrhoea. Pigs are considered one of the largest reservoirs of salmonella infection among animals (Edwards, 1956). In Sri Lanka too several types of salmonella have been isolated (Subasinghe, 1973) and these infections may have caused the poor performance and death of piglings. As the public health aspect of these findings is also very important, effective measures have to be taken to control salmonella infections in pig farms.

Foot & Mouth Disease (FMD) strain C has been reported among swine herds on several occasions. It was suspected that the virus had spread from cattle to swine. The disease in swine was soon controlled by vaccination. Affected herds caused severe economic losses. The mortality among susceptible herds is almost 100 percent. Piglings may die due to myocarditis but the adult mortality is due to immobility and scarcity to feed and secondary infections of the wounds. Pregnant sows would abort; suckling mothers refuse to suckle due to blisters on the teats. Reproductive efficiency and sperm counts of the affected boars have been decreased.

Both internal and external parasitic infections are common in pigs in Sri Lanka. Internal parasites which are mostly gastro-intestinal cause severe economic losses due to diarrhoea and poor weight gains. Round worm infections (*Ascaris* infections) are controlled by regular worm treatments. *Coccidia* infections are mostly associated with young pigs. Depending on the management system and the hygiene, lung worms and kidney worms could be prevalent. Sarcoptic and *Demodectic* mange are the common ectoparasitic infections in pigs. Mostly, the adult suffers from this condition. Due to irritation caused by the ectoparasite, the production may go from bad to worse due to skin damage of the pig causing low market value. As a treatment to this condition, many farmers apply used engine oil. Although this helps to reduce the severity of infection, in white skin pigs, black patches occur on the skin due to oil application, thus resulting a drop in market value.

Although the incidences are less, respiratory diseases are reported in all farming systems among all age categories. Generally, respiratory conditions are reported more during the March-July period. This indicates the fact that the diseases are associated with the rain. In case of a disease-situation or any health problem, farmers rarely seek assistance from the government veterinary office. The majority of farmers give treatments on their own and many of them are even competent in administering parental injections. Routine iron injection for piglet anaemia and some vitamin injections are given by farmers. Heavy use of antibiotics was commonly seen in fattening farms of mostly swill-fed. The unavailability of veterinary drugs, especially in small quantities had become a hindrance to treatment.

Mortality

The highest mortality was reported in pre-weaned piglets (52.2 percent). The rate of stillbirth (28.6 percent) was also very high indicating that immediate attention to be focused on mortality. About one-fifth of the total mortality was at birth (19.7 percent). The waste of piglets due to mishandling and accidents too attributed to this total rate of mortality. The latter in adult animals was low, except during outbreak of diseases. It is also noted that farmers used to sell grown animals when they are found sick or not in good health condition.

Vaccination

Swine fever and Japanese B encephalitis was the two important vaccines routinely administered on pig farms. Japanese B encephalitis is given free of charge, but still only about 65.8 percent farms utilise this facility. The use of vaccine against swine fever was 33.9 percent. The assistance of the government veterinary office was available, particularly the vaccination (Table 6.6). However, availability of small dose containers (10 and 25 dose vials) was a problem very often encountered by the farmers.

Table 6.6: Use of vaccines, vitamins and minerals for pigs and the source of assistance

Type of application	% farms used	% farms received assistance from		
		VS office assistance	Private assistance	Self assistance
Japanese encephalitis	65.8	93.0	1.5	1.0
Swine fever	33.9	79.6	8.7	9.7
Minerals	44.4	48.1	10.4	37.8
Vitamins	34.5	23.8	51.4	21.9

Source: Gajanayake, S, 2005

6.2.4 Meat production

The annual production of pig meat in Sri Lanka has been estimated as 1,053 metric tons, which is about 1.5 percent of the total meat production of our country. According to the livestock slaughter data (2005), the total number of pigs slaughtered at the district slaughterhouses were 30,249. Since this data did not include the animals illegally slaughtered, the actual figure would be higher. Pig meat production is not properly regulated as it does not strictly come under some statutory legislation such as Butchers Ordinance etc, like ruminant meat (beef and mutton). This has some public health concern.

However, this is very low compared to the slaughtered number of cattle and goats (215,181 and 74,601 respectively). The number of animals slaughtered from 2000 to 2005 are given in Table 6.7 below. Except poultry, the number of cattle, goats and pigs remained more or less static.

Table 6.7: Statistics on slaughter (2000-2006)

Number of animals*	2000	2001	2003	2004	2005	2006
Cattle	211,058	201,443	205,025	216,066	206,979	215,181
Goat	84,683	79,116	80,889	70,449	71,605	74,601
Swine	24,082	26,865	25,628	29,752	29,240	30,249

Note: The number of animals slaughtered at licensed slaughterhouses are included here

Source: *<http://www.statistics.gov.lk/agriculture/Livestock/slaughterstatistics.htm>

The per-capita consumption of pork also is the lowest compared to beef, mutton and chicken. We have a very marginal per-capita availability of pork (110g/person/year) compared to some of our Asian counterparts (24 kg, 15 kg, and 12 kg in China, Malaysia and Philippines respectively). According to world statistics, pork was the most eaten meat in the world in 2000 (about 91.5 million metric tons compared to 70.4 million metric tons of chicken). Accompanying table shows the FAO forecasts for production and consumption of meats.

Table 6.8: World meat markets (2005-2007)

Production	2005	2006	2007	Change:2006/2007
	Million tons			%
	269.7	276.6	283.0	2.3
Bovine meat	64.6	66.2	66.6	0.5
Poultry	82.8	84.0	86.2	2.7
Pig meat	104.0	107.4	110.7	3.1
Ovine meat	13.1	13.6	13.9	2.1
Per caput food consumption/ world/kg/year	39.5	40.1	40.6	1.2

Source: UN/FAO database (2007)

Compared to other regions of the world, pork consumption is on the increase among Asian countries (Table 6.9). However, there is no clear evidence to show any increasing trend in pork consumption in Sri Lanka. The reported values were 110 g (Wickramaratne *et al.*, 2000) and 120 g (Dharmawardena, 2002). The low supply of pork and less popularity of pork compared to other animal protein sources could be the possible reasons. Despite the low consumption, pork prices remained for some time the lowest (Table 6.10). The price changes, in 2007 of common food items show that pork price had come down (Table 6.11)

Table 6.9: Pork average consumption in kg/person/year

Geographic regions	1990	2000	Growth (%)
Europe	41.5	34.0	-18
Africa	1.0	0.9	-10
South America	6.3	8.4	33
North/Central America	21.4	22.6	5.6
Oceania	15.6	16.7	7
Asia	9.5	13.6	43
Global Average	13.2	14.8	12

Source: UN/FAO database, 2000

Table 6.10: Average prices of meat in Sri Lanka, 1994–2000 (Rs/Kg)

Year	Pork	Chicken	Beef
1994	80	80	70
1995	80	83	80
1996	90	100	100
1997	109	125	113
1998	240	144	130
1999	120	130	130
2000	118	133	130

Source: Department of Animal Production and Health

Table 6.11: Retail prices of items in Colombo and suburbs (LKR/Kg or LKR/piece)

Commodity	Average price		Change
	Current* (2007)	Last year** (2006)	%
Rice (Samba)	58.33	42.21	38.19
Rice (Red)	44.93	31.45	42.86
Bombay Onions	77.22	48.30	59.88
Carrot	76.86	63.97	20.15
Coconut	28.41	19.44	46.14
Plantains (Ambul)	3.75	3.51	6.84
Fish (Thora)	683.00	619.17	10.31
Fish (Paraw)	472.86	408.7	15.7
Eggs (White)	8.12	7.26	11.85
Beef	305.00	291.43	4.66
Dried Chillies	196.10	223.82	-12.38
Beans (Green)	97.30	108.29	-10.15
Green Chillies	91.25	110.88	-17.7
Lime	109.19	204.85	-46.7
Pork	200.00	244.00	-18.03

*Current- November 2007

** Last year - 2006

Source: The Sunday Times, November 11, 2007

The pork and pork products also exported from Sri Lanka. Export of pork and pork products and their value during period (1992-2006) is given Table 6.12.

Table 6.12: Export of pork and pork products (MT) from Sri Lanka

Year	Amount (MT)	Value (Mil/LKR)
1992	161.6	20.5
1993	195.9	30.3
1994	236.0	31.5
1995	79.6	17.7
1996	15.2	1.5
1997	7.1	1.2
1998	6.2	0.8
1999	2.2	0.7
2000	3.2	0.9
2001	54.1	12.7
2002	67.2	11.1
2003	26.7	14.4
2004	51.6	27.8
2005	0.3	0.2
2006	0.5	0.4

Source: Customs reports, Department of Customs

Swine meat and meat products are also imported; especially for production of value-added products and for hotels. Details of the imports are given in Table 6.13 below

Table 6.13: Import of swine meat and meat products

Year	Amount (MT)	Value (Mil/LKR)
1992	0.15	0.06
1993	59.1	4.3
1994	13.8	1.6
1995	3.6	0.9
1996	7.3	2.8
1997	26.9	3.5
1998	154.2	17.2
1999	1.1	0.3
2000	7.5	1.3
2001	2.0	0.9
2002	1.6	1.1
2003	2.0	1.0
2004	10.7	1.8
2005	1.0	9.8
2006	48.7	6.2

Source: Customs reports, Department of Customs

6.2.5 Production of breeding materials

Of the domesticated animals, the pig is extremely prolific, grows fast and matures early. Due to this reason, an average breeding sow will farrow twice a year and produce approximately 20 piglets per year. If all these piglets are fattened they will produce approximately one ton of meat. This is the reason why a sow is known as “A ton of meat on the four hoofs”. If our aim is to increase the per capita availability of animal protein, the best animal to rear is the pig. As far as pig husbandry is considered, the availability of fast growing pigs is important for production of quality meat. Taking this fact into consideration, the government has taken the initiative to promote pig breeding activity through an organised system. The pig breeding policy was formulated and the swine development federation was established. Breeding pyramid consisting of nucleus, multiplier and commercial units were clearly identified and supported by ADB funded livestock development projects during the 80s and 90s. Unfortunately these structures are not in place now. The swine development associations are not active. The government involvement has become minimal and the pig breeders are in desperate need of quality breeding stocks. As no improved genetics were introduced into the country at a significant level for a long time (after the 80s) the small pig population in the country can be considered highly inbred. However, there have been a few attempts to upgrade the breeding stocks using imported semen and live pigs of superior quality.

The earliest record available on artificial insemination of pigs goes back to 1961. Jaganathan and Fernando (1961) obtained successful results by insemination of gilts with chilled semen imported from Britain. Chandrasiri *et al.*, (2002) reported first time in Sri Lanka artificial insemination of pigs using deep-frozen semen imported from USA. In 2006, a bore semen production centre was established at the Kotadeniyawa Animal Husbandry Training Centre and artificial insemination using locally produced chilled semen was commenced in 2007, in the western province. Now the technique is gradually gaining popularity among the pig breeders in the Colombo and Gampaha districts.

Supplying breeding materials was an important function of the government farms earlier but, now there are a few private farms producing breeder piglings. Welisara pig breeding farm was the first to commence supply of breeding materials in the country. Later, in 1998, under the Swine Development Programme, Marawila and Horakelle pig breeding farms started with exotic animals from USA. In addition to these state-run farms, a few private breeder Chutiduwa farm imported exotic breeding animals; Large white, Landrace and Duroc from USA. A few private farms Maxie's and New Bernard too were supplying a part of breeding material requirement of the country.

Natural breeding is the main breeding method used by pig farmers. Rearing a breeding boar was considered a costly practice. The percentage of farmers having their own breeding boar varied from 52 percent in off-farm based to 85 percent in livestock based system with an overall figure of 58.3 percent. There were farms where boar service was available on charge but they had no breeding boar service available even on payment. About 31.8 percent farms got services on payment. The cost per service – including transport, labour and handling – varies from 500 to 2,000 rupees with a mean value of 840+/-67.50 rupees. This variation is mainly due to genetic superiority of the boar. When it is needed to repeat the service, it is provided free of charge. There are many instances where a weaned healthy piglet is exchanged instead of a charge. Origin of breeder boars on most large-scale breeder farms was from the government breeder farms.

6.2.6 Marketing of fatter pigs and breeding materials

There were four main marketing channels, through which pigs reach the consumer from the producer. The middleman or private collector was one of the established marketing channels. In addition to purchasing pigs, the private collector also provides some of the inputs like, feeds, piglings, boar service and credit etc. The private collector maintains a record of animals on farms coming under his area and make regularly visits. Price is determined on general appearance and bargaining with the pig owner. Small-scale subsistence farmers, away from main cities prefer this system of marketing.

There were a few processing companies which purchase fatteners for processing. Although, they pay a premium price, only registered farmers who can supply quality fatteners on regular basis – have access to this market. The Keells Private Limited, the Cargills Private Limited and the Elephant House Private Limited are the leading processing companies. Of them, The Keells Private Limited has the largest capacity. Local butcher in the small town was the source of retail market especially for small-scale farms. Although this is a small market, it assures a continuous outlet. Some farmers have their own market outlet in the city or sell at the Sunday fair. This method of marketing gives the best profit margin for the farmer. The live marketing weight of fatter varies from 48-95 kg, averaging 70 kg. The age of fatteners at marketing is around 5-8 months.

There were about 112 pig meat stalls and 24 authorised pig abattoirs in the "pig belt" area according to a survey conducted in 2000 (Wickramaratne *et al.*, 2000). The abattoirs leased out by the local authorities and legal slaughter houses operate for about 6 days a week and slaughter about 2 to 3 pigs a day. There are a large number of illegal or unregistered places, where wet pork is sold. These centres operate only for about 2 to 3 days a week and each place the meat of one pig is sold a day. The owner of an authorised abattoir normally employs only one hired hand. He is paid about 250 rupees a day in addition to the fringe benefit of taking home pork to the value of about 150 rupees. One man manages each illegal slaughter point. Thus the legal abattoirs slaughter about

20,000 pigs while the illegal abattoirs and sales points slaughter about 14,000 pigs, which totals 34,000 each year in the western province. The number of pigs slaughtered in registered abattoirs during 2003 to 2006 are given in Table 6.14.

Table 6.14: Pigs slaughtered in licensed abattoirs

District	2003	2004	2005	2006
Colombo	11,061	11,072	10,721	11,191
Gampaha	7,569	5,486	6,504	5,565
Kalutara	-	-	-	-
Kandy	-	-	150	38
Matale	-	412	197	152
Nuwara Eliya	-	-	281	70
Galle	300	600	350	313
Matara	-	-	-	-
Hambantota	-	-	-	-
Jaffna	6	-	-	2
Killinochchi	100	189	-	72
Mannar	-	-	-	-
Vavuniya	-	-	-	-
Mulativu	-	-	-	-
Batticaloa	-	-	-	-
Ampara	-	-	-	-
Trincomalee	-	-	-	-
Kurunegala	1,866	2,578	2,199	2,083
Puttalam	8,486	8,423	9,300	8,752
Anuradhapura	262	30	230	131
Polonnaruwa	42	49	87	58
Badulla	-	-	-	-
Moneragala	-	-	35	9
Ratnapura	-	-	-	-
Kegalle	60	401	195	284
Total	29,752	29,240	30,249	28,720

Source: Department of Census and Statistics

The sale of piglets for raise as breeders or fatteners is a good business. Most of the piglets are sold when they are around the age of 1-2 months. However, there are few farmers (29.5 percent), selling after four months of age as growers.

6.2.7 Economic aspects of pig farming

The pig industry accounts for about one percent of the livestock GDP, which is the lowest compared to other sub-sectors such as poultry and dairy. However, its contribution to the household income of the small-scale rural pig farmer is significant.

At the level of the individual producer, it was found that any production system could give a positive gross margin (no loss in the enterprise). A recent survey (Wickramaratne *et al.*, 2000) estimated the annual gross margin of an average pig farm as 1,332 rupees per pig unit. It has been suggested that a reliable market and reduced feed cost will help in raising the gross margin.

Among the existing marketing channels, the private collector or middleman plays an important role, reducing the profit margin of the majority of smallholder producers. Processing companies like The Keells Private Limited provide a fairly attractive marketing channel. As a result only the large-scale producers who produce quality pork benefit the most.

