CHAPTER 1:

1.1. INTRODUCTION

Throughout the world, extension is predominantly publicly funded. According to World Bank (1997), "About 80 percent of the world's extension services are publicly funded and delivered by civil servants. Universities and nongovernment organizations deliver about 12 percent of services, and the private sector another 5 percent. Swanson et al. (1990) also reported that "worldwide, agriculture extension employs at least 800,000 extension staff and hundreds of thousands more farmer technicians or leader farmers, reaching about 1,200 million people". The conventional view of 'public good' of various types of agricultural knowledge diffusion induced most government to take exclusive responsibilities for extension delivery (Birkhaeuser et al, 1991; Deininger & Diana, 1996). However, there has been a gradual trend toward privatization of extension services, and many countries in the world have privatized all or part of their extension services, usually in stages; this is because of profitability in the extension services and private sector being spending in the sector. Some countries in this list are, Chile, Netherland, Brazil, Taiwan, Albania, Colombia, Mexico, Uruguay, Korea (Deininger & Diana, 1996; Gershon, Willett, & Zijp, 1999).

In third world countries like Pakistan, where food security is a major issue, milk can play an important role. Food security is defined as "*Access of all people at all times to enough, safe and nutritious food for an active and healthy life*" (FAO, 2010). In the past, the Pakistani government has emphasized the "Green Revolution" meaning production of more crops as a means of ensuring food security in the country. However, in 2006, the government commenced working on the concept of a "White Revolution" (producing more milk) in parallel to "The Green Revolution" and stated, *"Food security would be ensured through increased production of wheat and dairy products"* (Government of Pakistan, 2006*).* Before this can occur there is a need to identify what problems they might be to achieving such goals.

There is an ancient Chinese saying *"Give a man a fish, he will have food for a day and teach a man to fish, he will have food for life"*. Previously most focus in dairy development has been on the provision of "Hardware" such as, the supply of vaccines, artificial insemination and animal genetics. In the latter case farmers and government farms have spent large amounts of money on importing foreign dairy breeds (PDDC,

2006). However the lessons that may be needed to ensure that "the man is taught to fish" are likely to be those related to the capacity building of extension workers and dairy farmers, so they can problem solve to increase dairy farm productivity and profitability. The historic development of extension in Australia is a good example of effective extension development for the third world countries. Since 2000, extension in Australia has been focusing on capacity building and community engagement (Coutts and Roberts, 2011). Vanclay and Leach (2011) further explain the meaning of extension in Australia context as:

> "Meaning of extension has been changed from problem-based technology transfer to the process of enabling change in individuals, communities and industries involved in the primary industry sector and with natural resource management". (p. 6)

In contrast, the dairy industry of Australia has extension support characterized by a large and effective public sector with a strong emphasis on production based technology transfer (Cary, 1998). There have also been recent and rapid changes in the provision of agricultural extension in Australia (Marsh and Pannell 1998) and State government departments, which have provided a large proportion of dairy extension services , have changed their extension strategy from one primarily focused on one-to-one extension to mostly group extension. It appears the logic behind this change is the expectation that transfer of technology to farmers through diffusion within the industry, will prove more effective than one-to-one extension. In addition, the current and future vision of agricultural extension in Australia shows that the involvement of private sector will be much more prominent, while the public extension service will work more hand-in-hand with agribusiness (Sheldrake, 1996).

The shift to larger farms and 'deregulation' have also challenged Australian dairy farmers to increase outputs and decrease inputs. However, this change is also opening doors for mergers, or to become part of national companies or multi-national companies (Dairy Australia, 2008). This industry rationalization is likely to increase the competition between individual farmers and consequently the challenge for the extension providers. While technology is far more advanced in Australia, the impact of social change and economies of scale that are impacting on extension services in Australia may provide

insights into what extension services may be relevant to a changing Pakistan dairy industry. The review which follows will examine in more detail these links.

1.2. Dairying in Pakistan; A Brief Overview

Pakistan is primarily an agricultural-based country, and livestock play a pivotal role in its economy by providing essential items of human diet in the form of milk, meat and eggs. At present, livestock contribute about 51.8 percent of agricultural value added, and 11.3 percent to the GDP (Government of Pakistan, 2008-09). The estimated total number of livestock in 2008-2009 was 154.3 million. Foreign earnings of the livestock sector exceed 35 billion rupees annually (AUD$686 million). Pakistan has a per capita production of milk around 230 kg per year, which is more than twice that of India and about 70 percent that of the United States of America. The recent growth in per capita milk production has been driven by an increase in the number of dairy animals rather than by milk yield improvement per animal (FAO, 2001).

The role of livestock in the rural economy may be assessed by the fact that 30-35 million of the total rural population is engaged in livestock-related activities, having household holdings of 2 to 3 cattle/buffalo and 5 to 6 sheep and goats per family, which contribute 30 to 40 % of total income (Bilal & Ahmad, 2004). These animals produced 35.1 million tonnes of milk during 2008-09 as well as providing 1.6 million tonnes of beef and 0.590 million tonnes of mutton (Government of Pakistan, 2008-09). The role of livestock is also important in converting crop residues, agricultural by-products and animal wastes into milk, meat, wool, hair etc. In this regard the buffalo in particular can efficiently convert poor roughages into valuable products, including meat and milk. Otherwise these by-products and wastes would lead to an increase in environmental pollution.

The total milk produced in the country is not fulfilling local population needs. The most important reason for this shortfall is that the human population is increasing (at the rate of 3% annually), but the milk production is not increasing at the same pace (Government of Pakistan, 2008-09). Milk production has shown a steady increase over the last several years, but this increase in milk production is due to an increase in total number of milk producing animals and is not due to increases in per animal production. Presently, Pakistan is importing dry milk products valued at Pakistani Rupee (PKR) 1.1 billion

(AUD$21.3 million), which is a burden on the country's economy (Government of Pakistan, 2008-09).

The current population growth of Pakistan, and the increasing demand for food, has created the need to produce more milk. The world's human population is predicted to reach 7.6 billion by 2020, where 85 % of this increase will occur in developing countries (FAO, 2000). World population has doubled (100% increase) in 40 years from 1959 (3 billion) to 1999 (6 billion). It is now estimated that it will take a further 42 years to increase by another 50%, to become 9 billion by 2042 (United Nations, 2011). With low costs of production, Pakistani dairy farmers need to be aware of the key drivers of change, so that they can plan for changing demand. The drivers of change for Pakistan dairy industry have been identified as; milk quality and market, animal feed, animal breeding/genetics, and most importantly dairy extension. Figure 1.1 shows the key drivers, which are interlinked by primary and technological drivers, and extension is playing the bridging role; through forging linkages between research organization and farmers, dissemination of modern technologies, mechanization, farmers' feedback or effective communication. Hence the primary and technological drivers are all dependent on proper dairy extension, which is the main key driver of future change for Pakistan's dairy industry. Dairy extension is playing and can play a major role in the effective delivery of all the primary and technological drivers.

The major share of production of milk in Pakistan is from buffaloes (66 %) followed by cows (32 %), and sheep and goats (2 %). The major buffalo breeds are Neli-Ravi (79% of total Buffalo population) and Kundhi, while Sahiwal and Red Sindhi are the dominant cow breeds. The vast majority (about 80%) of dairy farmers in Pakistan are smallholding farmers, and up to 43% of dairying households in Pakistan maintain herd sizes of 1-2 animals, while another 37% of the households maintain herds ranging from 3-5 animals. Some 90% of milk production comes from these smallholder farmers. Improved milk marketing is the main issue for the dairy production in Pakistan, and approximately 97 % of the dairy farmers are not linked with formal dairy market, and hence not progressing in economic terms (PDDC, 2006).
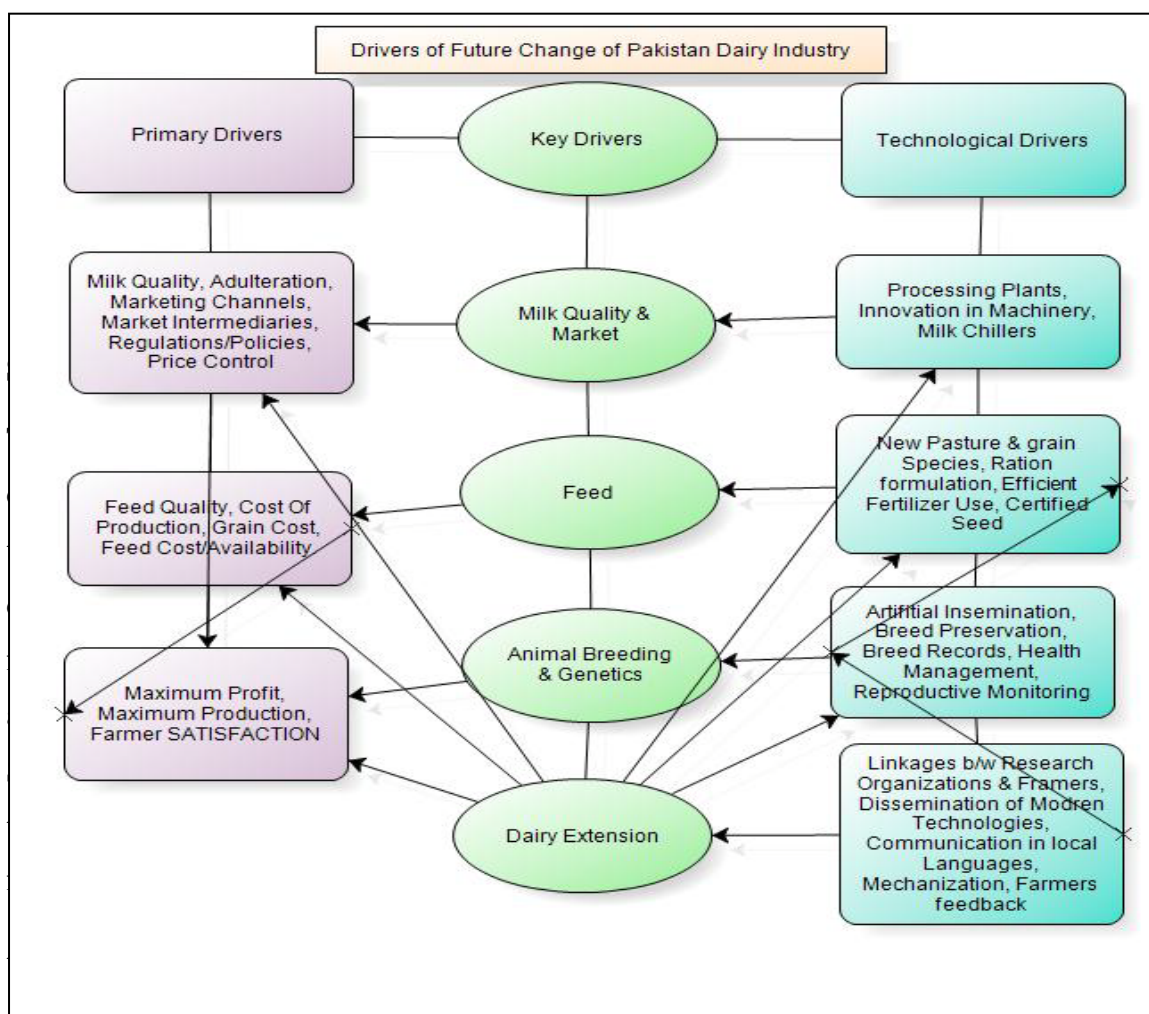
Figure 1.1: Drivers of future change of Pakistan dairy industry. (Source; derived from this review)

