AGRICULTURAL RESTRUCTURING IN THE SOUTH AUSTRALIAN DAIRY INDUSTRY: A CASE STUDY OF THE ADELAIDE MILKSHED

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ERRATA

Pg. 204, line 17 (additional paragraph)

Further in depth discussion of the impact of dairying in urban fringe regions of the United States can be found in research by Fielding (1962, 1964), and Gregor (1963a, 1963b).

Pg. 391, line 16

Fielding, G.J. (1962) 'Dairying in cities designed to keep people out' The Professional Geographer Vol.XIV (1) 12-17

Fielding, G.J. (1964) 'The Los-Angeles Milkshed; a study of the political factor in agriculture' The Geographical Review Vol. LIV, 1-12

Pg. 392, line 39

Gregor, H. (1963a) 'Industrialised dry-lot dairying: an overview 'Economic Geography Vol.39, 299-318

Gregor, H. (1963b) 'Urbanisation of Southern Californian Agriculture' Tijdschrift voor economische en sociale geografie VOL 54, 273-278

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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ABSTRACT

Over the last two decades a great many farmers in the Adelaide Milkshed (that is, the region supplying Adelaide with its liquid milk), have left the dairy industry which has led to a decrease in milk production relative to demand. Based on the results of two surveys (one of current farmers and one of ex dairy farmers) analysed within a systems framework, deteriorating perceptions of lifestyle, the cost price squeeze and urban expansion are identified as significant causes for this process of restructuring within the dairy industry. How the dairy farm system operates and the means by which farmers can adopt to malfunctioning or breakdown within the farm system is also discussed. Reasons for farmers leaving the dairy industry are explored. Improved management of the farm, and relocation of dairies to the south east and mid north of South Australia are considered as possible options for increased milk production.

ACKNOWLEDGEMENTS

I would like to give my sincere thanks to the South Australian Dairyfarmers' Association, its two executive officers, Mr Terry Inglis and Mr Adrian Scott, its members, the dairyfarmers, for access to their records and personal experiences, without which this research would have been impossible.

Much assistance was received from many other areas of the dairy industry, and contributions and advice from the Metropolitan Milk Board, South Australian Bulk Milk Handlers, Dairyvale, Farmers Union, and staff of the South Australian Department of Agriculture were invaluable. Financial assistance from the Cattle Compensation Fund of the Department of Agriculture was crucial to the project's completion.

Grateful appreciation is extended to my supervisor Derek Smith, whose expertise, encouragement and contagious enthusiasm enabled me to complete the research.

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CHAPTER 1

INTRODUCTION

Milk in South Australia is marketed in one of two forms:

a) liquid milk, used for direct human consumption and cream production, and

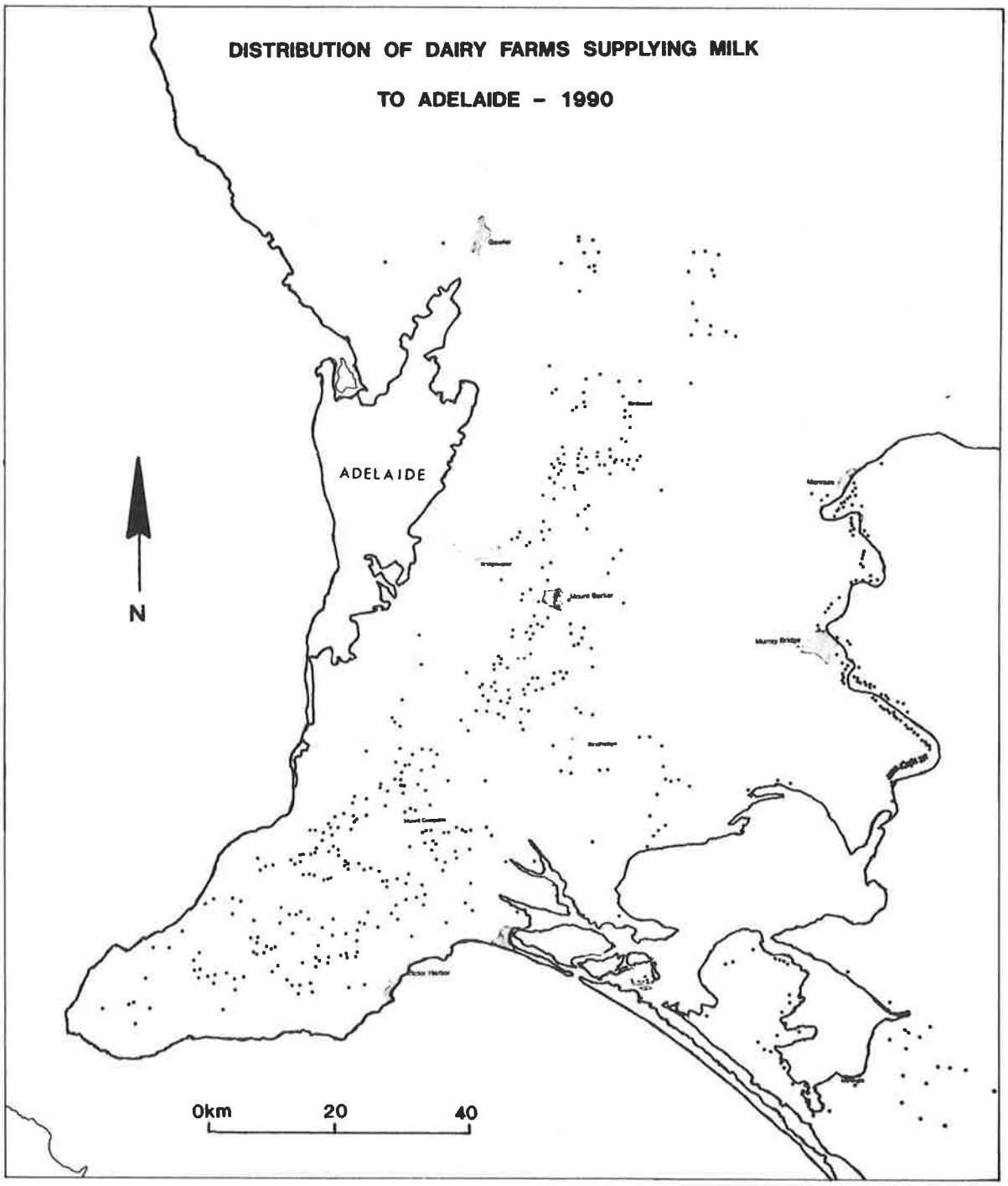
b) manufacturing milk, used in the production of milk based products.

The vast majority of South Australian dairy farmers is involved in providing manufacturing milk, but the liquid milk for the residents of the Adelaide metropolitan area is obtained solely from farmers located in the Adelaide Milkshed region, under the jurisdiction of the Metropolitan Milk Board (figure 1.1).

Early in 1990, in response to a prolonged decline in the number of dairy farmers in the Adelaide milkshed, the South Australian Dairy Farmers Association (S.A.D.A.) attempted to define clearly the problems being faced in the dairy industry, the origins of the problems, and possible solutions.

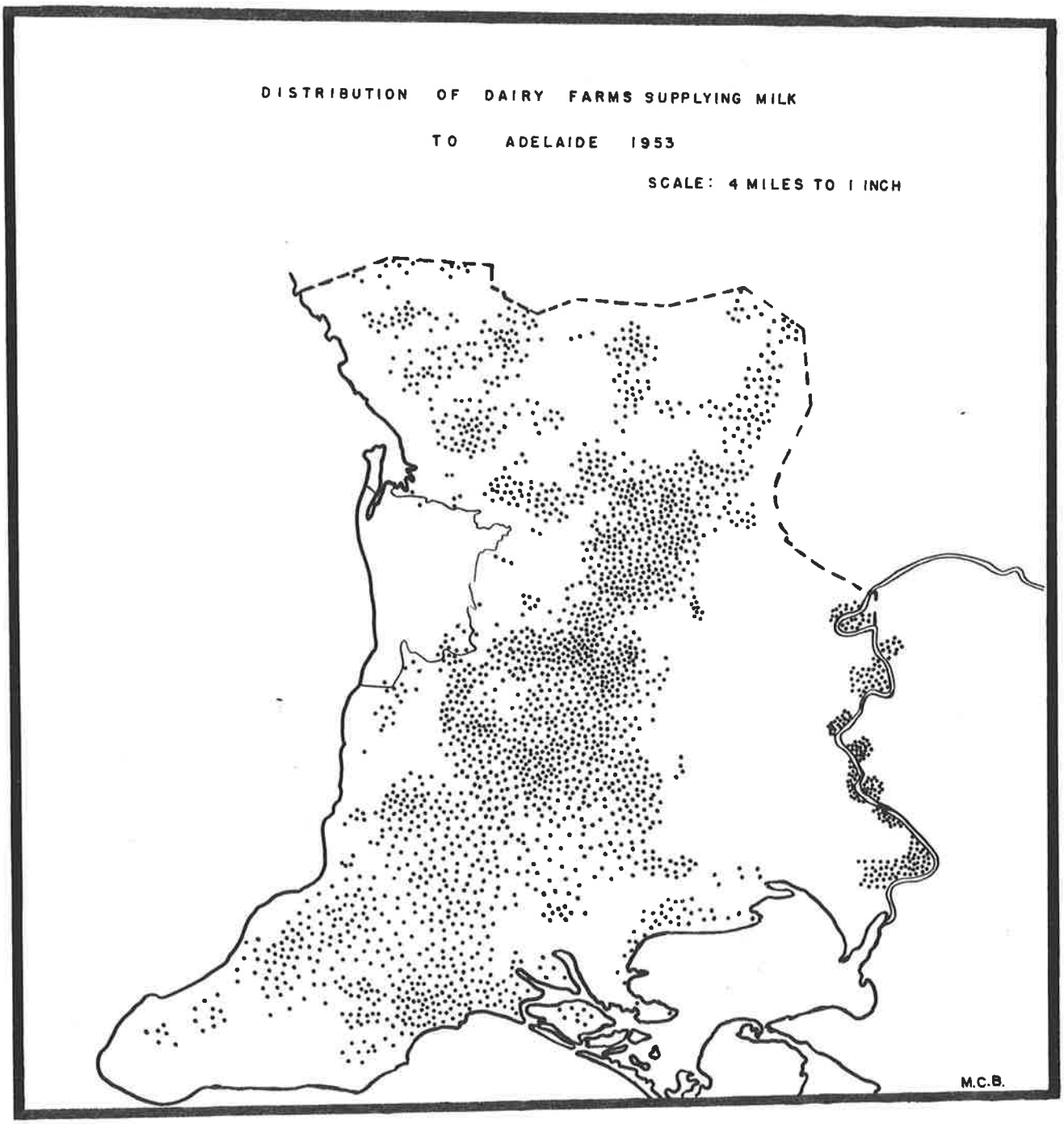
The decline in farmer numbers is revealed in figures 1.1, 1.2, and 1.3. Although this decline has been offset by an increase in the average number of cows per farm (figure 1.4), and average farm size (figure 1.5), throughout the region there has arisen, nevertheless, a

Figure 1.1 Distribution of dairy farmers supplying milk to Adelaide 1990



Source: S.A. Bulk Milk Handling Company

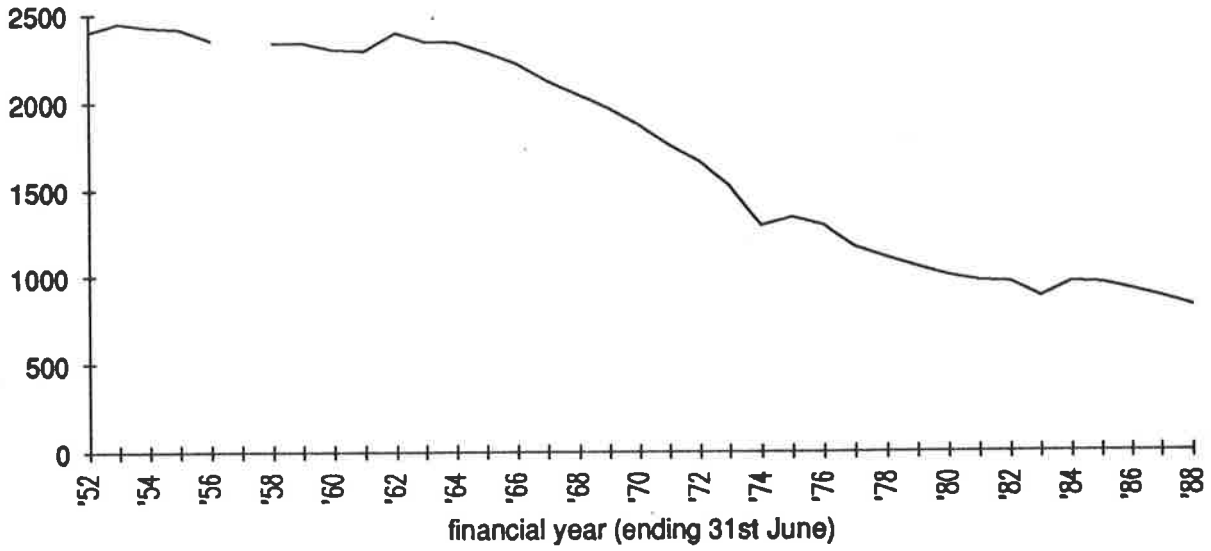
Figure 1.2 Distribution of dairy farmers supplying milk to Adelaide 1953



Source: Bennier, 1953

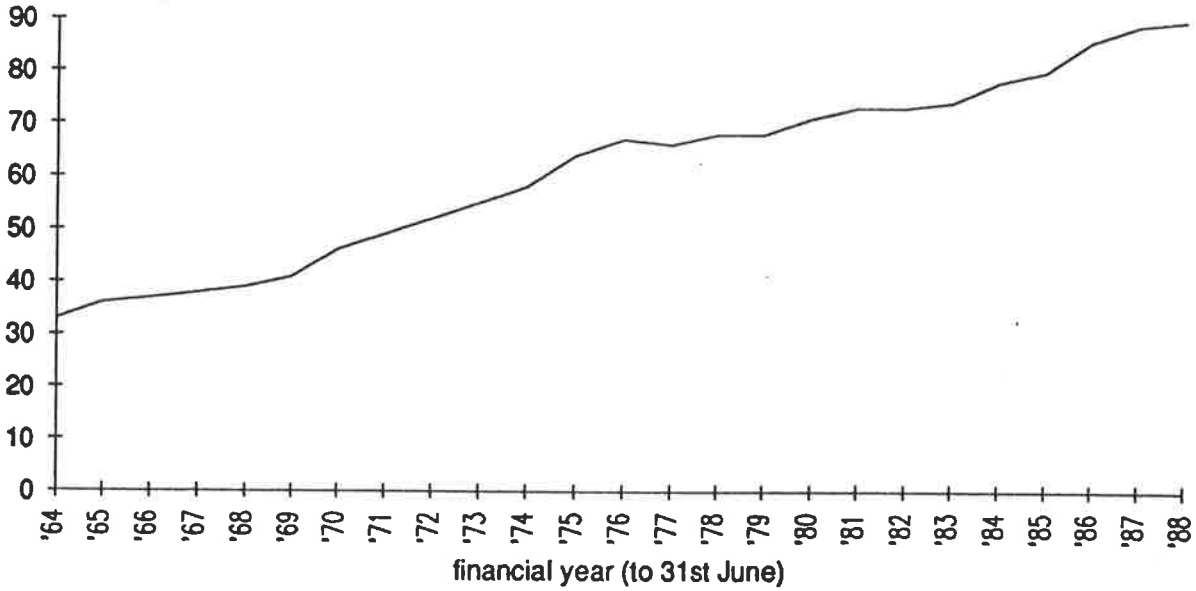
Figure 1.3

Number of licensed milk producers (M.M.B region) 1952 - 1988



Source: MMB data

Figure 1.4 Average number of milking cows per farm (MMB region)



Source:MMB data

Figure 1. 5 Number of farms by size (ha) in 1975, 1979 and 1989 (MMB region)

Source: MMB data

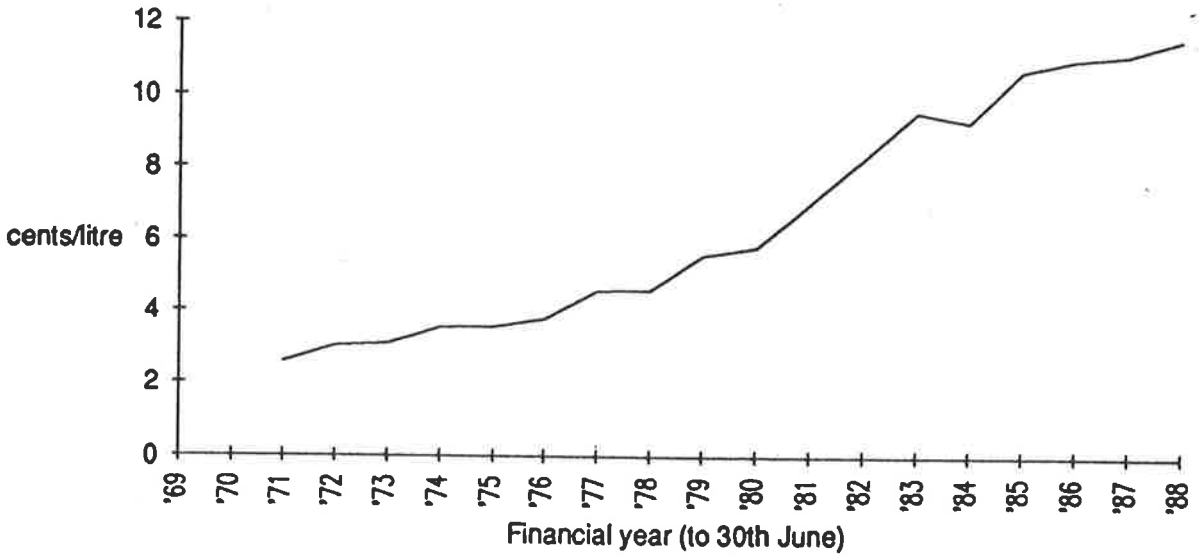
serious concern that growing demand is placing increasing pressure on supply. Similar trends have been occurring in all the other dairying states of Australia.

A variety of causes was proposed by the S.A.D.A. to explain these changes, and a primary aim of this research has been to determine the validity of these perceptions, from a detailed survey of those being affected, the farmers themselves.

Economic factors, including the cost price squeeze which is being applied to almost all agricultural enterprises and thus deteriorating financial returns (figures 1.6 and 1.7), high interest rates, more profitable alternatives for landuse (especially subdivision for urban expansion), and an inability to increase property size because of high land prices, were seen to be major contributing factors. Interstate milk trading was also viewed as posing a potential problem.

Social factors were also seen as significant causes of change within the region. These included the increasing age of farmers, and the failure to replace these farmers after retirement, the high labour inputs and long hours required by dairying, and poor transfer of information to and between farmers.

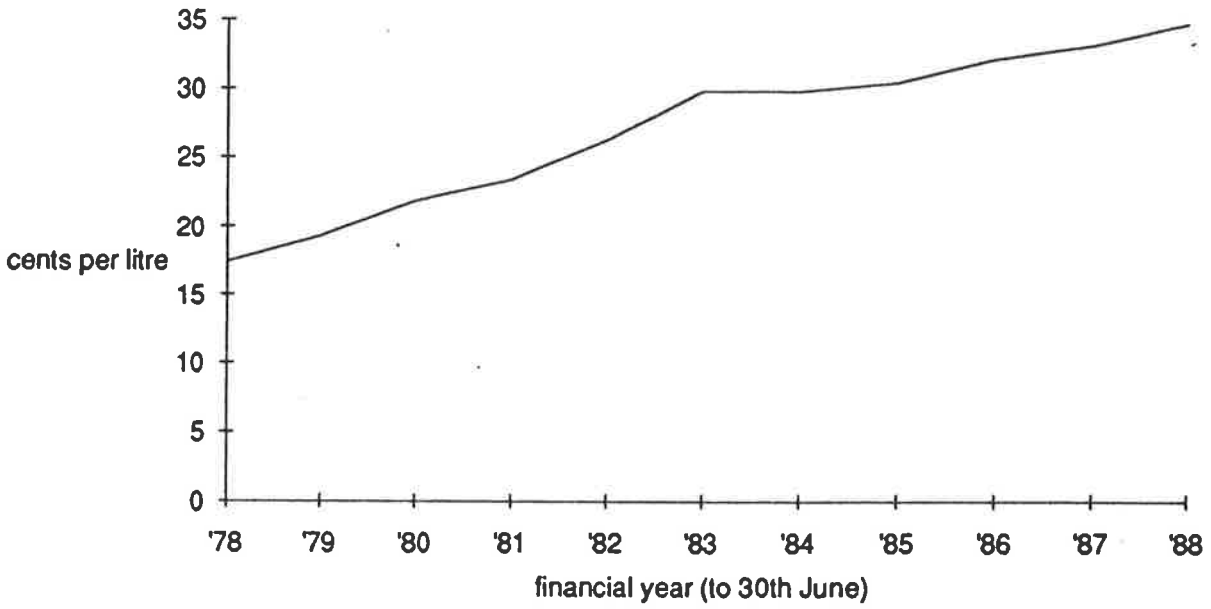
Figure 1.6 On farm costs of production (c/litre) (MMB region)



Source: MMB data

Figure 1. 7

Gross return to producer (in Adelaide Milkshed) per litre, 1978 - 1988



Source: MMB data

Environmental factors within the region were also considered, including the declining productivity of pastures, problems of effluent disposal (particularly in the Adelaide Hills and along the Murray River), increasing government planning regulations, environmental degradation, and other constraints to farm expansion such as soil type, slope and climate.

There was also considerable concern shown over the perceived overregulated nature of the industry and other constant government interference. Pricing arrangements continued to promote conflict between government, farmers in the Adelaide milkshed, and farmers elsewhere in the state, causing much dissatisfaction within the industry as a whole.

The two milk processors, Dairyvale and Farmers Union, were primarily concerned with the inadequacy of milk supplies at certain times of the year which has resulted from declining production relative to demand. Liquid milk supplies are not yet threatened, but milk which would normally by used for manufacturing purposes has been diverted to liquid milk processing in 1990 and 1991.