With respect to feed cost, it has been estimated that the swill-based production system produced fatteners of adequate slaughter (90 kg) at the cheapest rate when compared to other feeding systems.

Quality of product is a very important factor for determination of the market price of pig products. The majority of pig meat produced in Sri Lanka are sold as wet pork. There is no proper system to assess the quality of wet pork sold in Sri Lanka. Several factors affect the final quality of meat (Jayatilaka *et al.*, 2005). Factors such as stunning and bleeding method, evisceration, packing, transport, storage etc., can affect the quality of the end product. Unfortunately, in Sri Lanka much attention is not made to any of these important aspects.

6. 3 Government Policies

Some of the government policies and programmes with some relevance to swine production are discussed below. However, it should be noted that the government investment and involvement in the swine sector is minimum or insignificant. This has clearly stated in the government livestock policy document, “National Livestock Development Policy and Strategies” 2006. There are guidelines for pig breeding (National Breeding Policy), importation (Document No A/4) etc. Environment regulations are now becoming important especially in urban areas.

6.3.1 National livestock development policy and strategies

The “National Livestock Development Policy and Strategies” 2006, published in September 2006, details out the government policy, intervention and investment in the livestock sector. It is evident that the government commitment is primarily to the dairy sub-sector and to poultry – to a lesser extent. The meat sub-sector, where the swine also included, there will be no public sector engagement. There is no clear indication for supporting the private sector for swine meat production either. Under these circumstances, any large-scale development programme or funding for swine development seems unlikely during the next few years.

Efforts have been made to develop the pig industry in our country. One such venture is the Swine Development Programme introduced in 1998. The Department of Animal Production and Health (DAFH) in collaboration with the National Livestock Development Board (NLDB) initiated this programme. The primary objectives of this programme were improving the genetic potential of the existing pig population, rectifying the marketing networks and educating the producers on environmental protection. Under this programme, breeding animals were imported from USA and the Horakelle Pig Farm was developed as a nucleus breeding farm. Selected multiplier farms have been incorporated into the project to produce commercial piglets from the genetically superior breeders.

6.3.2 Procedure for import of pigs

DAPH has introduced guidelines to be followed in the importation of pigs to Sri Lanka (2003, Document No A/4). These guidelines clearly detail out information required to be submitted by importers when applying for permit to import live pigs. Animal Disease Act No 59 of 1992 insists on submission of certain information, specifically the international veterinary certificate to the Director General of DAPH.

6.3.3 The national breeding policy for livestock in Sri Lanka

The National Breeding Policy for Livestock in Sri Lanka (1994) has been drawn up in order to bring about professionalism of performance in livestock breeding activities of both the government and the private sector. In the pig breeding programme, the whole island is considered one agro-climatic zone and the breeding objective is to produce genetically superior fast growing fatter pig. The breeding policy recommended is to maintain the existing exotic breeds of pigs and to produce suitable commercial crossbred pigs. The breeding strategy suggested is – crossbreeding. It is recommended to produce two-way or three-way cross fatter pigs. The exotic breeds of Land Race (LR), Large White (LW) or Duroc (D) pure lines will be used for cross breeding programmes. The proposed breeding programme for production of fatter pigs in Sri Lanka is shown in Figures 6.2 and 6.3. However, due to insufficient numbers of pure bred animals, poor management of the pure lines in the nucleus herd, and the unplanned manner in which these animals are used, there is considerable level of inbreeding.

Figure 6.1: Production of two-way terminal crossbred fatter pigs

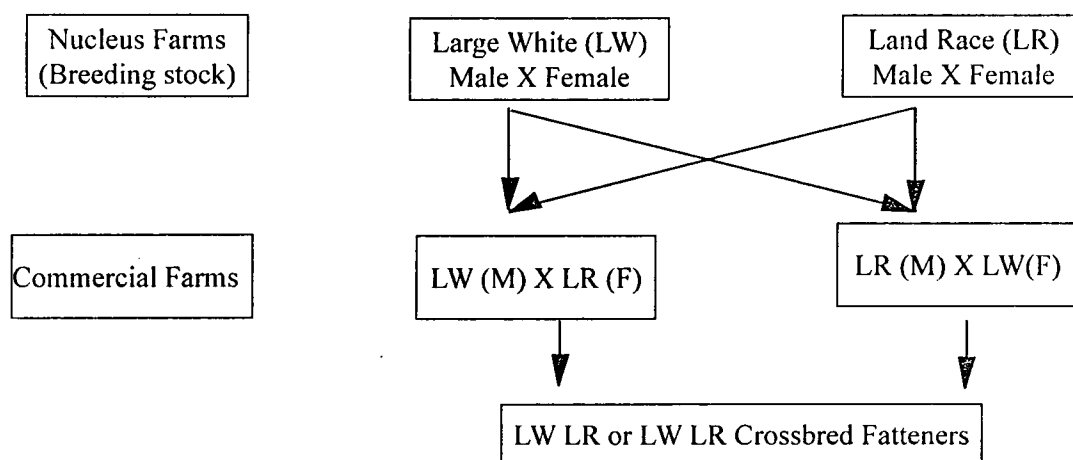
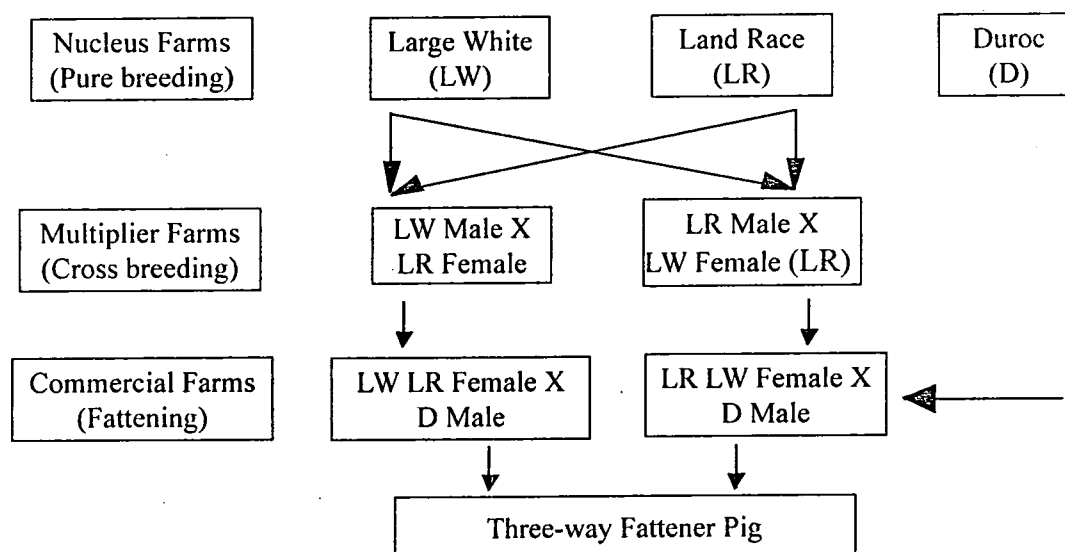


Figure 6.2: Production of three-way fattener pigs



Presently, two state farms and few private sector farms maintain parent stocks of exotic breeds. In the original programme, the government is expected to maintain a nucleus herd and the multiplication and production of commercial piglings should be handled by the private sector farms. However, this structure is not functioning now. Breeder farms have imported few animals and semen from time to time to improve their breeding stocks and most of them have adopted their own breeding programmes. As there is no proper monitoring and follow-up activities carried out either by the qualified personnel in the government or by the experts in the private sector, quality of breeding material available for the farmers is questionable.

6.3.4 Environment policies affecting swine farming

Pig farmers have to stick to several regulations imposed by government authorities. There are requirements to be met at the *Pradeshiya sabha*¹⁸ and provincial council level. A certification by Central Environmental Authority (CEA) is also a legal requirement. However, many farmers still operate without fulfilling these requirements. According to Wickramaratne (2000), awareness among pig farmers about the status of legal authority for pig farming and slaughtering is as below.

Table 6.15: Awareness among farmers about the legal requirements and legal authority for pig farming and slaughtering

Status of Authority	Purpose	
	Pig farming (n=193)	Pig slaughtering (n=55)
No proper authority	82.4	80.0
Pradeshiya Sabha	15.5	16.4
Provincial Council	2.1	3.6
Central Environmental Authority	0	0

n= Total number of respondents

Source: Wickramaratne, S.H.G. *et al.*, 2000

¹⁸ *Pradeshiya sabha*: Elected local councils represent the lowest tier of government in Sri Lanka.

6.3.5 Past and ongoing livestock development programmes / projects

During the last several years, Sri Lanka received funding from bilateral and multilateral organisations to promote livestock development. However, the majority of funds have been earmarked for dairy development. The Livestock Sub-sector Strategy Report of the Ministry of Rural Industrial Development (1984) shows that about 80 percent of funds have been assigned to dairy development. The goat and poultry industries are ranked next to the dairy and swine industry probably the fourth in the order of priority. Although this report was produced more than 20 years ago, the situation still remains more or less unchanged. The only programme which had identified swine development as a component was the Sri Lanka-ADB Livestock Development Project (1983-1988) where, 300 improved pigs were imported. Swine development cooperative organisations (farmer organisations) were also established under the project.

6.4 Constraints and Challenges for Pig Industry

Abeyratne (2007), summarised results from a series of workshops conducted during 1997, to identify constraints on swine farmers in the Kalutara, Welisara, Kesbewa and Negombo areas. The workshops consisted of brain storming sessions, where farmers listed their constraints. The constraints were grouped and farmers were requested to prioritise them and suggest possible solutions.

Wickramaratne (2002), also summarised important constraints on swine industry. Followings are some of the major constraints identified in the above two publications with possible solutions for consideration. Many of them still exist, but their importance in the order of priority could be different.

6.4.1 Availability and quality of breeder and fattener piglets

The breeder animals available with farmers are of poor quality. There are no avenues to obtain animals for breed replacement at reasonable cost, since the animals of private breeder-farms are too costly. National Livestock Development Board (NLDB) and few private breeder farms maintain imported breeding stocks (grandparents) to supply breeding materials (parents) for multiplier breeder farms. However, none of these grandparent farms were able to stick to proper replacement programme in order to replenish their breeding herd. As all these farms manage with a small number of breeding animals, it is an essential requirement to introduce new animals regularly to avoid in-breeding. Further, the situation is aggravated by the non-availability of proper artificial insemination programme at least to use imported semen to introduce fresh genetic materials.

The bulk of the weaned fattener piglets available for sale comes from the private sector farms. Management practices adopted in most of these farms were sub-optimal. Many of them feed swill for their breeding stock. Milk re-placer or creep feed is rarely used. They do not maintain proper breeding records. As a result, the quality of available fattener piglets has deteriorated.

6.4.2 Feed cost and availability of feed raw materials

The high cost of concentrated feed and non-availability of feed ingredients are also identified as major constraints on pig producers of our country. The majority of raw materials used

in commercial pig feed-stuffs are imported. Since intensive pig production needs balanced feeding, the high feed cost is a major factor deciding the cost of production. When DAPH sponsored swine farmer associations in operation, feed ingredients and other inputs were supplied to farmers by the associations. Currently, these associations are not functioning and the farmers lack the ability to obtain required inputs at a reasonable cost.

6.4.3 Social objection and religious taboos

The social objection and religious taboos are specific constraints on pig farming. Different dietary and eating habits among certain religious groups of the country also limit the pork production and consumption. The social objection is primarily due to the impact of the pig farms on its immediate surroundings. A recent study indicated that the majority of the pig farmers (44.2 percent) disposed the solid wastes by heaping it on places like open land, which on decomposition, causes unbearable odour to neighbours. In addition to this, effluents and excreta disposed in such an irresponsible manner would leave room for breeding of flies. Pollution due to piggeries poses a serious problem to humans when the piggeries are located in densely populated human habitats such as urban areas.

6.4.4 Japanese B Encephalitis

Pigs are the intermediate hosts for the Japanese B encephalitis virus, which causes fatal encephalitis in humans. Outbreaks of this condition have been reported in some of the areas. Herds have to be vaccinated in order to break the infection cycle of the pathogen.

6.4.5 Diseases and poor extension service

Diseases also are considered one of the main constraints – especially to the smallholder producers who do not have much access to veterinary services when needed. Diarrhoea and pneumonia (the causes are numerous) are the main causes of piglet mortality. When infectious conditions are considered, swine fever is prevalent in Sri Lanka, causing considerable mortality during outbreaks and leaving a burden of the cost of vaccination to producers. Conditions like porcine reproductive and respiratory syndrome (PRRS) and parvo viral infection causes reproductive failures in the herd. Apart from these infectious conditions, poor performance of animals and various deficiency disorders also occur due to improper management practices.

Another identified constraint on the enterprise is the poor performance of the existing farm units. This is partly due to lack of good quality breeding materials, and partly due to lack of skills and knowledge especially with smallholder producers. Often the farmer stocks his holdings from unreliable local suppliers who put out animals with less production potentials. Undeveloped extension services leave the producer with inefficient ways of management.

6.5 Conclusions and Proposals for Future Development

Pig meat is the most popular meat in the world. The fastest growth and highest consumption of pig meat is seen in the Asian region. This trend is expected to continue in Asia at least for next few years. However, similar growth or consumption pattern is not seen in Sri Lanka; thus not

indicating any good signs growing consumption in the near future either.

Swine population has been static during the last two decades and has been mainly concentrated in the coastal belt “pig belt”, spreading from Puttalam to Kalutara covering mainly the western and north-western provinces. There are no new farms or projects coming up in other areas of the country. Swine production in areas outside the “pig belt” especially in areas where swine population is less should be encouraged.

Although the farmers are getting a marginal profit in most of the time, fluctuating market prices of pork has caused concern and prevented new farmers coming to the industry. Unplanned imports, e.g. April 2007, caused severe price drop in the local market. The imports of swine and swine products have progressively increased in the recent past while the exports have sharply declined. This situation can be a cause for the industry to remain static. The importers, who are the main buyers of swine, control the local price by increasing the imports. To prevent this situation, production of value-added products locally must be encouraged while any imports of pork should be subjected to a flat rate of imports tax.

As clearly stated in the government policy documents, its involvement in meat production, including swine production is – to the minimum. At present, the government maintains breeding farms to produce piglings for breeder and for fatterer farms. However, the quality of materials issued from state farms are below the levels of standards expected. Therefore, improving these farms and monitoring their breeding programmes are of paramount importance to ensure quality breeding materials to farmers. The breeding programmes at private farms are not conducted according to any plan. The implementation of the national breeding policy guidelines and the active participation of national breeding committee and the reactivation of swine development committee at the government level will benefit the industry.

The government has commenced, artificial insemination in pigs in the western province using chill semen. This satisfied the long-felt need and should be extended to other areas preferably using deep-frozen semen. Training more people for AI in pigs will be an urgent requirement.

With less involvement of the government, there should be a system to get private sector to actively participate in the swine production. Such an environment is yet to come into being. Farmer organisations which were very active during the 80s and 90s should be reviewed. These organisations can become the focal points to communicate with the government and input suppliers. They also can involve in the marketing.

Diseases are relatively less in pigs compared to other livestock in Sri Lanka. However, a disease like classical swine fever can devastate the industry at any time, as experienced in 1983. Japanese B encephalitis is also an important disease to keep under control due to its possible transmission to human beings. The government should ensure that at least, these two vaccinations are easily available and regularly given on swine farms.