Despite genetic potential among animals, low production occurs primarily due to poor nutrition, miss-management, failure to control diseases, and lack of proper marketing of this highly perishable commodity (Afzal, 2008). The average milk production of animal is 8.5 litres per day, but the average of a year is calculated at 6.5 litres per day and 2,366 litres in a year. Per capita milk production more than twice that of India, and 1/7th of USA, 1/3rd of New Zealand and Germany (PDDC, 2006).

The per capita consumption of milk among the people of Pakistan is suggested to not be at an optimum level due to a growing gap between the demand and supply and rising prices. Per capita consumption in 2005 was reported to be 200-250 litres per year (PDDC, 2006).

In Pakistan, 85.4% of the total population live in rural areas and 30% in 462 cities. Milk available for sale locally is only 12 million tonnes, or 45% of the total production, with

15-19% wasted due to lack of storage facilities and 28% is consumed in cities (PDDC, 2006).

Table 1.1 Summarizes the key aspects of a "white paper" by Pakistan Dairy Development Company

33.6 billion litres produced in year 2006

27 billion litres available for human consumption

7.9 billion litres urban share

19.1 billion litres rural share

6.5 billion litres is household use

1 billion is processed

190 litres/capita/year consumed

90 litres/capita/year consumed as informal (Loose) milk

7l/cap/year of formal sector (UHT) milk consumed

Low Productivity = 1333 litres/animal/year (per lactation production)

15-19% wastage from spoiling in transportation and handling

National herd constitutes of 70% buffalo

67% of production in Punjab

The contribution of dairying to the national economy is of the order of PKR.540 billion, with 97% described as informal non-documented economic activity, and this value was expected to grow at 4% per year in 2006 (PDDC, 2006). The major causes associated with the under-developed buffalo farms have been identified as: i) calf losses, irregular breeding, imbalanced feeding; ii) ungainly loans and; iii) a hostile marketing system (Qureshi, 2000). The author further explained three constraints to commercial buffalo herds throughout Pakistan, lead to annual losses to the tune of PKR.1043.67 billion (US$ 1=PKR. 60) In a later study, Qureshi et al. (2002) concluded that excess intake of crude protein, associated with higher serum urea levels and low energy intake, associated with poor body condition, were the key factors for low reproductive efficiency which could be corrected by adopting a proper feeding strategy.

1.2.1. Distribution of Milk Production

As shown in Table 1.1, milk production of the country was 33 million tonnes in 2006 (PDDC, 2006). Figure 1.2, shows the distribution of milk production, with Punjab region dominating (63 %), followed by Sind (23 %), North West Frontier Provence (NWFP) now called Khyber Pukhtoonkhwa (12 %) and Baluchistan (2%).
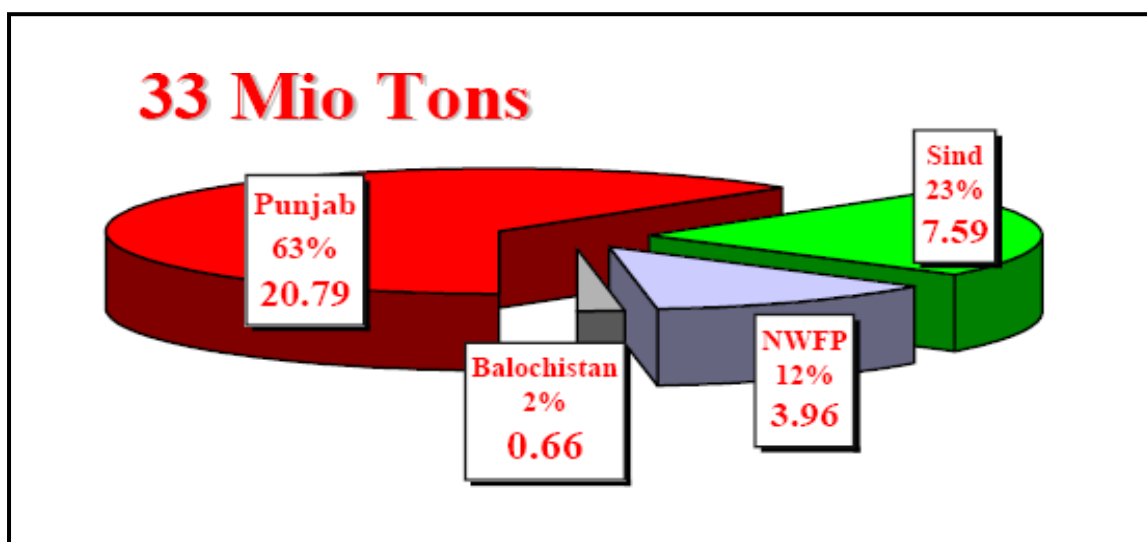

Figure 1.2: Distribution of milk production in Pakistan, Source: White Paper, Dairy Pakistan, 2006.

1.2.2. Improving production through extension

Agricultural extension was once known as the application of scientific research and new knowledge to agricultural practices through farmer education, but now agricultural extension operates within a broader knowledge system that includes research and agricultural education (FAO). Extension of knowledge is an important part of agriculture in most countries of the world. Unfortunately in Pakistan, the research conducted in research centres or universities is not regularly communicated to farmers. These institutions focus on conducting quality research and publication of research papers, but information is not necessary transferred/translated to the farmers. Often scientific outputs are in English, and information needs to be translated into local dialects/languages.

(Ahmad, n.d) states that "*In Pakistan linkages between research, extension and education are quite loose. The research workers at the Universities are more concerned with the writing of scientific papers or articles without considering that their research findings are applicable in the field or not. Mostly, work is done in isolation and therefore, their contacts with other organizations are quite limited. They rarely take part*

in extending their research findings in the farmers' field and seldom meet the extension people. There is poor liaison between the research organizations resulting in research duplications, uncoordinated research programs which are not aligned with the national needs and priorities, poor communications between the researcher, extension service and farmers".

The training and visit (T&V) system has remained the main agricultural extension system in Pakistan and is known to have many shortcomings. The T& V system has not succeeded in improving production practices, level of resource input or crop yields (Sharif et al, 1987). Most of the weaknesses of this traditional extension system still exist, and more effort is required to improve efficiency of extension.

In Pakistan, various types of agricultural extension programs have been tried from time to time, including government programs, private sector programs, non-governmental organizations (NGOs), and Agriculture Universities (Ahmad, n.d.). These systems of agricultural extension (not specifically associated with dairying) are briefly described below.

1.2.3. Government Extension Programs

1.2.3.1. Traditional Agriculture Research System

Before the introduction of training and visit system in Pakistan, two common traditional agricultural research systems were in practice until 1978. These were the 'services to farmers' approach and the 'input at the farmers' door step' approach. The first approach dealt with establishment of model farms with progressive farmers which would have a "trickle down" effect on the other farmers and ultimate adoption of the others farmers of the area" (Government of Punjab, 1978). The second approach was based on providing agricultural inputs, such as improved seed, fertilizers, and pesticides by the extension workers near the door steps of the farmers. Government subsidized these inputs to encourage their use.

This second approach helped to bring about a substantial increase in agricultural production, but required the extension worker to become a salesman for agricultural inputs (Government of Punjab, n.d.). This traditional approach was replaced with the T & V system in 1978.

1.2.3.2. Barani Area Development Program

Barani means rain-fed, and the Barani Area Development Program (BADP) started working in Pakistan in 1978 for the rain fed areas. Later on the Agency for Barani Area Development (ABAD) took over the operational control of BADP. This program was the extended form of traditional extension agriculture research system, which worked on almost the same principles. The program was limited to crop production aspects of rain fed areas. The staff work in a similar manner to traditional extension people led by a Project Director.

1.2.3.3. Crop Maximization Program

The crop maximization programs (CMP) were run in different parts of Pakistan, both by research and extension organizations on cotton, rice, wheat and maize crops. The programs aimed at maximizing commodity production through an integrated approach (Chaudhry and Siddique, 1987) . These projects are increasing the productivity of the four major crops in the country; they provide extension by training, providing support at the door step of farmers, developing demonstration plots and supervising/providing 'soft credit' to farmers.

1.2.3.4.Training and Visit system

The training and visit (T & V) system in Pakistan was launched with the financial support of World Bank in two stages. According to (Benor et al, 1984) T & V means:

> "*A professional system of extension based on frequently updated training of extension workers and regular field visits, provides an organizational structure and detailed mode of operation that ensures that extension agents visit farmers regularly and transmit messages relevant to production needs; problem faced by farmers are quickly fed back to specialists and research for solution or further investigation*".

The initiative to use T & V system initially came from the Government of Punjab when they found that the traditional extension services had many shortcomings (Government of Punjab, 1978; Khan, Sharif & Sarwar, 1984). These are summarized in Table 1.2.