In view of the pressures building up within the dairy industry in the region, the processing companies proposed relocation of some dairy farmers outside the milkshed, to

the Upper and Lower South East of South Australia (On the land, March 28, 1990), and to the Mid North of the state.

It may also be that farmers supplying manufacturing milk may increase in size or production in these alternative locations leaving farmers in the Adelaide milkshed to specialise in the supply of the liquid milk requirements of the Metropolitan area.

The situation is further complicated by indications that the very process that is increasing the demand for milk (i.e. population growth) is tending to curtail production as a result of urban expansion in all its manifestations. This trend appears to have much in common with a large body of theory concerning the impact of urban expansion on rural landuse from Von Thunen (1842), Sinclair (1967) to Bryant (1974, 1981, 1982), and in the context of the Adelaide Hills, Menzies and Bell (1981).

However, urban growth is but one factor contributing to the widespread occurrence of adjustment or restructuring within the dairy industry. This adjustment is a consequence of a complex combination of economic, environmental, social and political forces interacting over many years.

For some farmers this restructuring phase may result in their making the 'ultimate' adjustment, deciding to leave dairying all together. For others it may mean adjusting the already established farm enterprise, for example, improving herd quality, increasing herd size, upgrading capital equipment, diversification, decreasing farm expenditure, adopting more environmentally sustainable management techniques and/or farming part time and seeking off farm work.

Given all these on-going and potential changes and conflicts what does the future really hold for the South Australian dairy industry? The mass of conflicting claims between government, processors and farmers merely serves to cloud the issue. Are declining numbers of farmers and levels of milk production really problems when viewed from a longer term perspective? Can farm practices be improved to increase productivity within the present milkshed, or is the relocation of many of the milkshed's dairy farmers to other agricultural regions of the state necessary? Perhaps expansion of the milkshed to encompass dairy farmers in other regions is a solution.

One way to approach the problem is to view the dairy farm as a system designed to supply Adelaide with liquid milk. It includes the cow, the feed, the farmer, the capital and land, as well as those components of the system

involved in getting the milk to market. It is this system which is currently under a great deal of stress, the ultimate consequences of which may be advantageous to the industry (for example, fewer more efficient and prosperous farmers producing more milk relatively more cheaply), or disadvantageous (such as reduced milk supplies, with farmers degrading their resources, using poorer land at a greater distance from the market place, paying higher costs of production and suffering family and community disruption).

The various stresses identified above provide considerable evidence to support the proposition that the environment within which the milk production system operates is undergoing profound change, the consequences of which have been a movement away from equilibrium in the system. If this is indeed the case, how has the total environment of the system changed, what are the manifestations of the disequilibrium, and how must the system be restructured to restore equilibrium?

This study seeks to understand how, and to what extent, the dairy farm system is coping with this period of restructuring, and to assess the validity of perceived problems within the industry.

CHAPTER 2

OBJECTIVES AND OUTLINE OF THESIS

As the previous chapter shows this study arose out of the concern felt in many sectors of the dairy industry over the decline in the number of dairy farms in the Adelaide region, and the threat that this poses for Adelaide's future supplies of liquid milk.

In this context the primary functions of the study are to reassess the economic, social, environmental and political factors which are impacting upon that part of the dairy industry which supplies liquid milk to the Adelaide market. At the heart of the study is a detailed examination of the individual dairy farmers, in an attempt to determine to what extent they are restructuring their farming systems in response to these forces. This leads inevitably into a consideration of adjustment in the form of possible alternative locations from which to supply Adelaide's demand for liquid milk.

To achieve these goals, an analysis of why farmers produce milk the way they do and the circumstances which cause them to make changes to production and management was carried out. In the process of analysis, a model was developed which facilitates an understanding of the dairy farm as a system aimed at achieving a number of

objectives. This model of the dairy farm was then used to explain the decline in number of dairyfarmers in the Adelaide milkshed. In this context it was considered necessary to define and analyse the processes causing structural and locational change in the industry (i.e. causes of industry restructuring and adjustment to a changing environment).

In so doing, the thesis provides answers to the following questions:

i) How does systems malfunction in dairy farming manifest itself?

ii) What has caused the malfunction?

iii) How have farmers responded to system malfunction?

iv) What obstacles exist for farmers adopting change

v) What possible locations exist for increased liquid milk production?

To achieve these ends the remainder of the thesis takes the following course.

Chapter 3 reviews a variety of methodological approaches to studying farming enterprises in a geographical context and concludes that the "systems" approach is the most appropriate means of assessing the complex interaction of economic, social, political and biophysical forces which are impinging upon the dairy industry in South Australia.

The system under review is identified as that leading to the production of liquid milk for the Adelaide region. A major purpose of the system, but not the only one, is to provide sufficient liquid milk to the Adelaide Metropolitan area.

Other major objectives of the system are to provide an economically viable and socially acceptable living for the farmers. This study seeks to understand if, where and why the system is failing to meet these objectives, and thus if and how the system is being adjusted and may be adjusted in order to continue to meet its objectives.

The chapter concludes with a description of the survey methodology adopted by this study.

The behaviour of individual farmers is a function of the characteristics of the farmers themselves and the environment within which they make their decisions. Chapter 4 therefore examines some of the theories which relate to the decision maker, while chapter 5 looks at biophysical, economic, institutional and urban fringe aspects of the decision making environment which are important to dairy farmers.

To achieve this end, and to understand the farmer's behaviour under such circumstances, it is necessary to examine the individual decision making unit, the farm firm. It is equally as important to understand the decision making environment and to appreciate that the behaviour of individual farmers cannot be simply deduced from events in the environment. Each farmer is different, and often individual behaviour is a consequence of an incomplete and inappropriate assessment of the decision making environment. It is the perceived environment to which the individual responds.

Only with such an understanding will it be possible to determine to what extent market forces can be left to 'control' the outcome of this entire period of change, how much planning and regulation there should be in the South Australian dairy industry, and the directions which that planning and control should take.

As a contribution to this objective therefore, the present study seeks to define and analyse the processes causing change on individual dairy farms, and to investigate possible alternative locations for dairy farmers seeking to supply the liquid milk market. The following chapter provides a more detailed statement of the objectives and structure of the present study.

Chapter 6 outlines the range of behavioural responses farmers make to situations of stress and disequilibrium within the farming system, ranging from slight adjustments in present farm management to leaving dairy farming altogether.

Using the findings of the present survey of enterprises, chapter 7 assesses the on-farm resources available to dairy farmers. Human, land, and capital resources utilised by the farmers are examined. This is followed by a discussion of how these resources are combined within the farm system by means of land and pasture management strategies to produce milk. Also considered is the extent to which these resources are used by the sample farmers for purposes other than milk production, that is the extent and nature of enterprise diversification.

Chapter 8 considers how dairy farmers are responding to malfunction within the farm system discussed in chapter 7, and discovers strategies such as improved management of existing resources, changing the resource mix, changing use of all resources, moving elsewhere (including a discussion of possible locations), off farm employment and selling the farm and leaving dairying. The latter section also includes the results of the survey of farmers who have left dairying within the last three years. The chapter concludes with an examination of

farmer opinions on the future of their dairy farms, and the South Australian dairy industry as a whole.

The study concludes with a summary of the current situation, an assessment of the study's value to geographical and agricultural enquiry, and suggest the relevance of its results for government and industry policy in the future. The implications of new legislation to be implemented in July 1993 are considered and avenues for further research are also explored.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Agricultural geography is concerned with the spatial (geographical) organisation of agriculture and is one of the oldest branches of geographical enquiry.

Until the 1950's, agricultural geography was primarily descriptive, with emphasis on two approaches, one describing landscapes (physical features, climate, soil, topography and so on) as the main way of explaining why certain crops and farming enterprises were located where they were, and the other, based on comparison of real world situations with theoretical models of agricultural location. During the 1970's and since that time, systems analysis has been developed as an additional method of analysis.

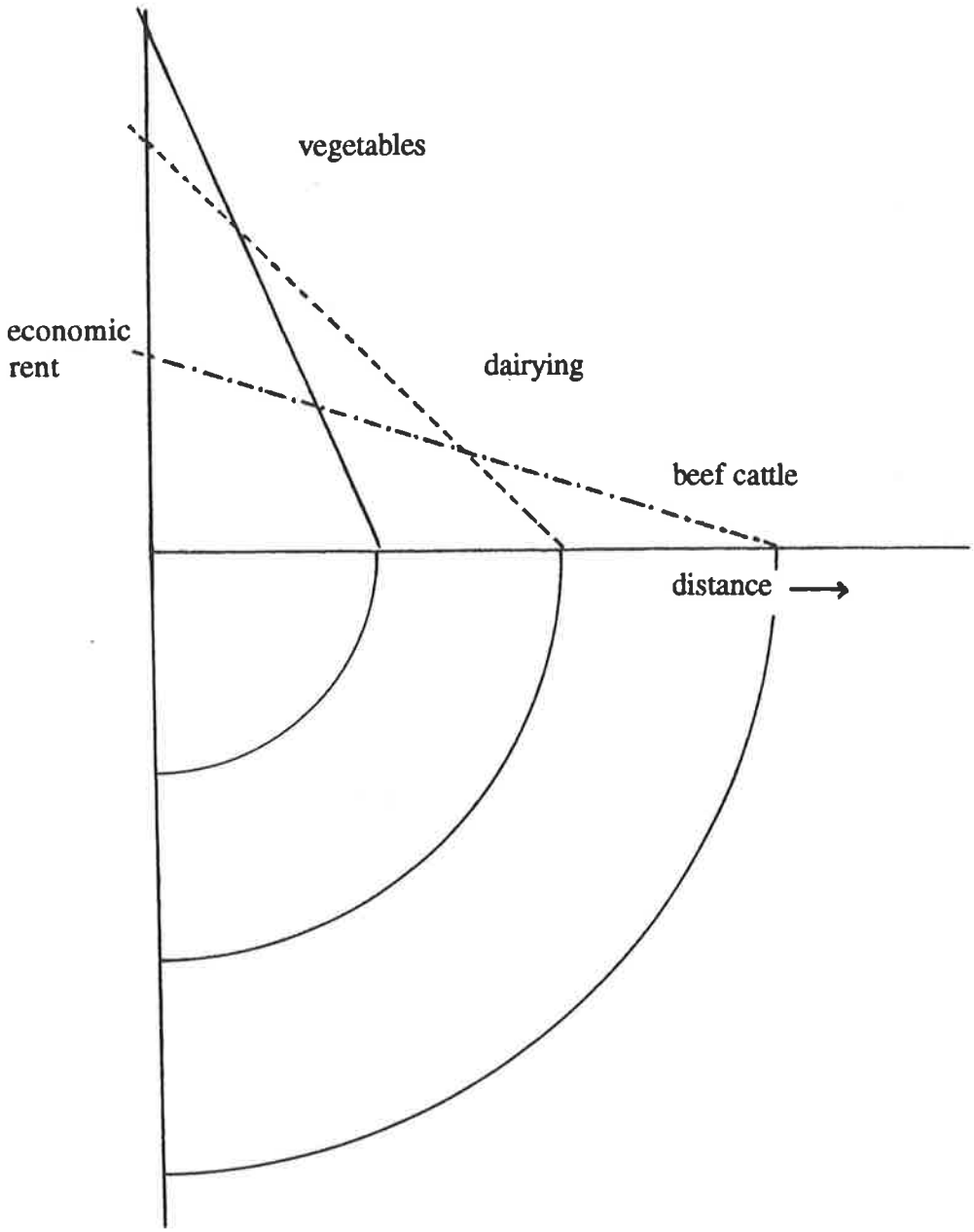
3.2 Locational modelling

The use of locational modelling was first based heavily on the theory of spatial location and economic rent developed by Von Thunen. He argued that the areal distribution of crops and livestock depended on the competition between products and farming systems for the use of any particular plot of land. On any specific piece of land, the enterprise yielding the highest net return

would be conducted. The further the farmer was from the market, the greater his transport costs and therefore the less was the residual difference between the market price and costs of production. This meant that the surplus above costs (known as economic rent) for any one commodity would decline with distance from the market. The economic rent was the return to a factor of production (in this case land) over and above that needed to keep the land in that kind of production (for example, dairying). As Harvey (1966, 363) explained, "different commodities will have differently shaped rent functions over space since the impact of transport cost will vary according to the bulk and perishability of the commodity". In other words, the process of competition for land would force farmers to undertake the enterprises which yielded the highest economic rent. Diagrammatically, the result was a set of concentric rings surrounding the market place (illustrated in figure 3.1).

The model is restricted in its applicability to real world situations by assuming completely rational behaviour and the availability of complete information for the decision maker. Harvey (1966, 364) argued that before any extensions to real world situations can be made, the assumptions needed to be considered carefully to avoid errors in locational prediction. Further, he

Figure 3.1 Diagrammatic representation of Von Thunen's theory of agricultural location



suggested that it must be recognised that the model ignores change over time in technology, demand, and transport costs. Certainly economic models do take these as given at any point in time, and they say nothing about why and how they change. Harvey also argued that it "fails to consider the economies of scale inherent in a large settlement compared to a production system developed around the tiniest settlement" (Harvey, 1966, 364). For example, the dairy industry providing liquid milk to a metropolitan area may permit greater economies of scale compared to a dairy farm system established around a small country town (e.g. Adelaide and Mount Gambier).

Rhind and Hudson (1980, 166) agree that "a considerable body of empirical evidence has accumulated which suggests that such patterns are commonly found at farm or village level". However, they suggest that there is evidence that "even when these postulated processes are not dominant, concentric land use patterns may still be observed" (Rhind and Hudson, 1980, 171).

With the 'quantitative revolution' in geography during the 1960's, alternatives to Von Thunen's concept of concentric rings in an agricultural context began to take precedence.

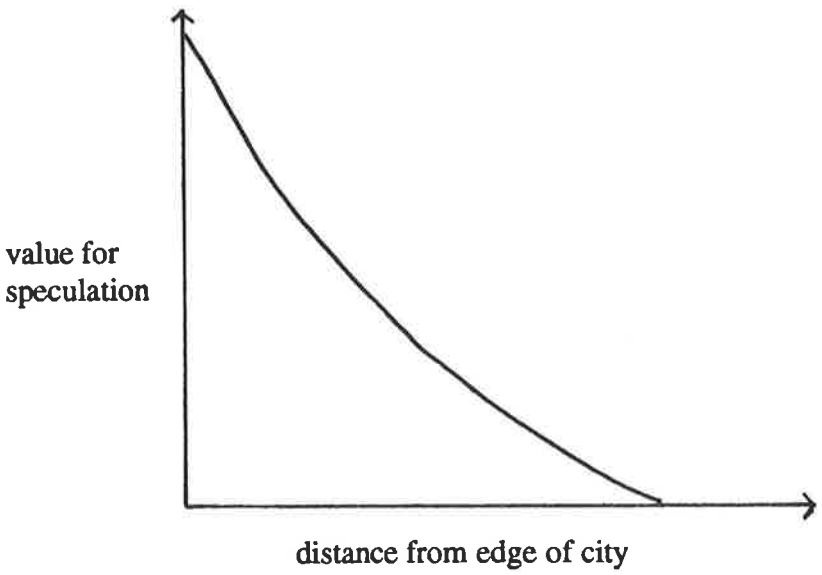
Spatial equilibrium models were developed using linear programming to determine the optimum pattern of one or more crops. Using this method it was deemed possible to determine where production should be located if certain goals were to be achieved (Harvey, 1966, 366), for example, the highest average profit among producers. Decision making was based on the use of data from actual properties enabling "many of the disadvantages of completely normative models [to be] eliminated" (Harvey, 1966, 367). On the other hand, it assumed homogeneity of a product between regions, constant production coefficients within regions, and that farmers were aiming to maximise productivity and profit.

In the context of rural/urban landuse competition Alonso (1960) developed his own variation of the economic rent model, whereby only those agricultural firms producing high economic rent per hectare would be able to survive competition with urban uses. The model was extended further by Alonso in 1964 with his suggestion of the 'trade off model'; households would trade off accessibility for space in making residential site choices. The transportation costs would be the sole determinant of location rent.

Sinclair (1967) argued that both Von Thunen and Alonso's theories were wrong and that a complete reversal of the

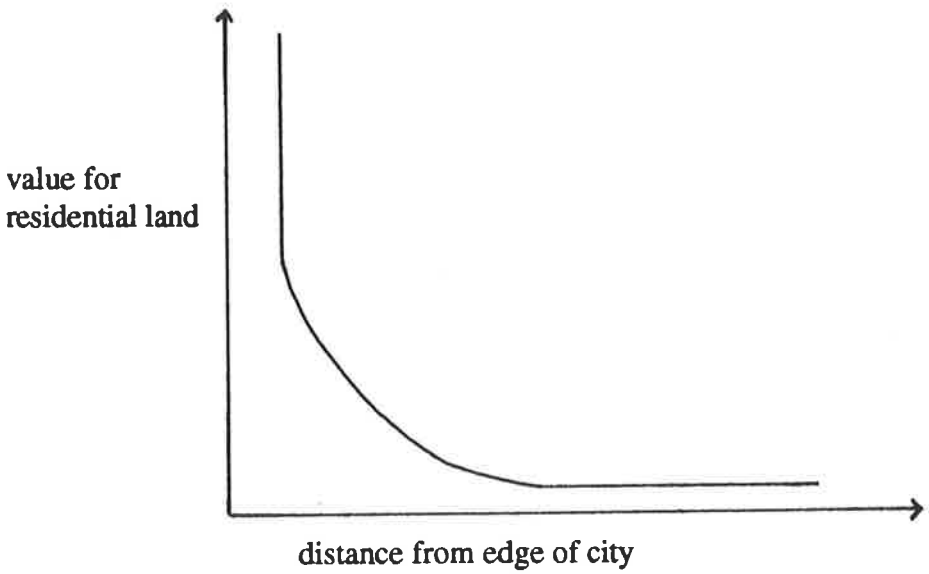
economic rent model was more appropriate in explaining location of agricultural enterprises in proximity to large urban areas (Found, 1974, 75; Smailes, 1988). Sinclair suggested that instead, distance decay functions had little to do with the market distance relationship but reflected the demand for rural land by various interests (ie. the land's potential for urban development, the land's value as a rural residence, and the effects of urban employment on farm output). The diagrammatic representation of the impact of these various demands can be found in figure 3.2. The closer the farm is to the city, and therefore potential urban development, the more reluctant the farmer may be to undertake investment in property or undertake intensive landuse over a short time span. This is an example of the principle of land use competition whereby urban users can afford to pay higher prices for the land than can farmers in the same location, as illustrated in figure 3.3. In such a situation, if demand for rural land as a residential area is great enough, urban buyers will outbid the value of land for agricultural purposes. Prices paid by residential users would reflect proximity to services or preferred location. Furthermore, Sinclair suggested that expectations of urban development could affect the current landuse as well as its potential value.

Figure 3.2 Speculative value - distance from city function



Source: Found, 1971, 76

Figure 3.3 Function relating residential value of rural land to distance from city



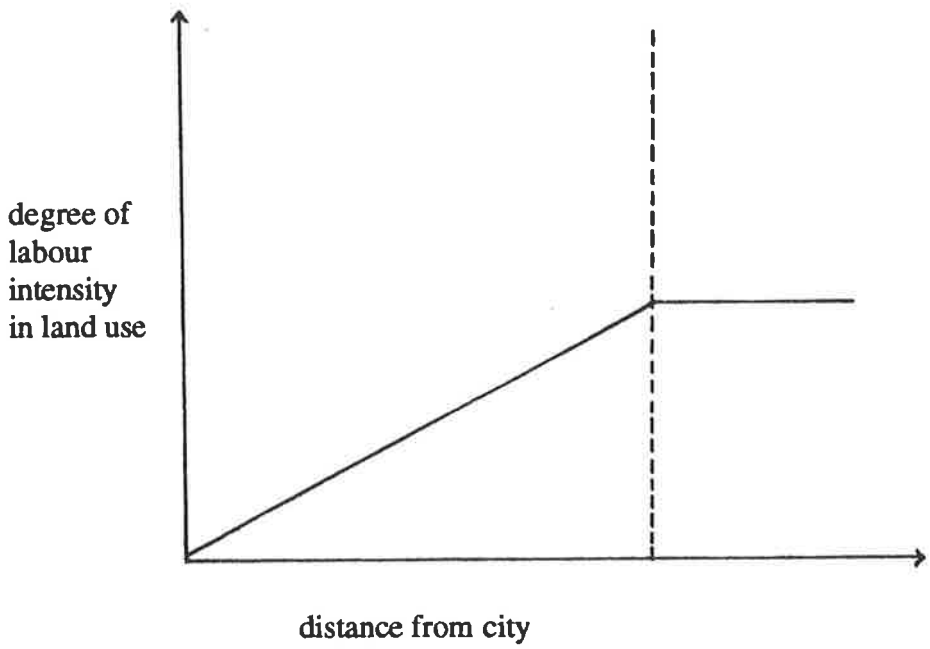
Source: Found, 1971, 77

Figure 3.4 illustrates the concept that up until a certain distance from the city, people from the farming communities would have the opportunity to commute to the city for work. As distance from the city increases, there are more people involved in working on the land. Under some circumstances the availability of off farm employment may enable the farm family to continue farming an otherwise unviable property, and off farm employment will be more available closer to the urban area.

Further development and discussion of Sinclair's model, developed to explain changes in agriculture on the fringe of cities will be dealt with in chapter 5 of this review.

The above models concentrate primarily on land and therefore are only partial explanations for the location of agriculture, especially around cities. Smailes (1988) discussed the value of Nordgard (1977) in overcoming the failure to consider capital, labour and management as other factors influencing agricultural location. Nordgard argued that agriculture was under pressure from competition for land and labour whereby a loss of labour led to a change in landuse. Where there was no non-farm demand (e.g. from urban expansion) for land, farmers were reluctant to withdraw labour from the farm, and they were less willing to see it run down. Where strong demand from urban growth existed for farm land, a much higher

Figure 3.4 Function relating land-use intensity with distance to city



Source: Found, 1971, 78

potential income (from the sale of land, or availability of off farm work) might tempt them to leave farming. Again, the implications of these models with regard to the rural urban fringe will be considered in greater depth in the relevant section of this review.