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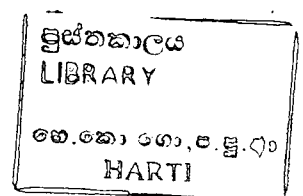
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Chapter **7**

**LIVESTOCK FOR
FOOD SECURITY**

*Thakshala Seresinhe
&
K K Pathirana*



7.1 Introduction

One of the biggest challenges Sri Lanka is facing is how to ensure food security for a growing human population. Farm animals are extremely important global resources in terms of their contribution to both food security and economic development. From the data presented, it is clear that in Sri Lanka, the smallholder farmer contributes a large share in all types of livestock production. At present, only the poultry industry has reached industrial status. Compared to poultry or swine, cattle rearing demands much more land while a large number of dairy farmers are the poorest of the poor among the farming community. Considering the huge foreign exchange involved in the imports of milk and milk products, the key to success lies principally with the smallholder base, enabling a wider participation. In this context, it is essential to use low cost and low inputs to result in relatively high outputs in a wholesome and in a sustainable manner. It is also essential to launch an islandwide efficient milk collecting and handling system as a basis for self-sufficiency in milk. The contribution of livestock to both agricultural and overall economic development is multiple but not adequately evaluated. Improved efficiency in the production of livestock together with its various contributions and service products is crucial for achieving sustainable agricultural development and food security under low income conditions. The role of livestock in food and agricultural development programmes is underrated almost everywhere in the country despite increasing demand for animal products.

7.2 The Role of Livestock in Food Security

Livestock, especially ruminants are an integral part of the agricultural economy of Sri Lanka. There is a strong symbiotic relationship between the crop and the livestock species and exploiting the synergies of these two sub-sectors will help enhance the productivity of the agricultural economy of Sri Lanka. Consumption of animal products has increased over the past two decades. There has been a dramatic change in the Sri Lankan diet – from a starch-, vegetable- and fish-based one to an animal-protein based one. To meet with the increased consumption of livestock products in the country, the import bill especially on dairy products has been tremendously increased. Therefore, the country has to strongly commit to increasing its self-reliance on livestock and dairy produce.

Livestock produce, while helping to improve the nutritional status of the population, often offer many possibilities for value addition and converting them into numerous high value products. Further, the livestock industry provides raw material for other industries and manure for crop production, apart from a renewable energy resource through work and manure – particularly of cattle and pigs. The nature of intensive labour in livestock operations creates employment possibilities, especially at rural level.

Smallholder farmers in Sri Lanka are normally engaged in a number of different activities which are related to each other in a complex manner. Among these activities livestock farming is often one; which cannot be considered in isolation. The importance of livestock in rural economy has fluctuated between 4 and 7 percent over the past twenty years. Although the major role of livestock is meant for human nutrition, certain substitutes are also being increasingly considered. In that sense, supply of high quality protein is the most important while substitutes such as fish and soya products are becoming popular due to health concerns. However, the flavour and taste of such substitutes can hardly replace livestock products. Therefore, the livestock industry has a more significant role in developing countries. While decisions concerning development, whatever the level at which they are taken – are not purely in terms of economic importance but of the cost and the return.

7.3 Multipurpose Nature of Livestock Production

7.3.1 Multipurpose nature

Growing and selling livestock products enable the poor rural families (women in particular) to enter the cash economy. In this way livestock production provides increased stability in income for the family without disrupting other food producing activities.

The majority of livestock in Sri Lanka (Table 7.4) are kept by smallholders with each producer owning a small number of animals. Specific areas are reserved for grazing or fodder production but livestock animals are fed in areas where other crops are not grown. They are 'opportunistic feeders'. In most cases, feeding of cattle and other ruminants does not cost farmer anything. Their diet is mostly made up of residues from farmers own crop (rice straw), and the livestock graze and scavenge on common or marginal land, road side verges, river bunds etc. Small-scale producers do not feed their cattle and other ruminants with food used for human consumption. Cattle and other ruminants produced under prevailing small-scale conditions in the country have a low level of productivity. This is partly because the diet is generally at or below the levels supposed to be maintained, and all

of the feed is used for maintenance rather than production of livestock products.

Livestock provides not only food for the producers, but also a range of other products which could be sold or consumed by the livestock owner to provide nutrition, income traction and fuel. The major products of livestock include draught power, meat, milk, eggs and manure which are also used for fertiliser, fuel, feathers, fibre, hides and horns. In addition to these products livestock serve as an asset and may provide a reserve that can be converted to cash when need arises.

7.3.2 Availability of livestock production

Table 7.1 gives livestock population in the country during the past two decades. Only the poultry population showed a steady growth. Large ruminant viz. cattle and buffalo populations, particularly the latter showed a decreasing negative trend in growth. Sheep, swine and goat population also showed the same trend in growth. In 1992, more than 50 percent of cattle and buffalo and nearly 50 percent of goat population belonged to smallholders. In 2002, the percentage of cattle and buffalo belong to smallholders have been decreased due to negative growth rates (Table 7.4). The majority of cattle are found in the dry and dry intermediate zones. The same is true for buffalo and for small ruminants. However, poultry population belonging to smallholders between 1992 and 2002 were almost similar. Pigs are more abundant in the wet zone. The distribution of poultry is very similar to that of pigs.

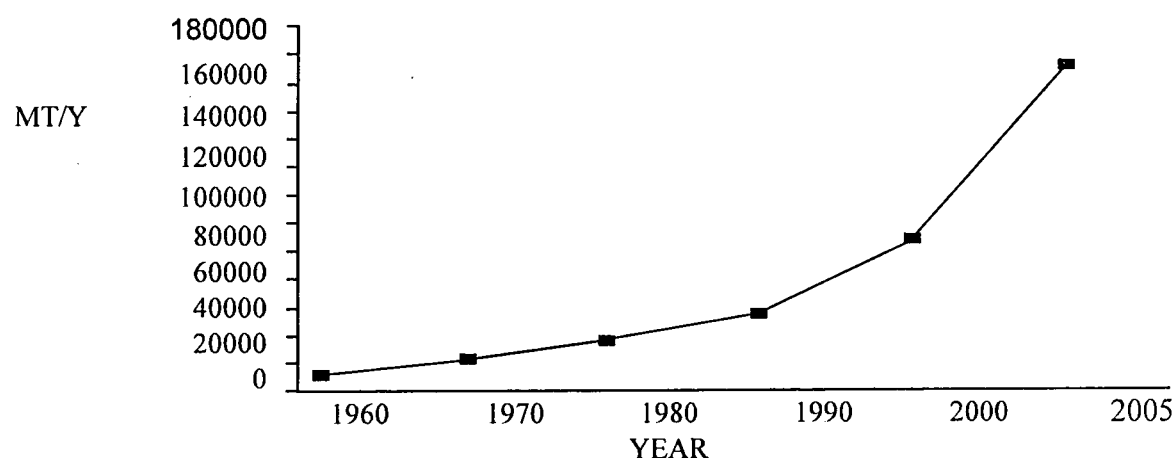
Over the past decades total meat production in Sri Lanka has increased by more than fivefold (Table 7.2), however, milk production has not shown substantial growth in the country due to several reasons. As a consequence, imports of powdered milk have drastically increased, the steepness of which is increasing in each decade and particularly so during the past twenty years (Figure 7.1). The total meat production in the country is expected to grow by nearly 4 percent a year between the early 1990 and 2010 while poultry meat production exceptionally grow even faster at more than 5 percent per annum. While the local production mostly supplies increasing demand for meat and eggs, the situation with regard to milk is pathetic, when comparing the trends in local production with the expenditure on imports. Imports of powdered milk continue to grow every year. The volume of imports has grown 4 percent per annum over ten years. In 2000, the value of imports of powdered milk reached nine billion rupees.

Table 7.1: Livestock population with growth rate in Sri Lanka (Unit 1000 heads)

Species	1992	1999	2000	2001	2002	Annual growth rate 1992-2002 (%)
Cattle	1,567.6	1,616.7	1,557.0	1,564.8	1,565.0	-0.7%
Buffalo	895.5	727.7	693.6	661.2	661.2	-2.5%
Pig	90.8	73.6	70.8	68.3	67.0	-3.5%
Sheep	17.1	12.1	11.2	11.7	11.7	-5.8%
Goat	502.5	514.4	495.2	492.6	490.0	-1.5%
Duck	0	1.0	1.0	1.0	1.0	7.6%
Poultry	826.0	1,159.0	1,062.2	1,066.0	1,061.0	4.0%

Source: Sri Lankan Livestock Statistics- 2002

Figure 7.1: Imports of milk products to Sri Lanka during 1960-2005



Source: Food Balance Sheet 1990- 2005

Egg production was more than double while the availability of chicken increased nearly fifteen times between 1980 and 2005. Increased production of chicken provides a clear indication of the rapid growth in the broiler industry over the last two decades.

Table 7.2: Livestock product availability in Sri Lanka

Livestock product	1960	1970	1980	1990	2000	2005
Beef (MT)	12,254	16,383	12,112	10,359	28,720	27,000
Mutton (MT)	1,237	1,302	1,366	825	1,750	750
Pork (MT)	468	671	1,143	832	1,690	1,100
Chicken (MT)	4,000	5,000	6,000	14,000	66,500	88,000
Total Meat (MT)	17,959	23,256	19,611	26,010	88,660	116,850
Eggs (Mil)	193	431	466	692	769	1,100
Milk (000 L)	110,237	161,489	283,656	294,373	291,880	193,000
Milk collection (000 L)	NA	NA	NA	82	120	100

Source: Food Balance Sheet 1990- 2002

7.3.3 Consumption of livestock products

In 1995, per caput consumption of meat, milk and eggs in Sri Lanka were 9.3, 14.3, and 9.3 percent compared with developed countries. In 2005, above values were 7.8, 30 and 15 percent respectively. Between 1995 and 2005, consumption of livestock products increased faster in Sri Lanka compared with developed countries. This is evident from the Table 7.3 in terms of the percentage

Table 7.3: Annual per caput consumption in Sri Lanka and developed countries

Product	1995	2000	2005	Developed countries 1995	Developed countries 2005
Total Milk products (kg)	15.3	36.0	40.03	106.9	130.5
Eggs (Nos)	28	35	56	300	356
Poultry meat (kg)	2.90	3.51	4.5	15.2	23.8
Beef (kg)	1.58	1.56	1.4	14.4	22.7
Mutton (kg)	0.17	0.14	0.036	3.4	6.5
Pork (kg)	0.13	0.10	0.6	18.4	28.6
Total meat (kg)	4.8	5.3	6.4	51.4	81.6

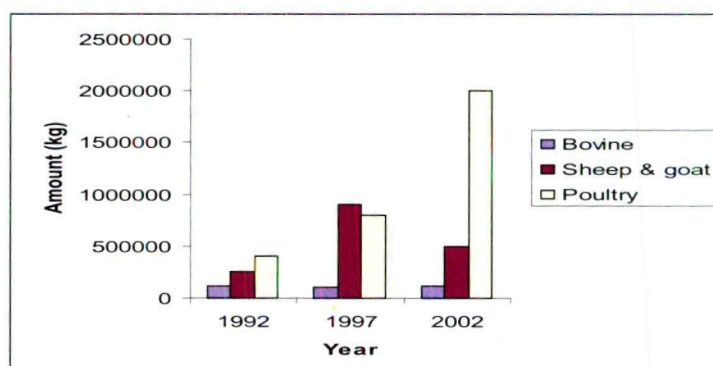
Source: Food Balance Sheet 1995, 2000, 2005, and FAO, 2006

Developed countries already increased high levels of consumption through slower population growth and rapid increase in livestock productivity by use of improved technology. Sri Lanka failed to bridge the gap in consumption in spite of much more increase in livestock production in order to meet the increasing demand. Sri Lanka imports increasing quantities of animal products – particularly dairy products. The country could be categorised as a heavy importer of dairy products and poor exporter of livestock products. The value of meat imports is also growing (Figure 7.2). However, meat imports are very insignificant in comparison to imports in dairy products.

Poultry meat consumption has grown the fastest and beef and goat meat shown only modest increases when compared with country standards. Sri Lankan is spending an increasing percentage of their food budgets on meat and milk products. In 1995/96, expenditure on animal products reached 13 percent of total food expenditure. The pattern is not favourable for rural poor. In 1995/96, expenditure on animal products by people in urban areas reached 18 percent of the total expenditure. In contrast, rural areas, expenditure on animal products was considerably low.

Increased livestock production in Sri Lanka may add to food security in several ways. Firstly, many poor smallholders will have direct access to more livestock food products. Secondly, increased production will keep prices of livestock products down and have low income groups access to them. Livestock products are subject to price- and income-elastic. The lower prices should increase demand, total production and farm revenue.

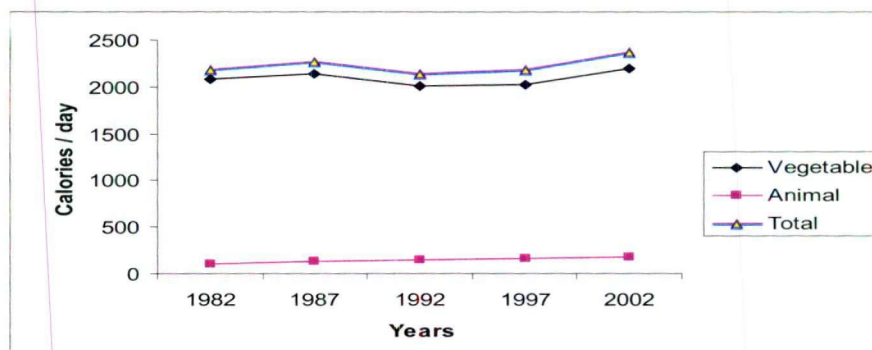
Figure 7.2: Imports of meat products during 1992-2002 per caput nutrient supply



Source: Food Balance Sheet, 2002

Calories - Animal products are primarily a source of protein and essential amino acid, but when they are a major constituent of the human diet they also contribute a significant proportion of total calories. For example, in developed countries they provide more than 30 percent of calories in the diet. In Sri Lanka, however this share is less than 10 percent.

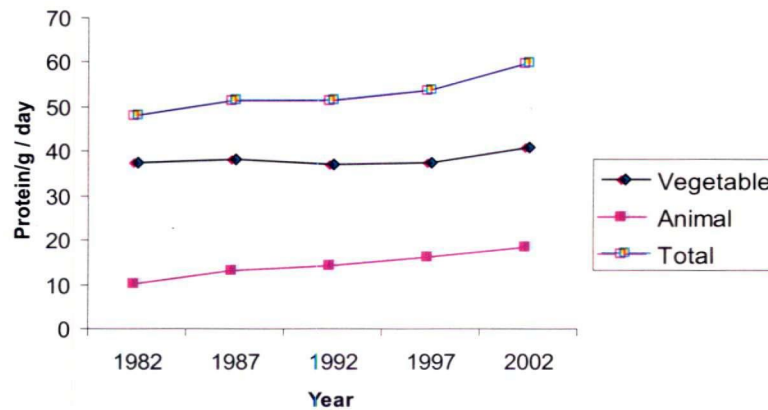
Figure 7.3: Consumption of calories from vegetable and animal food sources



Source: Food Balance Sheet, 2002

Protein- What is mostly significant in protein nutrition under these circumstances is – the role of animal proteins in supplying critically limiting essential amino acids – particularly lysine. In developed countries, about 60 percent of the dietary protein supply is derived from animal products, which is higher than that of the essentially required amino acids in Sri Lanka.

Figure 7.4: Consumption of proteins (g/day/head) from vegetable and animal food



Source: Food Balance Sheet, 2002

The figure is 15-20 percent (Figure 7.4) which is less than the expected level. The poor actually have a much lower protein. In Sri Lanka, where diets are composed only of a small number of staple foods, animal products are of great importance in preventing malnutrition as they are concentrated sources of limited essential amino acids in vegetable protein of basal diets.

7.3.4 Livestock as source of income

Animal products are a source of disposable income for many smallholders in the country. In fact, livestock is often the most important cash crop in many smallholder mixed farming systems. Disposable income is important for purchase of agricultural inputs and other family needs.

The first two of the forty-five ranked agricultural commodities in developing countries are rice and milk. Eggs, poultry and goat meat rank ninth, twentieth and twenty-first respectively (FAO quoted in TAC/CGIAR, 1993). On a global basis, meat, milk, eggs and fibre together contribute about 40 percent of the total value of crop (excluding trees) and livestock (excluding fish) production. The proportion is 50 percent for developed countries and 25 percent in developing countries. If trees and fish are included in the definition, livestock accounts for 19 percent of all agricultural commodities. These figures do not include the values of draught power and manure and the contribution from other minor livestock species. Adding these would further increase the proportional contribution of livestock in developing countries.