Table 1.2: Short comings of traditional extension services:

- No effective liaison between research and extension.
- Multifarious duties assigned to extension agents.
- Lack of extensive and regular field demonstration program.
- Too vast operational area to give satisfactory coverage.
- Unorganized and ineffective visits to the farmers.
- Preferential treatment to big land owners.
- Lack of effective organizational structure and proper programming.
- Insufficient pre-service and in-service training facilities.
- No specific evaluation of work.
- Unsatisfactory terms and conditions of service concerning salaries, housing and mobility.

Source: (Government of Punjab, 1978; Khan, Sharif & Sarwar, 1984).

To overcome the above deficiencies, the Training and Visit (T & V) system was introduced in 1978, in the first phase in the five districts of Punjab province. In second phase, it was extended all over the country in 1986-87 (Ahmad and Haq, 1994). The T & V system was based on top to bottom approach with three main components, adoptive research, trainings and an extension wing. The farm families in the jurisdiction of an extension worker were divided up to provide them with better technical support; and these extension workers also organized and presented group-based extension, such as farmer days, exhibitions and field demonstrations (Government of Punjab, 1987). This approach is still in use, but has failed to bring about the desired changes in production practices, input use level and crop yields (Khan, Sharif and Sarwar, 1984). The other concern about this system is the higher operational cost (Ban and Hawkins, 1996). The other reason for partial failure, is the top down approach used, with the large farmers or bureaucrats valuing the system while the small and medium farmers are not satisfied. Nayman (1990) reported that, *"In Pakistan bureaucrats appreciated T & V system because the pattern of internal communication in the Department of Agriculture is asymmetrical (geared to control rather than to create understanding) and top to bottom"*. This suggests that like other agricultural extension programs, the main program also benefits large farmers or landlords, while medium and small farmers can be neglected or ignored.

1.2.3.5. Technology Transfer Unit

In 1982, Pakistan Agriculture Research Council (PARC) created the Technology Transfer Unit (TTU) at the National Agriculture Research Centre (NARC) in Islamabad. The aim was to provide links between scientists and farmers, by dissemination of modern technology among farmers, and providing feedback to researchers. It also facilitates training courses and field demonstrations for both the farmer community and extension workers (PARC, 1986).

TTU provides assistance to various fields including fisheries, soil science, livestock and dairy development, but its work is limited to the outskirts of Islamabad because of a limited number of staff.

1.2.4. Private Sector Extension Programs

Private sector extension is an important aspect of communicating technology advances to farmers, and it was introduced in the early 1980s. According to National Commission on Agriculture; the transition from subsistence to commercial agriculture in Pakistan was only possible because of the active participation of the private corporate sector (Government of Pakistan, 1988). This role of private providers has opened a door for various national and multi-national companies/organizations to play an increasing role.

1.2.4.1. Fertilizer Producing and Marketing Firms

The fertilizer companies in Pakistan have extensive programs. These companies include; National Fertilizer Company (NFC), Fauji Fertilizer Company (FFC), Exxon Chemical Ltd (ECL), and Dawood Hercules Ltd (DHL). Their aim is to reach every farmer using three extension approaches adopted by these companies namely; extension agronomy, Zarai (agricultural) services, and Mass media (Bajwa, 1987).

Extension agronomy aims to provide advisory service through farmer calls, farm visits, group discussion, farmer's meeting, demonstration and field days, crop/agriculture seminars, agriculture exhibitions, crop movies, soil testing and farm adoption. Zarai service produces quarterly magazines in local languages, a letter service for literate farmers, posters containing crop production and protection recommendations, publication and dispersal of crop and product folders containing full information on crops and products, mainly fertilizers and pesticides. Mass Media includes NFC-

sponsored radio agricultural programs, newspaper and magazines, roadside boarding bearing slogans on modern agriculture management practices, and TV brand promotion programs which in part displays production technology.

In addition to meeting sales targets, these companies also focus on farmers' education on the effective use of fertilizers. Some other programs include soil testing, crop demonstrations, farmer meetings, and training its marketing manpower and dealers. One of the new companies, Engro Chemical Pakistan Limited (ECPL), which started working in 1991, is also working for farmers' education and providing extension services. *"Over the years, ECPL's advertising campaigns have introduced mass education to aid farmers in choosing the most favorable package for their crops. The sales and promotion efforts have provided valuable merchandising assistance to ECPL dealers"* (Ameer, 2011).

1.2.4.2.Pesticide Companies

There are hundreds of pesticide companies in Pakistan, the biggest being Ciba Geigy, Jaffar Brothers Ltd., ICI, Al-Akhbar group, Granulars Ltd. Ciba's agricultural division. They are marketers of imported products, with the following objectives;

a) Introducing new pesticides on to the market.
b) Providing facilities to the dealers for the betterment of the farming community.
c) Providing technical services to the progressive farmers at their door steps concerning the safe use of pesticides.
d) Conducting free pesticide trials at progressive farmers' fields, and arranging field days to show the results of the pesticides.

These pesticides companies contact farmers and organize farm visits, farmer meetings or gatherings at their farms or at community level to educate them about various techniques, but are mostly involved in marketing their products, and their objective is to promote sales and earn profit.

> *The objective of conducting extension work and reaching farmers by the extension personnel has the inherited objective of promoting sales through popularizing their products among the farmers and ultimately earning more profit for the firm* (Ahmad, 1998) .

1.2.4.3.Rafhan Maize Product/Sugar Mills

Rafhan is private maize processing firm, dealing with maize growing farmers in production and marketing of maize. This firm provides inputs on credit, and technical knowledge to the maize growing farmers. They also purchase maize crops from their registered farmers. Some of the sugar mills of the country have similar approach for sugar cane crop like Rafhan Maize Products, and they are using the same approach like Rafhan maize product.

1.2.5.Non Government Organizations

A number of non-government organizations (NGOs) are involved in rural development activities, including agriculture. Organizations like the Agha Khan Rural Support Program (AKRSP), National Rural Support Program (NRSP), Punjab Rural Support Program (PRSP), Sarhad Rural Support Corporation (SRSC), and many small NGO's are actively involved in undertaking rural development initiatives using the principles of participatory development and the methodology demonstrated by AKRSP. They all place emphasis on the participatory approach designed to build on local leadership skills (SRSC, 1991; Waqar, 1993). Their extension programs aims at increasing the income of the farmers by:

> (a) Imparting training to representatives of Village Organizations (VOs) in agriculture and livestock management (Bajwa, 1999) .
> (b) Facilitating timely arrangement and supply of agricultural inputs.
> (c) Introducing technological innovation such as inter cropping, bee keeping etc.
> (d) Introducing improved farm machinery.
> (e) Demonstrating and experimenting with high yielding varieties of crops etc.
>   (SRSC, 1991).

1.2.6.Universities of Agriculture

Agriculture Universities in Pakistan make use of their extension departments to translate some of the research material to local languages. These are then widely distributed in the form of pamphlets, books and through university journals, printed and published at their own level (Z. A. Chaudhry, 1987). The Universities also provide extension services to the farming community in the form of farm seminars, workshops, agricultural fairs and other continuing education activities (Mullah, 1993). However, there is wide variation in

the extension activities of the agricultural universities. For example, Sindh Agriculture University, Tandojam, has established a Farmers Advisory Cell, which is responsible for coordination between farmers who need technical help and the scientists of the University.

University of Agriculture, Faisalabad, has established the Institute of Applied Research and Technology Transfer. This Institute provides extension services to the established community organizations and to the general farmers at two project sites in Faisalabad and Khushab districts. Khyber Pukhtoonkhwa (KP) Agriculture University, (previously called NWFP Agriculture University) has implemented the TIPAN project to strengthen and further develop the areas of teaching, research and outreach to improve the lives of the farmers. Major cooperation between the extension and outreach program of the KPK Agriculture University is in the areas of technology development, as represented by the Integrated Village Demonstration Program, Communication, Training and Continuing Education (Seiders, 1987). The agricultural extension of these universities are limited to their regions, while there is a need to disseminate research findings to a wider range of farmers across the country, translated into a local language.

1.3. Social and Economic Characteristics of Dairy Farmers in Pakistan

Dairy production in Pakistan competes with crop farming, and under traditional agriculture farming, priority will always going to crop production because of high grain demand from the human population. Under Pakistani conditions, dairy animals are kept under a variety of production systems including grazing systems, mixed farming systems, and peri-urban dairy colonies (Devendara, 2001). There are also various herd sizes in Pakistan, which can be categorized into very small farmers (less than 5 cows), small farmers (5-10), average farmers (10-20), medium farmers (20-60) and large/cooperative farmers (more than 60). The contribution of these farmers to the total milk production of the country is, 90, 4, 2.2, 2 and 1.8 percent respectively (Government of Pakistan, 2006). These classifications of dairy farms in Pakistan are shown in Table 1.3.

These five groups can be further merged into three main groups on the basis of the social and economic characteristics, for example, Small farmers (very small and small), medium farmers (average and medium) and large farmers (large and cooperatives). The second category of medium farmers is becoming important in the supply of fresh milk for urban population, and the government is also keen to develop this sector in order to fulfil the growing demand from cities for fresh milk. Among the three main groups of dairy farmers in Pakistan, the first group consists of small farmers who are subsistence producers. This group is more than 90 percent of the total dairy farmers of the country, who have less than 10 animals. These farmers have low genetic potential breeds that are mainly kept under traditional farming conditions, which result in low milk productivity.

Commercial dairy farming is limited, as these farmers mostly live in rural areas, and the family's decision to sell milk and the amount to sell is poverty-driven. These small farmers sell milk only because they have no other source of income. The land tenure system of these farmers varies from region to region and province to province. The land available is mostly used for agriculture, and some free grazing is done on rangelands which are usually called 'barren' land. The animals are mostly of low genetic merit, with little potential to produce milk, and they are also mostly underfed. These farmers cannot afford to use modern technologies to increase herd size.