So what is the significance of such models to the current research? Dairying has always tended to locate close to the market (as Von Thunen predicted). As a result, the industry has tended to be vulnerable to urban expansion, perhaps for the reasons postulated by Sinclair and other modellers of fringe areas and it remains to be seen how much impact 'economic rationality' has in a real world agricultural situation. The current study seeks to compare the dairy industry in the Adelaide region with these models and to discuss their applicability to the real-world situation. The research is also seeking to determine the significance of economic rationality in farm management decision making.

3.3 Systems analysis

3.3.1 Introduction

An alternative to traditional economic locational theory can be found in "systems analysis" which accepts that there are many elements within a system each interacting with the others, while the system also interacts with other systems. In such an approach location theory

becomes an important component rather than the absolute focal point. It is not only economic theory which can then be incorporated into the assessment process, but also, for example, the impact of the urban fringe on the decision making processes occurring within the system, the role of political economy, the farmers' decision making characteristics, and the physical environment.

The value of the systems approach therefore lies in its ability to bring together all aspects of the dairy farming system and its external environment and provide an integrated means of analysing the system's economic, environmental, and social sustainability, both in the short and the long term.

3.3.2 General concepts

Definitions of the concept of a 'system' vary considerably, but it can probably most adequately be defined as "a group of interacting components, capable of reacting as a whole to external stimuli applied to one or more components and having a specified boundary based on the inclusion of all significant feedbacks" (Roseworthy Agricultural College, 1990).

This is, of necessity (at this point) a very general definition. A frequently used example of a system is that of an 'ecosystem', a collection of organisms (plant,

animal, microbial, and inorganic elements) which interrelate with one another, and with their physical environment. The ecosystem forms a basis for the science of ecology, and implies that the whole entity is analysed, as opposed to the study of the individual parts (Commission of College Geography, 1968, 1).

There are many other types of systems, and they can be found in such diverse disciplines as engineering, biology, sociology, agriculture and geography. Those of greatest significance in the context of this research (i.e. sociology, agriculture and economic geography) will be dealt with in greater depth in another section of this chapter. However, despite this great diversity there are certain fundamental concepts which are basic to all types of systems analysis and a descriptive definition of each of these concepts follows:

a) interaction ; a process whereby the effect of one factor varies with the level or strength of another (Conway, 1985a, 34; Marten, 1988,294).

b) feedback: the carrying back of the effects of a process to their source so as to modify these effects and continue to make equilibrium.

The following definitions are taken from the Commission on College Geography 1968 (1-3) study on systems in geography.

c) homoeostasis: maintenance of the balance in the system (also known as equilibrium),

d) entropy: tendency towards disorder, and/or randomness,

e) negative entropy: movement in the direction of increased order,

f) open system: a system requiring energy for its maintenance and preservation,

g) closed system: a system possessing clearly defined closed boundaries across which no import or export of materials or energy occurs,

h) environment: the larger system to which a system belongs, and

i) components: the small subsystems within a system.

The value of systems analysis lies in its ability to direct attention to all the interacting elements which make up a system and thus help understand why a system is malfunctioning or decaying, thereby providing insight into how the system can be improved (for example, made more productive).

3.3.3 The role of systems in economic and agricultural geography

A point often overlooked when systems theory is applied by other disciplines is that many systems operate over

space - therefore there is an important geographical dimension to many systems. Understandably then the concept of systems analysis has become popular in geographical studies in many ways, particularly because of its applicability to the multidisciplinary approach adopted in assessing many geographic phenomena. Analysis of an agricultural system can particularly benefit from such an approach. The Commission of College Geography (1968, 22) cited the following distinguishing features of an agricultural system: - its environmental constraints, attitudinal variations, size of the farm, tenure, marketing, and the general economics of agriculture (labour, technology and comparative advantage).

Duckham and Masefield (Roseworthy Agricultural College, 1990) suggest the aims of food production systems are to optimize inputs of human skills, human and animal work, abiotic materials of mainly industrial origin (herbicides, fertilizers, machinery), suitable genotypes of plants and animals and interfarm inputs such as purchased feed or breeding cattle in order to

- maximise plant growth,
- minimise plant and animal wastage,
- obtain either an adequate economic return or subsistence level, and
- be capable of reduction, expansion or adjustment to meet changes in demand for particular

components (Roseworthy Agricultural College, 1990).

Obviously, given these definitions, agricultural systems can be extremely complex, and the analysis of the entire system is not always practical. One means of investigating an entire agricultural system is to consider the farming system as a component of the agricultural system. According to Wilson (1988, 28-30), a farming system is a particular design of an agricultural system which has been clearly defined and properly analysed and compared with others. It is a disturbed ecosystem, manmade in an attempt to "obtain certain advantages over a situation without a system" (Roseworthy Agricultural College, 1990, 30).

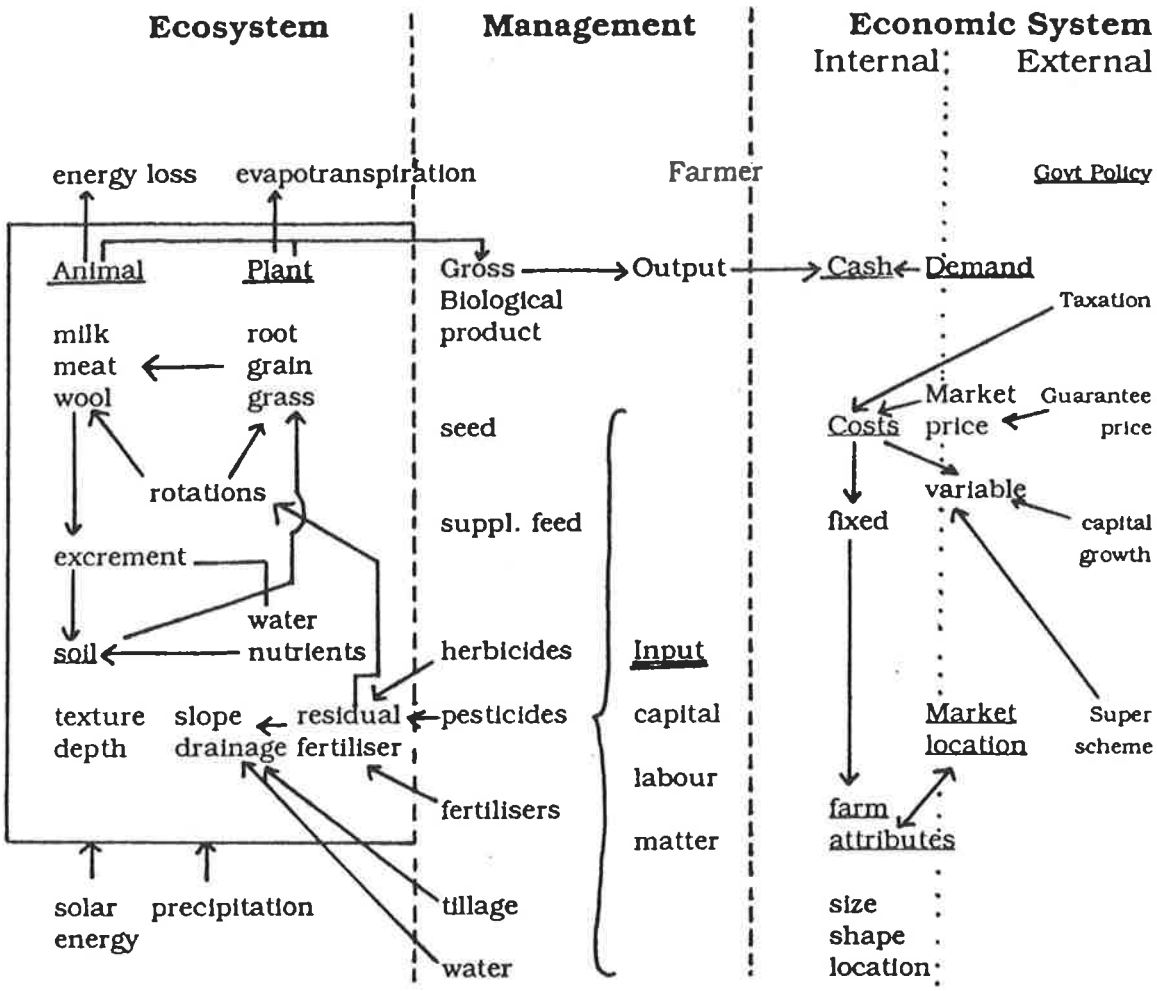
Even more specifically, Wilson (1988, 17-18) argues that the more the 'normal' ecosystem is disturbed, the more the farmer has to monitor and intervene in the system if productivity is to be maintained. Like any ecosystem, the farming system is dynamic and is constantly changing. Any artificially imposed order tends to revert to disorder (for example, a paddock returning to weeds requires spraying with herbicide and intervention to restore 'order') and the constant intervention required to stop this trend is a characteristic of any highly capitalised farm. Indeed, it is a major distinguishing factor in

comparing a human constructed with a naturally occurring ecosystem.

Within the farm system boundary there will be a number of subsystems. For example Wilson identifies the plant production subsystem, the animal production subsystem and the management subsystem; Cooke and Johnson (1969) illustrate three different subsystems in their model of a farm system (shown in figure 3.5), the ecosystem, the management system and the economic system. Norman and Collinson view it from a slightly different perspective (figure 3.6). Anderson et al. (1985, 77) make the distinction between the human and technical components of the farming system (illustrated in Figure 3.7).

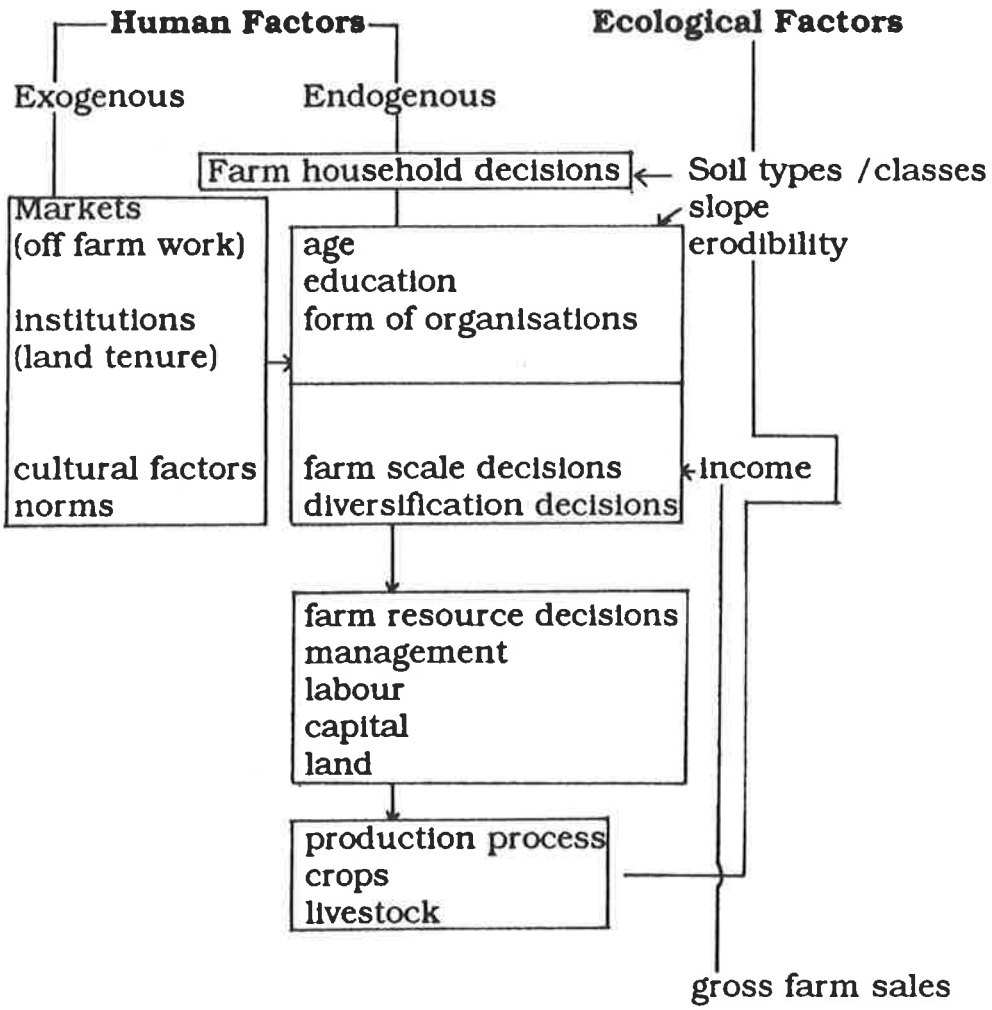
Whichever one of these models (or one of many others) is considered, the important underlying principle is still the same - where a high level of interaction of many components in a system exists a change in one of the components will result in alterations to other aspects of the system. Management decisions cannot be made (successfully at least) by the decision maker unless consideration is given to all the important interacting elements in the system in addition to factors outside, in the system environment, over which the farmer has little or no control (but would like, and has often sought, more control). It cannot be forgotten that a farm does not

Figure 3.5 Model of farm systems



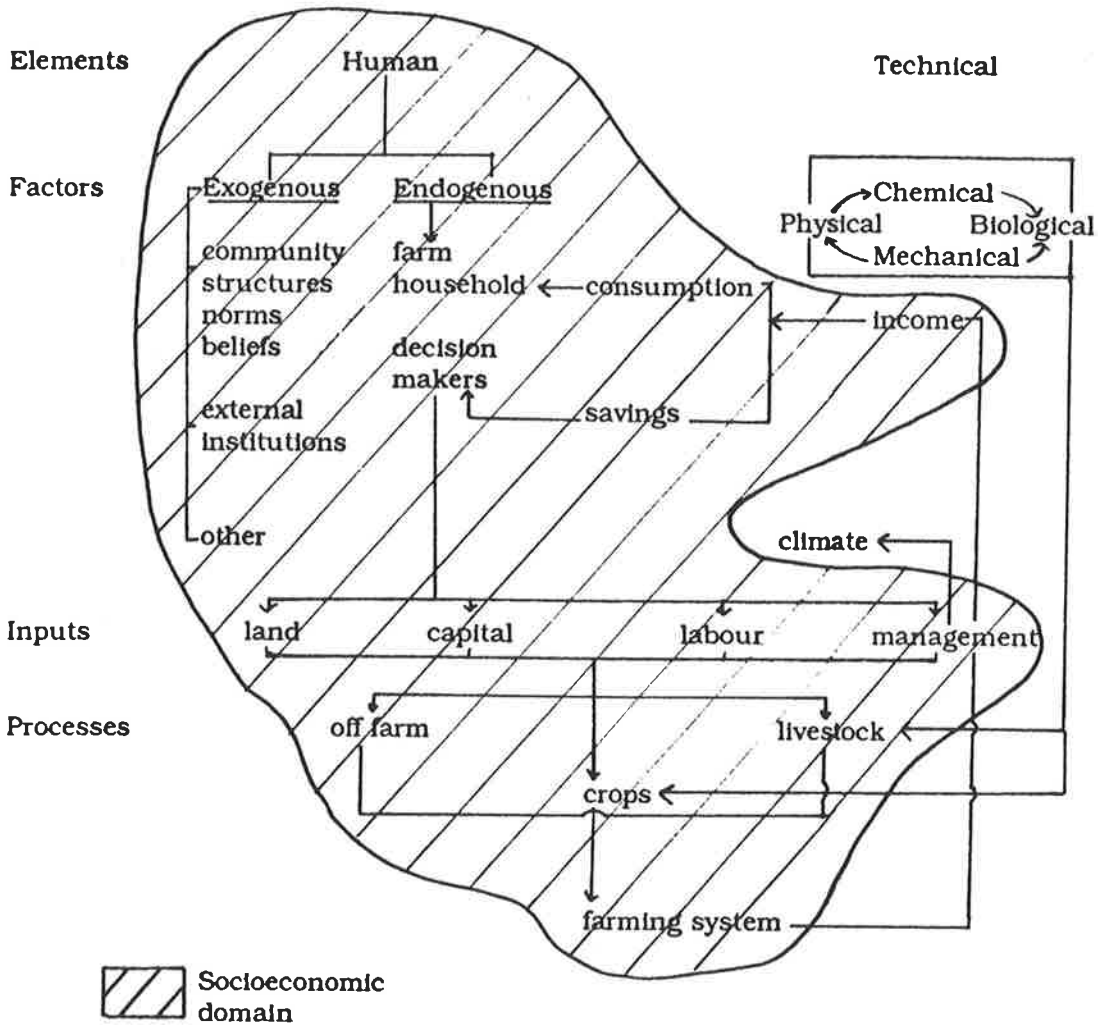
Source: Cooke and Johnson, (1969)

Figure 3.6 Model of farm system



Source: Norman and Gilbert, 1982, in Anoiske and Coughenour, 1990

Figure 3.7 Socio-economic modelling



Source: Anderson et al.,(1985), 77

function in isolation. As Wilson (1988, 29) notes, each farm is a subsystem of an agricultural region containing many similar farms and associated service industries. In this way farming could also be said to be an example of a human activity system. Already an important distinction can be drawn, between the decision maker (the farmer), and the decision making environment, a distinction which will later form the basis of a model of the dairy farm system (figure 3.12).

Throughout this century the means of improving a farm system has often been left to the agricultural scientist or the agricultural economist. The systems approach helps to add a more 'human' dimension to solving production and profitability difficulties on farms by recognising the importance of social organisation to agricultural production (e.g Cruise and Lyson, 1991, 52). The economist may be able to determine optimal production levels using modeling, or a scientist establish a highly productive pasture species, but failing in the meantime to consider how the farmer is actually going to implement such improvements,(whether they are affordable, profitable, suited to a particular physical environmental situation) or whether the farmer is actually interested in change, may completely negate the feasibility of any proposed alteration.

The social scientist can present the 'human' perspective to advisers and farmers alike. Figure 3.7 illustrated earlier, indicates many areas of potential interest to the geographer. Anderson et al. (1985, 81) outline the value of a socioeconomist whose role could encompass:

a) the social milieu in which farming decisions are made,

b) the institutional setting and policy environment in which farming is conducted (e.g. taxation, credit, tenure),

c) economic environment of farms, including long term market prospects for inputs and outputs and understanding opportunity costs and transaction costs faced by farmers, and

d) attitudes and personal constraints of farmers, including desire or otherwise for change, leisure, education, food and so on.

In other words, in conjunction with the economist and biological scientist, the inclusion of a geographical aspect to decision making can promote much more appropriate, efficient and acceptable management decisions. It also bridges the interface between the physical world and human world, between physical and human systems. Again, it is possible to see the distinction (and potential interactions) between the decision maker, and the decision making environment.

3.3.4 Farming systems research and analysis

3.3.4.1 Introduction

Farming systems research has been pursued in many developing countries during the last fifteen years, and in some Australian situations. The primary objective of research and analysis is "to improve the well being of individual farming families by increasing the productivity of their farming system given the constraints imposed by resources and environment" (Norman and Collinson, 1985, 17). This aim is very close to that of this present research and shows the potential relevance of using the systems approach to the present investigation.

How can this methodology be used to improve agricultural productivity and profitability? Theoretically it enhances awareness of all transformations and possible measures of performance and can contrast a specific farm with what one might expect an 'ideal' property would be. Further, it may bring to light areas of knowledge and skills, and the types of attitudes a situation improver may need if he/she is going to be able successfully to monitor and intervene in a particular system (Wilson, 1988, 50). Very significantly, it can also be used to determine differences in management of farmers still in the industry, with those who have left farming.

Farming systems analysis generally has four main phases (Norman and Collinson, 1985, 18):

i) the descriptive/diagnostic stage to determine the constraints farmers face, inefficiencies and potential flexibility using particular assessment methods (i.e. diagnosis and analysis),

ii) design and planning a range of strategies that is thought to be relevant in dealing with constraints which are technically feasible, economically viable and socially acceptable (policy development),

iii) testing,

iv) recommendation and dissemination stage.

Those of greatest significance in the context of this research into South Australian dairying are phases (i) and (ii) and these will be dealt with in greater depth shortly. However, the recommendation and dissemination stage is also important to the industry itself.

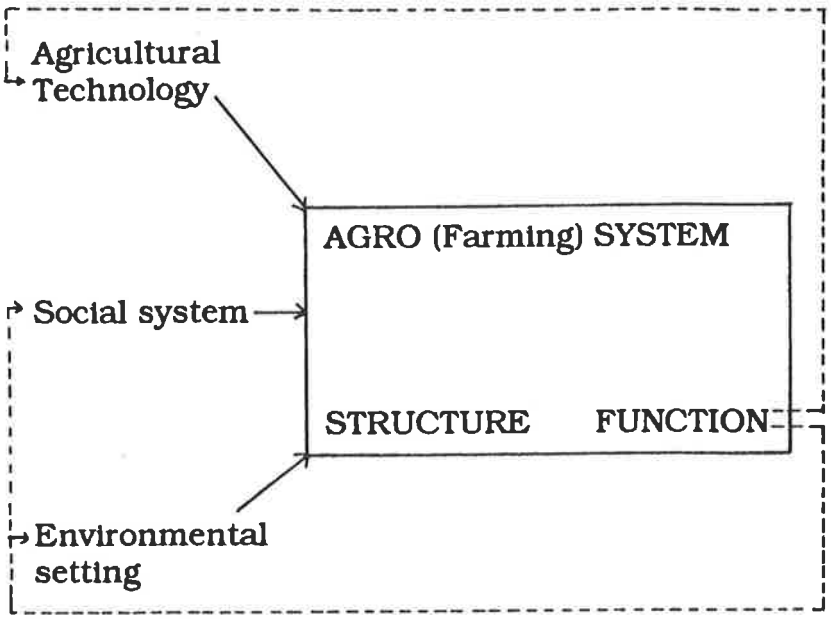
Ideally systems thinking "gives us the tools and processes whereby we can better diagnose areas of inefficiency in maintenance practices within the farm systems boundary and successfully incorporate the improvements necessary to cope with the challenges issuing from a changed world beyond the farm gate" (Roseworthy Agricultural College, 1990).