At smallholder level, ruminant livestock are especially important as an income source. Table 7.5 shows that more than 50 percent of livestock in Sri Lanka come from smallholders. However, the actual sources of income vary across different agro-climatic conditions and production systems which, in turn determine the species raised and the products and services generated. Cash can be generated from the sales of livestock products regularly (milk, eggs) or occasionally by sale of animals or by providing services (draught). The sale of milk is the most regular income generator. At present, dairy development has given emphasis to increase income and consumption especially at peri-urban and rural level (*kiri-gamma*).

At present, dairy development has given emphasis to increase income and consumption especially at peri-urban and rural level (*kiri-gammana*).

Livestock increased economic stability of farmer households, acting as a cash buffer (small stock), a capital reserve (large stock) and as a hedge against inflation. In mixed farming systems, livestock reduces the risk through diversification of production and income sources and reduces the risk of seasonal crop failures. Livestock represents liquid assets which can be realised at any time.

7.3.5 Livestock in generation of employment

Increased production implies higher employment. Dairying is labour intensive at farm level and women are active in production and marketing. Labour typically amounts to over 40 percent of total costs in smallholder systems. It is pathetic that our consumption of imported powdered milk not only deprives improvement of local smallholder based milk production but also the resulting chain of job opportunities. Goat, sheep, poultry and rabbit and particularly from backyard production systems are an important source of part-time work, particularly for landless women and children.

The processing sector has also been identified as a focus for generating employment and limiting rural depopulation. Small-scale milk processing sector produces 50-100 kg/working day generating considerable employment and income. The meat sector also provides employment for slaughter, marketing and processing.

Table 7.4: Distribution of livestock population in smallholding sector

Type of distribution	Cattle	Buffalo	Goat & Sheep	Swine	Chicks	Ducks
Total population (1992)	1,567,600	895,500	519,600	90,800	8,260,000	18,400
Total population in smallholding sector	1,263,614	534,263	246,912	28,510	3,622,421	Na
% in smallholding sector	80	60	48	31.8	44	-
Total population (2002)	1,565,000	661,000	501,700	67,000	10,611,000	10,000
Total population in smallholding sector	1,067,160	2,766,72	2,382,75	35,000	4,868,840	Na
% in smallholding sector	68	42	65	53.2	44	Na

Source: Sri Lankan Livestock Statistics, 1992- 2002

7.3.6 Livestock as renewable energy source

7.3.6 (a) Draught

Mainly buffalo and cattle are used for draught operations in Sri Lanka. Animal power is used

for a variety of agricultural purposes including ploughing, puddling¹⁹, threshing, levelling of fields, transporting of harvested products, etc. Outside agriculture, livestock – especially cattle and buffalo are also used for transport purposes, hauling, pulling carts or as pack animals. At farm level, draught animal ownership patterns have implications for food production and security. There are positive correlations between draught animals and rice production. Economics of draught power can be improved, if one animal is used instead of two and also a cow can be used instead of a buffalo. This strategy reduces the cost of maintaining the larger herd necessary to satisfy replacements and milk production. Milch cows – when used for draught – should be given additional feed to maintain milk yields.

7.3.6 (b) Dung for fuel and biogas

Remote villages used dung as plaster and building material in the past. Biogas from manure is an excellent substitute for fossil fuel or firewood. The best sources for these purposes are pigs, cattle, horse, camel, poultry (Kumar and Bisas, 1982). About 1m³ of gas is produced from 25 kg of fresh dung. Simple low cost bio-digesters have recently been developed by NERD centre. Biogas production on the farm reduces the workload of women by eliminating wood collection or the purchase of fuel. It is women friendly because of convenience, increased hygiene and the supply of services such as lighting, warm water and heating. Biogas can also be used to drive small machinery such as water pumps.

Effluent from bio-digesters can be recycled as fertiliser, with even better results than the original manure, being free from worm eggs and other disease causing micro-organisms. It is also useful as a fish feed, or to grow *Azolla* and duck weed. Bio-digestion has positive public health aspects as well.

7.3.7 Livestock in integrated agriculture

7.3.7 (a) Weed control

Livestock – particularly cattle, sheep and buffalo are efficient in controlling weeds, and thus help to increase crop production. They are used in coconut plantation as sweepers to reduce under growth in order to reduce the cost of weedicides. Livestock can save up to 40 percent of the cost of weed control. Such systems also safeguard the environment and avoid chemical pollution while supplying additional organic material to the soil through livestock excreta.

7.3.7 (b) Nutrient recycling

Nutrient recycling is an essential part of any strategy for sustainable agriculture. Integration of livestock and crops allows for efficient recycling through use of crop residues and by-products as animal feeds and for animal manure as crop fertiliser. Nutrients (N, P and K) composition of excreta/dung of different livestock species is presented in Table 7.5. In addition, manure returns organic matter to the soil, helping to maintain its structure as well as its water retention and drainage capacities.

¹⁹ Puddling –prepare paddy fields

Source: Kumar and Bisas

Throughout the country, manure is the primary source of plant nutrients for home garden crops. Chemical fertilisers are expensive and applied mainly to high yielding crops such as rice etc. In areas where crop-livestock mixed farming is concerned, manure is an important link.

7.3.8 Recycling of secondary products

Manure can be a valuable source of feed for other animal species while poultry manure is commonly used for ruminant feeding. Poultry and pig manure can also be used to generate algae as a feed for fish. By-products such as slaughterhouse wastes, when adequately processed, are useful protein (skin and inner organs) and minerals (bones) in animal feeds. Household wastes are commonly fed to pigs and small animals such as poultry in backyard systems in rural areas. In urban and peri-urban areas, restaurant and catering wastes can easily be processed for pigs. Fish wastes create pollution around processing areas. Preservation of fish waste as fish silage for feeding has proved to be technically and economically feasible for use by poor farmers.

7.3.9 Other attributes of livestock

7.3.9 (a) Saving of foreign exchange

The long-term decline in the animal feed products such as coconut *poonac* has greatly reduced the amount of feed available for livestock. Import bill of livestock feed increased accordingly. Sri Lank is importing about three billion rupees worth of animal feed annually. The major feed items imported are maize, fish meal and oil cakes as shown in Figure 7.5 .

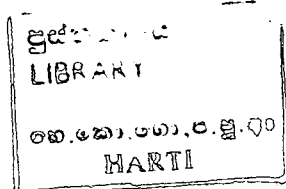
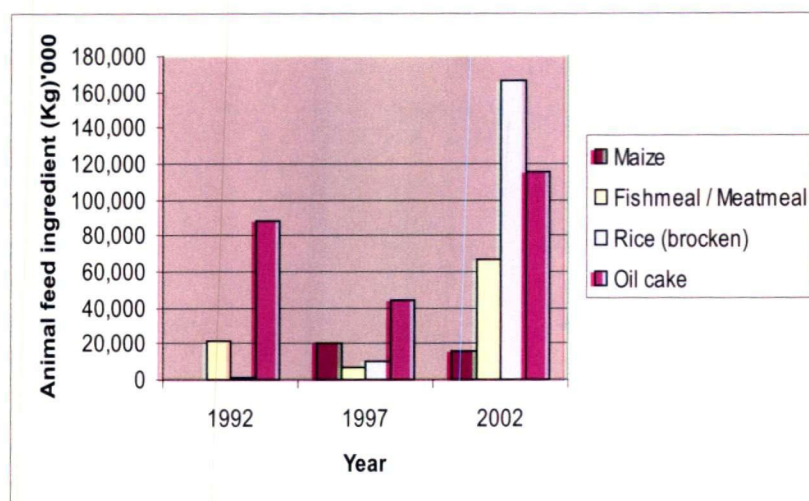


Figure 7.5: Animal feed imports during 1992-2002



Source: Sri Lankan Livestock Statistics, 2002

Therefore, increasing animal production along with the animal feed production can save considerable foreign exchange.

7.3.9 (b) Savings and asset accumulation

In rural areas, financial services such as credit, banking and insurance are virtually non-existent. In these areas, livestock play an important role as a means of saving and capital investments. A combination of small and large livestock that can be sold to meet petty cash requirements – to cover seasonal consumption deficits or to finance larger expenditures – represents a valuable asset to the farmer.

According to data available, sale of livestock involves purposes such as purchasing of household items like soap, salt and petrol besides school fees, building materials, agricultural inputs, health expenses, paying taxes and meeting, weddings, funeral expenses, etc. Livestock assets serve as a form of insurance against crop failure, unemployment or ill-health, which are the major financial difficulties for households.

7.3.9 (d) Animal by-products

Hides and skins –Production of animal by-products in 2005 is presented in Table 7.6. The yield of hides and skins in relation to the overall weight of slaughtered animal is approximately 6.5 percent for cattle and 10 percent for small ruminants. Pig skin is not considered a by- product in Sri Lanka since pork is sold and consumed with the skin intact.

Table 7.6: Production of animal by-products during 2005

Product	Amount
Bone Grist	144 metric tons
Dog Chew (number)	1.8 million
Animal Hair	9 mt
Hides and skins	61.6 mt

Source: Department of Animal Production and Health (2005) Livestock data

7.3.10 Farm animals as social and cultural assets

Rearing of livestock by rural livestock keepers is often influenced by social and cultural factors rather than strictly commercial motivations. Animals are often slaughtered to feed guests on special occasions such as weddings, birthday celebrations and funerals. In many parts of the country, exchange of livestock has been a tradition and is a form of maintaining social ties. The inability to participate in such events and activities can leave a person excluded from the social life of the community. Moreover, the ties built up in this manner can be important assets, which are drawn up at times of need. In some cases, there are particular requirements for the breeds that are used in the meeting of traditional obligations.

Culture is an important factor for livestock products. In many places there are cultural preferences determining the particular foods as well as the breeds. Traditional crafts often require particular livestock products often from specific breeds as inputs. Traditional healing practices also often involve livestock products, and the requirements in terms of very specific breed or characteristics such as colour etc. Similarly, livestock plays a role in sports and pastimes. Many breeds have long been bred for their capacity to compete in sporting activities.

7.4 National Livestock Development Policy

7.4.1 Development policy

The policy statements and the strategies of the government aim at developing the livestock sector for economic development and social stability of the country. It also attempts to spell out the government's role in the livestock development process, so that the private sector, the non-governmental organisations and, other interested groups involved in the economic development of Sri Lanka, will be able to make better decisions about their role in the livestock sector of the country (Ministry of Livestock Development, 2007).

Principles

- i. The native livestock species of the country have several traits of technical importance which helped them survive in very hostile environments and on low quality feed. The genetic merit of these species should be preserved for future use in animal breeding activities.

- iii. Developing the livestock sector is a necessary condition for ensuring food security in the country. It is true that it increases availability of livestock produce, in return resulting in greater crop productivity through improving soil fertility.
- iv. Local feed raw materials are produced at extremely low levels of efficiency. Developing the feed resource base is therefore crucial for profitable livestock farming.
- v. The dairy sector is the priority for public investment because of its importance in the national economic development process. The government also recognises that there should be no restrictions on the rearing of animals for meat and meat processing by the private sector.
- vi. There is a tendency among individuals to move away from livestock farming and to look for more attractive and socially accepted livelihood options. This trend needs to be arrested by making livestock farming more lucrative so that the younger generations will realise its potential for poverty alleviation, livelihood improvement and increase in food security.
- vii. The state-owned enterprises for livestock development will continue to remain under the state management while private sector agencies will be complimented on commercial activities.

Goals and targets

- i. The achievement of sustainable and equitable economic and social benefits to livestock farmers.
- ii. Increasing the supplies of domestic livestock produce at competitive prices to the consumers.
- iii. Achieve increased self-reliance at least 50 percent, in domestic milk by 2015.
- iv. Double the current domestic production of poultry products by 2015.
- v. Domestic livestock products to be competitive with the imported livestock products.

Policy objectives

- i. Spell out clearly the development goals of the livestock sector and the role of the public sector in livestock development activities.
- ii. Facilitate the private sector and other interested agents to identify the scope and possibilities for their activities in production, processing and marketing of livestock and livestock produce.
- iii. Rationalise investments on livestock sector provided from the consolidated fund through the national budget and avoid crowding-out of private sector investment.

7.4.2 Livestock planning projects

7.4.2 (a) Ten-year Livestock Planning Project

A ten-year livestock planning project was implemented during the period from 1983 to 1992, as follows; 1983-1985 (phase I), 1986-1988 (phase II), 1989-1990 (phase III), 1991-1992 (follow-up phase). Aims of the project were: strengthening the planning and coordination capacity related to livestock development; and establishment of adequately equipped and manned planning entities at the ministry level and its line agency - the Department of Animal Production & Health (DAPH). Activities included; provision of technical advice, office equipment and vehicles, and staff training. Under this project, a livestock planning entity at the ministry and at DAPH, and a monitoring cell at the National Livestock Development Board (NLDB) were established. Units for monitoring livestock farms set up under DAPH and NLDB helped contribute to a great deal.

7.4.2 (b) Agricultural Planning and Analysis Project

The then Ministry of Agricultural Development and Research implemented the above project during the period from 1986 to 1992. The objectives were to develop an integrated national level agricultural planning system which could provide a rational basis for policy formulation and decision making in the agricultural sector by bringing planning units of concerned line ministries to a higher level of capability and influence. Planning units were established at the Ministries of Lands and Land Development, Agricultural Development and Research, Coconut Industries, Fisheries Industries, Plantation Industries, and Mahaweli Development.

Facilities for these units such as data processing equipment and software, office equipment and facilities, vehicles and library reference materials, and operational expenses – were provided. Technical as well as support staff in the planning units were trained in different fields related to planning.

7.4.2 (c) Integrated Rural Development Project (IRDP)

Since the late 1970s, the government adopted the integrated approach to develop the rural sector. Several programmes were launched with assistance from several donors. While the other ministerial departments accommodated rural credit, women development, agriculture development etc., Ministry of Policy Planning and Implementation coordinated IRDPs and DAPH implemented the livestock components of the project. Other activities involved in the projects included animal husbandry development, establishment/ assistance for marketing organisations, provision of credit for livestock. As a result, animal husbandry development in the respective districts has improved to a greater extent. However, the inadequate funds for operation and maintenance of certain facilities such as vehicles prevented the full use of facilities provided while assistance provided for milk marketing was successful.

7.4.2 (d) Rehabilitation in the North and East

DAPH and MILCO implemented this project during 1988-1992 while the then Ministry of Rehabilitation and Reconstruction coordinated. The principal objective was to rehabilitate the economic infrastructure vital for animal husbandry development in the north and east provinces. Assisted by the Federal Republic of Germany, the project contributed greatly towards improving the state of the livestock farms (Polonnaruwa, Kotaliya, Weearwila, Kundasale, and Marawila) and they are now equipped to supply breeding stock to the north and east. The equipment and vehicles for VS ranges in the north and east have resulted in better services to farmers. However, the implementation of the activities for strengthening the vaccine production and disease investigation centre (VIC Polonnaruwa) has been very slow.

7.5 Institutional Support for Livestock Sector

7.5 (a) Ministry of Agriculture and Livestock

The government support for livestock sector primarily emanates from the Ministry of Agriculture and Livestock. The ministry is responsible for overall development of the sector in the country and is mandated with the formulation of policies, programmes, projects and allocation of

resources to facilitate and ensure continued growth of the sector. The ministry is also responsible for coordination with other ministries and to garner external assistance and support for livestock development.

7.5 (b) Livestock Division of the Ministry

The Livestock Division of the Ministry is entrusted with the task of accomplishing goals/objectives set out for the livestock sector. It is responsible for;

- Identification and analysis of policy issues pertaining to livestock sector,
- Direction and supervision of the following institutions,
 - a) Department of Animal Production and Health (DAPH)
 - b) National Livestock Development Board (NLDB)
 - c) MILCO (Pvt) Ltd
- Provision of support to provincial administration in identification, preparation of livestock development programmes, projects, monitoring and supervision.
- Review of prices of inputs, livestock and livestock products to ensure fair prices to producers and consumers.
- Formulation of new legislations to achieve government objectives.
- Ensuring adequate and continuous supply of inputs, support services and improvement of marketing network.
- Promotion of research and extension for sustainable livestock development.