In rural areas, most of the population is directly connected to farming, and they have at least one or two milking animals for their domestic use. Surplus milk is sold to the local bakers or confectioners for making 'Halwa' (a traditional sweet). Demand for milk in the local market only increases at specific times of the year or for ceremonies, but prices remain relatively constant. More than half of the milk produced has no access to market (Afzal, 2008). Some farmers transport milk to urban areas by car, motorcycle, bicycle or tanga (horse/donkey cart) with a resulting slow supply to consumers. Transaction costs can be prohibitively high for small-scale producers because of the small quantities of marketable product produced, and the absence of adequate market infrastructure in more remote areas. The lack of government facilitation for the formation of producers' associations, or other partnership arrangements, also makes it more difficult for smallholder producers to reduce transaction costs through economies of scale. Therefore brokers (middle men) from other areas, come to purchase milk from these poor farmers relatively cheaply and then sell it in city markets at almost double the price. In some regions of the country, national and multinational milk processing companies also buy

milk from these farmers using specific collection points or mobile milk collectors. The price is based on fat percentage in the milk, and is comparatively better than the middle men. Although these farmers are large in number, but they are subsistence producers and utilize traditional methods and poor marketing.

The second (medium) groups of dairy farmers are mostly found on the outskirts of urban and peri-urban areas. This group comprises almost 7 percent of the total dairy farmers of the country, and have between 10 and 60 animals (Government of Pakistan, 2006). The good herd size in Pakistan is considered to be 40-50 animals, but is increasing, especially in this group. These farmers comparatively earn more profit and are cost effective and progressive, and are the main producers of fresh milk for cities. Dairying is considered a business (in contrast to subsistence of small holders) by these farmers, but investment in breeding, artificial Insemination (A.I) and fodder planning is limited. This is possibly due to land tenure system which is predominantly leasehold with some privately owned land.

Due to the lack of research into fodder sources, limited availability of suitable multi-cut fodder species and certified seeds are the main problems resulting, in difficulties of producing year-round fodder. Most of these farmers have created their own marketing channels, eliminating the middle men. They are the main suppliers of dairy products to urban markets, and obtain a fair price for their dairy products. These are the farmers who are fulfilling the demand of fresh milk for urban areas of the country, and are expanding as they invest money into their business. There is potential for these famers to increase the herd size because of land availability, and if properly facilitated with dairy extension and innovation information, they provide the most likely group for expansion and supply for the cities. Although these farmers are only 7 percent of the total, it appears that this group has the potential to bring the "White Revolution" and "shift" in the country that is the main goal, of the government policy for the dairy industry.

The remaining dairy farm group is the large or cooperative farms, which are mostly located in the best dairy regions of the country. The herd size of these farms is above 60 animals but they are only 0.3 percent of the total dairy farms in the country (Government of Pakistan, 2006). These commercial farms are owned by companies like, Nestle, Hala, Haleb, Olpers or landlords, and most of the milk is processed and supplied to provincial capitals or big cities/markets or dairy companies. These farms are mostly owned and

operated by international or national companies and are well equipped with all modern dairy equipments. They practice fodder planning, keep detailed management records, have animals of high genetic merit, and use breeding programs to improve this further. These farms have access to the milk market, and obtain a price per litre almost three times more than the first two groups (PDDC, 2006). The owner/landlords usually provide/allocate more than enough land for these farms, and some of these farms are government owned (Research and Army farms). Others are owned by large private companies, for example, and these private companies process the fresh milk and sell the different dairy products under their brand name. These companies also collect milk from a wide variety of dairy regions with the help of their collection units. The price per litre given to the small dairy farmers is 2-3 rupees more than the local price, and hence milk is happily sold to these big companies. In short, this group is the biggest investor in the dairy sector and provides a model for the industry in how modern technologies can be used for milk production.

Table 1.3: Classification of Dairy Farms in Pakistan:

HERD SIZE	TOTAL NUMBERS =5071112	TOTAL MILK PRODUCTION =40 Mil Tones	TYPE OF OWNERSHIP
< 5 (Very Small)	4102888 80.9 %	90 % of the total milk production	Private
5-10 (Small)	623,110 12.3 %	4 % of the total milk production	Private
10-20 (Average)	237,929 4.7 %	2.2 % of the total milk production	Private / Commercial
20-60 (Medium)	91,831 1.8 %	2 % of the total milk production	Private / Commercial
>60 (Large) Cooperative Farms	15,354 0.3 %	1.8 % of the total milk production	Commercial

Source: Government of Pakistan (2006)

Although dairying in Pakistan has potential to help local food security and improve the production, various extension programs have been used from time to time, that are not specifically associated with dairying. If government and private extension providers work closely with the research centres and universities and formulate a specific dairy extension strategy, then improved productivity and profitability of the dairy industry is more likely. There is not only a need for an appropriate extension model or strategy for the growth of the dairy industry, but also training of the extension workers. This training needs to be based on appropriate and applicable extension techniques and modern dairy practices. The gaps between large farmers and small or medium farmers need to be removed, by providing extension support for all. There is a need to support the development of the small to medium farmers as they provide major share of production. It is presently not clear who will take the responsibility of summarizing or translating research findings by research institutions into comprehensible terms and local language for the farmers.

1.4.Need for Dairy Extension in Pakistan

Extension services in Pakistan emphasize practices as they apply to various enterprises, and there are no specific staff employed for dairy extension, but rather generalist agriculture extension workers. Therefore farmer meetings or gatherings are often not for specialist audiences, and it is difficult for untrained extension worker to deal with a diversity of specific knowledge required. These gaps between traditional farmers and progressive farmers can only be removed with the help of specialist dairy extension. Some other issues in Pakistan are the poor linkages between research, dairy extension and educational institutions.

Many researchers (Bindlish & Evenson, 1997; Hussain, Byerlee, & Heisey, 1994; Khan, et al., 1984) believe that reorganization, redesigning and restructuring for agriculture extension is necessary. A report '*Dilemmas of agricultural extension in Pakistan*' also mention that "in the late 1980s, the national commission on Agriculture, citing the failure of public extension to appreciable increase agricultural productivity, recommended the inclusion of private sector for the accelerated development of agriculture". This also shows that both private and public sectors of agriculture extension in Pakistan 'operate competing and overlapping programs'. Public and private extension providers in the

country are biased in providing extension information primarily for farmers with education and landholdings (Davison, Ahmad, & Ali, 2001) .

Many critics think that agricultural extension has not remained effective for small or medium farmers, as the majority of the services are offered to large farmers or landlords, possibly in the hope that the modern practices will 'trickle down' to the poorer educated small farmers, who are not contacted (Bindlish & Evenson, 1997; Hussain, et al., 1994; Khan, et al., 1984). The small and medium farmers produce approximately 93 % of milk, while having little or any formal contact with agricultural extension (Davison, et al., 2001).

In the last decade, the dairy industry has shown some progress towards using modern dairy farming methods, with improvement in dairy extension and the extension professionals in this field. The objective of these extension positions is to work with farmers on farms rather than from an office. The new extension programs and strategies are 'farmer friendly' and this initiative is expected to be one of the important drivers of future change of the industry. If both government and private sectors work together towards improving agriculture sustainability, this may contribute to a second 'Green Revolution" or 'White Revolution" in Pakistan.

Insights from the dairy extension strategies used in Australia may help the Pakistan dairy industry, specifically extension professionals and dairy farmers, to identify the best extension strategies for their needs. The brief overview of Australian dairy industry in the next section identified the similarities and differences, and identifies the gaps in knowledge that may be needed to find application to the Pakistani context

1.5. Dairying in Australia; A Brief Overview

The dairy industry of Australia is one of the three leading rural industries in the country, contributing \$5.2 billion to the Australian economy in 2010/11, from a national dairy herd of 1.6 million cows. The total milk production recorded in 2010-11 was 9101 million litres, with 6883 dairy farms. The average herd size consists of 230 milking cows, with an average milk production of 5699 litres per cow per year. This industry sector directly employs a work force of 40,000 people, with 61% of the industry found in Victoria, South Australia and Tasmania (Dairy Australia, 2011)

Australian dairy is a pasture-based industry (approx 75 %), which means a low cost of production, but lower yields than other countries with comparable genetics (Dairy Australia, 2011). In addition, the past two major droughts have seen an increase in the use of grains, hay and silage. This feeding regime seems to have remained in post drought conditions. The results of the National Dairy Farmer Survey shows that; *"In 2007/08 season 93 % of the Australian Dairy Farmers provide 1.7 tonnes per cow of these supplementary feed, up from an average of 1.4 tonnes in 2006/07"* (Dairy Australia, 2008).

The Australian dairy industry has shown some remarkable changes in terms of farm size, milk production and its utilization since the 1990s (Dairy Australia, 2011). These changes take the industry to peak growth, but the severe drought of 2002-03 limited this growth in recent years, and it is now stabilizing. Some of the changes to various sectors of the dairy industry in the past decade are outlined below.

During 1991-92 to 2010-1,1 the number of Australian dairy farms declined by one third, but milk production increased by 42 % in the same period. This increase was associated with an increase in the total number of cows and also in average milk production per cow (Ashton & Mackinnon, 2008). These authors also report that there was a comparatively smaller increase in the average number of dairy cows per hectare and the effective dairy land area. They suggested that this was due to an increase in the average land area operated by dairy farmers.

Since the deregulation of the farm-gate milk prices in July 2000, the farm income of the dairy farmers has been unpredictable. Aston and Mackinnon (2008) pointed out that this has been partly a function of fluctuations in the world dairy products prices, linked with the droughts of 2002-03 and 2006-07. Figures given by Dairy Australia (2008) showed that Australian dairy farmers were receiving low prices when compared to other producing countries; however the recent softening in the commodity prices and strong Australian dollar has shown improvement (Dairy Australia, 2011). However, the prices received by dairy farmers varies regionally; for example, the northern dairy regions have often received comparatively high prices for drinking milk as compared to southern regions, as southern regions have lower costs of production due to seasonal production and producing less for domestic trade.

Owner-operated farms are the dominant system of production in Australia, with 80% of farms in this category. Share farms (operated by two or more farmers) make up 18% of the farms and the other 2% are owned by large cooperatives (Dairy Australia, 2009). Across all these ownership groups there has been a shift to the large farms with an increase in herd size and also an increase in productivity and decrease in production costs. The average herd size has increased from 85 cows in 1980 to 215 cows in 2007/08, (Dairy Australia, 2008). The results from National Dairy Farmer Survey (2008) reported that *"Eight per cent of the dairy farms have herd sizes of more than 500 cows and produced 25 % of the total milk produced in Australia. At the other end, 48 % of the farms had fewer than 200 cows and produced 24 % of the milk"*. .