3.3.4.2 The diagnostic stage

An informal, but preferably formal 'social' survey is generally used at this stage to determine the credibility, representativeness and magnitude of certain characteristics in a sample of farms. According to Marten (1988, 295) data may be collected concerning three major subsystems (illustrated in figure 3.8):

a) agricultural technology system; the total package of technology which the farmer or community uses to 'mold' a given area into a farming system (Marten, 1988, 294-295), including available capital resources, and inputs from outside the farm system, but within the decision making environment. They are applied to specific environmental and social conditions to form real world farming systems. There is an implication here of a one way causal line which, in fact, systems theory should enable to be avoided. The 'environmental' conditions and social structures also help determine what kind or type of technology is applied. It may be that a certain technological package would be desirable to increase output, or reduce costs or decrease soil erosion but is incompatible with other structural characteristics of the system. In such circumstances one or other or both must be

Figure 3.8 Major subsystems for data collection



Source: Marten, 1988, 294.

modified. The agricultural system includes the information generated within the system (crops, livestock, rotations and all inputs, and soils measured in physical and financial terms (for example, the butterfat yield per cow))(Wilson, 1988, 52);

b) the environmental setting which defines the material resources available to the farmer, climate, soil and so on (i.e. land resources), and

c) farmers and their social setting "which conditions how people interact with one another and the ecosystem in which they live" (Marten, 1988, 295). It is necessary also to incorporate the political subsystem (a component of the decision making environment) in the model in any discussion of the approach's applicability to the dairy industry bearing in mind the public sector and regulation which in so many ways are important to the industry.

This information can be obtained at a regional, an enterprise specific or single farm level, depending on the purposes for which the research is being undertaken.

One important aim of the diagnostic stage of the analysis, which seems to receive inadequate attention, or be 'assumed', is the **purpose** of the system. A dairy

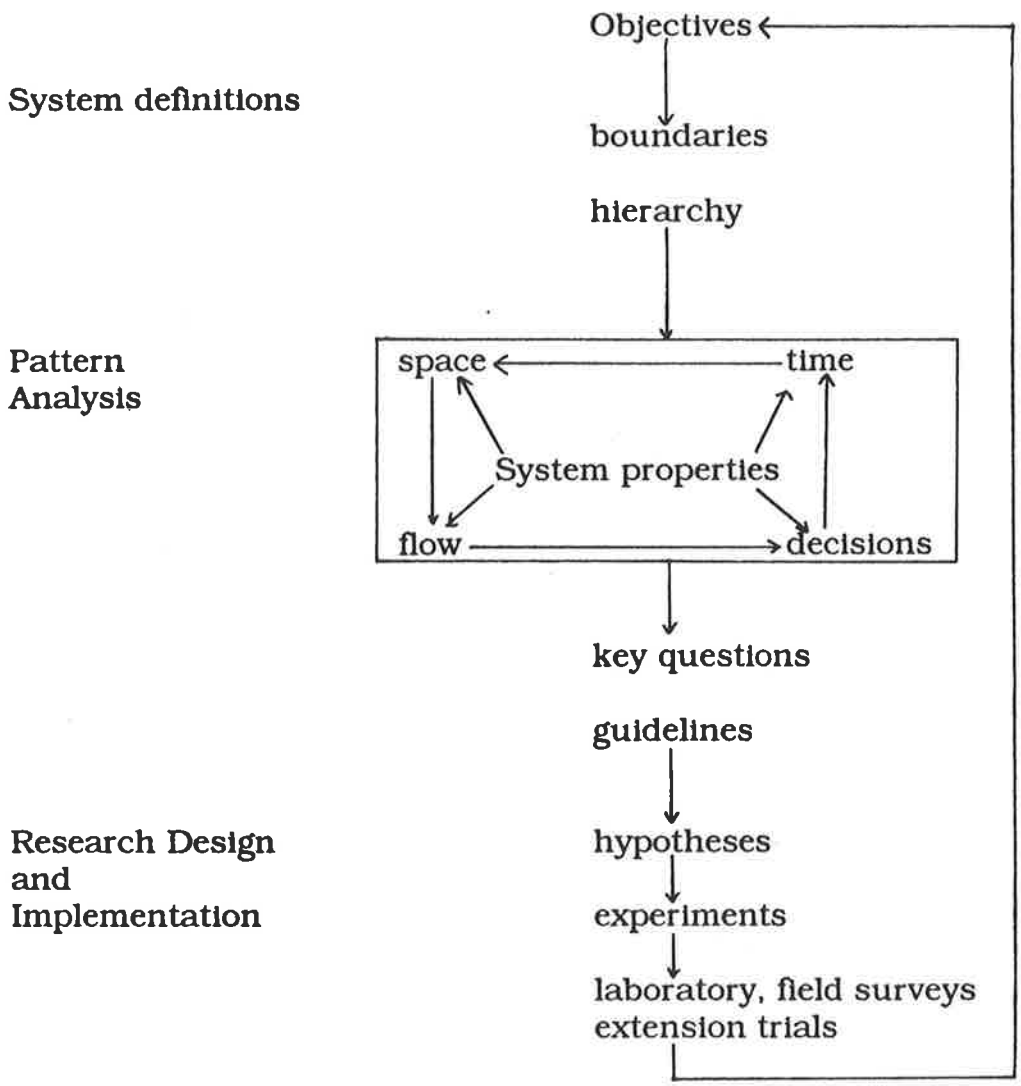
farming system for example, could from different points of view have different objectives. It may be seen as a food production system, or a system for producing a living for farmers, or a system for producing profits for milk processing companies.

This means of course that changes in a system which appear desirable from one point of view, may be undesirable from another. What is good for the milk consumer may not be good for the farmer, different people, groups, and institutions viewing the purpose of the system differently. Because of this, in the end, restoring the system to equilibrium will involve satisfying the objectives of all involved. That is, the farmer must receive acceptable returns, the processors receive an acceptable return on capital, the market, receive milk at an acceptable price, and society as a whole, receive efficiency in resource use, and a sustainable, efficient production system.

3.3.4.3 The Analysis stage

The procedure of analysis is discussed in depth in two papers by Conway (1985a) and Marten (1988). The process recommended by Conway is illustrated in figure 3.9. Initially the system/s are identified and boundaries set (at early stages these may be subjective and tentative). Biological and chemical and physical boundaries are often

Figure 3.9 Procedure of analysis of agricultural systems



Source: Conway, 1985, 38

fairly clear but cultural and socioeconomic boundaries are often more indeterminable. Once these have been established, description and analysis can proceed within the boundaries.

Conway (1985a, 35) suggests that the "behaviour of agroecosystems can be described by four systems properties": a) productivity, the yield or net yield per unit of resource, b) stability (assessed in terms of fluctuation of production above or below a long term average, or fluctuation of production around the long term trend), the degree to which productivity is constant in the face of small fluctuations in climate, and other environmental variables, c) sustainability, the ability of the system to maintain productivity in spite of a major disturbance (drought, flood, soil salinity, price fluctuation), and d) equitability, how evenly the products of the farming system are distributed among human beneficiaries.

Marten (1988, 298) notes that a "given ecosystem can be relatively stable with regard to some measures of productivity and low in regard to others". Equitability may be assessed with respect to the distribution of the products or with respect to access of inputs such as land, capital, inputs, information and so on" (Marten, 1988, 301).

The data collected in the previous stage can be analysed to observe any patterns which may emerge. Such an analysis may involve:

a) spatial patterns (which may be illustrated using maps and/or transects),

b) patterns over time, expressed graphically, including, for example, seasonal change, prices, production, climate, and demography, and

c) flow, patterns of flows and transformations of energy, materials, money, and information in the farming system (best illustrated using conventional flow diagrams). Conway (1985a) suggests that these flows be analysed mainly for major causes and effects, and for the presence of stabilising or destabilising feedback loops.

Finally comes an analysis of decision making, perhaps by using decision trees, to reflect the choices made in a given ecosystem under differing conditions, thereby defining the spheres of influence on decision makers.

The analysis of these patterns should, in theory, "help to indicate likely key relationships and decisions" (Conway, 1985, 48) within the system.

Marten (1988, 306-307) identifies several factors which must be kept in mind throughout the pattern analysis. A single value (for example, low stability) is not an appropriate description for a farming systems whose performance varies widely over a range of environmental and social conditions in an area. Under such circumstances it may be necessary to indicate a range of values.

Improvement in one system property should not be at the expense of other properties (or at least the cost should not be too great). For example, increased profitability in the face of the cost price squeeze should not be achieved at the expense of long term soil damage.

Marten also suggests concepts which may be useful in directing the assessment process:

i) under what circumstances (economic, social, or political) is the farming system's stability satisfactory (Marten, 1988, 306),

ii) the importance of determining which kinds of farming systems are most appropriate for which social and environmental conditions (or vice versa) (Marten, 1988, 306),

iii) the identification of points of vulnerability in the agricultural technical [and other] system/s

to suggest how it could be strengthened (Marten, 1988, 309) and

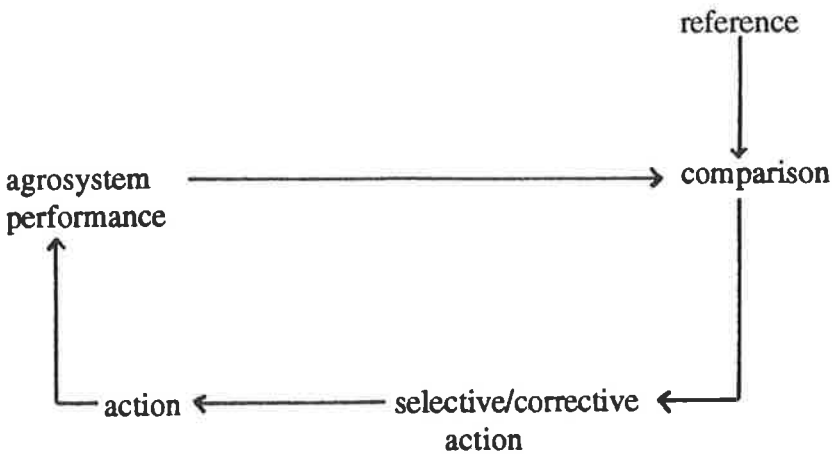
iv) under what circumstances are the relationships positive or negative (Marten, 1988, 310).

He then identifies several structural elements (components) in the farming system that are closely related to production and need therefore, to be taken into account: cropping intensity, diversity of seed varieties, cropping or pasture sequence, balance and reliability of agricultural inputs, equity of access to inputs, and nature and channels of transfer of technical information and influence of social factors (Marten, 1988, 311).

The aim of this assessment is to ensure improvement is balanced and viable. It should also be more adaptable, and be able to cope with the more common minor stresses experienced by an agricultural enterprise.

Marten (1988, 313) also identifies the significance of the corrective feedback mechanism in the process of adaptability (figure 3.10) and the completed analysis will usually identify corrective feedback mechanisms already in place in the system, and others which could possibly be implemented to enhance adaptability and long term sustainability, productivity and profitability.

Figure 3.10 Basic elements in corrective feedback loop for adaptive agroecosystem development



Source: Marten, 1988, 313

In theory then, the variety of individual research projects arising from the analysis will ensure that changes arising from such projects will benefit the whole farm system on a long term basis.

3.3.5 Systems modelling of dairy farms

Wilson (1988, 36-38) discusses the procedure whereby a simple model of a dairy farm can be constructed. In this process, he develops a visualisation of the farm, explores concepts relevant to the dairy farm, then categorises the inputs, transformations and outputs of the property. This is then put into a diagram or model which depends, for its particular emphasis, on the purpose of the particular model itself.

Wilson also outlines several stages in the development of a methodology for improving ill defined situations (ie. where the systems components are not easily discerned).

Firstly, the researcher should develop a mind map visualising the particular situation. The activities taking place, the resources needed in the situation, the boundary (within which the owners have some decision making authority), degree of resolution and detail required, who owns the systems, and who acts in it, the purposes of the system, the values systems which appear

relevant, and the environment in which the system operates are then noted.

Following this, the system is defined: for example, a dairy farm is a farmer owned and operated system for turning fodder into saleable products in such a way as to provide a satisfactory living and lifestyle necessary within an environment of declining terms of trade and to provide a market with a product at a price which is satisfactory. The formal models and methodology described earlier are then used to analyse the system.

A simple model of a dairy farm based on this methodology has been developed by Wilson (1988, 37-38). This is illustrated in figure 3.11.

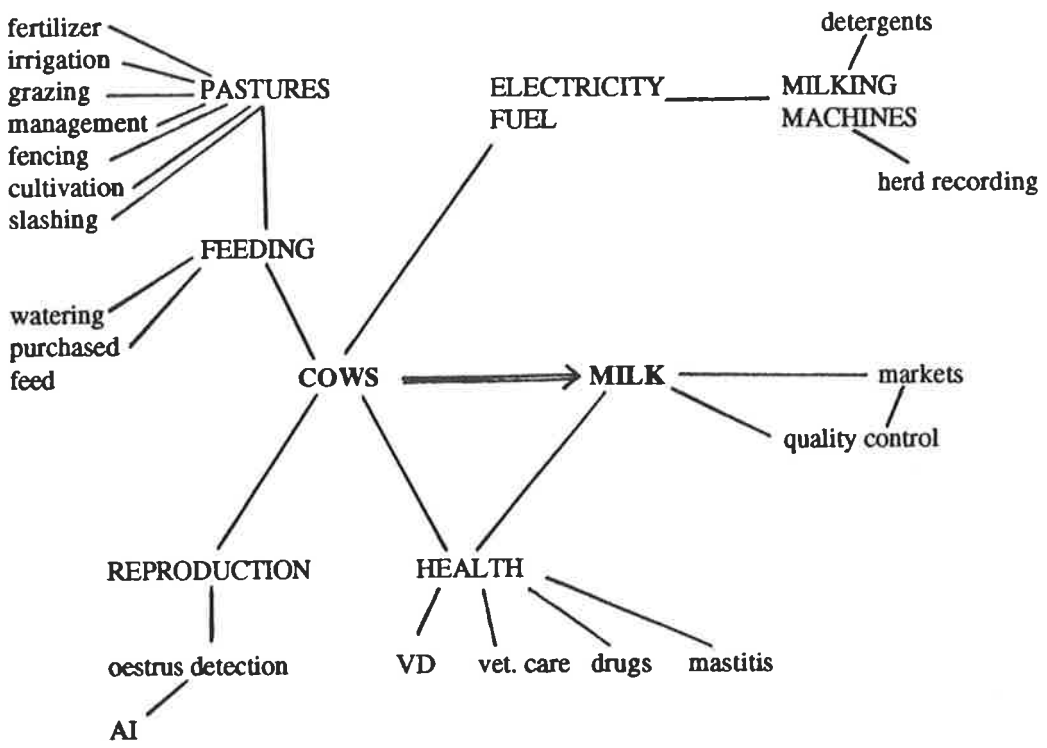
What is included in the model depends on its purpose, in this case the manager's role in monitoring transformations and intervening in a dynamic ever changing production system by varying the allocation and timing of resource inputs.

Model for dairy farm system

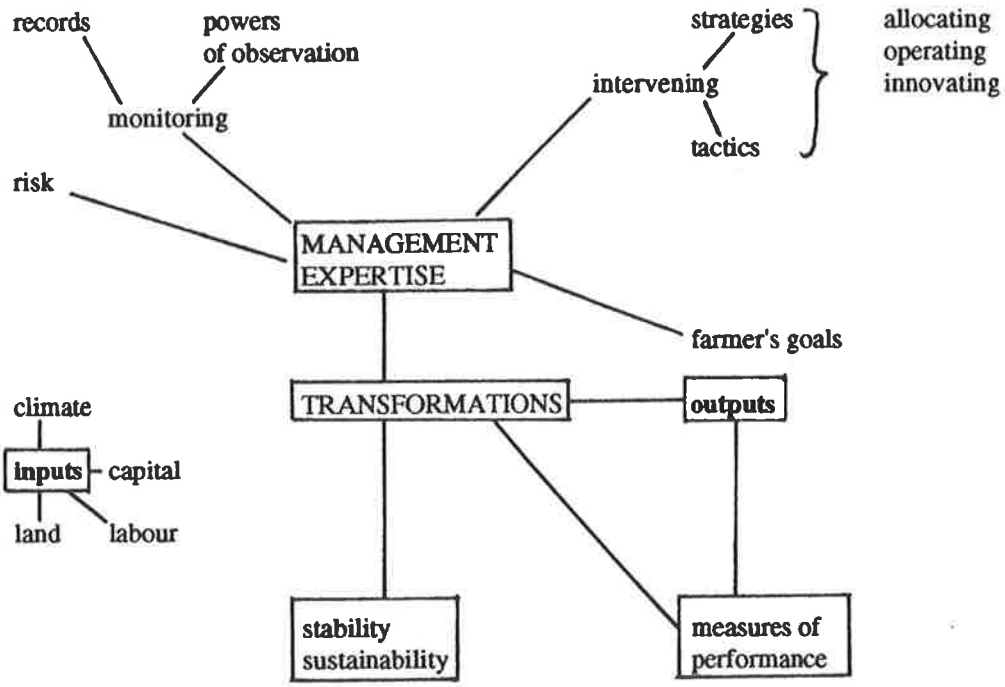
Such a process of diagnosis has been used to develop the model (figure 3.12) upon which this thesis is based, incorporating the various aspects of the decision maker's

Figure 3.11 Building a simple systems model of a dairy farm
(Source: Wilson, 1988)

a. Build a picture (mind mapping)



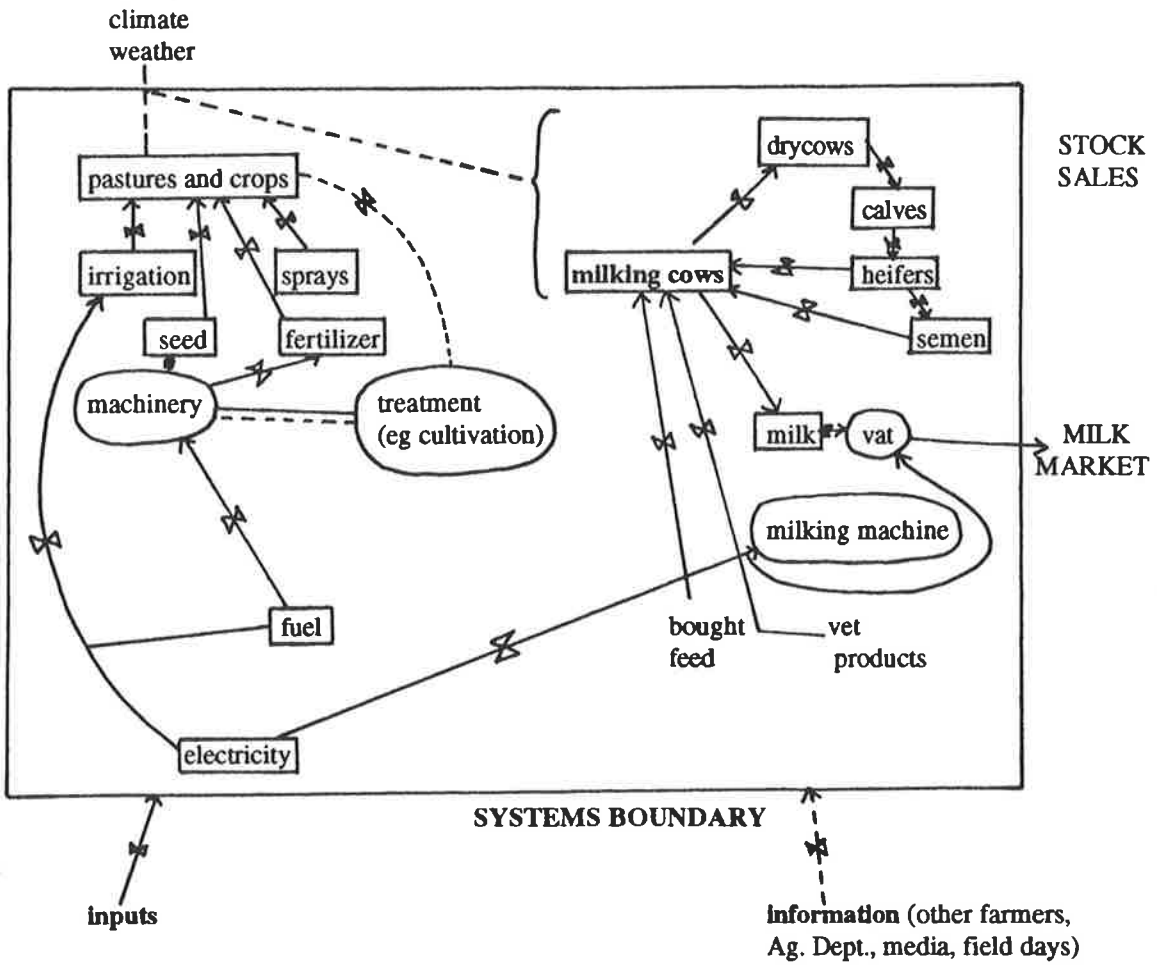
b. Explore concepts relevant to the dairy farm