7.5 (c) Provincial Ministry of Agriculture, Animal Production and Animal Husbandry

The Provincial Ministry of Agriculture, Animal production and Animal Husbandry was responsible for the implementation of livestock development programmes and projects in the respective provinces. Specifically, it provides the following through the Provincial Director of Animal Production and Health and its network of field veterinary surgeons.

- Development of district level programmes / projects for animal husbandry and implementing, supervising and monitoring them.
- Carry out extension activities for promotion of improved techniques for livestock farming and economic production of meat, milk and eggs.
- Provision of animal health services, both preventive and curative through network of provincial veterinary offices.
- Implement the national breeding policy for the genetic improvement of livestock through artificial insemination and natural service.
- Issue/coordinate the supply of improved varieties of cattle, buffalo, sheep, goat, pig and poultry for farmers in the province.
- Dissemination of knowledge on improved varieties of pasture and fodder and crops and their establishment and maintenance for efficient utilisation and profitable livestock production.
- Training of farmers and other target groups within the rural sector on dairy, sheep, goat, pig and poultry husbandry.
- Organisation of livestock farmers into farmers associations for furthering the development of the livestock sub-sector and improving the marketing structure for livestock and livestock products such as meat, milk and eggs.
- Issue of suitable varieties of pasture and fodder planting materials.

7.5 (d) Department of Animal Production and Health (DA PH)

The Department of Animal production and Health is the key institution responsible for livestock development in the country. The DAPH's main activities are listed below:

- Surveillance, prevention and control of emerging animal diseases and development of eradication programmes
- Provision of animal disease diagnostic services
- Operation of animal quarantine services
- Production and procurement of veterinary biologicals for disease control
- Conducting research on animal health, production, breeding, and nutrition etc.
- Development and implementation of special livestock projects
- Administration of Acts
- Conducting training programmes for farmers, officers etc.
- Production and supply of inputs for artificial and natural breeding programmes and monitoring of the progress.

7.5 (e) National Livestock Development Board (NLDB)

National Livestock Development Board (NLDB) is the pivotal organisation for supply of breeding materials for livestock development. The NLDB's salient activities could be outlined as follows:

- Infusion of new technologies in farm operations
- Production of superior breeding and planting materials for expansion of livestock production
- Introduction of new types of livestock
- Conducting training programmes
- Provision of inputs and support services
- Processing of livestock products
- Provision of facilities for the Department of Animal Production and Health to conduct research
- Promotion of crop-livestock integrated farming

7.5 (f) MILCO (PVT) LTD

MILCO (PVT) LTD, the government-owned private company is the key player in the dairy sub-sector. It performs a raft of crucial activities to enhance and expand dairying in the country. The main activities include the following:

- Milk collection and procurement through establishment of milk collection and chilling centres
- Processing of milk into a range of dairy products
- Marketing of processed milk and milk products
- Formation of smallholder groups, namely farmer managed societies
- Provision of inputs and services to dairy farmers

7.5 (g) Mahaweli Authority of Sri Lanka

Mahaweli Authority of Sri Lanka (MASL) coming under the purview of the Ministry of Agricultural Development and Agrarian Services makes considerable contribution to promote and develop livestock production among farmers in the Mahaweli project area. The project area covers most of the dry zone which has a high concentration of cattle and buffalo.

The Mahaweli Authority of Sri Lanka has two organisations, namely Mahaweli Livestock and Agro Enterprises Ltd and Mahaweli Livestock Enterprises Ltd. The former contributes to dairy production while the latter plays a predominant role in poultry. The Mahaweli Livestock and Agro Enterprises Ltd operates ten farms and helps in the supply of breeding materials, formation of farmer organisations and marketing of milk. It also provides services and inputs to farmers besides operating mini-dairies.

The Mahaweli Livestock Enterprises Ltd has played a useful role in promoting and popularising broiler farming among the rural settlers. It runs broiler breeder and out-grower operations and is also engaged in processing and marketing of chicken meat.

7.5 (h) Samurdhi Authority of Sri Lanka

Samurdhi Authority coming under the purview of the Ministry of Samurdhi is engaged in promoting livestock related micro-projects especially among the poverty stricken disadvantaged segment of the population in an effort to alleviate poverty and generate incomes as well as self-employment opportunities. In fact, the authority has highly recognised the significance of livestock rearing as a means of alleviating poverty.

7.5 (i) Non-governmental organisations

A multitude of non-governmental organisations contribute to livestock development in the country. Their efforts to empower rural poor communities embraced livestock production as a potential instrument to generate income, employment and thereby mitigate poverty and malnutrition. Some of the non-governmental organisations that make useful contributions to livestock sector are:

- Sarvodaya Movement
- Agromart Foundation
- Seva Lanka
- Gami Seva Sevana

7.6 Credit Facilities for Livestock Sector

The use of agricultural credit is extremely important for the success of dairy managers as they adapt new technology and continue to increase the size of their business. Credit and money management are key variables that make it possible to develop a business of sufficient volume to provide adequate cash flow and ensure profitability. Credit is one of the tools of production, and proper use can build earning capacity.

To properly obtain and manage credit for farm business requires that dairy manager has first-hand knowledge concerning the major credit institutions serving agriculture. It is also vital that a

dairy farmer has a general idea of the institution's capacity and desire to serve agriculture, and terms and rates that are available. It is of extreme importance in the credit selection process to have an individual connected with the agricultural institutions that understand the business of agriculture, problems and needs.

Many institutions, businesses, and individuals compete for dairy manager's business. The largest agricultural lender to farmers is the Farm Credit System, an institution comprising three farm credit banks: Federal Land Banks, Production Credit Associations, and the Bank for Co-operatives. The Federal Land Bank is designed to formulate loan for farm improvement while Production Credit Associations grant loans to farm co-operatives. Loans are made on the basis of five basic criteria: repayment ability, equity, security, financial growth, and the individual. The size and use of loan proceeds are also important components.

The credit facilities for the livestock sector emanated from the following banking institutions:

1. State-owned commercial banks, namely Bank of Ceylon and People's Bank
2. All private domestic commercial banks
3. Development banks, namely National Development Bank (NDB), Development Finance Corporation of Ceylon (DFCC) and regional development banks.

Many domestic commercial banks offer credit facilities under their normal and special lending criteria.

Normal Scheme

Credit limit: Variable
 Market rate of interest: 16 – 18 % per annum
 Repayment period: 3 years
 Grace period: Variable
 Collaterals: Any security acceptable to bank.

Special Credit Schemes

- a) Many domestic banks participated in special credit schemes, namely *Sasuka*, *Savana*, and *Sasana* for micro and small-scale special enterprise development programmes implemented by the government under 'Samurdhi programme'

Credit limit: 10,000 - 50,000 rupees
 Interest rate: 10% per annum
 Repayment period: Maximum 3 year
 Grace period: Maximum 1 year
 Collaterals: Inter-se guarantee of other borrowers/ any other security

- b) The Central Bank of Sri Lanka too provided funds to commercial banks to implement 'Surathura' credit package to assist micro-enterprises outside Samurdhi programme.

Credit limit: 50,000 rupees
 Interest rate: 10% per annum
 Repayment period: 3 year
 Grace period: 1 year
 Collaterals: Inter-se guarantee of other borrowers

- c) Small and Micro-Industries, Leader and Entrepreneur Promotion Project (SMILE II) was

launched with the financial assistance from Japan Bank for International Co-operation. The National Development Bank (NDB) provided refinance facilities to participating credit institutions (PCI), namely all the commercial banks

Credit limit: 7 million rupees
Interest rate: 13.5 - 14% per annum
Repayment period: 10 year
Grace period: 1 year

d) Small enterprise development loan scheme

This special scheme was implemented by the Bank of Ceylon with its own funds to assist small-scale enterprises.

Credit limit: 50,000 rupees
Interest rate: 15 - 16.5% per annum
Repayment period: 5 year
Grace period: Maximum 1 year
Collaterals: Inter-se guarantee /project assets/ any other security acceptable to bank

e) *Gamipubudu* Scheme

Hatton National Bank (HNB) continued this special scheme.

Credit limit: 100,000
Interest rate: 18 per annum
Repayment period: 5 year
Grace period: Maximum 1 year
Collaterals: Project assets

f) Indian Line of Credit

A credit assistance of 100 million US dollars from the Government of India to the Government of Sri Lanka was provided to enterprises to procure capital goods and services etc. The interest rate ranged from 15-15.5 percent per annum. A number of quasi formal institutions, namely co-operative rural bank (CRB) and 'Samurdhi' banks etc too provided credit facilities.

The Central Bank of Sri Lanka (CBSL) has launched the Agro Livestock Development Loan Scheme (ALDL) in association with the government to boost local liquid milk production, milk and milk-based products and to promote agricultural crop processing industries in the country. The special credit programme launched in April 2008 disbursed five billion rupees at a concessionary rate of interest to small-scale dairy farmers, liquid milk processing industries and agricultural crop processors. The scheme has been introduced as partial fulfilment of the 2008 Budget.

With the sharp increase in the price of powdered milk and food crops in the global market, it has given added vigour to develop the local dairy industry and the food crop sector. Non-availability of a credit scheme for dairy products was identified as one of the major constraints on developing liquid milk production in the country.

Further, strengthening of agro-processing industry by providing financial facilities for agro-based industries, storage and processing of crops would help develop the cultivation of food crops on a sustainable basis. It is expected that this credit programme will increase the investments in the local liquid milk and food crop sectors in the country. It is generally difficult for the poor to get access to credit by conventional means because banks generally require security of collateral loans.

Micro-finance and micro-insurance schemes are innovative ways of providing the poor with access to capital and hence a way out of poverty. Particularly, women often lack access to financial resources necessary to escape poverty and social dependency. Micro-credit schemes can enable women to engage in economic activities and join social networks through which both poverty and social dependency can be overcome. Governments can coordinate, control, support and enhance micro-credit institutions founded by private and civil society actors. Micro-credit has empowered women in a number of ways:

- Improved access to health and education, allied with expanded opportunities for employment and access to micro-credit, has expanded choice and empowered women.
- With increased social and political consciousness, women are now more likely to take part in local government and national elections. They are gaining control over their lives, reducing their dependency and taking a greater part in decision-making processes of the family.
- While disparities still exist, women have become increasingly powerful catalysts for development, demanding greater control over fertility and birth spacing, education for their children, and access to services.

7.7 Credit Accessibility by Livestock Farmers

According to project completion reports, the utilisation of credit under most of the earlier loan schemes had been very low. The reason for this poor utilisation was on account of difficulties in sourcing good - quality breeding cows for dairying and the low level of profitability of dairying in the past. As profitability of dairying was low, there was no incentive for farmers to save breeding animals from going to slaughter, resulting in the loss of valuable breeding animals. The problem of shortage of breeding animals still persists and is a major issue.

Similarly, the newly- introduced credit scheme for milk processing where loans up to 300 million rupees are made available at concessionary rate of interest has created a great enthusiasm in the private sector. Many private sector agencies are planning new investments and this measure is likely to produce new milk marketing opportunities in the country, thereby benefiting the small dairy farmers.

7.8 Livestock Insurance

Livestock companies are another source of agricultural credit, with individuals providing well over one-fourth of all real estate credit provided by institutional lenders and are particularly popular in the Midwest and West. Most companies are flexible and work out terms best suited for their borrowers. Terms are usually fifteen to twenty-five years, with options concerning balloon payments or refinancing at longer terms for maturity. Rates can be variable and fixed depending on the company. Service charges and closing fees are also applied at closing of the loan.

The livestock insurance servers included the following organisations.

- a) Agricultural and Agrarian Insurance Board (AAIB)
- b) Ceylinco Insurance Company Limited

A public sector institution as well as a private company was involved in providing livestock insurance coverage. The insurance schemes implemented by the Agricultural and Agrarian Insurance Board covered cattle/ buffalo, goat, sheep, heifer and imported cattle.

Ceylinco Insurance Company Limited too operated insurance coverage for all the types of livestock except for the last three types included in the insurance schemes of Agricultural and Agrarian Insurance Board. Though the age ranges were identical, the maximum insurance coverage provided by Ceylinco Insurance Company Limited for cattle, buffalo and cross-bred goat varied. The premium rates were similar and attractive discounts were made available.

7.9 Indian Livestock Development Model

India is self-sufficient in milk. The daily per caput consumption is approximately 1 litre/d. They produce 100 million tons of milk annually. Compared with that, Sri Lanka's daily per caput consumption is one gulp of milk (nationally produced), thus spending a great amount of foreign exchange on importing powdered milk from different countries. India, where 60 percent milk is produced from buffalo, a large number of smallholders, particularly women, agricultural workers and landless labourers should be credited with this achievement. Small dairy producers in India were able to perform "White Revolution" in the country. Sri Lankan dairy industry also exhibits similar problems that the Indian dairy farmers experienced, in the early days of their dairy revolution.

Indian dairy development model is totally based on dairy co-operatives. Most of the village dairy co-operatives are managed by women workers. They involve themselves in milk collection, chilling, feed formulation, providing credit facilities etc. The National Dairy Development Board of India a statutory body under the Union Ministry of Agriculture also helps village co-operatives to build up their strength (for an example, Kerala).

Approximately, three decades ago Kerala in India launched policies to improve the potential of milk production of local animals, to which the government gave priority. Today they are self-sufficient in milk production.

Increased demand for milk had forced the policy makers of Kerala to think seriously on the ways of improving production potential of animals. The inception of Kerala Livestock Development Board for cattle breeding was the major step taken in this direction. Kerala is the first state in India to give due importance to the need for cattle improvement through breeding policy, thereby uplifting economic and social standard of the rural people. As a result a systematic crossbreeding programme for cattle was started in 1963. The impact of this programme could be accessed by the fact that the total milk production – which was about 220,000 tons during the year 1963-64 increased up to 2.6 million lack tons during 1999-2000 (Danial & Batuwitage, 2008). The percentage of crossbred females in the population has reached 68 percent, the highest in the country. It aims at:

1. Increasing the genetic potential of animals
2. Increasing the proportion of crossbred in the population
3. Augmenting the overall management of animals
4. Management of information and establishment of *Pashubhavanas* ²⁰
5. Supporting research and development programmes

²⁰ *Pashubhavanas*- Animal husbandry farming associations in Kerala

The dairy sector is regarded as the priority sector for public sector investment in livestock development.

- i. Promoting a market for liquid milk and expanding to regions outside the traditional centres of milk consumption, is identified as a precondition for increasing competitiveness of domestic milk.
- ii. Upgrading the native herd is considered a fundamental necessity for dairy development. This will be a thrust area of public investment but active involvement of the private sector for same is considered essential.
- iii. Similar to developing the dairy cattle for dairy development, efforts will also be made to increase the role of dairy buffalo and dairy goat in the domestic dairy industry.
- iv. Government will facilitate the transformation of the present subsistence level of the dairy production into a viable as well as commercially-oriented level.
- v. Import policy and fiscal policy on dairy products will focus on providing an environment conducive for the domestic dairy industry.
- vi. The market forces will govern the pricing mechanism for domestic milk and the government role in this will be limited to increasing competitive environment in the market.
- vii. The development of a viable, large-scale and commercially-oriented private sector engaged in the dairy production is regarded crucial for long term sustenance of the domestic dairy industry.
- viii. Dairy farmer empowerment and facilitating the participation of dairy farmers and the processors in the value chain of dairy products will be actively facilitated.

Unlike in Kerala, the major issue which has held back the dairy production in Sri Lanka since the 1980s to recent times is – the lack of policy environment for dairy industry after the five-year-plan which was completed in 1977. Preference of Sri Lankans for powdered milk rather than liquid milk was also a major reason for the drawback in the dairy industry until recent times.

In Sri Lankan context, historically it has been clearly demonstrated that the collection of milk (marketing facilities) alone increased production. It is noteworthy that, even with open economy, the private sector firms did not invest in milk production, leaving it largely in the hands of the poor smallholders. As a result, several foreign aided projects have failed to achieve the desired objectives. Considering the historical aspects of dairying in Sri Lanka, similar to Kerala, it is clear that more locally based technology and greater involvement by the government is the way to make smallholder-based dairying a viable enterprise. Then only the private sector firms could be expected to invest in milk production as seen in poultry production.