Deregulation in the Australian dairy industry came into effect in 2000 after a long period when state and federal government schemes were in place to ensure stable farm incomes and milk supply. Before deregulation, milk processing was to some extent regionally organised by small processing companies and a few larger ones. However the processing industry is now dominated by a few big national companies; and the mergers and a shift toward multi-national ownership has emerged.

Production of milk increased over the last decade, but has now stabilised. The reason for this is the slow recovery from the drought of 2002/03 and 2007/08. Statistics show that the domestic consumption of milk has remained almost the same at around 4,500-5,000 million litres over the decade while exports were above 10,000 million litres until 2004/05 with the peak of above 11,000 million litres in 2001/02. These exports declined

to around 92,000 million litres in 2007/08. Presently, Australia has an 11 % share of the world dairy product trade being third behind New Zealand and European Union.

1.5.1.Technological and Managemental Changes

The Australian dairy industry has undergone various technological and managemental changes in the last two decades. During this period, productivity has improved, largely because management and new technologies at the farm level. Some of these changes are listed below.

1.5.1.1.Milking Shed and Equipment

Since 2001, improvements in the milking shed design and the installation of new equipment has been a major reason for the increasing labour use efficiency. The common milking shed designs are the "Herringbone Milking Shed" "Rotary Shed" and "Walk through Shed". Recent figures by ABARE (2008), shows that the Herringbone Milking Sheds are most common for dairy farmers; while the numbers of the Walk-through Milking Shed has declined; however the shift to the large farms also resulted in the improvement and up gradation of the milking shed and farm equipment and now farmer are switching rapidly to rotary sheds.

1.5.1.2.New Investment/ Productivity Growth

Recent investment in dairy farms has been based on the productivity growth, and this was also true in the previous decade with net capital investment showing a steady increase in terms of land acquisitions, and the expansion in the scale of the dairy farms operations. Elliston et al. (2008) reported that there was moderate growth (1.2%/a) between 1998-89 and 2005-2006, and according to the further findings by ABARE (2005). This was largely associated with use of new technologies such as improved herd genetics and farm management practices, including the improvement in the cultivation and harvesting methods of pastures and fodder, along with and increase in the use of grains and concentrates resulted in productivity growth (ABARE, 2005).

1.5.1.3.Feeding Management:

Figure 1.3 shows that majority of Australian dairy farmers supplement pasture-based production by feeding grains, concentrates and by-products to cattle. In 2008–09, around 98 per cent of farms used these supplementary feedstuffs. Since 1991–92, there has been a gradual upward trend in the quantity of concentrates, grain and by-products fed per cow (ABARE, 2008). Ashton & Mackinnon (2008) reported that most dairy farmers pointed out that feeding concentrates, grains and by- products result in an increase in herd milk yield and a higher milk yield per animal. These results also showed that the use of hay and silage remained stable at around 53 % from 1991-92 and 2004-2005 but rose to 68 % in 2006-07 as a result of the drought that year.
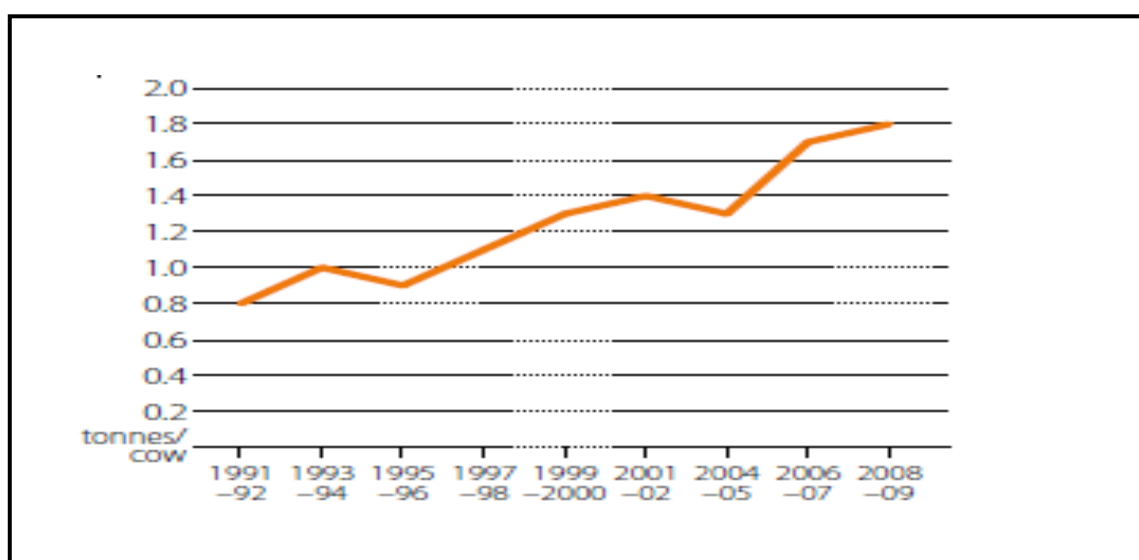

Figure: 1.3. Concentrates, grains and by products fed per cow, Source ABARE (2008)

1.5.1.4. Informal Education:

In the last decade, Australian dairy farmers have received informal education through trainings, seminars, workshops and conferences provided by various public and private sector providers. According to Aston and Mackinnon (2008), dairy farmers received a variety of training including addressing issues of herd nutrition, pasture management, concentrate & feed management, soils & fertilizers, computer skills, milk quality management, business management, fodder conservation, herd management, and people management & employment, etc. The results of their survey indicated that "dairy farmers actively seek information to better manage their farms, with the main sources of information being other farmers, family and the media".

In such trainings, dairy farmers have also been involved in a broad range of discussion groups, workshops, field days, and other information programs. These programs have been conducted by various private & public sector organizations and agro-political groups (Aston and Mackinnon, 2008).

1.5.2.Agricultural Extension in Australia

In Australia, agricultural extension is mostly privately conducted, and as such reflects the world wide trend towards privatization (Dancey, 1993; R. W. M. Johnson, Schroder, & Taylor, 1989; Rivera & Gustafson, 1991).This is due to the fact, that the Australian state governments are spending less on both agricultural support and extension (Sheldrake, 1996).

Previously, Australian agriculture extension was characterized by a large and effective public sector with a strong emphasis on production-based technology transfer (Cary, 1998). There have been recent and rapid changes in the provision of agricultural extension in Australia (Marsh and Pannell, 1998). State departments, which provide agricultural extension, have changed their extension strategy from primarily one-to-one extension to mostly group extension. It appears the logic behind this change is the expectation that transfer of technology to farmers through diffusion within the industry, will obtained more effectively from a group extension approach. In addition, the current and future vision of agriculture extension in Australia shows that the involvement of private sector will be much more prominent, while the public extension service will work more hand-in-hand with agribusiness (Sheldrake, 1996).

In Australia some of the important players in agriculture extension are; farmer organizations, cooperatives and groups; seed, fertilizer and chemical companies, local government, marketing boards, Research and Development Corporations, Cooperative Research Centres and University departments (Marsh and Pannell, 2000). These bodies provide extension to almost every sector of agriculture and are well spread in all states across Australia.

According to the critical assessment of selected extension policy changes by Marsh et al. (2000) there are seven types of extension in Australia. These are; group based extension, extension focusing on human resources development, increasing emphasis on nationally-based programs, organizational changes within public sector agencies, increase in the number of extension service providers, privatization/commercialization of extension

services, and extension for delivery of information. The extension services provided through farmer groups and cooperatives is gaining popularity with farmers. The emphasis on group-based approaches in extension practices in Australia is generally a positive development. It enhances the prospective for farmers to adopt the appropriate farming systems or new technologies (Marsh *et al*, 2000).

Though there were some issues relating the governance of group-based extension approaches in Australia, Vanclay and Lawrence (1995) explained that *"although there has been a growing commitment to group extension in Australia, this has occurred largely because of the disarray in traditional extension due to financial constraints and agency restructuring"*. These authors argue that it has not been because of any evaluation of the effectiveness of the new models to deliver more desirable outcomes. Group extension has many advantages, such as: it is based on participatory adult learning process, encouragement for the producer, it provides a good platform for information delivery and experience sharing and it provides a scaffold for information delivery of different range of factors. However there are some limitations to this approach including some farmers being over-shadowed, and over-representation of farmers with greater wealth and larger properties and, a lack of involvement of women in implementation of activities etc (Kerby *et al*, 1996).

Environmental factors also affect the extent and nature of extension services. Coutts *et al*, (2001) highlighted two 'converging trends' in the Australian environment,:

- Severe environmental and global problems facing rural landholders.
- An increasing focus in extension on holistic development, human capacity building and facilitating interdependent relationships.

Coutts *et al*, (2005) further described five extension models for capacity building presented in their report The first model is a group facilitation model which is about ownership and responsibilities. In this model the target group defines their own problems and opportunities and then seeks their own avenues to address them. The second model is programmed learning model, which mainly deals with workshops and courses in terms of 'adult learning'. The third, technology development model is use for dissemination of new technologies. The fourth one is information access model which is use for linking people with information they need. The fifth is the individual consultant/mentor model

which is used for "what works and why" in the relationship between client, consultant or mentor.

Group approaches have also been successful in Australia for mobilizing farmers based on their common interests. It provides an excellent opportunity for the farmers to share information and resources. For example, Landcare producer groups have contributed towards a change in farmers' attitude (Wilson, 2004). Curtis and Lockwood (cited in Wilson, 2004) argued that Landcare participation has increased awareness of issues and enhanced landholder skills and knowledge. Curtis *et al,* (1999) also suggested that networks are important and enhance the impact of groups by improving inter-group communication and 'pulling down' resources. Sobels *et al,* (2001) added that Landcare network groups attract more government resources than the groups would have obtained independent of government funding on their own. It also unites farmers to cope the conservational or environmental issues. It enables producers/farmers to set their own priorities and strategies.

According to a short report, by RIRDC (1999) "*under the new model, it is seen as appropriate that farmers should have more control over the information that they need or want and over the way it is delivered. It is held that extension should be 'demand-pull' rather than 'science-push'*". The report further considers that the increased use of farmer groups for agriculture extension has been one of the important changes associated with this new model. Extension officers now often act as facilitators rather than as experts in science or technology. Marsh and Pannell (2000) observed that the current emphasis on groups may be excessive and result in problems relating to effectiveness in all situations, in the longer term and the ability to involve all who need to be involved.