c. Categorising the concepts

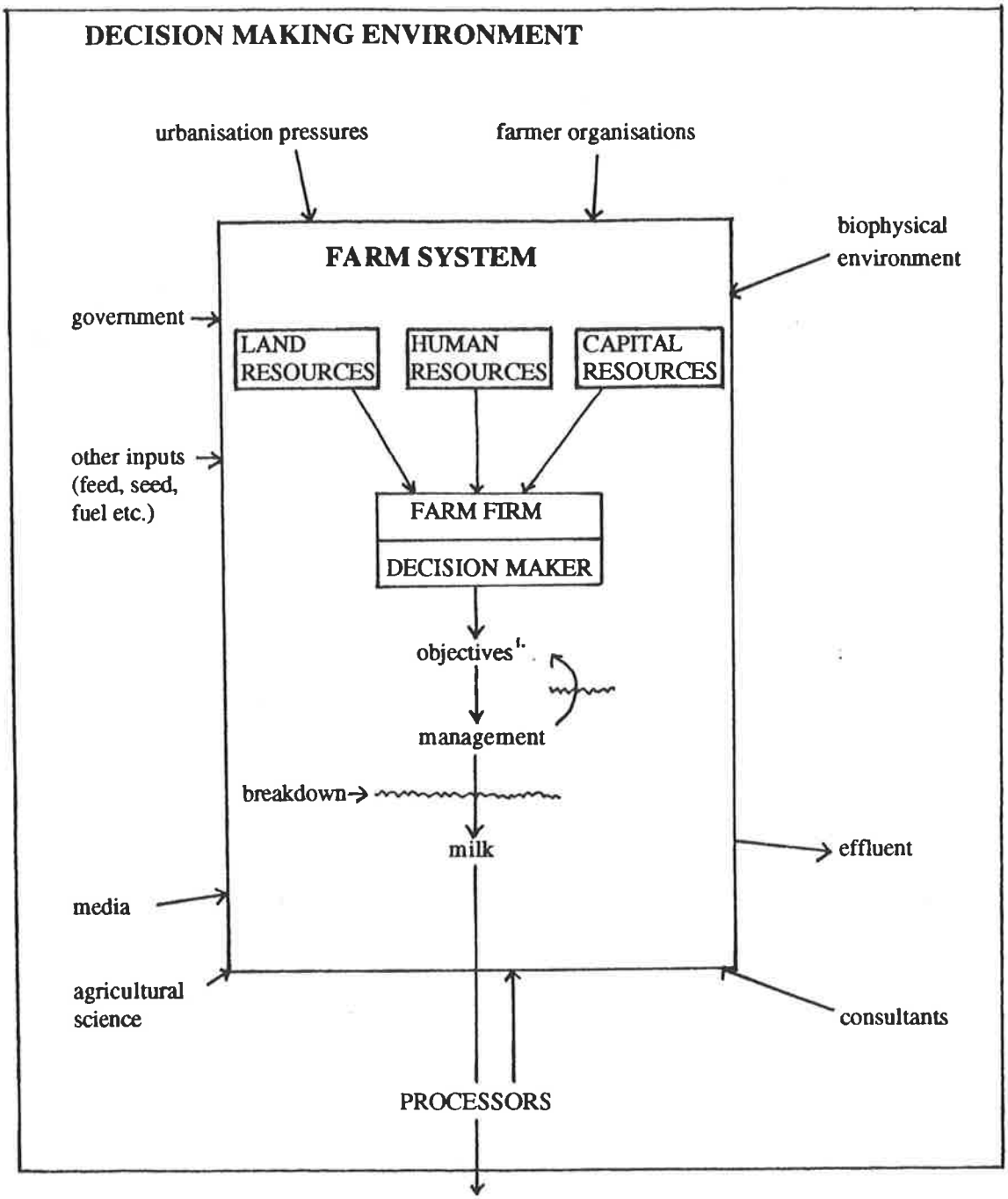
Inputs	Transformations	Output
fertilizer	Chemicals and energy to grass,	milk
cows	grass to milk and animal	animal
irrigation, water	tissue	manure
pasture seed	Milk in cows to milk in tanker	
chemicals	Calves to cows, empty females	
machinery	to pregnant ones	
electricity	AI semen and eggs to embryos	
fuel	Embryos to calves	
labour		
stock feed		
semen		

d. Programming and structuring



points where the farmer's skills in monitoring, recording and decision making are important

Figure 3.12 Agricultural system for the dairy industry (Crockett)



1. Objectives may include profit
economic survival
passing on sustainable system to next generation
enjoyable, rewarding lifestyle

decision making process, and the environment within which these decisions are made.

The diagram shows how the farm system, the focus of the current study, fits into the overall agricultural system of the dairy industry. All components of the diagram are considered in the ensuing discussion.

First, the diagnostic stage involves the discussion of current resource levels on farms - land, labour, and capital, then focuses on how the resources are utilised to meet the purposes and objectives of the decision maker, acting within the farm system. The impact of the decision making environment (government, urbanisation, other inputs and a variety of external information sources) on decision making and management is also considered. At this stage it is important to determine how closely the hypothesized objectives (that is, making a profit, surviving economically, achieving a satisfactory lifestyle, and passing on a viable and sustainable system to the next generation) coincide with the actual and perceived purposes and objectives of the decision makers themselves.

As with any farm system, the dairy farm enterprise is subject to a variety of difficulties which lead to a breakdown or system malfunction, including low returns

on production, high costs, environmental concerns, and the aging farm population. Farmers adopt a variety of strategies to counteract breakdowns in the system, and by means of management as a feedback mechanism, seek a return to equilibrium. In this context, a discussion of management strategies aimed at restructuring the farm system is incorporated into the study. By using the systems approach therefore, it is possible to integrate all the components of the farming system to determine how well they function together, and what options are available in the management of the farm system in order to achieve the system's purposes.

3.3.6 Conclusion

Clearly a systems approach to the assessment of farming systems provides a valuable insight into the way a farm system functions, and into the diverse range of factors, processes and relationships affecting the productivity and profitability of the system and its longterm survival. The studies of agricultural economists and scientists are often able to improve specific aspects of the system, but changes based on their recommendations may not always have positive results for the farm as a whole. Indeed, the farmer may choose to ignore, or at least not act on, the advice at all, for a variety of reasons.

By adopting a systems approach, and using the model illustrated in figure 3.12 it is possible to integrate all the components of the farming system to determine how well they function together, where the 'breakdowns' occur, and what options are available in the management of the farm system in order to achieve the system's purposes.

In this way it is also possible to achieve two of the primary purposes of the study:

1) to explain declining levels of production and why so many farmers are leaving dairying (i.e. how and why the farm system is malfunctioning), and

2) to discuss improved management strategies, including potential for dairy farm relocation (i.e. management to promote a return to equilibrium to the system).

3.4 Survey process

The implementation of a survey at the diagnostic stage of the study was determined to be the most effective means of obtaining the information required concerning the farmer's available resources, impact of forces external to the farm, management strategies, and perceptions of the future of the dairy industry, in addition to identifying problems being encountered in the farming system. Here the information gathered bears some resemblance to the subsystems for data collection

proposed by Marten, but the environment is extended beyond the physical, to encompass also other aspects of the decision making environment, government, urban expansion, and inputs which would appear to have an important role to play in the decision making process.

Information on productivity, stability and sustainability of individual farm systems was also sought, and the whole gathered together and analysed on a regional basis to explain the restructuring process; that is, how, why, and the extent to which change is actually occurring within the agricultural system in the Adelaide milkshed.

A copy of the questionnaire is located in appendix 5.

Prior to the commencement of the preparation of the survey of current dairy farmers, contact was made with several dairyfarmers and the Executive Officer of the South Australian Dairyfarmers' Association (S.A.D.A.) - the former to obtain some 'inside' information about the current situation in the dairy industry, and the latter, for the same reason, and to obtain the support of SADA in the study. Their cooperation made the data collection process reasonably straightforward, and ensured the support of many farmers. Contact was also made with both Farmers Union and Dairyvale, the two milk processing companies, the Metropolitan Milk Board, the South

Australia Bulk Milk Haulage Company, and the Lecturer in Dairying at Roseworthy Agricultural College (now Roseworthy Campus, University of Adelaide). All were most helpful and provided much information which could be used as background for the study.

It was decided that a postal survey would be the most appropriate means of obtaining information from current farmers because of the large sample size desired and the extensive region to be covered, from the Lower Mid North to Meningee, on the shores of Lake Alexandrina. Phone surveys could not be considered due to the length of the survey, the cost, and the need for respondents to refer to records kept for the past ten years.

In order to facilitate appreciation of the value of the survey in the eyes of the farmers several articles relating to the researcher and the work were placed in the SADA journal. Attendance at the SADA annual conference also proved beneficial in this regard, as was an article in The Advertiser's rural supplement 'On the land'.

The pilot survey was posted on 1 July 1991, to ten farmers selected by the SADA as being willing to respond. The pilot sample was not random - because of time constraints and the necessity to get the main survey

underway as soon as possible this was deemed to be the most efficient means of obtaining prompt feedback. The survey was accompanied by a covering letter from the SADA's Executive Officer. Seven surveys were returned (one three months later).

The sample space for the main survey was the mailing list of all SADA members - this represented 95% of the total number of dairy farmers in the Adelaide milkshed, in June 1990. The Metropolitan Milk Board has the names and addresses of all dairy farmers but this information is not accessible.

Fifty percent of members were chosen at random (every second person on the list), a total of 362 farmers. Non metropolitan milk board farmers were then discarded, resulting in a final sample of 345 farmers.

The surveys were posted on the 6th August 1991, accompanied by a postage paid envelope and covering letters from the researcher and SADA Executive Officer.

The response level to 4.9.91 was 86 completed surveys (24.9%) (see table 3.1). On this day a second reminder notice was sent, a follow-up to a reminder included in the SADA journal received by most farmers in the last week of August.

Table 3.1 Response rate to primary survey

Type of response	Number
response to 4.9.91	86
response to 30.9.91	75
returned by postoffice	12
refusals (returned)	15
left dairying	19
TOTAL USEFUL RESPONSES	161

A further 75 usable surveys were received after this data, a total of 161 usable responses, and 48% of questionnaires sent.

The locations of all surveyed farmers are indicated in figure 3.13, and are further divided into subregions, based on postcodes (figure 3.14) to facilitate the regional comparisons in the discussion to follow. The regions incorporate the following towns:

Fleurieu Peninsula

Clarendon/Blackwood, McLaren Vale, Willunga, Yundi, Second Valley, Hope Forest, Myponga, Yankalilla, Normanville, Mount Compass, Currency Creek, Victor Harbor

Hills

Kersbrook, Gumeracha, Birdwood, Eden Valley, Oakbank,

Mount Torrens, Woodside, Verdun, Hahndorf, Mount Barker, Nairne, Strathalbyn, Flaxley

River/Lakes

Mannum, Murray Bridge, Mypolonga, Monteith, Milang, Clayton, Narrung, Wellington, Jervois, Meningie, and

Adelaide Plains/Barossa

Greenock, Lyndoch, Williamstown, Angaston, Sheoak Log,

Tanunda, Kapunda, Eudunda, Marrabel, and Two Wells.

Figure 3.13 Location of surveyed farmers

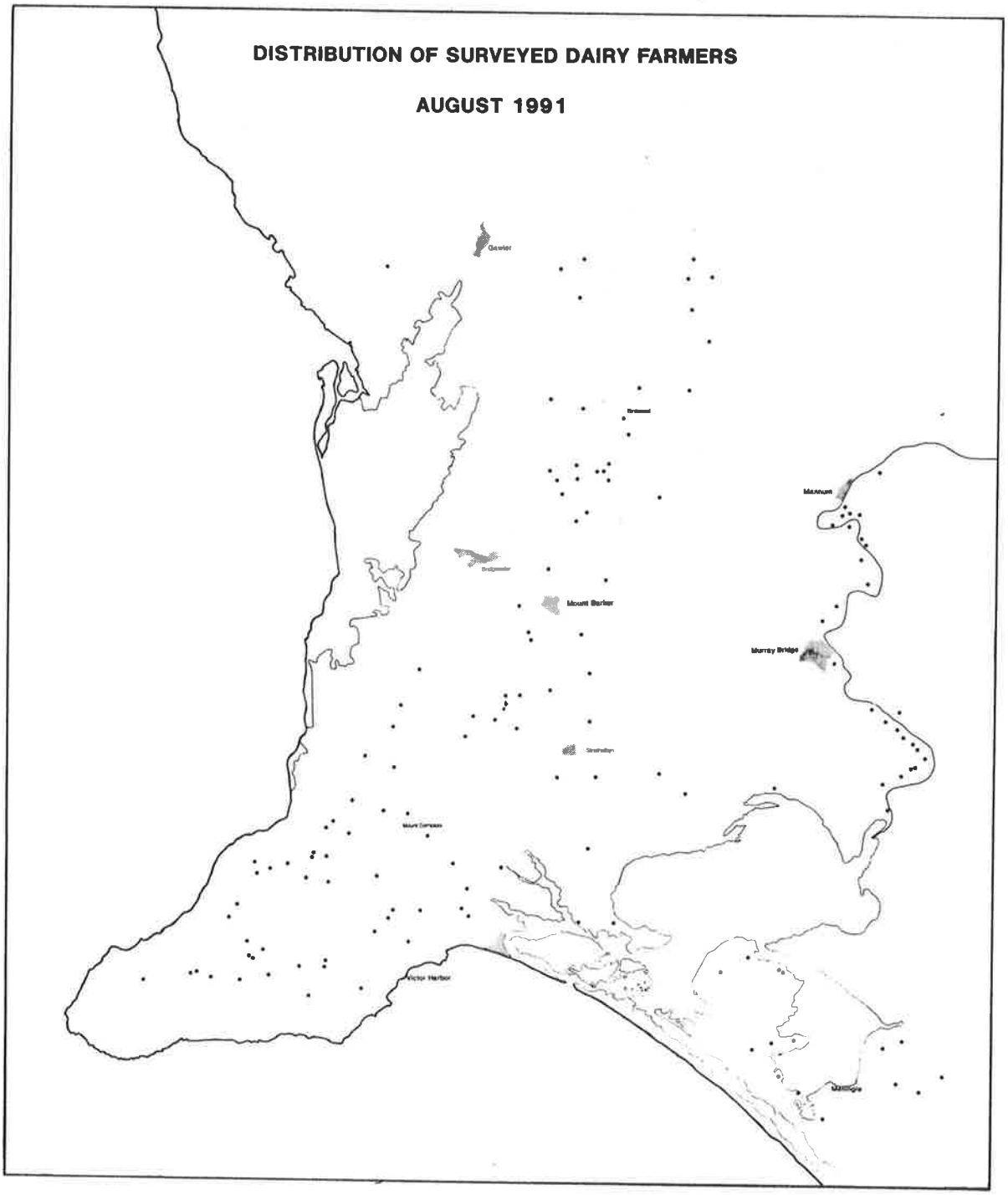
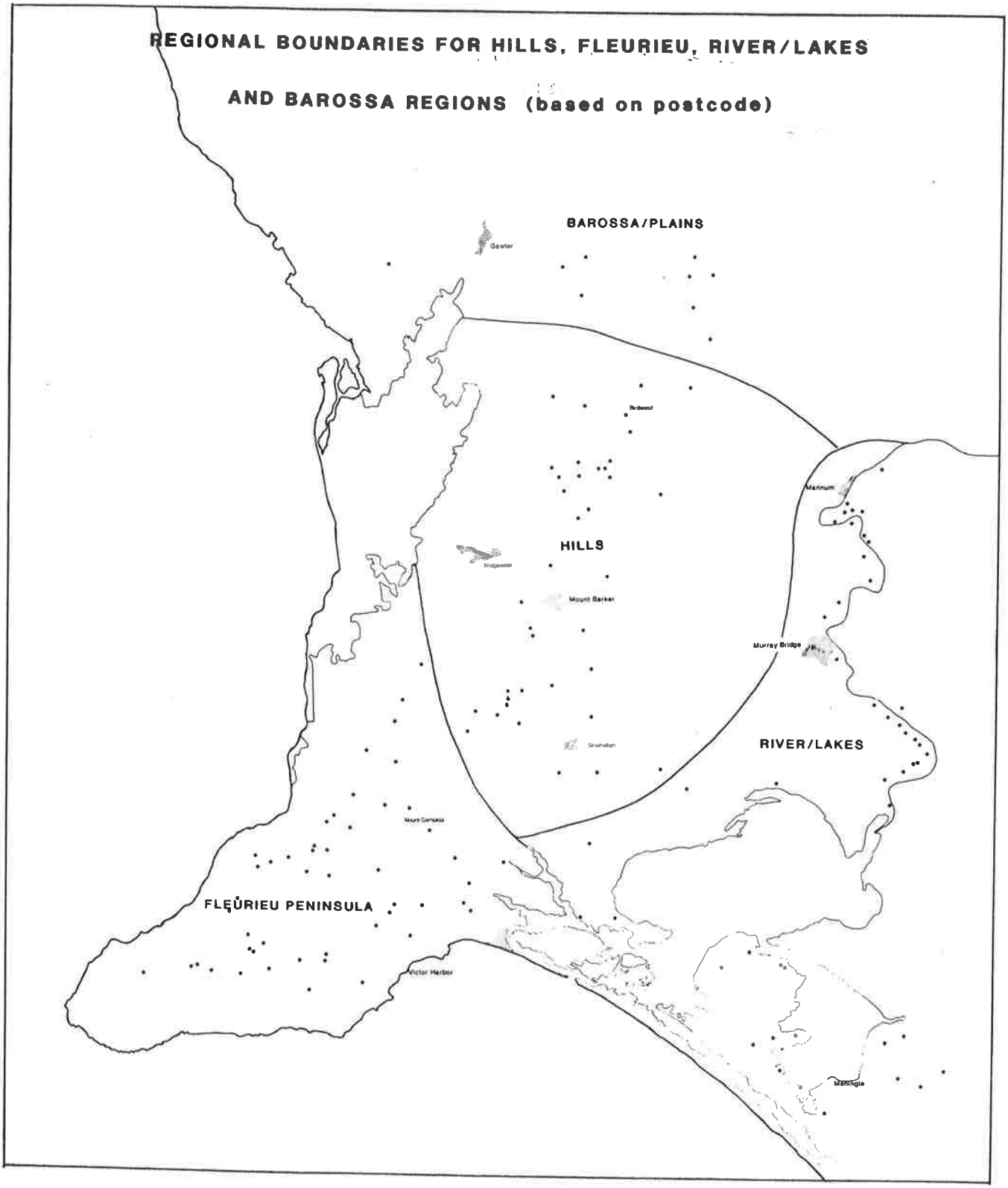


Figure 3.14. Subregions of surveyed milkshed


REGIONAL BOUNDARIES FOR HILLS, FLEURIEU, RIVER/LAKES
AND BAROSSA REGIONS (based on postcode)
BAROSSA/PLAINS
Gawler
Birdwood
Mannum
HILLS
Pridgewater
Mount Barker
Murray Bridge
Strathalbyn
RIVER/LAKES
Mount Compass
FLEURIEU PENINSULA
Victor Harbor
Meningie

A complete breakdown of the type of response to the survey is given in table 3.1. It is interesting to note that nineteen farmers indicated they had left dairying since the list of dairy farmers had been compiled ten months earlier.

In order to have some basis for comparison between current dairy farmers and those who had left the industry a follow-up survey of a small sample of ex-dairy farmers was undertaken. A copy of the questionnaire can be found in appendix 6. The sample in this case comprised those who had indicated, in their response to the initial survey, that they had left their farm, and who were willing to tell of their experiences. Sixteen questionnaires were sent out to these farmers on 11/11/91, and a response rate of 75% (eleven completed surveys) was achieved. One respondent had left the previous address and the questionnaire was returned by the post office.

It would be most beneficial to the accuracy of the study at least to double the number of ex-farmers in it.

CHAPTER 4

THE DECISION MAKER

4.1 Introduction

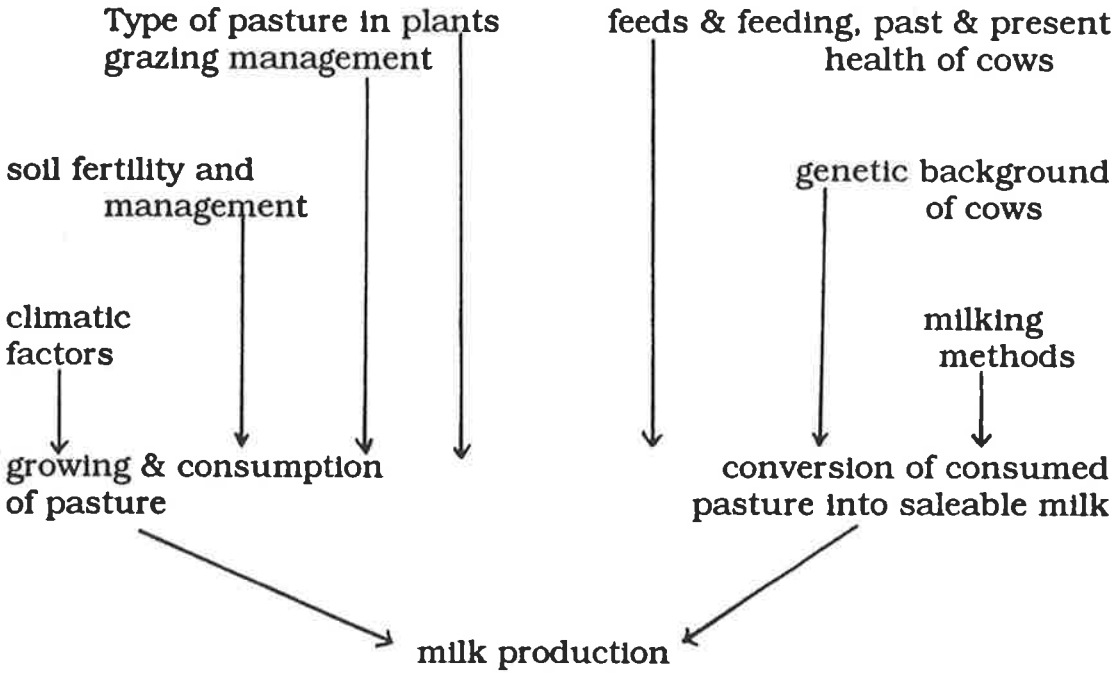
By referring to figure 3.12, it can be seen that systems theory emphasises that it is the interaction between the decision-maker and the decision making environment which determines management outcomes. This chapter will therefore consider characteristics of the the decision-maker, the dairy farmer, while the following chapter will examine the most important aspects of the environment within which the dairy farmer makes his/her management decisions.

4.2 The dairy farm as a system: farm management decisions required

In order to understand the relationships between a farming system and its environment it is necessary to appreciate how the subsystem, the dairy farm, functions.