However, for the collection of produced milk, there was growing competition among private sector firms. In spite of the competition, the producer never received a reasonable price. Relatively recent appreciative increases in the price paid to the producer with the promotion of fresh milk with consumption through government intervention have already had a considerable impact.

Today, India has become self-sufficient in milk (production) due to her sheer commitment and adherence to the rigidly far-sighted policy she introduced and implemented in true spirit. At the time, when there is a global concern over escalating food prices, the government too is concerned over food security particularly to improve the national milk production of the country. Therefore, it is useful to learn a lesson from the neighbouring India.

7.10 Food for Thought

From the data presented, it is clear that in Sri Lanka, the smallholder farmer contributes a large share in all types of livestock production. They are also mainly the peasants with limited land. Compared to poultry or swine, cattle rearing demands much more land while a large number of dairy farmers are the poorest of the poor among the farming community. Since the poultry rearing is profitable; smallholders to very large-scale firms are involved with it and have attained international standards. In dairying, however, large-scale private and semi-government establishments are involved only in the collection and processing of milk leaving the production to the smallholders in the local peasantry. That shows the economics of poultry against dairying and in the case of the latter, milk production, collection and processing.

Many developed countries such as Japan initially emphasised self-sufficiency in the main staple food. Once that is achieved, emphasis will be on livestock production. Now that Sri Lanka too can be attained self-sufficiency in rice production. The present administration is making efforts which should be commended. The key to its success lies on boosting milk production with the smallholder base to a more economically viable industry, enabling a wider participation in it as with poultry production.

While there is a need for converting non-technical policy decisions, following will provide food for thought towards achieving self-sufficiency in milk production.

1. Man power resource base for the milk production is largely with the poor peasantry farmers.
2. While understanding the reasons for their keeping cattle for a comparatively marginal profit, all inputs should be tailored to an affordable level. Meaning, low cost, low inputs to result in relatively high outputs in a wholesome (technically, practically, socio-economically and environmentally) and in a sustainable manner.
3. Available cattle resource base is largely indigenous, Indian and exotic type crosses. Indigenous blood gives the ability to thrive under local smallholder low level of management conditions. That is resistance to ticks, diseases and ability to thrive under humid conditions in low levels of nutrition and other management practices but also with a low level of production. Inadequate feeding (quantity as well as quality) is the main constraint recognised on milk production; while one would argue that genetic limitations for the production are another major cause. But how often does genetic inability limit production with high levels of feeding and management compared to farmer's inability to feed and manage to derive the maximum genetic potential? Certainly, most often prevailing situation is the latter. Clear examples from up-country exotic Holstein-Frisian, Jersey etc. with a high production potential were giving an average production of about 4L/cow/day during the late 1980s and early 1990s when indigenous cows were giving comparatively yields at Hakmana on very low but critical inputs. It is same as with high yielding paddy varieties which also require high levels of inputs and management; if not, it is better to have traditional low input but more sustainable varieties. There is strong and repetitive historical evidence with successive governments introducing improved breeds to an 'environment' which cannot sustain the level of feeding and management required and therefore ending in disaster for both the farmer and the animal. Broadly, environment entails roof only the adverse climate for exotic blood, but also the farmer's commitment, experience and ability to sustain required inputs, much more than with paddy, partly arising from the fact that unlike paddy dairying is around the year organised operation. Therefore, it is strongly recommended that 'environment'

be carefully assessed before commitment. Several dairy farmer surveys conducted by Seresinhe and Pathirana (2006;2000) indicated that low inputs such as sufficient drinking water (milk is 85 percent water) at least common salt in the absence of complete mineral mixture twice instead of once a day milking (former preferably requires twice a day collection as well) etc. were often lacking.

4. What is the available feed resource base (grasslands) for grazing has remained only a talking point for decades and would certainly remain so in practical terms, particularly under the prevailing economics of milk production against many other options available to farmers. Based on the reasons mentioned under above items one to three, agricultural by-products or wastes such as rice straw in combination with commonly available multipurpose tree fodders such as gliricidia, erythrina, etc. offer a great alternative to grass-based milk production. Rice bran, fertiliser grade urea and molasses (for milk production versus high demand for liquor, requiring government policy decision) with a mineral mixture when properly fed up to seven litre /cow/d production potential. This is against a comparable farmer. Generally speaking, milk production level of one litre/day of indigenous cows has been increased to four litre/day with above mentioned simple inputs including grazing of weeds under coconut instead of cultivated grasses in a continuous six-year research/demonstration study (Pathirana *et al.*, 1996) and later in the process of being confirmed in a another study at Mirissa by Seresinhe *et al.*, (still under investigation).
5. While improving milk production with available appropriate resources, there is a need of improved breeds with reference to Table 7.1, where high level of feeding and management practices could be adopted. Also from extensive type of grazing with a larger herd, stall feeding with a few higher producing cows using above mentioned feed resources plus fodder grasses under land limiting conditions could be recommended. This strategy has a strong scientific backing for optimising the utilisation of limited feed resources for maximum production from minimum land.
6. Apart from all above concerns again there is strong and repetitive historical evidence that, wherever a reliable milk collection has been organised, the quantity collected increased rapidly, often exceeding the expected storage capacity. Prompt income in milk collected is not only due to farmers taking better care of the cows, but also due to milking of un-milked cows, thereby turning a rigorous cycle around benefiting the community and the nation. Since fresh milk is a perishable collection, transport and storage are essential. Therefore, it is strongly recommended that there should be an efficient milk collecting and handling system islandwide as a basis for self-sufficiency in milk.
7. A prerequisite for sustainable development of livestock resources is the identification, testing under local conditions and promotion of appropriate technologies that utilise local and affordable resources.
8. Policies, infrastructure and supporting services enabling such technologies to succeed and availability to small-scale farmers must be established.

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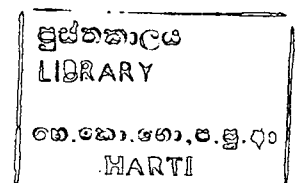
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Chapter **8**

**CHALLENGES AND
MAJOR THRUST AREAS**

Dhanawardana Gamage



8.1 Introduction

The nature of livestock production and its multiple roles in the context of South Asia present many opportunities for poverty reduction. Emerging scenario relating to the livestock sector in general and the small-scale livestock production in Sri Lanka in particular has been extensively dealt with in previous chapters. It is found that the livestock production in Sri Lanka, except for the poultry sub-sector – is largely concentrated in remote and ecologically marginal rural areas and such sub-sectors of livestock like cattle, buffalo and goat farming are largely found amongst the smallholder farmers. It is also found that ensued by growing population, increasing per capita income, growing urbanisation and changing food habits, – the demand for livestock based products like the dairy products, poultry meat and eggs – has been growing. On the other hand, the average per capita consumption of livestock products in Sri Lanka is much lower than the average per capita consumption in developed countries. Increasing per capita income and changing food habits from largely a cereal based diet to a one with more animal protein, vegetables and fruits will increase further demand for livestock products.

The emerging scenario in the agricultural sector, particularly in the SFS as was discussed in chapter one and two, points to major issues. For instance, the per capita availability of agricultural land is dwindling: farmlands operated by most farmers are small; productivity of most crops is sluggish if not stagnated; nutrition of population remains low; disparities in rural income increase; and incidence of rural and agrarian poverty remains high. Existing literature indicate that small-scale livestock production and marketing can contribute significantly to diversify the rural livelihoods, increase rural incomes and nutrition and reduce poverty. However, a closer examination of the trajectories of transformation in the livestock sector as revealed from previous chapters that the existing potential has not been realised. To make a win-win situation out of the shortages and hiking prices of international dairy products that have hit hard the local consumers and expanding the sources and levels of income of small-scale livestock producers, a few challenges and thrust areas for interventions are identified and examined in this chapter.

8.2 Challenges

The development of the smallholder livestock sector will depend on many factors. The major ones are: policy; farmer access to assets like land, pasture, water, labour etc and stocks of productive and healthy breeds; and extension of advice, markets, infrastructure like roads and electricity.

8.2.1 Government policy

The authors of preceding chapters have given sufficient attention to identifying and discussing the policy issues related to livestock development in the country. Seresinhe and Pathirana (in chapter seven) by focusing attention to major issues affecting the dairy sector in Sri Lanka, raises two fundamental concerns. First concern is related to policy environment and they maintain that, after completion of the five-year plan in 1977, policy environment for livestock development is yet to evolve into present day requirement. There is a solution to above since the policies can be always corrected, if there is the necessary inclination. The second concern they raise is more fundamental and has implications for future of the sector altogether. They raise the issue whether Sri Lanka has a comparative advantage in milk production. But, if this is a major constraint influencing the observed impasse in the sector, there is little solution unless the country is ready to produce milk at the intensive margin like through application of most advanced technologies and stall feeding systems. However, adopting the above type of production practices can have but relatively little impact on poverty reduction.

Seresinhe and Pathirana's first claim holds true to an extent. It is clear that Sri Lankan Government has placed priority over the crop sector by overlooking the livestock sector. In the sphere of the livestock development policy, the government has tended to place emphasis on cattle, buffalo and goat farming than swine production. The National Livestock Development Policy and Strategies of 2006 gives details of the government policy, intervention and investment in the livestock sector. It is evident that the government commitment is primarily to the dairy sub-sector than poultry. In this regard, upgrading of the native herd of cattle and buffalo has been stressed in the 2006 policy.

The national breeding policy for cattle, buffalo, goat, sheep, pig, etc was formulated by the National Animal Breeding Committee of 1994. Its major objectives included the upgrading of the existing stocks through cross-breeding using genetically superior breeds while ensuring uniformity. Within this policy, artificial insemination (AI) has been considered the preferred method of genetic upgrading of the native animals. However, in areas where AI is not feasible, use of genetically superior stud bulls has been recommended for upgrading programmes.

The swine development programme was introduced in 1998 with the objective of improving the productivity potential of the animals through genetic improvement. Gunaratne, Chandrasiri and Gajanayake (in chapter six) indicate that the government investment and involvement in the swine sector is minimum or insignificant and the support for the private sector is also not significant. Therefore, under these circumstances, any further expansion in the swine sector seems unlikely during the next few years. On the other hand, the swine population in the country has declined over time and pork consumption is one of the lowest in the world. Policy apathy has implications for meeting the demand for meat. For instance, there is an unmet demand for beef and mutton resulting

in reduced per capita availability and relatively high market price. Gunaratne, Chandrasiri and Gajanayake also note that there should be a system to get the private sector to actively participate in the swine sub-sector. Slaughter of buffalo has been prohibited since 1972. This was for the purpose of using it as draught power. However, since the late 1970s steady rise in the use of mechanical draught power has been noted:

8.2.2 Breeding

The livestock population in the country is dominated by indigenous varieties that have the ability to survive under most difficult circumstances, but with low productivity. The experts in the sector believe that cross-breeding of native or local animals with high producing exotic animals is the most appropriate strategy to improve the existing livestock population. The major reasons for taking such a position seemed to be the observed immunity of the local breeds against diseases and adapt to stern conditions and produce under low resource and management conditions. The implementing strategy of the government agencies for livestock development through support services has principally been to improve the local stocks that have been adapted over generations to local conditions. Artificial insemination – using the semen from improved breeds – has been found to be an effective method for improving the productivity of the existing local stocks. This approach to improving stock allows preserving essential traits of local animals like the ability to sustain in environmental conditions and low quality feed while improving their productive traits.

However, as revealed by the dominance of local varieties in the existing stocks, breeding programmes appear to have had limited impacts on improving the existing farm animals. Over 90 percent of the buffalo population in Sri Lanka are of native type, referred to as 'Lanka buffalo' (Subasinghe, Perera and Pushpakumara, in chapter five). Of the pig population estimated at 70,000, about three-fourth are indigenous animals and the rests are exotic breeds or their crosses (Gunaratne, Chandrasiri and Gajanayake, in chapter six) with other types of indigenous animals, productivity of the local swine stocks is characteristically low. On the other hand, in spite of the genetic upgrading programme in operation in the country, the quantity of beef and mutton produced per animal slaughtered has been constant for the past forty years (68 and 10 kg of meat per animal slaughtered for cattle and goat respectively).

Ineffectiveness of cattle and buffalo breeding practices has been noted by all authors. The breeding programmes have had limited success due to a number of factors. A major one is poor management. For example, as Subasinghe, Perera and Pushpakumara (in chapter five), note that though the exotic river type breeds of buffalo like Murrah, Surti, Nili-Ravi have been imported to Sri Lanka on several occasions in the past to upgrade the indigenous buffalo population, but it has not provided the expected impetus in breeding due to poor management.

Existing cattle breeding systems consist of local breeds crossed with local breeds, and local breeds crossed with breeds brought from temperate climate countries. In open systems, better-quality dairy cows and heifers run together with indigenous cows and bulls resulting in uncontrolled breeding resulting in progeny of inferior quality. Cattle and buffalo breeding is also constrained by poor heat detection resulting from genetic as well as poor nutrition, deficient infrastructure and communications and lethargy or inefficiency by dominant service suppliers. Maintaining stored semen in cryopreservation and the exact timing of the insemination too affect the breeding efforts. The paucity of infrastructure affects efficient delivery of AI services.

It is also noted that pig breeding programme has fallen short of expectation, especially due to negligence. For instance as Gunaratne, Chandrasiri and Gajanayake (in chapter six) note:

"The government involvement has become minimal and the pig breeders are in desperate need of quality breeding stocks. As no improved genetics were introduced into the country at a significant level for a long time (after the 80s) the small pig population in the country can be considered highly inbred".

Therefore, conservation of local genetic resources and their improvement is a major challenge in livestock development in general and a thrust area for small-scale cattle and buffalo farming development in particular. On the other hand, there are particular issues related to smallholder livestock farmers themselves. One major issue is lack of awareness of techniques and benefits of improved breeding and adoption by the farmers. For instance, recommendations for cross-breeding and use of progeny as dairy animals have been poorly adopted. On the other hand, whilst the breeding schemes need to take into account the necessity to improve the productivity of animals, their ability to survive under stern conditions and their being less vulnerable to diseases also should be taken into account. This is because the small-scale livestock producers operate in marginal areas where climatic conditions are harsh and there is lack of resources; as the fodder and feeding material vary temporally and spatially. In these circumstances, the exotic breeds are less adapted as correctly pointed out by many authors of preceding chapters. If one is to elaborate the point further, the size of a small herd – that the small-scale cattle, buffalo and goat farmers operate – does not allow the maintaining of sires at the level of household farms as needed for maintaining highly productive animals bred under temperate climate.

8.2.3 Stocks

Smallholder livestock farmers usually start with fewer animals. In the case of cattle, buffalo, goat and pigs they are likely to start with one or two animals and gradually increase the herd size. However, obtaining the necessary stock is found to be a problem to those who wish to start anew. The author has noted on many different occasions how difficult it has been for the government and non-government organisations (NGOs) to implement poverty focused projects to find suitable animals for targeted beneficiaries. This situation results from two major constraints. One is the difficulty in accessing breeding animals and other is the financial capital. As the authors note, the animals that can be accessed by small-scale dairy producers are not suitable in terms of their productivity. To reduce the scarcity of productive breeds, there is a need of an effective breeding strategy that improves the availability of stocks and their productivity potential. Improving the productivity per animal is particularly important for increasing farm income and helping the small-scale livestock operators to graduate out of poverty.

8.2.4 Capital

For subsistence or marketing purposes, livestock is a productive capital asset. The farmers need some capital when they attempt to transform from subsistence-oriented livestock production to market-oriented production²¹. Capital required for starting livestock largely depends on the type of livestock, how many animals one begins with and management practices adopted. Purchase of buffalo, cattle and pig requires relatively large capital outlays. The number of animals kept by

²¹ In considering the subject of capital, one also should consider the need for improvement in human, physical and environmental capital, which is largely a task for the government. Improvement in human capital is needed for improving the farmer understanding and ability to manage the production system, look after the animals and market the produce.

the small-scale livestock producers depends largely on each one's financial resources and his/her management capabilities. In addition to the number of animals one starts with, the management system that will be adopted also determines the capital needed. Investments in housing, fencing and special equipment for feeding, rearing or milking and technological improvements are such costs. Furthermore working capital is needed in the form of feed reserves, drugs and medicines etc.