There have been continuous changes happening in agricultural reforms for many decades in Australia and since the 1980's various reforms have occurred in agricultural extension. These reforms can be grouped into four main categories (Alex, Zijp and Byerlee, 2001). These changes are summarized in Figure-1.4 as they relate to funding of delivery of private and public sector extension: They define the changes as involving a political structural change, (the first upper-left quadrant of figure 1.4) often referred to decentralization. In the illustration, decentralization refers to a reduction in **concentration** of authority to branch offices or institutions, as well as the shifting of staff from national to provincial, district or sub-district levels. The second change is

towards **partial privatization** (lower-left quadrant) and the third (upper-right quadrant) change of **systems where the producer pays** directly to the provider. The final change (lower-right quadrant) is situations where governments have either commercialized their public sector agriculture extension services, or have otherwise **transferred these services in total to the private sector**. The central rectangle in Figure 1.4 represents a situation where governments employ several strategies (e.g., devolution, partial privatization and or cost-recovery measures to foster extension activities for agricultural development). This figure further illustrates that there is no single political or institutional strategy prevailing in the reform of public sector agricultural extension. It is apparent that there is also no procedure for reforming extension although there are many lessons to be learned from these strategic determinations and their different expressions.

Alex, Zijip and Byerlee (2001) concluded their discussion on change in extension that: "*The new vision of agricultural extension is more than it used to be. Its function and tasks are increasingly assumed by multiple public and private organizations*". There is now a wide spread of extension providers available at various levels. The role of non-governmental organizations, producers, private companies, national and international extension services etc is all working to strengthen agriculture extension.
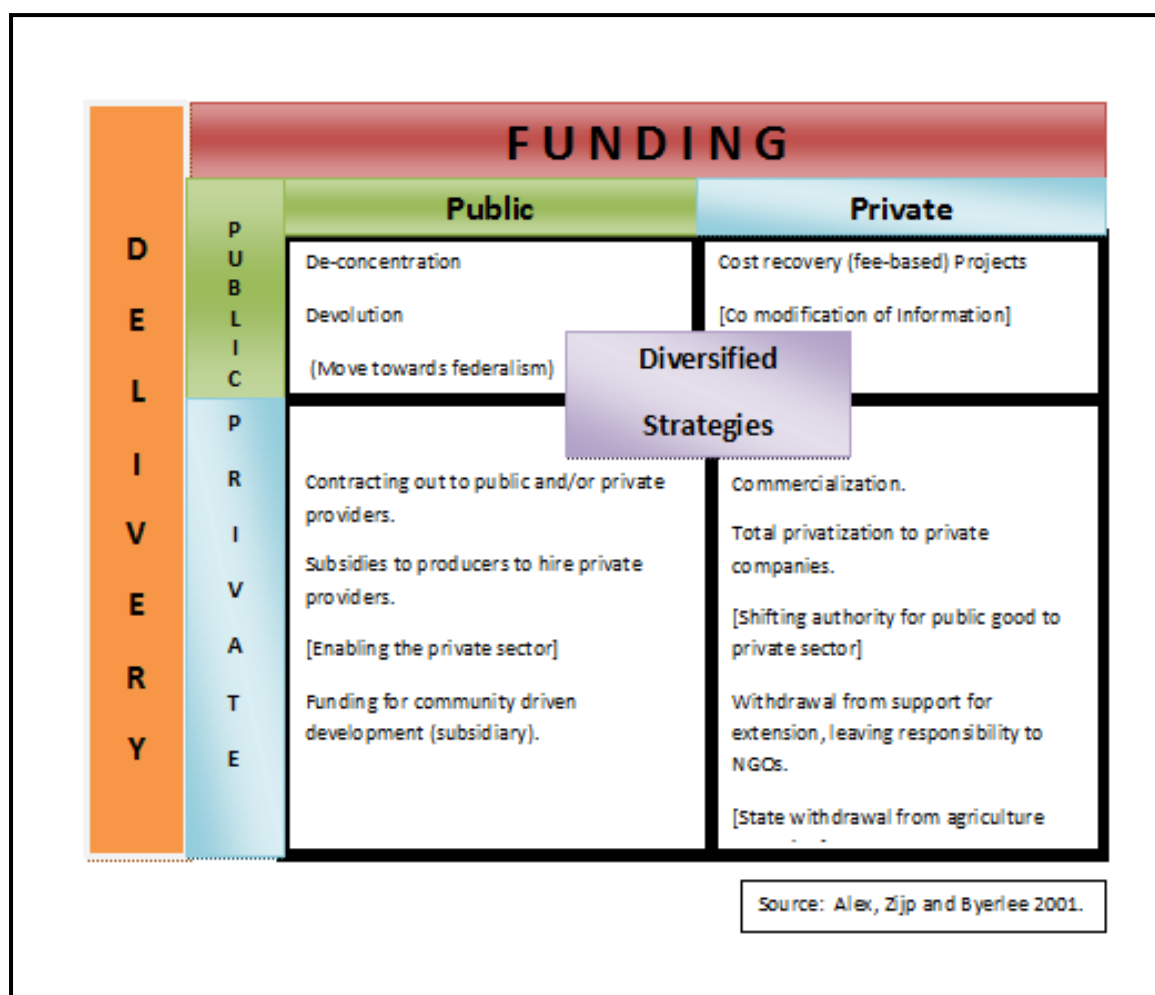
FUNDING

		Public	Private
DELIVERY	**PUBLIC**	De-concentration Devolution (Move towards federalism)	Cost recovery (fee-based) Projects [Co modification of Information]
	PRIVATE	Contracting out to public and/or private providers. Subsidies to producers to hire private providers. [Enabling the private sector] Funding for community driven development (subsidiary).	Commercialization. Total privatization to private companies. [Shifting authority for public good to private sector] Withdrawal from support for extension, leaving responsibility to NGOs. [State withdrawal from agriculture

Diversified Strategies

Source: Alex, Zijp and Byerlee 2001.

Figure 1.4: Australian public sector agricultural extension reforms since the 1980's.

1.6. Conclusion

Different kinds of agriculture extension programmes have been tried in Pakistan from time to time without particular emphasis on dairy extension until recently. The public and private extension programs, along with agricultural research institutions and universities, mostly provide overlapping programs for the farmers. There is a need to transfer research findings to the farmers in easy local languages. Medium and small dairy farmers of the country are still relying on the traditional approaches and the managemental practices, which can hardly help to bring the 'white revolution' in the country. The need for restructuring extension strategies were identified by many researchers mentioned in the review. It is proven that, extension usually plays an important role in the initial stage of dissemination of a new technology, and as the information is distributed among farmers and they become aware of new technology, the need or impact begins to decline and the need for new or more technologies arises, (Byerlee, 1998) in (Jock & Gershon, 2004). Thus there is always a challenge for extension providers and policy makers to design a better strategy.

Dairy extension in Australia plays a major role in the development of the industry. Various technological and managemental changes in the industry in the last couple of decades made progress because of better private and public sector extension services. However, dairy farmers have also played a key role in dairy development. In addition the provision of effective and need based informal education to dairy farmers have also helped in improved productivity and profitability. The future planning of the Australian extension professionals and dairy farmers especially for environmental factors affecting the extent and nature of extension services have also minimized the losses caused by natural calamities in the past. The organised and strong public-private extension programs with emphasis on group based extension are one of the main strength of effective extension delivery. In short the dairy extension in Australia is 'demand pull' and farmers have control over most of the information. In contrast, extension in Pakistan is 'Science Push' and service providers have mostly controlled over the information, which needs restructuring.

This review has shown that extension usually plays an important role in the initial stage of information dissemination of new technology (Jock and Gershon, 2004). Thus there is a continual challenge for extension providers and policy makers to design extension

strategies that match the changing needs of farmers. Moreover, there is also a range of different extension strategies and delivery methods adopted by public and private extension providers. The public sector mostly provides extension services free of cost to farmers, while private consultants often charge for these services. Many researchers have found that innovation and adoption achieved through extension is difficult to measure (Rogers 1995; Feder and Umali 1993; Linder 1987; Feder et al. 1985), so the perception of extension professionals and dairy farmers regarding the use of extension strategies can provide important insights. Therefore this study follows to investigate current extension strategies employed by professionals (government and private) and dairy farmers operating in NSW and Victoria, and to identify perceptions of the effectiveness of these strategies; and thereafter determine if these strategies might be appropriate for use with the Pakistani medium-sized dairy sector, which are further discussed in next chapters.

1.7.Aims and Significance of the Study

The aim of the study that follows was to investigate current extension strategies employed by extension professionals (government and private) and dairy farmers, currently operating within the industry in NSW and Victoria, and the perceived outcomes of those extension strategies. The outcomes showed will help extension professionals and dairy farmers in Pakistan to adopt the most suitable extension strategies that may have application to extension methods to be used by extension practitioners in Pakistan.

1.8.Research Questions

The research objective was to investigate extension strategies in Australia suited to the capacity building of medium-size Pakistani dairy farms. In order to achieve this objective, the following research questions were addressed:

1) What extension strategies are used by extension professionals (government and private) and dairy farmers in Australia?

2) In the opinion of the extension professionals and dairy farmers, to what extent are these extension strategies effective, and why?

3) What is the potential application of these extension strategies to meeting the needs of Pakistani medium-sized dairy farmers?

1.9.Organization of the thesis

Chapter 2 describes the research approach and methodologies utilised in this study. Chapter 3 presents the results, analysis and discussion of case study A, the extension professionals in New South Wales and Victoria. Chapter 4 presents the results, analysis and discussion of case study B the dairy farmers in the two states. Finally, chapter 5 synthesises the research findings of this study, and highlights suggestions and strategies that may be appropriate for use with the Pakistani medium-sized dairy sector.

Chapter 2:

Research Methodology

2.1. Introduction

This chapter outlines the research methodology used to address the research questions of this thesis. The main focus of the research was to develop an understanding of the effective use of extension strategies by the participants in the light of their experiences.