Some of the main factors which influence dairy farm productivity, from a 'scientific' viewpoint are illustrated in figure 4.1. As outlined earlier, a dairy farm is a system whic is managed in such a way as to combine resources (land, labour and capital) to produce milk. No one single factor is sufficient to obtain milk production, and all components are interrelated. Usually changes in one aspect of farm management will have ramifications for other components of the farm system.

Figure 4.1 Factors influencing milk production



Source: SADA Journal, 1990.

A brief outline of all these aspects of cow and pasture management is provided in appendix 1.

Some of the management decisions faced by Australian dairy farmers are:

i) the number of cows that should calve each month,

ii) total herd size,

iii) level and type of supplementary feeding,

iv) area of each pasture type,

v) whether fodder crops should be grown,

vi) area from which fodder should be conserved, and

vii) the method of fodder conservation used (Olney and Kirk, 1989, 367).

Considerable research has been undertaken into ways of optimising management strategies relating to the above list of decisions. However, this research has not always had a great impact on the decision making behaviour of many dairy farmers.

Because of constant changes in physical and socio-economic variables which comprise the decision making environment successful farmers are almost continuously involved in the process of assessment and adjustment of their farm programme in the context of a variety of external constraints.

Farm planning models can go part way to determining management best suited to a particular farming situation.

There are three distinct types of models:

i) small scale representations of a real situation,

ii) analogue, representing the real system in a different form (for example, a farm map), and

iii) symbolic: representing the real world in algebraic form (for example, annual farm budgets, gross margins and linear programming).

Another significant component of dairy farm management, apart from normal budgeting processes, risk management, input/output analysis and so on, is feed budgeting. It is a concept which incorporates most aspects of production on the dairy farm, and can be used for a variety of purposes:

i) to obtain optimum use of feed produced or available,

ii) to assess and relate daily feed supplies and stock requirements,

iii) to forecast and relate future feed supplies and stock requirements, and

iv) to evaluate stocking/feeding alternatives.

The main factors involved in assessing 'utilizable' pasture dry matter available are the precise assessment

of the dry matter (DM) available, accurate assessment of paddock area, wasteage allowance, and the type of stock involved.

4.3 The decision maker and the farm firm

4.3.1 Introduction

Social behaviour and habits of farmers, how they view risk and uncertainty, their resources, their expectations, and their priorities, will all influence farm management decisions. It is important to realise that optimum decision making requires access to perfect information, something which no farmer ever has.

Geographical theory put forward in this context has dealt with many aspects of how the decison maker arrives at a decision, and developed initially based on the rationale "that an understanding of the spatial distribution and pattern of man-made phenomena on the earth's surface rests upon the knowledge of the decisions and behaviours which influence the arrangement of the phenomena, rather than on knowledge just of the positional relations of the phenomena themselves..." (Golledge, 1972, 59). In other words, a deeper understanding of the person-environment interaction can be gained by looking at the "various psychological processes through which [we] come to know the environment" (Walmsley and Lewis, 1984, 3).

First, it is necessary to define a number of basic concepts (Gold, 1980, 20-23):

i) environment, the total milieu in which humans live,

ii) perception, the "psychological function that enables an individual to convert sensory stimulation into organised and coherent experience",

iii) cognition, the physical process whereby human beings obtain, use, store, and operate upon information including sensing, perceiving, remembering, imagining, judging, deciding and virtually every other type of mental process: all of these are closely related to experience and behaviour,

iv) motivation, the force/s leading a person to seek certain goals in relation to their needs. How motivated a person will be to pursue any course of action depends on the nature and importance of the needs associated with a particular situation,

v) needs, anything an individual regards as essential for happiness and well being,

vi) emotion, which embraces a wide range of physiological and mental conditions defined in a state of excitement or perturbation marked by strong feelings, and usually by an impulse towards a definite form of behaviour, and finally,

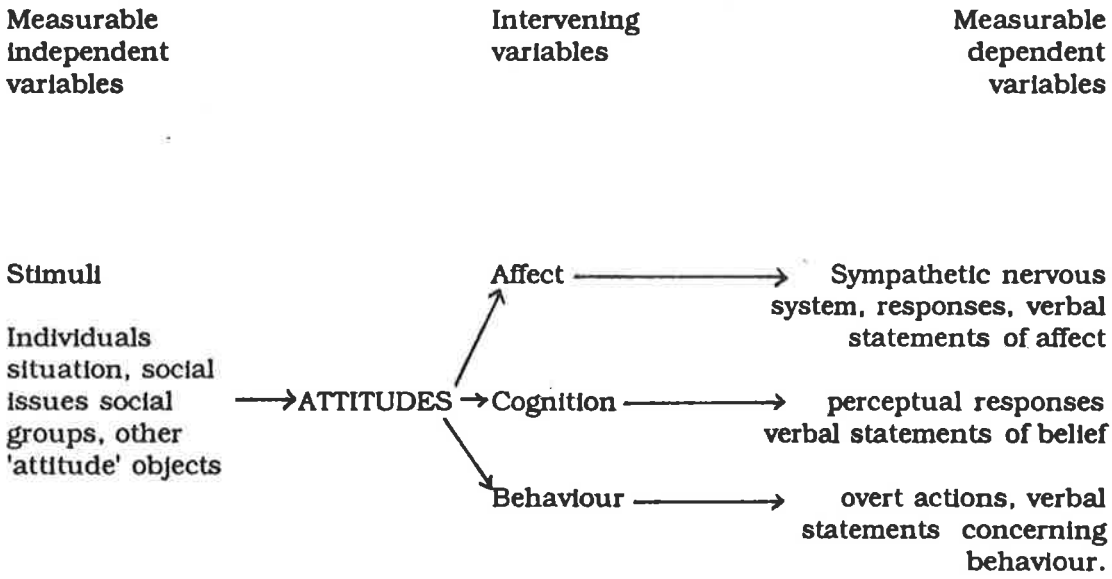
vii) attitudes, bringing together both the internal mental life (including cognition, motivation and emotion) and external behavioural response within one framework. They are a learned

> predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object, person, or spatial environment.
>
> Attitudes include belief, bias, doctrine, faith, ideology, judgement, opinion and stereotype. Values are enduring beliefs that a specific mode of conduct or end state of existence is personally or socially preferable to another (Rokleach, 1973, in Reich and Adcock, 1976, 18). Belcher (1973, in Gold, 1980, 24) defines a stereotype as a set of beliefs about a particular group of people, places or objects, containing no more than a grain of truth, but which forms the basis of opinions about them to rationalise conduct towards those people.

Triandis (1971) has developed a systematic conception of attitudes which shows how they can be best measured. This is illustrated in figure 4.2. In the model he argues that assessment of the stimuli which lead to the development of attitudes (and how they manifest themselves) can be used to monitor attitude development and change.

How a person perceives the environment relates closely to how decisions are made by that person on how to relate to that environment. Nowhere is this person-environment relationship more important than in providing insight into the way farmers (and their families, as well as agribusiness) make decisions relating to the farm

Figure 4.2 A systematic conception of attitudes



Source: Triandis, 1971, 31.

environment. As Holahan (1982, 46-47) argues, "a chief psychological function of environmental perception is to direct and manage the activities that make up our daily lives...[by]...providing information necessary to orient ourselves in the environment".

There are three main theories which have been developed to explain man-environment relations:

i) Gestalt theory, which argues that human perception can only be understood as an holistic process, where the "whole is greater than the sum of its parts" (Holahan, 1982, 47),

ii) ecological theory, which explains environmental perception in terms of the nature and properties of environmental stimulation, and

iii) probabalistic theory, which emphasises the active role people assume in the perceptual process, whereby "the observer resolves perceptual ambiguity by coming to a probabalistic estimate of the true environment based on sampling of sensory cues from a great many environmental settings" (Holahan, 1982, 47).

Whatever the explanation, these perceptions will give rise to environmental attitudes, favourable or unfavourable feelings towards some feature of the physical environment or toward an issue that pertains to the physical environment (such as government regulation) (Holahan, 1982, 121).

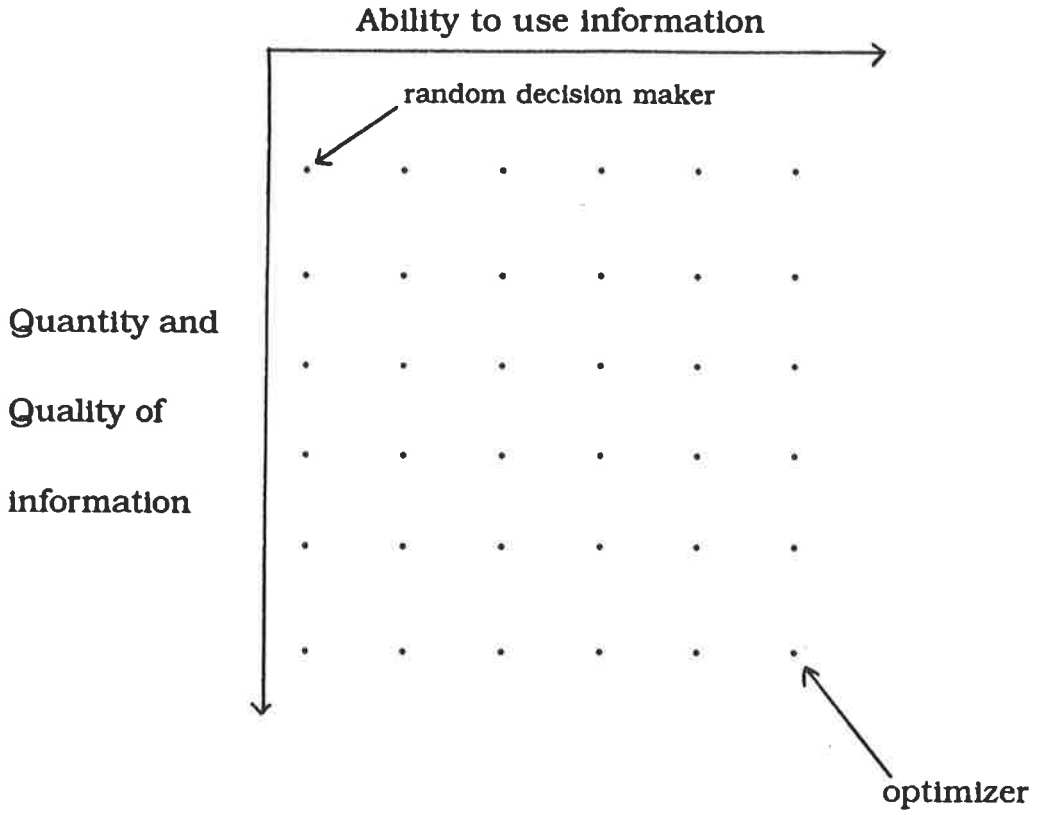
4.3.2 Models of man-environment interaction

Simon's satisficer model (1952, 204) was the forerunner of man-environment-economy interaction models. In this model, Simon argued that "man [tends] to simplify highly complex problems which he cannot fully comprehend and then attempts to act rationaly within this simplified model of reality" (Simon (1952), in Walsmley and Lewis, 1984, 6).

Pred (1967, 1969) took an even more mathematical perspective which emphasised probability in the development of his behaviour matrix of decision making (shown in figure 4.3). In the diagram, the quantity and quality of information increases downward and the ability and speed with which the knowledge is utilised increases to the right. The perfect optimiser is located in the lowest right corner, the random decision maker, at the origin.

Probability theory has also been used in a variety of forms including game theory, as a numerical means to simulate probable strategies by individuals in hypothetical environment contexts (Pred and Kibel, 1970; Wolpert, 1970; Cohen et al., 1973). All these models are essentially mass behavioural, whereby what one unpredictable individual does cancels out what another unpredictable individual does (Gold, 1980, 33).

Fig. 4.3 Pred's behaviour matrix



Source: Pred, 1967, 27

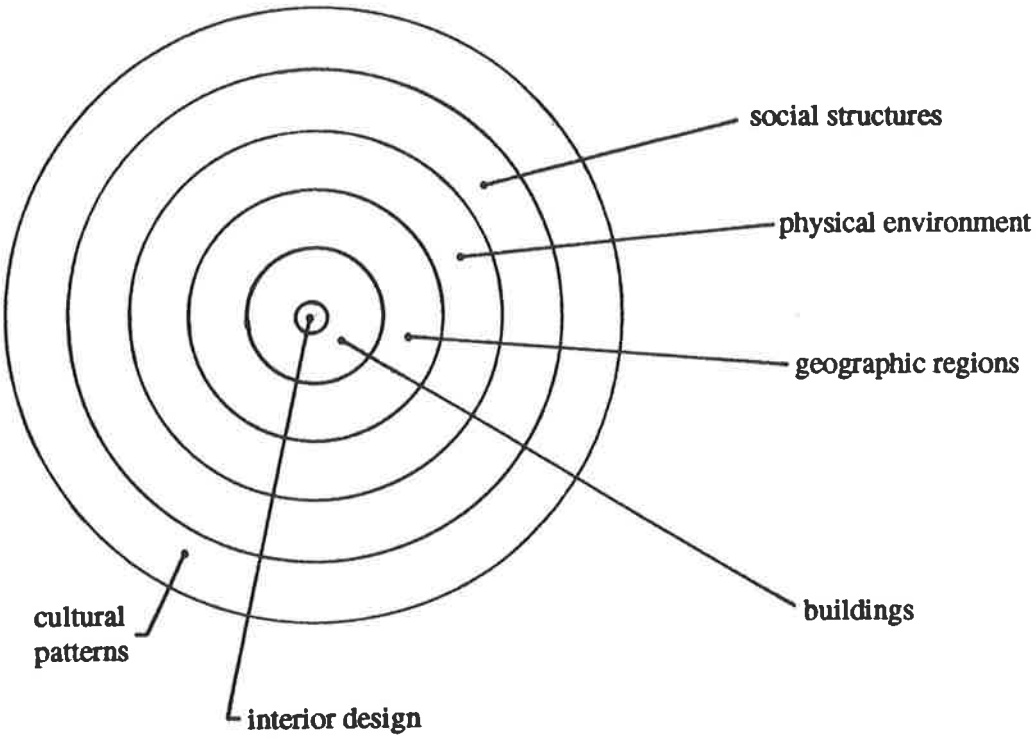
There have been other models developed which emphasise the influence of individual behavioural characteristics on interactions with the environment:

i) the holistic model of the environment, a conception of behaviour which is nested in a series of encircling contexts. It argues that a person functions as "a total, integrated entity in the environment behaviour equation" (Holahan, 1982, 363). This concept is illustrated in figure 4.4.

ii) the adaptational view of the individual as a total person who interacts with the environment (illustrated in figure 4.5). In this model the information from the environment is received, evaluated and encoded by interlocking psychological processes of environmental perception, cognition and attitude formation. This information then becomes the basis for the individual's behaviour towards the environment.

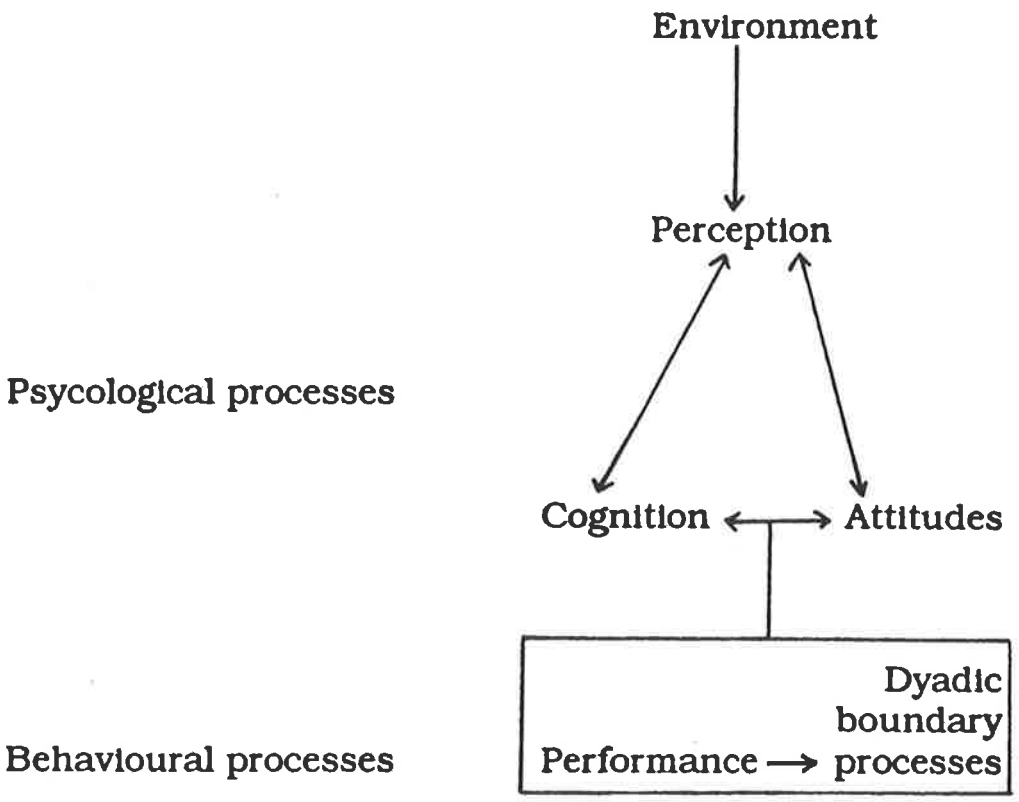
iii) the transactional model, with emphasis on the person and environment as being involved in a transactional relationship: the effects among environmental, psychological and behavioural variables are represented as being reciprocal, with each variable both acting on, and being acted upon, by others (illustrated in figure 4.6). This appears to be the model of greatest relevance to the integrated approach of systems theory.

Figure 4.4 Holistic model of the environment



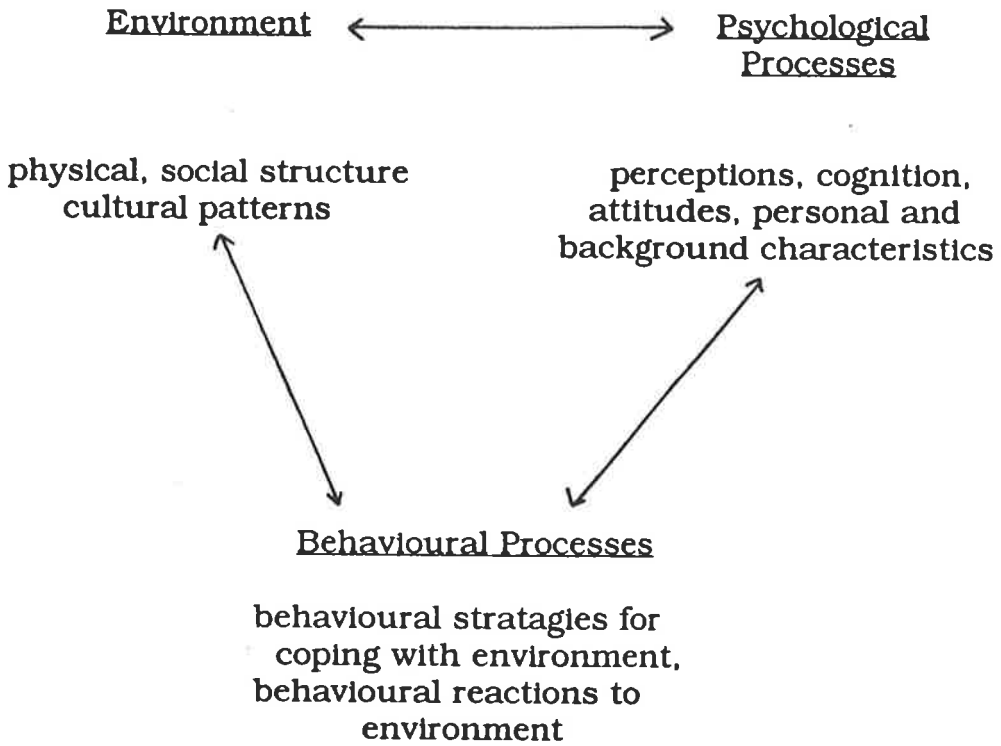
Source: Holahan, 1982, 349

Figure 4.5 The adaptation model



Source: Holahan, 1982, 349

Fig. 4.6 Transactional model of relationships amound the environment, psychological processes and behavioural processes.



Source: Holahan, 1982, 355

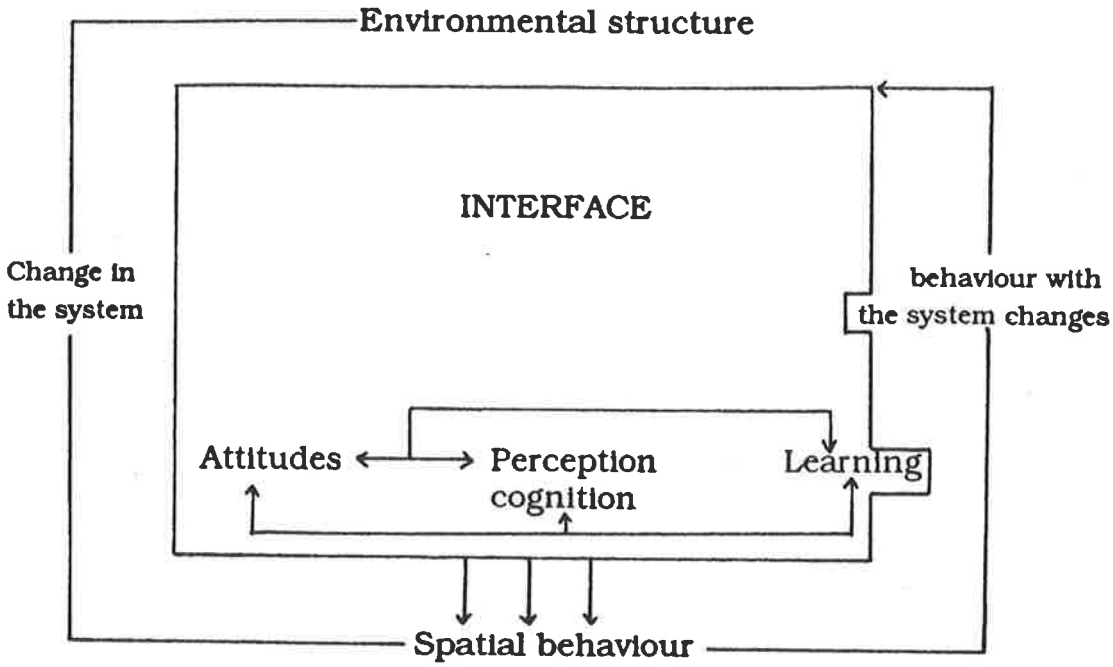
Golledge (1987, 13) brings all these components together in what he terms "a paradigm for understanding man-environment relationships". This is a base from which spatial movements and locational decisions can be explained, and is illustrated in figures 4.7 and 4.8.