Capital – the smallholder livestock farmers use – includes savings, loans from relatives, friends and informal money lenders, local banks, programmes under government and non-government organisations. Though the capital investments in small-scale livestock farming is proportionally lower than the more intensive large-scale commercial farming, poorer households interested in running a livestock farm – face problems with finding initial capital. For instance, the main source of income for the poorest – wherever they are located – is usually wage labour. They also have little access to productive assets like land and as such they are not likely to have access to credit to use as capital as they often do not have collateral. Given the structure of the situation – the poorer is in and in spite of the fact that the financial institutions have been mushrooming and micro-finance systems are widespread – he/she faces difficulty in accessing capital through credit. Another major issue faced by him in accessing capital is absolute inadequacy.

8.2.5 Labour

Labour shortages have long been affecting the agricultural sector. A recent tendency, especially in the paddy sector, has been the mechanisation to meet labour shortages and escalating labour costs. Livestock demand labour throughout the year whilst the farmers have difficult times in coping and adjusting to heavy labour demand.

Most projects that aim at helping small-scale livestock production do not seem to have recognised the time budget of the rural farming families. Contrary to general belief that the members of farming families have ample leisure time; this is not the case in practice. For a day elder farmers perform many monotonous jobs; many of them involving in drudgery that could be replaced with innovative technologies and methods of working. They spend travelling or walking many hours on dilapidated village roads. The females in the households perform most monotonous, inconvenient and wearisome routine jobs. Therefore, when introducing livestock to rural households, one major aspect to be considered seriously is – the time budget of the farming families. Disregarding this aspect can bring unnecessary stress to the farming family ending ultimately in failure of the production.

8.2.6 Land

Sri Lankan dairy and goat farmers do not practise migratory herding which is still practised in many other poorer tropical countries. On the other hand, the livestock farming in developed countries is becoming less dependent on land as modern technologies reduce the requirement of large land areas. As elsewhere in developing countries, landless livestock farmers, often living in peri-urban areas, feed their animals with residues of arable crops and fodder from communal areas Gunaratne, Chandrasiri and Gajanayake (in chapter six), a majority of the farmers surveyed by Wickramaratne *et al.*, (2000) use their neighbour's land and reserved lands for pig farming activities. Small-scale farmers in Sri Lanka access lands for rearing animals by various means; like encroaching on government reserves, renting in or mortgaging in addition to using solely or jointly owned land. Evidence suggests that pig farming is less dependent on large plots of land, relatively

to that of cattle and buffalo farmers. However, pig farming is little popular in many districts and amongst most small-scale farmers due to social, cultural and religious reasons. Some also note that there is little support for swine farming by the state. Swine farming is practised in the relatively and heavily populated western coastal zone and raising pigs in small-holdings in archaic conditions causing environmental problems and nuisance to neighbours.

Small-scale farmers in the dry zone require relatively large extents of land for cattle and buffalo farming for accommodating them in the night and to growing grass as supplements to feed in the night. Therefore, decline of area used as pasture land is becoming a major issue.

Given that the livestock farming has to struggle for land for human settlements and crop production and thus compelling more innovative and land saving strategies to be adopted. One way is to grow crops that support livestock. Paddy farming has been well integrated with the cattle and buffalo farming. However, storing paddy straw for feeding animals during cultivation seasons has declined over the years. Economics of doing so has been changed, especially due to the tightening of time budget of the farming family. Unless farming becomes economically profitable and socially attractive, taking farming as secondary employment by land and livestock operators cannot be avoided.

8.2.7 Feeding material and practices

Most livestock farmers follow virtually different feeding schedules. Feeding of animals also varies in different management systems; from farm to farm and season to season. However, an important characteristic of feeding by the small-scale livestock producers in Sri Lanka is the inadequate consideration for feeding of animals. This issue is due to many factors. Firstly, the farmers spend relatively little time on livestock management; especially on feeding animals to improve animal nutrition, health and productivity. The smallholder farmer depends on multifarious income generating activities²². In addition, members of the farming family are also engaged in non-farm activities to supplement the income from farming. Secondly, the farmers lack appropriate ideas about human or animal nutrition. The ultimate result is the insufficient feeding of the animals. Inappropriate or inadequate feeding results in less productivity and income. At the end, many farmers become exasperated with livestock they start with difficulty²³. Thirdly, when the income from farming becomes inadequate to support the household with basic needs, members of farming families take up off-farm employment making smallholder farming enterprise a secondary source of income. This premise is well evident from the composition of rural and farming household incomes. A larger portion of the household income for a significant percentage of the farming families comes from non-farm sources, particularly from salaried employment.

The issues relating to feeding in the small-scale livestock sector results from a variety of other limitations too. Some of these include the inadequate feed base, the high costs of commercially sold concentrated feeds and the lack of farmer awareness of the connection between the animal nutrition and productivity. As noted by authors, small-scale cattle, buffalo and goat farming is typically concentrated in very marginal areas of the dry zone characterised by composition of high species

²² Farm enterprise of the farming household constitutes farming of paddy, variety of other food crops, annual crops on home gardens and some livestock.

²³ The author has seen on many occasions the despondency of farm families resulting from the introduction of improved varieties of cattle which they cannot manage in the contexts they are.

and weak growth in sward. Particularly, during the dry periods and the droughts, feeding of animals with natural grass and fodder becomes a major problem in the parched dry land areas. Dry weather conditions affect both the quality and quantity of forage available with increasing severity. During such times fodder dependent livestock like cattle, buffalo and goat are fed on poor quality crop residues like the straw and the agro-industrial by-products.

Besides availability of fodder, feeding systems generally practised by the farmers also affect the sufficient feeding and nutrition of animals. For instance, cattle and buffalo are grazed in small private enclosures and/or are sent out for fodder, particularly into areas used as common property grazing areas, and farmland areas during the off-season to feed on agricultural residues. Such resources used as common property has tended to deplete rapidly due to uncontrolled feeding or lack of fortification. On the other hand, the land available for grazing has been reduced drastically over time due to a number of factors.

Firstly, burgeoning population has converted the land formerly used as crop and forest lands, government reserves and common property resources, village grazing areas and scrublands – into housing and human settlements. Very large areas of lands, including forest lands also have been converted into irrigated cropland areas. Secondly, due to cash, land and labour shortage, farmers give priority to crop production over the fodder production. As a result, mostly marginal and poor quality lands are left for grazing and integrated farming of crops and livestock. Thirdly, those producing fodder produce too little in comparison to herd size. Finally, farmers face problems in processing or conserving forages due to lack of appropriate technology, machinery and storage space and facilities.

Pressure of the burgeoning population for land and drive towards crop production has implications for small-scale livestock in a few other ways. As noted by the authors, the small-scale cattle and buffalo farmers mostly use open grazing methods. Emerging pattern under population pressure means that the cattle graze in open areas during day time with little monitoring and are driven back into cattle fences or cattle sheds (*Gava Gala*) where they are fed with cut fodder and some concentrates for mainly milking purpose. Cattle and buffalo statistics also indicate that the number is decreasing or has not kept up with the growing number of human population. Competition for land results in crops *versus* livestock farmer conflict which has been reported in major land settlement schemes like the Udawalawe and Kirindi-Oya in the southern province. In this province, a significant area of the grazing land that was used as common property resources has been converted to cropland.

Major issues related to feeding the livestock have already been discussed in detail by rest of the authors in respective preceding chapters. Bought-in concentrates that are used as supplements for the dairy animals are relatively expensive in terms of the milk and meat prices the farmers obtain. Almost all ingredients used for poultry feed is imported. For this reason, the feed cost of poultry is the highest in Sri Lanka compared to other South Asian countries. Cattle feeding are usually twice a day where lactating cows are fed during milking. However, cattle farmers use concentrates in moderation or not at all. Once weaned, all female calves are kept as replacement heifers, while almost all male calves are culled, exchanged or sold to neighbouring small-scale dairy farmers. Self-sufficiency in animal feeds is expected to reduce high dependence on the market for industrially produced feed and decrease the cost of feeding. Therefore, enhancing home grown fodder is a challenge in the context of scarcity of land which is an important factor to be considered

invariably in respect of feeding livestock at the small-scale farmer level.

Given the fact that the land and labour are becoming increasingly scarce, adoption of more innovative ways in feeding livestock should be considered. One such strategy that would readily come to one's mind is the production at the intensive margin. However, at this juncture of transformation of the agrarian economy as discussed in chapter two, sheltered and closed-fence rearing of animals with concentrated feeds that are sold commercially will pose a serious limitation to small-scale cattle and buffalo farmers. For instance, while they lack capital and technology, they might have to teem with costs. Particularly, the pricing systems of livestock products – in which farm gate prices surpass the production cost – can work against intensification of the production at the small-scale farmer level. Therefore, simple and new technologies in breeding, nutrition and management are called for.

Experience in other countries is showing many innovative ways of integrating crop cultivation with livestock farming. In Brazil, farmers use whole sugarcane plants as the dry season feed. Unlike grass, it has been found that sugarcane retains moisture in the dry season and is preferred as feed material. Research in countries like in Vietnam has shown that the unit cost of producing one kilo of sugarcane dry matter is lower compared to that of grasses. There is also the possibility of incorporating dairy complementary crops such as maize and sunflower. As noted by Subasinghe, Perera and Pushpakumara (in chapter five) in relation to buffalo farming:

The feed resources that can be used in addition to natural grasses include fibrous crop residues such as rice straw, maize stover, and AIBP such as molasses, rice bran, waste from fruit canneries, brewer's grain. Some non-conventional feeds like sugarcane tops and rubber seed meal are other low cost materials that can be used in feeding buffalo.

There is also a need to improve methods of forage conservation and storage. Context specific participatory planning and on-farm research could be useful in designing more appropriate crop-livestock farming systems for the small-scale livestock sector. There has been a tendency at the international level to adopt participatory research to change the farmer attitudes towards innovation and greater adoption of new techniques.

8.3 Major Thrust Areas

Throughout preceding chapters, the role of the livestock sector in rural development, poverty reduction and nutrition has been established. Analysis also shows that the potentials of the livestock sector in the country have not been exploited to a satisfactory level. Therefore, the following section identifies and examines what seems to be trust areas to be addressed by policies and programmes for livestock development.

8.3.1 Issues in production, productivity and consumption

The major issue in the livestock sector, in particular in the small-scale farming sector, is low productivity. It has been noted that milk productivity varies between seasons, areas, production systems, different breeds and farm households. Analysing the number of milch cows and their production from 1972 to 2002, Chandrasiri (in chapter four) indicates that the daily per cow milk production is 1.5 on average. Besides low productivity, the figures provided by Chandrasiri show

that there has been little productivity growth per cow from the early 1970s. Chandrasiri also shows that the percentage of milch cows has gradually increased from 19.5 to 42.9 percent during the past three decades. Analysis by Serasinhe and Pathirana (in chapter seven), notes that though the annual milk production has gradually increased over the past four to five decades, the rate of increase has declined gradually. Chandrasiri shows that annual milk production during the past eight years has increased by 4.6 percent.

Similar pattern of low productivity can be observed with the buffalo sub-sector too from the analysis given by Subasinghe *et al.*, and Chandrasiri (in chapters four and five) They show that milk productivity of the cattle and buffalo is low. Although the percentage of milch cows has increased gradually (from 13.1 to 34.4 percent), the average daily milk production per buffalo cow has not been increased significantly (0.9-1.5 lit/day) for the last three decades (Subasinghe, Perera and Pushpakumara, in chapter five). This indicates poor productivity of the buffalo in terms of milk production. The problem has been attributed to lack of proper selection and culling programme at the farmer level.

The authors also note that the meat productivity per goat, pig, buffalo and cattle too is low. In spite of the genetic upgrading programme in operation, the quantity of beef and mutton produced per animal slaughtered in the country has been constant for the past four decades with 68 and 10 kg of meat per animal slaughtered respectively. This situation has created a huge gap between the demand and the supply and reduced per capita availability and very high consumer price for the two products. Similarly, an impasse could be seen in relation to pork production. Over the past two decades, swine population in the country has decreased by around 15 percent with per-capita pork consumption remaining below 0.20 kg/annum (Seresinhe and Pathirana, in chapter seven).

It has been noted that even with imported breeds and their crosses; the productivity of animals has been low²⁴. The poor productivity of native livestock is found to be associated with many factors. Poor nutrition and poor animal health explain the issue largely. Poor feeding practices adhered to by the farmers has been widely observed. For instance, it has been noted that little dry fodder is used for feeding while the existing green fodder is not used efficiently. Besides the issues of feeding cattle, buffalo and goat, similar problems have been identified with feeding swine. For instance, in discussing swine production Gunaratne, Chandrasiri and Gajanayake as well as Serasinhe and Pathirana (in chapter seven) indicates that growth performance of pig is poor as a result of erratic and low quality swill feeding by small-scale farmers. It has been pointed out the fact that the small-scale producers do not have possibilities to obtain swill from the government institutions such as hospitals since it is sold in large quantities through tender procedures. High cost of concentrated feed sold in the market also compels the small-scale farmers to use it; as a result diseases continue to affect the animals.

On the other hand, it should be recognised that simple productivity measures and direct economic rate of return analyses are not appropriate and less useful in gauging benefits from small-scale livestock production, particularly in integrated farming systems prevalent still in South Asia. The systems in South Asia have more indirect economic benefits than direct outputs like the meat and milk and direct social and environmental benefits. However, low productivity of animals is a

24 The authors contributing to this volume note that efforts to replace commonplace low yielding indigenous stocks with crossbred high yielding stocks have not yielded desired results.

major issue in increasing the livestock production and has effects on poverty reduction and rural development. Therefore, all possible efforts must be made to increase the productivity of animals.

The state-of-the-art feeding technologies applied to improved breeds have helped increase the productivity of animals in the developed parts of the world. For instance, within the cattle industry, matching nutrition to physiological state and age of animal and the management have enabled cattle farmers to increase milk production substantially while controlling costs. Similar gains have been obtained in sheep, goat, poultry, duck and swine farming too – through application of scientific techniques in feeding and management. These achievements have been made in such contexts as rapidly growing demand for livestock products, increasing access to ever improving breeder stocks, highly productive technologies, research and extension as well as non-interfering but facilitating state policies.

In contrast, Sri Lanka's livestock sector appears to be operating in a distinct milieu. It has largely engaged small-scale producers for whom the agriculture is only a part-time livelihood and livestock is only one aspect of agriculture. The animals they tend to manage are largely unimproved varieties with low productivity. They feed animals with low cost feed or agricultural and industrial waste giving little concern for the aspect of the nutrition of the animal. The technologies they apply are largely archaic and have not adapted to the dictates of the market. For instance, milking of cattle is done by hand and local people raise the issues related to hygiene when they think of buying the product. As already noted, costs of concentrated and commercially supplied animal feed in Sri Lanka are relatively very expensive and therefore beyond the affordability of many small-scale livestock farmers. About 70 percent of the total production costs for each produced litre of milk are feeder costs. In the light of such problems faced by Sri Lanka's small-scale livestock farmers, there is a need for dissemination and adoption of livestock management methods and technologies that can keep the costs down with some increases in productivity. However, the issue is that the small-scale farmers keep the cost down at the expense of productivity.

In industrialised and developing nations where the dairy sector is well established and has increased production at the initial stages – has been associated with the increased herd size. However, Sri Lanka's ability to increase livestock production substantially through extensive margin is restricted mainly due to limited land resources. Large increase in cattle, buffalo, and goat and swine populations are also likely to have adverse implications for land use and result in undesirable environmental impacts. Many small-scale farmers in some districts like Hambantota tend to have relatively large herds of cattle and buffalo and practise open grazing bringing effects on irrigation systems, open land and forest resources and cropland. Existing situations like the dominance of small-scale livestock farming and low productivity also show the increasing livestock production at intensive margin. This means that at this stage, Sri Lanka has to pursue the paths of countries where the livestock sector has developed. One illustrative example in this regard would be the dairy sector of India.