The chapter discusses the qualitative research method and research design used for this study. The discussion is further followed by details on selection, ethics requirements, interviews format and the research sample. In addition data management, reliability and validity and categorizing the data are also discussed in details.

2.2. Qualitative Research Methods

In the field of social sciences many types of research methods are used but most commonly used are quantitative and qualitative research. Quantitative research deals with numerical data and statistical analysis, usually gathered from large groups samples (Walter, 2010). Qualitative research method deals with participant observation and unstructured in-depth interviews with a relative small sample size (Bryman, 1988). Sandelowski (1995) concluded that "Qualitative analysis has scientific dimensions, in that a disciplined and systematic approach to inquiry that can be reliably communicated to others is considered essential for acceptability of the findings of a study as scientifically valid" (p. 375). Qualitative analysis also has artistic dimensions that are often unclear and incommunicable, involving playfulness, imaginativeness, and creativity (May, 1994). In this study, qualitative research method is used, because the participants' observations are studied and the understandings from the complex unstructured data were derived. The main reasons for working qualitatively were summarized by Morse and Richards (2002) as; *"the research questions requires it and the data demand it"*. As the focus of this research was to investigate extension strategies used by Extension Professionals (EPs, government and private) and Dairy Farmers (DFs) in NSW and Victoria, the overarching questions were:

What extension strategies are used by EPs and DFs in New South Wales and Victoria? What strategies do the EPs (Government & Private) and DFs think are effective and non effective and why?

So the selection of qualitative research method was suited to the main research question and on the other hand 'the data demand' was the powerful push, which leads the data to speak for itself. As the data were derived from open ended semi-structured interviews and there was a need to describe that perspective responses in a logical way. Moreover in order to describe and analyze the participants' experiences, perceptions and interpretations required qualitative method. Morse and Richards (2002) described five different ways of addressing qualitative research purposes, one of which states that;

> To learn from the participants in a setting or process the way they experience it, the meaning they put on it, and how they interpret what they experience, you need methods that will allow you to discover and do justice to their perceptions and the complexity of their interpretations. Qualitative methods have in common the goal of generating new ways of seeing existing data. (Morse and Richards 2002, p. 28)

2.3.   Research Design

A research design is an overall structure that enables researchers to map out strategies to be implemented in collecting relevant data. There are many research designs and the selection depends upon a number of considerations such as world view assumptions, procedures of inquiry, nature of the research problem, audience and the researcher's personal experiences (Creswell, 2009). Designs need to be consistent with the research paradigm chosen.

A case study research design was used for the current study, as it was considered best suited to the research questions. According to Yin (1994) case study is "a way of investigating an empirical topic by following a set of pre-specified procedures". These 'pre-specified procedures' can be single cases or multiple cases. Case studies allow the use of multiple sources of information based on what the researcher wants to investigate and the nature of the research questions (Creswell, 2007). Case study is a qualitative

research approach which "provides a detailed account and analysis of one or more cases" (B. Johnson & Christensen, 2000). There are three types of case study research design; 'Intrinsic case study' deals in understanding a specific case; 'Instrumental case study' deals in understanding something more general than the particular case; 'Collective case study' deals with multiple cases in one research study (Stake, 1995).

One objective of the study was to give an in-depth description of the dairy extension strategies used by Australian extension providers and farmers. Consistent with the points above, a case study research method was the most applicable research approach for this study. Collective case study research design was adopted, which is also called as multiple case designs by Yin (1994). In this study, two case studies (Case Study A and B) were selected from the participants. It was believed that multiple cases would gain greater insight into the study. Several cases can be studied in multiple case studies as there are several advantages of studying more than one case (Johnson and Christensen, 2000). This was helpful in the study, first, in order to compare for similarities and differences. For-example, the different approaches of government and private extension professionals. Second, effective testing of theory that which extension strategies work best for participants. Third, it is helpful to generalize the results from multiple cases than from a single case. Thus the researchers have more confidence that a similar result would happen in a new case of multiple case studies (Johnson and Christensen, 2000). Similarly in this study 'the replication logic' for the multiple cases were taken into consideration in terms of the perceptions of the participants.

However, the disadvantage of multiple cases is that the in-depth analysis of each case is not possible. This is because of the limited resources (money and time) available for most of the research studies. Johnson and Christensen (2000) explained this, *"It takes considerable time to study one case in-depth, but you end up with a deep understanding of the case, while on the other hand in multiple cases, you will have to reduce the amount of time spent on each case but you get important comparative information"*. In this study, apart from the limited resources, it was also important to study multiple cases in order to identify the perceptions of the participants in variety of cases.

2.4.   Selection and Ethics

The participants were identified through name contacts and selected on predetermined set criteria of experienced extension professionals, and dairy farmers working with the industry for at least five years or more, shown in table 2.2. Invitations were sent to various potential participants through emails and interested participants replied. The interested participants were then interviewed by phone on their agreed date and time. Participation was completely voluntary and they were told that they may withdraw from the project at any time. It was also explained that any quotation of the participants will be quoted anonymously, and they will not be identified as an individual. They were also asked to sign a consent form (Appendix C) before the interview. It was also explained that the interviews would be recorded and then transcribed. Participants were provided with an information Sheet (included in Appendix D) that stated the research objectives and outlined the research process. This project was approved by the Human Research Ethics Committee of the University of New England, NSW, Australia (Approval No: HE10/174).

2.5.   Interviews and Research Sample

A semi-structured interview was the main data collection tool for this study. The survey instrument is included in Appendix (A & B). Many researchers supports and have used interviews for collection of qualitative data (Berry, 2007; Reinharz, 1992; Sommer & Sommer, 1980; Vithanapathirana, 2007; Vu & Pridmore, 2007). In order to appropriately address the research questions, it was important that EPs (both government and private) and DFs were interviewed. The experiences of all the participants were critical to understanding the nature of the perceptions of the extension providers and end users (DFs). Semi-structured interview techniques were used in the study. Most of the questions asked in the semi-structured interviews contained "what" and "how"; these types of questions are best addressed by using a case study design (Yin, 2003). The study for this thesis was bounded by time and place (explicit features of a case study research design). Grounded Theory Method (GTM) was used for data analysis; *grounded theory approach to data analysis means allowing the data to 'speak for themselves' rather than approaching the data"* (Welsh, 2002). GTM was chosen as the project was design to understand the process of extension strategies used in the study area. Grounded theory is considered as *"an appropriate method for the researcher wishing to learn from the participants"* (Morse & Richards, 2002). They further added that; *" Research questions in grounded theory reflect this interest in process and change overtime, and the methods*

of making and analyzing data reflect a commitment to understanding the ways in which reality is socially constructed". Thus the two main themes 'actions' (what the participants do) and 'perceptions' (what the participants think) were identified from the data. These themes were not only based on 'what?' questions, but also on questions of 'how?' This helped in gathering the factual responses from the participants and their perceptions. This also helped in the detailed exploration with 'theoretical sensitivity' for constructing theory grounded in data.

The earlier work and methods described for GTM by Strauss (1987) *"are by no means to be regarded as hard and fixed rule for converting data into effective theory"*. The inflexible rule for GTM was well described as;

> Researchers need to be alive not only to the constraints and challenges of research settings and research aims, but to the nature of their data. They must also be alert to the temporal aspects or phasing of their researches, the open-ended character of the "best research" in any discipline, the immense significance of their own experiences as researchers and local context in which the researches are conducted. (Strauss, 1987, p. 7-8)

In this study, the themes are directly generated from the two case studies. This is also called 'inductive analysis' as "getting into the data" during data collection and analysis. Johnson and Christensen (2000, p. 313) highlighted the inductive analysis as "Immersion in the details and specifics of the data to discover important categories, dimensions, and interrelations; begins by exploring genuinely open questions rather than testing theoretically derived (deductive) hypotheses".

Data collection and analysis in GTM are concurrent and continual activities, and the popular data collection method for GTM is open ended interviews (Johnson and Christensen, 2000). Interviews for this study were conducted during the second half of 2010 and first half of 2011. Eighteen extension professionals and seven dairy farmers across NSW and Victoria were interviewed. Interviews lasted between 30 to 45 minutes and each interview was recorded and then fully transcribed. Initially, two interviews (one each with EP and DF) were conducted for pilot testing the interview questions. The questions posed were used as prompts, in order to get detailed information from the participants. These prompts were used for obtaining the participants actions,

observations and perceptions. The purpose of doing a pilot study was to get the "bugs out of the instrument so that respondents in the main study will, experience no difficulties in completing it" (Bell, 2005). After testing and some minor changes the remaining participants were interviewed, subject to their availability. There are numbers of extension providers and dairy farmers in NSW and Victoria but due to budget and time constraints, it was not possible to interview all. It was very difficult for a single researcher to be involved in such a large number of interviews. Thus a manageable sample was selected because interviewing is time–extensive research. Initially the total planned participants were 30, (10 each from government extension providers, private extension providers and dairy farmers). But due to the uncertain situations, such as floods and time, a total of 25 respondents were interviewed from both states, and are categorised in Table 2.1.
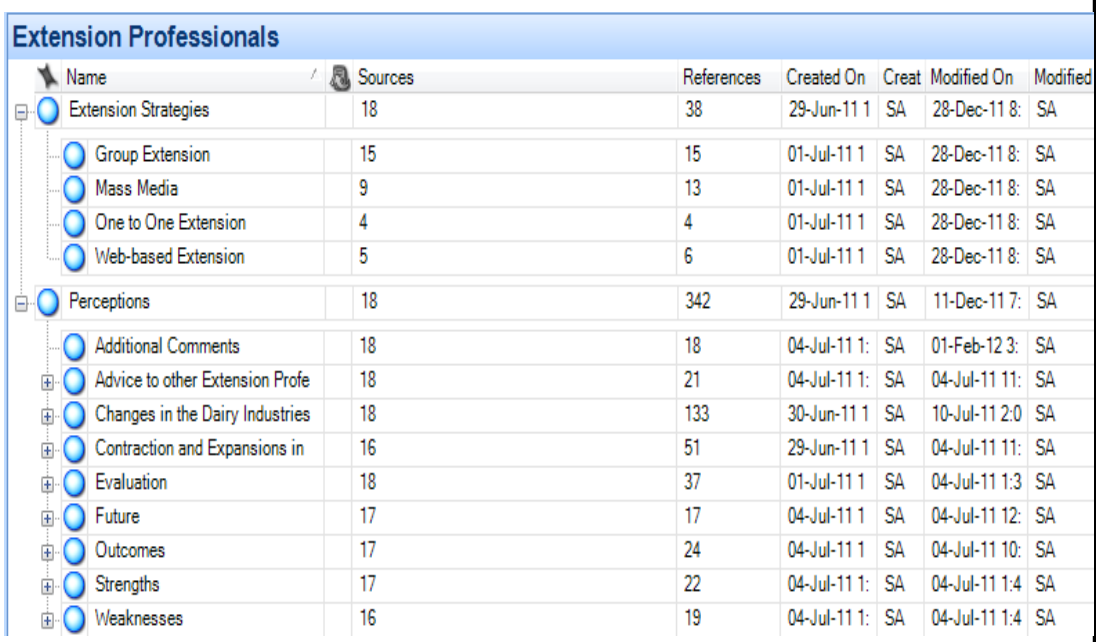
Table 2.1: Interview Participants Planned and Conducted.