Other writers have preferred to focus on a more systematic approach to combining sociological theory with environmental awareness in discussing a study of agriculture - the result has been, for some, " [an] increasing recognition of the importance of viewing human societies from an ecological perspective" (Dunlap and Martin, 1983, 213). The concept of the ecosystem has been mentioned elsewhere, and some social scientists argue (for example, Dunlap and Martin, 1983, 216) that "viewing agricultural systems from an ecosystem perspective would help sociologists overcome their inclination to exclude vital non human aspects of agriculture from analyses".

This is precisely what the present study is seeking to achieve, providing an assessment of the processes causing change within the dairy farming system by taking into account the whole decision making environment and the decision maker. Excluding either presents an unbalanced argument.

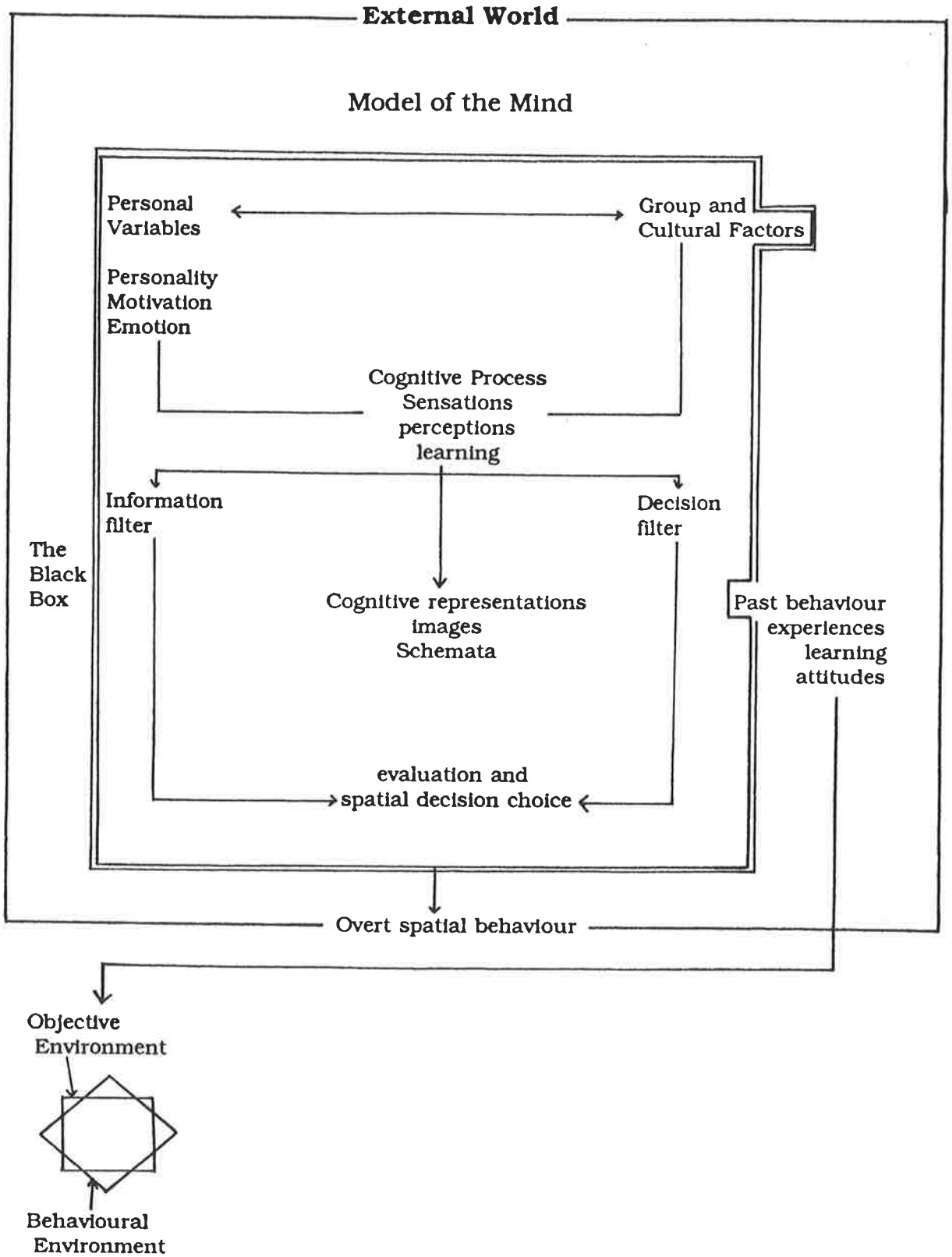
Coughenour (1984) deals, in greater detail, with the relationships between social ecology and agriculture. The starting point is competition theory under which two

Figure 4.7 Man-environment interface



Source: Golledge, 1987, 11

Figure 4.8 Paradigm of individual behaviour, spatial cognition, and overt spatial behaviour



Source: Golledge, 1987, 13

populations of organisations are competitive (Coughenour, 1984, 12) - "no two populations can continuously occupy the same niche (consisting of all..the conditions of resource levels at which a population can survive and reproduce itself)" (Hannan and Freemand, 1977, 947). Coughenour further argues that

> "despite similar enterprise activities [on a farm] large and small organisations occupy different niches and compete most intensively with others of the same size rather than with each other. The principle can be applied to the purchase of certain types of inputs and adoption of new agricultural techniques...
>
> (Coughenour, 1984, 12)

and perhaps also to a more spatial niche, such as the rural urban fringe.

4.3.3 Decision making

From these interaction models have developed explanations for decision making. In this section of the review, the process by which decisions are made, and the relative significance of economic and 'social' factors in the decision making process will be considered.

Moore and Thomas (1976, in Walmsley and Lewis, 1984, 54) classify decision making into a number of types, ranging from highly deliberate problem solving to habitual, subconscious decision making behaviour. They argue that most decisions tend towards the "latter type, largely because of man's inability to process large amounts of information and his predisposition towards minimizing

effort" (Jarvis and Mann, 1977 in Walmsley and Lewis, 1984, 54).

There have been two main theories developed to explain 'geographical' decision making, behaviouralism and gestalt theory. Behaviouralism is the process whereby decision making involves a simple stimulus response relationship which arises from a learning process. Gesalt theory requires the incorporation of the individual mind into any consideration of human decision making (Walmsley and Lewis, 1984, 55). The theory emphasises that "behaviour is guided, not by the external environment as such, but rather by a distorted psychological representation of it" (Walmsley and Lewis, 1984, 56).

Both of these models fail to address what is actually going on in the mind while decisions are being made. March and Simon (1958, 256) argue

> "that most human decision making is... concerned with the discovery and selection of satisfactory alternatives... conditions for satisfaction are adjusted upwards or downwards on new experience and new aspiration levels...".

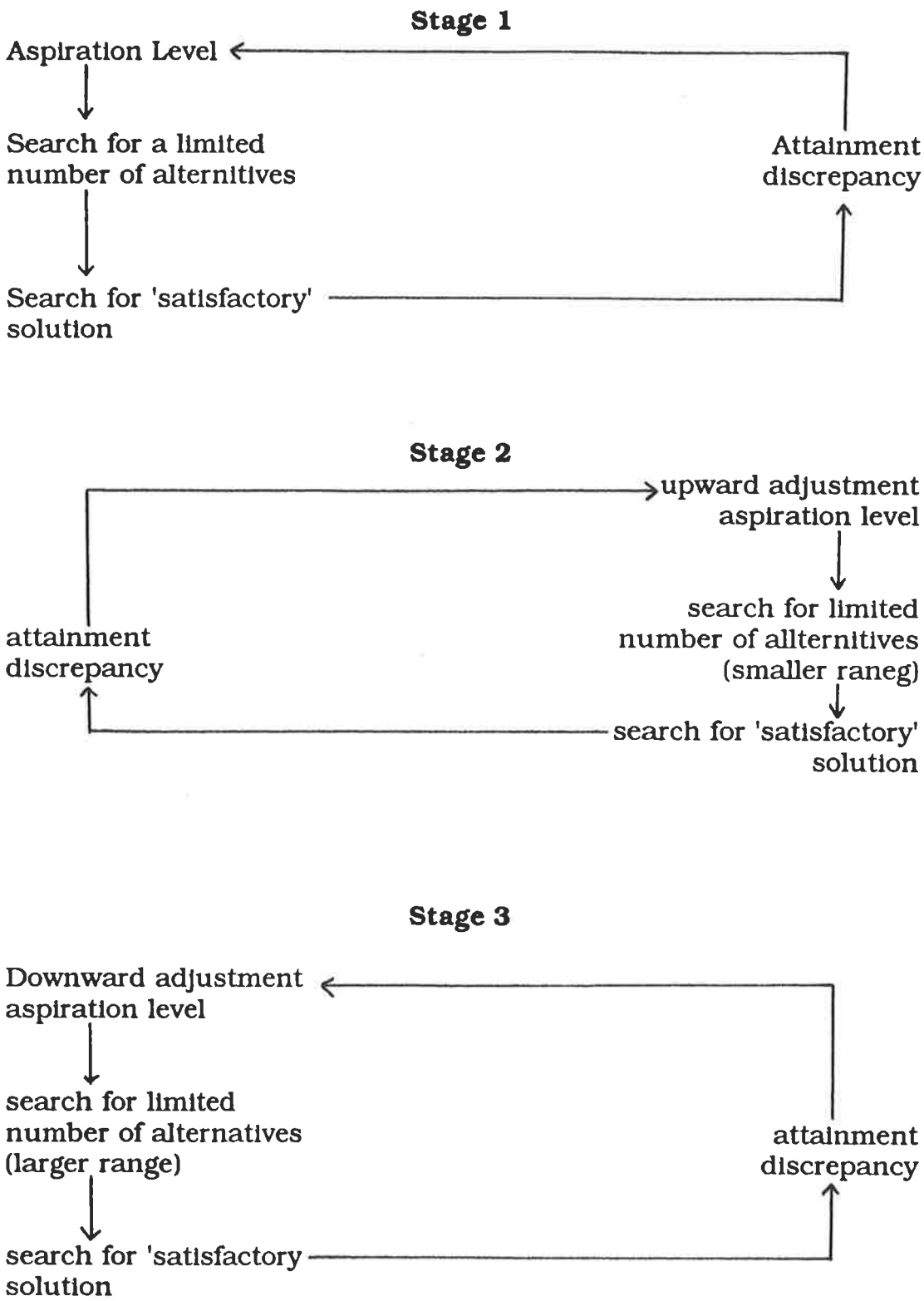
The same criticism has been levelled at the game theory models referred to earlier. Although they incorporated the concepts of risk and uncertainty, obviously major considerations in any decision making process especially for farmers, they failed to determine how and what the decision maker was thinking at a particular time.

A model of decision making was developed by Walmsley and Lewis (1984) in the context of aspiration levels and satisfactory solutions (with concepts taken from work by Wilson and Alexis, 1962). This model is illustrated in figure 4.9. In some ways it includes assessment of the mode of thinking of the decision maker. Eyles (1971, 247) in his analysis of factors leading to a decision on spatial preference identified two main aspects of spatial behaviour, opportunity (the possibility of behaving in a certain way) and preference (actually behaving in a certain way). Further he argued that preference could be divided into two main types of spatial preferences, absolute and relative. Absolute preference describes the way people, usually through lack of opportunity, perceive that they have no choice or no need for choice. Relative preferences occur when people perceive they have or need a choice. Eyles illustrated these concepts in a model (illustrated in figure 4.10) which focussed on the factors eventually leading to a decision.

Coughenour summarises the situation: "Farmers' perceptions of environmental resources for agricultural production are shaped by farmers' goals, interests, capital resources and technical skills" (1984, 15); the natural resource use strategy the farmer uses may depend on

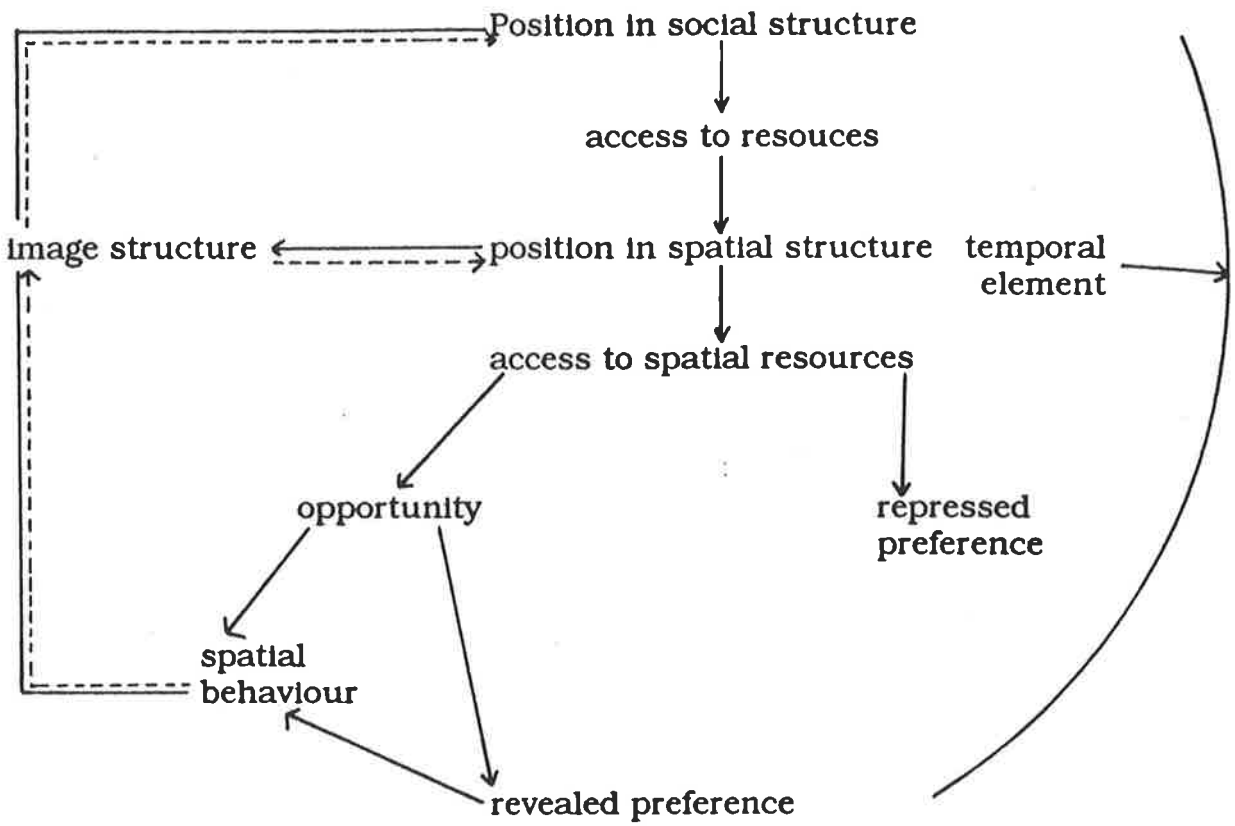
> "(i) whether he views the resource as renewable or non renewable, (ii) how he regards the resources as fitting into the resource requirements of the farm, (iii) management style, (iv) stage of family life

Figure 4.9 Single and multiple choice decision making



Source: adapted from Wilson and Alexis, 1962, 24

Figure 4.10 Factors leading into a decision on spatial preference



Source: Eyles, 1971, 246

cycle, and (v) unpredictability of environmental and economic conditions" (Coughenour, 1984, 9).

All these factors will be discussed in greater depth as the review proceeds.

4.3.4 Problems of the behavioural approach

Despite the rapid development of behavioural geographical concepts, several problems relating to their ability to explain decision making behaviour have been identified. Walmsley and Lewis (1984, 9) argue that conceptual thinking has gone ahead faster than the actual testing of such theory. Furthermore, behavioural studies tend to lack a common methodology which limits comparisons, and "hinders the development of any behavioural theory of agricultural location" (Hart, 1980, 101). Bunting and Guelke (1979, 449) make the same criticism, in that the "research hasn't produced a coherent body of knowledge that significantly augments our understanding of man-environment relationships".

Bunting and Guelke (1979) argue further that the theoretical framework is weak. They are critical of what they perceive as the philosophy's dependence on two broad assumptions, firstly, identifiable environmental images exist that can be measured accurately, and secondly, that there are strong relationships between revealed images and preferences, and real world behaviour (Bunting and Guelke, 1979, 453). They believe that behavioural studies tend to place too much emphasis on "ego-centred" interpretations.

Another problem arises from the behavioural approach's heavy dependence on quantitative relationships and increasingly complex analysis, making it difficult for those not well versed in statistical analysis to understand what other researchers have done, and for researchers with a limited quantitative background to undertake research in these areas.

Cullen (1978, in Walmsley and Lewis, 1984, 12) has argued that geographers using a behaviouralist approach fail to consider a time dimension in their studies.

Hart (1980, 101) finds the approach "difficult to equate with an economic approach". He asserts that, because of the need to compare profit maximising alternatives with behavioural decisions "some form of economic analysis is an essential prerequisite to the behavioural" (1980, 102-103).

To overcome these problems Bunting and Guelke suggest "a need for reorientation, a refocusing towards overt or active behaviour patterns...an examination of individual activities rather than an exclusive concern with specific types of behaviour" (1979, 456) and further, "a thorough description of human geographical activity [based on] detailed external evidence...critical and imaginative available data...against a thorough background knowledge

of the specific circumstances of the group under study" (1979, 458).

Walmsley and Lewis (1984, 1-2) also comment that "researchers in geography must be on their guard against the dangers of psychologism...whereby social phenomena are explained purely in the terms of the mental characteristic of individuals".

The argument here is that decision making can not completely be explained by considering the mental characteristics of individuals any more than it can by considering purely economic forces. Instead, a wide variety of behavioural factors need to be taken into account in explaining farm decision making, and its ultimate relationship to profitability and productivity.

4.3.5 Goals, values and the family farm

Who then are these decision makers, and what goals and values do they have? This section of the review considers the significance of 'family' in decision making on the farm, and looks at the way it may influence the goals and values of farmers.

The tradition of the family farm is almost legendary in the context of farming in most capitalist countries, and no more so than in Australia. In this tradition the farm is to be passed on to the next generation, then the next, in perpetuity. Farmers are born, not made. Farming is a

way of life, not just a job. Decisions are made with the view of ensuring the farm's on-going economic viability, and if more than one child wishes to remain on the land, money needs to be saved to purchase additional land. Is the family farm fact or fiction? How much importance is placed on the concept of 'family farm' in decision making?

Some economic rationalists would argue that a 'family farm' is now no longer really important, and is declining in significance as agribusiness takes over what once were family run farms.

Gasson (1973, 521) discusses in great depth the goals and values of farmers, suggesting that a knowledge of these, combined with information concerning land resources, would be a far better guide to the way farmers make economic decisions than economic theory provides. Gasson defines values as "instrumental, social, expressive, or instrinsic aspects of farming" (1973, 521) and argues that their ordering in relation to one another influences a farmer's decisions when he/she actually has a choice. Goals, suggest Gasson, are "ends or states in which the individual desires to be, or things he/she wishes to accomplish" (Gasson, 1973, 524). Goals may be interconnected, a hierarchical series of goals leading to an ultimate goal, and they may change over time and circumstance. Values are most likely to be more permanent, and will underlie the goals.

Gasson's research indicates that farmers have an intrinsic orientation to their work, "valuing the way of life, independence and performance of work tasks above expressive, instrumental or social aspects of their occupation" (Gasson, 1973, 521). She tentatively concludes though, that larger farmers are motivated towards economic success, and that smaller scale farmers emphasise independence and farming for its own sake. In the latter case it could be argued that behaviour is not economically rational and they may be unwilling to obtain help from other farmers or advisors for fear of loosing control of the enterprise (Gasson, 1973, 535).

Further, Gasson argues that values are organised into systems (known as value orientations) which in turn determine the "desired ends of behaviour and prescribe norms or socially acceptable means of attaining them" (Gasson, 1973, 525). If this is the case, uncovering the farmers' value orientations is a key to predicting their behaviours. These can only be determined by discovering where each of these values stand in relation to each other, and in turn will indicate how the farmer will act in a given situation.

Gasson's 1973 article provides insight into how best to study values, by observing behaviour and verbal responses. Past behaviour can be used in value recognition in situations of preference (for example, the

use of leisure time), but is arguably of little value where behaviour is influenced by situational factors. Verbal indicators of values include "direct questions about how much certain items are desired, ranking, rating or indicating agreement with statements embodying values, response to hypothetical questions involving choice [and] replies to open questions about what is important or desirable" (Gasson, 1973, 525).

There are several problems with using verbal indicators which must be taken into consideration when assessing the value of responses: response may depend on whether the interviewee is interviewed along with family or at work. The subjectivity of the interviewer may have an impact and respondents might wish to appear 'acceptable' in some way in the response.

A possible general classification of values is:

i) instrumental values: maximum income, making satisfactory income, safeguarding income for the future, expanding the business, providing congenial work conditions.

ii) social values: gaining recognition, prestige as a farmer, belonging to the farming community, continuing family tradition, working with other family members, maintaining good relations with workers,

iii) expressive values: feeling pride of ownership, gaining self respect for doing

worthwhile job, exercising special abilities and aptitudes, chance to be original and creative, meeting challenges, achieving objectives and personal growth,

iv) intrinsic values: enjoyment of work tasks, preference for healthy, outdoor farming life, purposeful activity, value in hard work, independence, freedom from supervision and control in a variety of situations.