Besides low productivity, the quality is a major issue related to livestock products and produces of small-scale farmers. Lack of effective methods used in pig farming to prevent environmental pollution, is an illustrative example in this regard. Possibility of spreading zoonotic diseases makes extensive pig farming unwise (Gunaratne, Chandrasiri and Gajanayake, in chapter six). Since effluent from pigs causes considerable problems of pollution and pigs are raised in

densely settled areas, pig farming poses a significant environmental health problem. Crude methods of slaughtering of pigs affect the quality of meat (Seresinhe and Pathirana, in chapter seven).

8.3.2 Consideration of socio-economic conditions of farmers in livestock support systems

Matters that need to take into consideration in policies and programmes of intervention for small-scale livestock development include management practices adopted by farmers and these have been discussed in detail in each chapter dealing with livestock sub-sectors in this volume. In considering the context of small farmers, there is the need for understanding the production costs and structure of cost with a view to helping the farmers to control the major items of expenditure. Landholding size that has gradually declined and tenure practices that have evolved over the years to access land, availability of labour within and outside the family, time budget of the individual household members and the availability of capital as was discussed in chapter one are important factors that have to be considered in intervention strategies to induce small-scale livestock development. On the other hand, cropping and land use systems that are mutually beneficial for crops and livestock like the crops that assure the access to fodder for cattle throughout the year should also be taken into consideration of planning for small-scale livestock development in the country.

8.3.3 Education, research and extension

Besides addressing the issues related to livestock production at the farm household level, there are many issues to be addressed at the policy and programme level to assist small-scale farmer to engage in livestock production. For instance, the potential the small-scale livestock has for rural development and poverty reduction will largely depend on continued and relevant research and effective extension at the field level. Research would include technical as well as socio-economic and marketing research aimed at solving the practical problems faced by small-scale livestock farmers. Research needs on technical aspects would include appropriate breeding and feeding systems, production and use of appropriate breeds and feeds, control of diseases and management of environment and health, and appropriate systems for milking, transportation and storage systems.

A major thrust area for socio-economic research would be the socio-economic, cultural and institutional factors which influence livestock productivity at the farm household level. A major focus of the socio-economic research needed would include the context of small-scale production like the availability of land and feed resources, stocks, labour, infrastructure and markets as well as farmer behavioural aspects such as the herd recording, feeding systems, and the multiple uses of animals. As a study of the Cornell University in 1999 has shown in relation to a different context yet from the farmer perspective, the socio-economic conditions of smallholders and constraints they face in storage, transportation, markets and integrated systems in which the animals are managed – are other areas requiring attention for research.

Farmers need the support for accessing capital, land and water, improved breeding stocks, low cost feeds, markets, facilities for cooling of raw milk in the case of dairy production. The majority of farmers are aware of the benefits of improved breeds of animals, but many of them face

difficulties in accessing. The progress of breeding programmes implemented to improve livestock has been slow and varied from area to area. Usually those offered for sales are not robust. Therefore, a major support would enable farmers to obtain good quality breed animals.

Diseases affect livestock health and nutrition, productivity and growth of stock and profitability. In sub-sectors like the swine sector for which the little attention has been given by the public and private sector service providers, diarrhoea and pneumonia cause havoc by increasing piglet mortality. Vaccination for swine fever takes up a significant share of the cost of production. As Gunaratne, Chandrasiri and Gajanayake (in chapter six) show the conditions like porcine reproductive and respiratory syndrome (PRRS) and parvo viral infection causes reproductive failures in the herd. Apart from these infectious conditions, poor performance of animals and various deficiency disorders also occur due to improper management practices.

To help the farmers overcome such problems, extension has a major role to play. Major objective of extension is to provide farmers with knowledge on improving management practices. Practical advice and training to farmers are needed on such subjects as nutrition, disease management, animal and milk hygiene in the case of dairy farming, health and hygiene of animals and maintaining records of costs and income. Though the Department of Veterinary Services and extension workers help farmers with treatments and vaccinations, many aspects of extension needs are yet to be met.

8.3.4 Marketing

Unlike in the past – when the animals were raised for self-sufficiency purposes and/or as a source of draught power – nowadays, the animals are kept by their owners mainly for commercial purpose or as a source of income. However, as is the case with the smallholder crop farmers, the small-scale livestock producers are not fully drawn towards the dynamics of market conditions and serving the market demand. As Thakshala Seresinhe and Pathirana (in chapter seven) note that the small-scale livestock producers are not fully market-oriented. They tend to sell their products at times of cash shortages, festival seasons etc without getting them ready to fetch a better price through fattening etc.

The large number of small-scale producers catering to the market add to enormous problems when it comes to organising and putting in place the effective collection and delivery systems. Though the direct producer and consumer connection as a market disposal system prevail in both urban and rural areas of Sri Lanka, there still is the issue of linking the producer with the consumer at large. For instance, milk being a highly perishable product, has to readily dispose to the consumers, collectors or processors. In most parts of the country, such facilities are not widely available. Where the facilities are operative, no collection is done in the afternoon though the milch cows can be milked twice a day – in the morning and afternoon. Therefore, without a way to disposing milk in the afternoon, farmers milk cows in the morning only. Non availability of reliable and steady markets for their products is noted as a major constraint frequently faced by small-scale livestock producers.

Sri Lanka's public sector, as elsewhere in other countries, has demonstrated the fact that it is an inefficient and ineffective deliverer of marketing services in terms of cost effectiveness. The sector has been weighed down with political interferences, procedural constraints; low motivation and rent seeking behaviour of the staff and even corruption resulting in the observed inefficiencies.

The co-operative movement in Sri Lanka, in its proper sense, has never succeeded. In spite of the continuing attempts by the government and some NGOs more recently, strong farmer organisations have not emerged to handle the services as well as input and output deliveries. Thus, it seems that, marketing seems to be achieved via producer markets or their integration with private sector processors, wholesalers and retailers. The role of the state, however, will remain as an effective regulator and provider of infrastructure services.

Vertical integration of the producers with collectors, processors and traders has advantages as well as disadvantages. Commercial organisations can help the small-scale producers with input supplies, provision of management information and technology. On the other hand, a significant portion of the surplus produced by the small-scale livestock producer could also be extracted by the business that serves them. Subasinghe, Perera and Pushpakumara (in chapter five) note that most often the Sri Lankan butchers and their agents exploit rural farmers and induce them to sell their surplus stock at unreasonably low prices. They also note that butchers do slaughter the buffalo in illegal slaughter houses and sell the meat as cattle meat. Despite the efforts by the government to conserve the buffalo population, recent census data show a serious decline

Many marketing constraints faced by the small-scale livestock producers have been reported by the authors. The small-scale dairy farmers often face problems of refusal of purchase or receiving a lower price. For instance, pricing of milk collected by milk collecting centres (MCCs) is based on a minimum price and premiums or penalties depending on the quality of the milk delivered. Premiums are expected to pay for quality in excess of the standards set, while penalties applied to milk of lesser quality. However, farmers complain that their milk is often graded low and paid a lower price. Locally marketed milk tends to receive a higher price compared to prices fetched at MCCs. But this price advantage is limited by the local demand fluctuating rapidly and increasing the vulnerability of the producer.

An estimated 40 percent of milk produced by small-scale dairy farmers is consumed at home or disposed through localised sales and about 56 percent is sold at collection centres usually once a day (Chandrasiri, in chapter four). Marketing issue has been found to be severe with dairy milk producers. Marketing constraints faced by the small-scale farmers are due to many different factors. Principally, the producers are dispersed spatially making it difficult for them to organise or access markets. On the other hand, it is practically difficult to provide organised marketing channels at a convenient range as the farmers are few, scattered and located from a long distance away. For this reason, the farmers have to travel large distances to local MCCs or other delivery points causing delivery problems, wastage and high marketing costs.

Delivery of milk to collection centres is being constrained by the steep terrain in mountainous areas and the long distances. Widespread collection centres have been constrained by relatively long distances to be travelled, increasing transport costs due to rising fuel prices and high wear and tear and high maintenance and replacement costs of vehicles mainly due to poor rural road conditions. This situation is aggravated by the existence of a poor milk collection network and poor infrastructure development.

Local supply of milk fluctuates rapidly resulting in an unstable market. Indigenous cows kept by the small-scale farmers usually calve their offspring during the rainy season with a glut of production. This causes destabilisation of the local niche markets and the farmers have problems in disposing milk. Therefore, widening of dairy milk product base through value-addition is important so that new market niches developed and part of the increase in profit could be absorbed by the farmers too. For instance, yogurt and curd making would be appropriate avenues for disposing excess of fresh milk. Milk processed as curd has better market as a value-added product. But, curd processing is largely confined to certain areas in few districts like Hambantota, Ampara, Batticaloa, Kurunegala etc. However, local level processing has not penetrated into remote rural areas due to such factors as the lack of electricity and proper road infrastructure. In recent years, processing of milk into other dairy products, such as sweetened milk, with a longer shelf life has been increased though the prices deprive low income groups of consuming them. The other major marketing constraints include the processing losses and relatively low producer prices.

Prices – the small-scale livestock farmers receive – are also affected by factors other than the demand and on-going market prices. Some of these include access to markets, practices by collectors as well as quality and packaging. The detrimental impact of the government policies in influencing the prices they get cannot be excluded. For a long time, small-scale dairy producers have suffered from price squeezes resulting in relatively static producer prices in spite of the escalating production costs.

An illustrative example as to how small-scale farmer linkages with processors and traders could help the former would be poultry industry in Sri Lanka. In the poultry sub-sector there has developed a very close link between the producer and the processor.²⁵ It could be observed that the poultry sub-sector has been transformed from a backyard production system to a market-oriented industry over the past four decades or so with reduced import dependency (Gamage and Gunaratne, in chapter three). Poultry industry has been expanded in the districts of Jaffna, Puttalam, and Kurunegala and in the poultry belt, (Gampaha, Colombo, and Kalutara districts) during the past four decades. By 1999, broiler meat consumption expanded by 99 percent though the per capita consumption is low in terms of international standards. For instance, the per capita consumption is approximately 56 eggs and 4.5 kg poultry meat and is low by consumption ratios at the international level. Means of disposal of poultry products include autonomous consumption, farm gate sales, and other informal, formal retail and wholesale markets. Gamage and Gunaratne (in chapter three) have noted of 65,000 poultry farmers in the island producing 1,100 million eggs and 8,800 metric tons of poultry meat per annum. The incentives such as the duty concessions on importation of day-old-chicks, incubators, feed ingredient etc helped further expansion of the industry. More recently the government has withdrawn from assistance for poultry development activities and has confined to statutory and regulatory activities (Gamage and Gunaratne, in chapter three).

25 In an empirical analysis of the gains from contract farming in the state of Andhra Pradesh in India Bharat, BIRTHAL and Joshi 2005 found that contract production is more efficient than non-contract production. The efficiency surplus is disproportionately appropriated by the processor. Despite this, contract growers still gain appreciably from contracting in terms of lower risk and higher expected returns. Improved technology and production practices as well as the way in which the processor selects growers are what makes these outcomes possible. Observation shows that contract growers have relatively poor prospects as independent growers. With contract production, these growers achieve incomes comparable with that of independent growers.

8.3.5 Experience in contracting poultry

Contracting has been used effectively in increasing poultry production and marketing in Sri Lanka. In a poultry contract, hatcheries provide day-old-chicks, feed and medicines to contract growers. The contract growers supply land, labour and other variable inputs (like electricity). The system is useful for both the farmer and contractor in few different ways. Until recently, producer price fluctuation has been minimal and has occurred within a narrow range, compared to the retail price. This guarantees to a significant extent price assurance to the farmers.

Contracting seems to have benefited the sector to a significant degree. Compared to other livestock sub-sectors, the poultry sector has attained industrial standards largely due to a sizeable investment from the private sector. Involvement of the private sector has meant rapid dissemination and use of technological breakthrough in breeding, feeding and health. Increases in per capita income, changes in social values, technical and managerial improvement in production systems are other major factors explaining the rapid growth of the poultry sector. The private sector involvement in poultry also has influenced the growth of the small-scale poultry farming in the island. Broiler meat production is concentrated amongst the larger producers, with farms in excess of 1,000 birds supplying 65 percent of broilers. On the other hand, small farmers with less than 1,000 layers are estimated to produce 60 percent of the eggs. The private sector participation involves supply of chicks, feeds, medicine, processing and outlets for distribution.

Most innovative system adopted by the private firms in getting small-scale poultry producers mobilised is out-grower schemes. In such schemes, hatcheries provide day-old-chicks, feed and medicines to contract growers. The growers supply land, labour and other variable inputs (like the electricity). At the end of the production cycle, the farmer receives a net price (by weight) that is pegged to an industry price set by a group of hatcheries (not the retail price). The industry price fluctuates within a narrow range and is a lot more stable than the retail price. Thus, the farmer receives considerable price guarantee. For sharp upward deviations of the retail price from the industry price, farmers receive an incentive. This practice presumably lessens the incentives to default on the part of growers and reflects the competition from the non-contract sector. Farm-to-retail price ratios are approximately 55-60 percent for broilers (live: dressed) and about 77 percent for eggs.

8.3.6 Social factor in production and marketing

Social values and religious taboos would explain the lack of rapid growth in the livestock sector in Sri Lanka, whilst the sector has gathered a momentum in Pakistan, Bangladesh etc after liberalisation of their economies. Expansion of cattle, buffalo and swine farming in Sri Lanka is perhaps influenced by religious prohibition to kill animals. The social objections and religious taboos have constrained eating pork and in turn pig farming. Different dietary and eating habits amongst certain religious groups of the country also limit the pork production and consumption. Another social objection for swine farming is primarily due to the impact of the swine farms on its immediate surroundings. Some opposition to swine farming is well founded. As noted by Gunaratne, Chandrasiri and Gajanayake (in chapter six) recent study has indicated that the majority of pig farmers (44.2 percent) disposed the solid wastes by heaping it on places like open land, which on decomposition, cause unbearable odour to neighbours. In addition to this, effluents and excreta

disposed in such irresponsible manner can act as a good breeding place for flies. Pollution due to piggeries pose a serious problem to humans when they are located in densely populated human habitats such as urban areas.

8.4 Conclusion

The major issue in the livestock sector – in particular in the small-scale livestock farming sector – is the low productivity. Therefore, improving the productivity per animal is particularly important for increasing farm income and helping the small-scale livestock operators to increase income and contribute to the development of the sector. Cross-breeding is the most appropriate strategy to improve the existing livestock population though the ineffectiveness of cattle and buffalo breeding practices adopted in the country is repeatedly noted.

Small-scale livestock farmers usually start with fewer animals and they need capital to purchase the initial stocks and other inputs and expand the enterprise into a viable unit in the process. Like for crop farming, credit facilities available for livestock farming is not spread widely. Livestock demand labour throughout the year whilst the farmers have difficult times in coping and adjusting to heavy labour demand. Most projects that aim at helping small-scale livestock producers do not seem to have recognised the time budget of the rural farming families and this needs to be given adequate attention in future interventions to reduce stress on farm family labour budget. One way to do so is helping the farmers to adopt suitable management practices. Small-scale farmers in the dry zone require relatively large extents of land for cattle and buffalo farming for accommodating them in the night and to growing grass as supplements to feed in the night. To overcome the problem of scarcity of land or to benefit landless, poultry and swine farming is encouraged in areas where high scarcity of land affects livestock rearing.

Most livestock farmers follow virtually different feeding schedules and practices with little consideration for animal nutrition due to lack of knowledge or feeding material or high cost of feeding material, farmer giving priority to crop production over livestock production. These need to be corrected through education/extension programme and by taking into consideration of input and output marketing prices of livestock products. Context specific participatory planning and on-farm research could be useful in designing more appropriate crop-livestock farming systems for the small-scale livestock sector. The small-scale dairy farmers often face problems of refusal of purchase or receiving a lower price. Locally marketed milk tends to receive a higher price compared to prices fetched at MCCs. Marketing issue has been found to be severe with dairy milk producers this needing careful attention of the government. Dairy Farm Village Programme has some impact on reducing marketing and extension problem due to dispersal of dairy farmers and there should be other programmes also to help the farmers to overcome marketing problems.

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