Participants	Participants Planned to be Interviewed (5 from each state)	Participants Actually Interviewed
Government Extension Providers (GEP)	10 (5+5)	10 (5 from NSW & 5 from Vic)
Private Extension Providers (PEP)	10 (5+5)	8 (3 from NSW & 5 from Vic)
Dairy Farmers (DF)	10 (5+5)	7 (4 from NSW & 3 from Vic)

2.6.   Data Management, Coding and Analysis

Qualitative data analysis generally deals with 'rich data', and it is difficult for a researcher to organize and analyze such data in a limited amount of time (Wood & Welch, 2010). The introduction of qualitative analysis software, such as NVivo, has allowed the researcher to undertake these tasks more effectively. NVivo supports the researcher in allowing him to undertake multiple strategies in parallel, reading, reflecting, coding, annotating, memoing, discussion, link journals and even presenting these in models (Bazeley, 2007).

In this regard, the audio data were transcribed and analyzed with the assistance of the qualitative research software NVivo version 9. Responses were categorized into two main themes; actions and perceptions. Nodes were created from the data and coding was done for thematic analysis of the data.

Extension Professionals

Name	Sources	References	Created On	Creat	Modified On	Modified
Extension Strategies	18	38	29-Jun-11 1	SA	28-Dec-11 8:	SA
Group Extension	15	15	01-Jul-11 1	SA	28-Dec-11 8:	SA
Mass Media	9	13	01-Jul-11 1	SA	28-Dec-11 8:	SA
One to One Extension	4	4	01-Jul-11 1	SA	28-Dec-11 8:	SA
Web-based Extension	5	6	01-Jul-11 1	SA	28-Dec-11 8:	SA
Perceptions	18	342	29-Jun-11 1	SA	11-Dec-11 7:	SA
Additional Comments	18	18	04-Jul-11 1:	SA	01-Feb-12 3:	SA
Advice to other Extension Profe	18	21	04-Jul-11 1:	SA	04-Jul-11 11:	SA
Changes in the Dairy Industries	18	133	30-Jun-11 1	SA	10-Jul-11 2:0	SA
Contraction and Expansions in	16	51	29-Jun-11 1	SA	04-Jul-11 11:	SA
Evaluation	18	37	01-Jul-11 1	SA	04-Jul-11 1:3	SA
Future	17	17	04-Jul-11 1	SA	04-Jul-11 12:	SA
Outcomes	17	24	04-Jul-11 1	SA	04-Jul-11 10:	SA
Strengths	17	22	04-Jul-11 1:	SA	04-Jul-11 1:4	SA
Weaknesses	16	19	04-Jul-11 1:	SA	04-Jul-11 1:4	SA

Figure 2.1: Nodes from case study A; extension professionals.

Figure 2.2: Nodes from case study B; Dairy Farmers.

Nodes provide a place to store data grouped into ideas or themes that emerge from analysis. Nodes allow the researcher to gather or 'tag' data sharing similar themes or other characteristics (QSR, 2010). In NVivo, the data segments are gathered together and the references to them are stored in a node. Some researchers create nodes at the beginning, as there are certain nodes that they will need for their project. Others researchers create nodes from the themes that emerge from the analysis of the data. The appropriate strategy for creating nodes is dependent on one's methodology and personal style; (QSR, 2010). The nodes in this study were created from the themes in the data. These nodes for case studies A & B (given in figure 2.1 and 2.2) are further explained in the next chapters.

The coding for data analysis was completed within the nodes shown in the Figures 2.1 and 2.2. Most of the interviews were very detailed, so thematic and descriptive coding was undertaken. The above mentioned nodes were derived from the data, so the participants' responses from the transcribed data fitted well within the nodes. According to Strauss and Corbin (1998), "a code is an abstract representation of an object or phenomenon". Ryan and Bernard (2000) described codes as "a mnemonic device used to

identify themes in a text". Richard (2005, p. 132) further explained that, "Codes ranges from being purely descriptive- this event occurred in the playground, through labels for topics or themes- this is about violence between children, to more interpretive or analytical concepts- it is a reflection of cultural stereotyping". Coding is a process by which the content about a specific theme or idea is gathered or tagged. The content of any imported document can be coded in NVivo. This can be text in the document, external document, memo, media transcript, pictures or videos (QSR, 2010).

In addition to these, there are many other data management tools in NVivo, which help in arranging and analyzing qualitative data. Some of the main tools used in this study were classification and attributes, memo and links, visualization, models and reports. Classification and attributes help in asking questions in the data. For example, which strategies were used by private extension providers? Attributes also help in assigning values, for example, a particular strategy, gender or age. Memo and links are important NVivo tools, which help the researcher in reflecting and decision making as he/she conduct analysis (QSR, 2010). It gives an option of linking one response to another or one interview with the other in different ways.

Visualization in NVivo displays interrelationship and patterns in the data, which can be helpful for both as tools for analysis and for describing and sharing the results. Models in NVivo are also visualization tool mostly used for exploring the ideas and presenting them visually. Models are also helpful in representing the development of the research and to demonstrate the findings of the research to others at the end of the project (QSR, 2010). In this study models were used for data analysis as well as for presentation. For example, various models were used for representing participants' responses to a theme or sub-theme. These models (shown and explained in the next chapters) gave a visual shape to the data and represented the responses of the participants to a specific theme or sub-theme. These models also represent the multi-dimensional approach of the participants' responses to more than one theme at the same time.

2.7. Reliability and Validity

Reliability means dependability and consistency of the instrument in measuring whatever it measures, while validity on the other hand indicates the degree to which measures reflect the underlying construct or "does it measure what it purports to measure" (Liamputtong & Ezzy, 2008, p. 33). Quantitative research needs to be valid and reliable (Merriam, 1998). There is ongoing debate on the relevance of the concepts of validity and reliability in qualitative research (Kelle and Laurie, 1995). Many researchers pointed out that in qualitative research instead of the term "validity and reliability" it is preferable to use terms like "trustworthiness", "rigorousness", or "quality" of the data, it is nevertheless important that qualitative research and data analysis are carried out in a thorough and transparent manner (Crawford *et al*, 2000; Creswell, 1998; Kirik and Miller, 1986; Lincoln and Guba, 1985; Miles and Huberman, 1994; Seale, 1999). According to Richards and Richards (1991), "using software in the data analysis process has been thought by some to add rigor to qualitative research". However, qualitative research analysis software like NVivo save time for the researchers as well as provide accuracy in the data analysis. There are enough chances of mistakes or overlapping in the data while doing it manually. Many researchers (Bazeley, 2007; Creswell, 2007; Ryan and Benard, 2000; Welsh, 2002) have recognized Nvivo as a well established data analysis software package.

2.8. Categorizing data

In this study, the data have been categorized into two case studies, the first one comprised EPs (government and private) and the second one, DFs. The twenty five participants were assigned a unique identification code (shown in table 2.2 below), first letter specify the participant, middle represents the type (i.e. Government (G), Private (P) or Dairy (D) farmer) and last letter represents the state, NSW (N) and Victoria (V). The category represented the participant's type and location. The reason for doing two case studies was because of the difference in the emerging themes from the data. As the themes and sub-themes in both case studies were slightly different and derived from the participants' responses, so it was difficult to manage the data in a single case study within the same node.

Table 2.2: The participants' identifications, work experience and categories utilized in this study.

S. No:	Identification Name	Work Experience (Years)	Category
1	AGN	10	GEP/NSW
2	HGN	20	GEP/NSW
3	MGN	20	GEP/NSW
4	KGN	20	GEP/NSW
5	RGN	25	GEP/NSW
6	JPN	5	PEP/NSW
7	KPN	12	PEP/NSW
8	NPN	8	PEP/NSW
9	DFN	16	DF/NSW
10	MFN	30	DF/NSW
11	RFN	25	DF/NSW
12	TFN	30	DF/NSW
13	FGV	20	GEP/Victoria
14	GGV	18	GEP/Victoria
15	JGV	5	GEP/Victoria
16	J2GV	17	GEP/Victoria
17	NGV	15	GEP/Victoria
18	APV	7	PEP/Victoria
19	A2PV	7	PEP/Victoria
20	GPV	13	PEP/Victoria
21	JPV	23	PEP/Victoria
22	NPV	12	PEP/Victoria
23	BFV	15	DF/Victoria
24	JFV	27	DF/Victoria
25	TFV	30	DF/Victoria

GEP (Government Extension provider), PEP (Private Extension Provider) and DF (Dairy Farmer)

2.9. Summary

This Chapter provided a detailed description and justification of the methodology adopted for this study. Invitations were sent to various potential participants through emails and the interested replied back. The participants were interviewed by phone using semi-structured interview techniques. Reponses from the participants were audio recorded, transcribed into words and then thematically analyzed with the assistance of the qualitative research software NVivo Version 9.

Most of the questions asked in the semi-structured interviews contained "what" and "how"; these types of questions are best addressed by using a case study design (Yin, 2003). The study was bounded by time and place (explicit features of a case study research design) and grounded theory approach is used for data analysis. Two case studies were selected on the basis of extension professionals and dairy farmers, which are further explained in the next chapters (3 and 4).