What then has the family farm to do with this? Indeed, what characterises a family farm? In most cases there is no separation of management from control, extra labour is often obtained from within the family, and they are generally small-medium sized enterprises.

Hay and Morris (1984, in Gasson et al., 1988, 4), in their survey of family firms, discovered that all those sampled desired to maintain control, and to pass on a secure and sound business to the next generation. "For many firms, the decision making time scale is intergenerational and short term profitability might be sacrificed to longer term growth" (Hay and Morris, 1984, in Gasson et al., 1988, 5). This type of assertion is very closely related to the previous discussion on goals and values. To make the decision making environment even more complex, the decision processes may involve several people (members of the family) who may not share the same

objectives, or may have a differing order of priorities for the business.

As with many other small firms, a farm business may theoretically have several advantages over larger enterprises - flexibility, adaptability, responsiveness to change, and so on (though in many cases, given a high level of capitalisation on a farming property, and risk and uncertainty associated with climate, markets and prices, response to change may be very limited, certainly in the short term). They can also have problems: extreme difficulty in establishment given the exceedingly high costs, reluctance to accept outside advice, government intervention, conflict between family members and inability to borrow money. Gregor also identifies similar disadvantages

> ...[they are] at a disadvantage in making use of more specialised and mechanised labour...and taking advantage of more intensive methods of managing production resources...[and lack the ability] to match the level of capital...attained by the larger [farms]...
>
> (Gregor, 1982, 2)

Whatever the case, Gasson et al. (1988, 10) suggest that "an appreciation of the dynamics of farm businesses may be hampered by having too static a conception of the farm family unit".

Harrison (1972, in Gasson et al., 1988, 16) asked the question "under what conditions family run farms act more cautiously or more innovatively than other farm

businesses?" (based on his thesis that if, in a family farm the family's fortune is at risk, decision making behaviour will tend to be cautious). Gasson et al. (1988, 16) suggested that decision making might be made over different time scales; Reid (1974, in Gasson et al., 1988, 16) argues that unless the wishes of all family members are considered (especially if they are providing labour input) the business may be threatened. The needs and objectives of other members of the family may not coincide with the wishes of the farmer and decision making in this context of differing goals and values can be extremely difficult. The situation does perhaps have parallels with decision making by large corporations.

The family cycle appears to be a very significant factor in arriving at certain on-farm decisions. Nalson (1968, 36) observes that "the family in family farming is not a constant unit...in the course of time a particular farm family will change in number, vigour and requirements". Salamon and O'Reilly (1979) in a research study of Illinois farmers developed four types of family development cycles relating to the farm enterprise. Survey data demonstrated a relationship between the age of the operator's first purchase of land and a family development cycle type: 1) expander families, protecting and expanding land so as to be able to give land to each child (1979, 531), 2) conservator families, little or no expansion of the farm, but still appreciating its 'ethnic value' (1979, 533), 3) pragmatists, who do not feel so

tightly bound to values as 1) and 2) (1979, 534), and 4) the convertor, with occupation/s other than farming (1979, 535).

Moran (1988, 84) suggests, "decisions are influenced by both different available resources and different demands on these resources". Both authors have developed their own models of such a situation. Nalson's life cycle phases are, in order, the early phase, with all children under school leaving age, and where only the labour of the farmer and his wife are available, the middle phase, where some of the children are of working age, living at home, and working on or off the farm, and the late phase, when all children have left home, or the wife is past childbearing and has no children.

Moran's equity cycle is more complex, and relates the behaviour of lending agencies to the decisions of the farm firm. When demand for funds for family and farm was greatest, interest and capital requirements were high, and lower towards the end of the family cycle. Heady (1952, in Moran, 1988, 85) concentrated his research on the impact of competition for finance between family needs and farm needs; when in the years of children growing up demand for family priorities is high. Later, the family could be substituted for hired labour, or can obtain off farm work, bringing additional money into the household. Both these could affect the viability of the farm, and decisions may be made differently. It is very

important to note that high levels of interaction in the family "is especially important for systems of production such as dairy farming which requires high inputs of labour" (Moran, 1988, 86).

Moran's study of dairy farmers in New Zealand indicated that approximately 50% of the variation in equity can be explained using a single variable - age. These income differences "result in different farmers behaving differently faced with the same stimuli. Risk taking will in some cases be related not to any behavioural predilection to risk, but to the favourable economic circumstances of the farm family" (Moran, 1988, 87). In his study some of the dairy farms were taken out of operation completely, or run on a much reduced scale and off farm work increased significantly if the family was facing financial pressure. In some cases, off farm work 'caused' the change of enterprise, in others, off farm work was made possible by the change.

Moran's study concludes "those with higher equity in property have been shown to be more likely to adopt a less labour intensive farming system...[it also explains] observed behaviour of a group of farmers who appear to have made a suboptimal decision [with other studies failing to give] adequate consideration of variable economic circumstances of farm families" (Moran, 1988, 90).

Gasson et al's (1988) review of the family farm also emphasises the growing significance of part-time farming and off farm income (1988, 28). Studies by Harrison (1975) and Gasson (1986) "reveal a general tendency for part time farmers to work full time in the other job and to regard it as their main activity" (Gasson et al., 1988, 29). These 'hobby farmers' are generally comparatively recent purchasers of land, and economic and family ties are less predominant. This trend may also reflect changing expectations of family members, declining labour requirements and changing family values.

The writers also identify having farmer and family labour surplus requirements as being a major cause of inefficiency; on the other hand, family labour, loyalty and so on can produce sufficient income savings on the farm to ensure its survival.

Godwin and Marlowe (1990, 25) indicate that farm wives' off-farm earnings are closely related to wives' education, labour market experience, presence of children, other family income, farm size and debt/income ratio. Changes in these factors have a greater influence on the labour market participation decisions of farm wives than on the variation in their earnings, once employed.

There is no doubt that the role of women off the farm differs from that of the male in many cases, due mainly

to differences in their involvement in the farm labour process and their relative inputs to farm production (Coughenour and Swanson, 1983, 23). Tom (1991, 34) suggests "contribution made by women to the work on farms has been traditionally undervalued...currently, as costs rise and incomes on farms go down, women's contribution to actual farm work increases". The type of farm (extensive, intensive, large, small) is also likely to be important so far as the role of women is concerned.

Orwin (1930, in Gasson et al., 1988, 30) described the family farm in industrial society as an economic anachronism; the predominant view at the time was that the future of farming lay in getting big or getting out. While there has been an increase in larger corporate run farming enterprises, substantial numbers of family farms remain. The 'traditional' advantages of the family run farm (cheap labour, low living standards, traditional authority structures, and emphasis on independence) "may by less appropriate for survival than they were 40 or 50 years ago" (Gasson et al., 1988, 32) but on the other hand, "family relationships...are sufficiently flexible to accommodate demands of larger, capital intensive farms" (Gasson et al., 1988, 32). The values of generational continuity and independence, with emphasis on profits and progress are arguably ideal in this situation which may require economic rationalisation. Very small farms may be unable to function in this

environment, and many farmers will leave farming, leaving others to survive and expand.

The authors conclude "it is probably more realistic to view the family as just one set of relationships which may be activated for successful operation of large farm businesses" (Gasson et al., 1988, 34).

The above discussion emphasised only one of the extremely complex influences on on-farm decision making, and highlights important considerations which must be made in the current research project. How important is the family farm in dairying? Does agribusiness play a role in the industry? What impact do goals and values, especially relating to family, have on the motivation of dairy farmers? Answers to these questions are all pertinent in a discussion looking at productivity and profitability in the dairy industry in South Australia.

4.3.6 Innovation and technological change - behavioural aspects

An important aspect of system change in agriculture, the study of which has relied heavily on understanding decision making processes in innovation and technological change, are the means by which innovations are developed, transferred and adopted. Such analyses provide an important insight into the behaviour of farmers when considering the adoption of new techniques or management styles. It also illustrates why or why not, a farmer

might choose to accept one innovation but refuse another. In the context of this research project, innovation diffusion may form the basis of an explanation for some dairy farmers who are unwilling to improve productivity by implementing 'better' management as the agricultural economist or scientist would perceive it.

There is little doubt that the means by which a farmer decides to adopt an innovation (or not, as the case may be) is important in assessing why (or why not) a farmer is making a reasonable profit, and production is efficient and up-to-date. Do farmers exhibiting higher profits than their counterparts adopt new techniques more quickly - are they more amenable to change? Why do some farmers adopt more quickly than others in the dairy industry?

What is an innovation? Clark (1986, 70) suggests an innovation is usually defined as "any new idea, organisation, practice, or piece of equipment which is used to achieve some social, economic or cultural objective". Barnett (1953, 7) argues that "every innovation is an idea or constellation of ideas but some.. remain mental organisations only, whereas others may be given overt and tangible expression". Improved practices may also be regarded as innovations if they are modified in form, have new functions, or are of wider or more restricted applicability with their forerunners. Obviously, an agricultural innovation is one which is

developed, and, if adopted, used on rural properties or related industries to improve productivity, profitability and/or sustainability.

Jarrett (1985, 217) identifies three main sources from which an agricultural innovation may arise: learning by doing (the farmer on his/her property), formalised agricultural research development publically and privately funded, and direct intercountry transfer. He suggests that in developed countries scientific and educational institutions have always focused on research into new technologies, and farm supply industries have developed their own system of research and development.

Jarrett (1985, 217) has developed two basic models which link research to farm practice:

i) the demand pull model: demand ⟶ invention development ⟶ diffusion ⟶ adaptation

ii) the science push model (induced innovation), whereby the direction of the innovation is determined by the scientist's own research (ie. pure science ⟶ applied science ⟶ development sales profits).

The actual processes of information transferral in these two models are by means of diffusion - the spread of new practices and ideas in both a social and geographic sense. Social diffusion refers to the spread of an innovation from its originating sources to potential users. Geographical diffusion refers to the changing

distribution of an innovation as it spreads from one or more areas to surrounding areas. Communication (between farmers, extension officers, scientists and so on) forms the basis of this diffusion process. The adoption of an innovation is the acceptance of it, and is normally an individual reaction.

Hagerstrand (1952) was the first geographer of note to undertake research into innovation diffusion. His main thesis was that diffusion was a contagious process and he based this on mapping successive distributions of an innovation. By means of the 'neighbourhood effect' an innovation was accepted by people nearest those who already had adopted it. In this way, Hagerstrand argued, the possibility of adopting an innovation declined as the distance from a previous adopter increased (Hagerstrand in Clark, 1986, 73).

Further work indicated that this model was incomplete, and new models were developed. Pederson (1970, 203-54) argued that interaction was a function of distance, where direction and the rate of diffusion was correlated to the population of two places.

Berry (1972) described a "hierarchical system" whereby an innovation would be adopted first in the most important place, then diffused its way down to less important places.

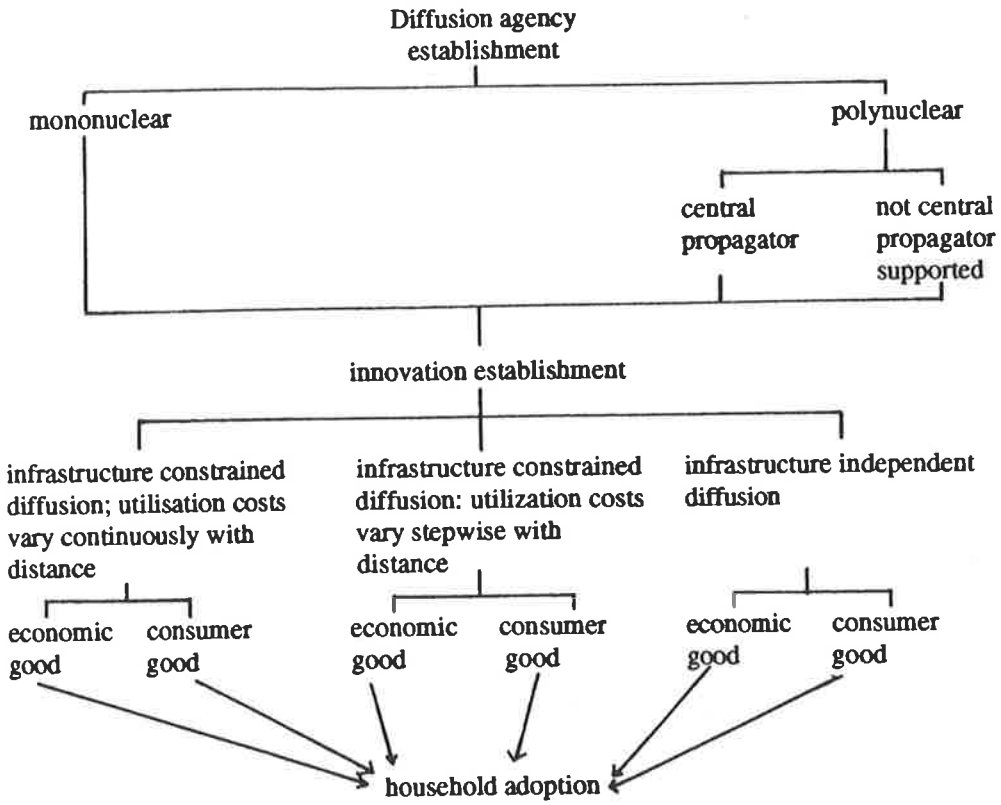
Hagerstrand (in Clark, 1986, 74) then proposed another model of the diffusion process, suggesting that it was based almost soley on word of mouth communication.

Brown (1975, 208) developed a further model, based on the supply side of the innovation (that is, aspects of the diffusion process, controlling the availability of the innovation to potential adopters). He considered the market and infrastructure context of diffusion "manifest in two steps, the establishment of the diffusion agencies and the establishment of the innovation in the service area of each agency...aspects [which] grossly shape the patterns of diffusion process" (Brown, 1975, 208). The diagrammatic form of this model is shown in figure 4.11 and outlines the taxonomy for the spatial diffusion of a propagator supported innovation.

Clark, in his analysis of innovation diffusion focused on the demand side of the process, up to, and including, adoption of the innovation. He also incorporated economic factors in his analysis. His analysis of three types of components of innovation diffusion, the structural, process and cultural is shown in figure 4.12. Clark emphasised that none of the categories was mutually exclusive of the others.

Jones (1967, 1-34) suggests that some information and conversations are more influential that others, and that rather than concentrating on the information, researchers

Figure 4.11 Taxonomy for spatial diffusion of propagator supported innovation



Source: Brown, 1975, 211

Figure 4.12 Components of innovation diffusion

Structural component	Process component	Cultural component
a) modelling how society and economy affect, and are affected by, innovation diffusion b) role of innovations in interactions between society and economy	a)analysis of an aspect of innovation diffusion b)analysis of innovation under specific circumstances c)spatial patterns of diffusion	case studies of one or a few\ specific innov-ations stressing cultural context and interrelation-ships with own societies and economies
LINK WITH OTHER THEORIES		
theories of development location and the state	decision making theory theory of the firm	anthropological and cultural theories

Source: Clark. year unknown, 5

must consider how the information is received, and what use of it is made in the decision whether or not to adopt the innovation. His stages of decision making are illustrated in figure 4.13.

Clark emphasises that the simplicity of this model is a result of its implied rationality on the part of the decision maker. Instead, as Gasson (1973, 77) observed, the criteria people use are varied and "minds quite often come already made up" before they even see a new innovation. Clark also suggests that the model (and other individual decision making) is "based on the assumption that time is available to assess the innovation and that the farmer is a free agent to determine investment in his own best interests" (Clark, 1986, 78). A study by Flowerdew (1976) in Clark (1986) suggested that decisions tend to be taken before deadlines imposed by others and hence are suboptimal. Of course, any decision a farmer makes will reflect his priorities and experiences, and whether he is making decisions on a short or long term basis.

Despite many studies and points of view there is little disagreement that the diffusion of an innovation, when shown graphically, approximates an 's' shaped curve (illustrated in figure 4.14). Clark indicates that an innovation will often evolve over time and that consequently diffusion "may really be a compound phenomenon", (the related but distinct diffusions of

Figure 4.13 Stages in decision to adopt

Problem

↓

Interest / Concern

↓

Awareness

↓

Information seeking

↓

Evaluation / mental conviction and decision

↓

Trial

↓

Evaluation

↓

Adoption

↓

Rationalisation
(post hoc)

Source: Adapted from Jones, 1967.

several models) which total up to form the complete diffusion; this is also shown in figure 4.14.

Similarly widely accepted by rural sociologists is the classification of adopters on the basis of relative time of adoption of the innovation (figure 4.15). In this case, a population is divided into the 'innovators', 'early adopters', 'early majority', 'late majority' and 'laggards'.

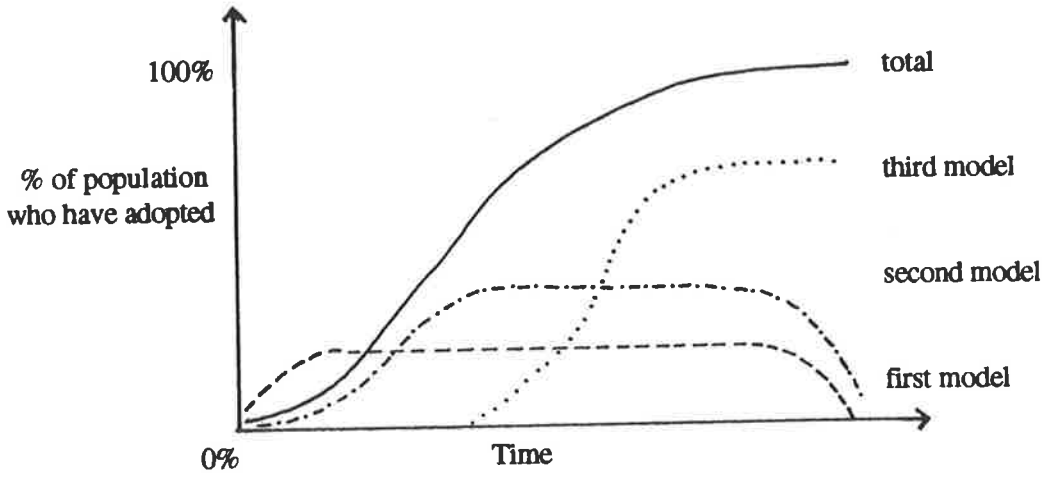
In a comparable fashion, the adoption of a farming innovation over an entire country is expected to approximate a normal s-shaped curve. Of course, the assumptions that an innovation is equally available everywhere simultaneously, and that the stage of complete diffusion in all areas also occurs at a single specific time are not possible in reality, but the concept of the curve still provides a useful framework for research.

Several writers have investigated factors influencing the speed at which various innovations are adopted within a group and these have been identified as follows:

i) national factors: government policy, state of the economy and so on, impacting on the overall state of rural industry will have some influence,

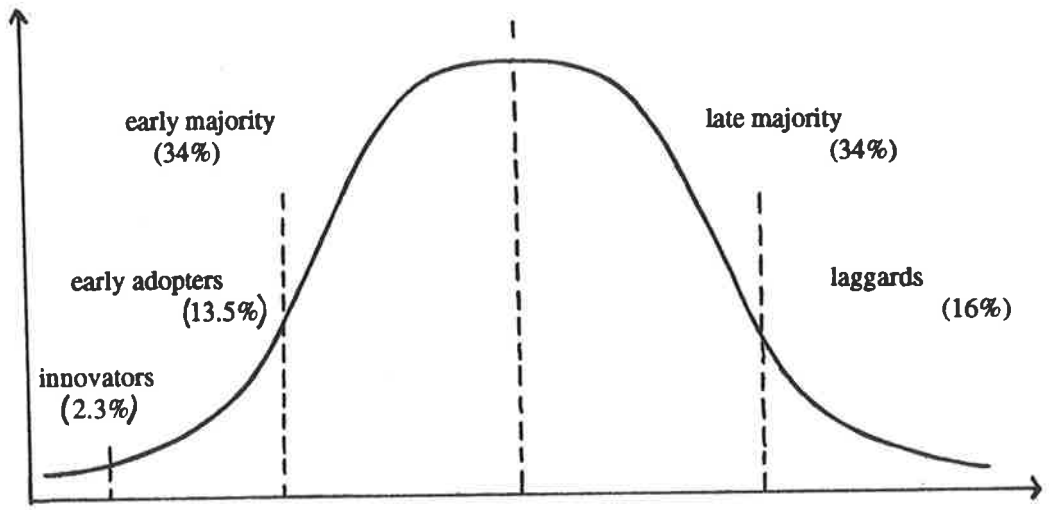
ii) characteristics of the innovation: initial cost, operating and maintenance costs, rate at which an investment is covered, and net effect on farm income will probably have a significant

Figure 4.14 Diffusion of an innovation over time



Source: Clark, 1986, 79

Figure 4.15 Classification of adopters on basis of relative time of adoption of innovations (after Rogers)



Source: Rogers, 1958, 23

impact on decision making. The general hypothesis is that the higher the costs and other economic constraints, the slower the rate of diffusion (Hooks et al., 1983). This was not supported in several investigations (Fliegal and Kuilin, 1962, 364-370; Wilkening, 1952, 5; Robinson, 1956, 85). In Wilkening's opinion, if "economic considerations were their only basis of acceptance, improved practices would be adopted as rapidly as their economic advantages were demonstrated". Obviously this is so, as long as benefits exceed costs - though there is still a question of access to necessary capital, at what cost, and sometimes the problem that to adopt a particular innovation may need some extensive changes throughout the system. Both Robinson (1956, 85) and Salter (1960, 198) argue that the speed of adoption will be related partly to the physical life of the capital inputs. The latter suggests that at any time 'best' practices are not fully adopted since this would involve scrapping equipment only partially paid for, and/or worn out.

Of course, the technical attributes of the innovation - its complexity, compatability with existing techniques, its ease of understanding, attractiveness and viability, will also play a part in the speed of adoption. Furthermore, Ashby in her 1982 study of adoption of high

yielding varieties of cereals in Nepal suggests "farmers' adoption behaviour appear more/or less innovative depending on the suitability of technology for different types of farm and has an ecological base" (Ashby, 1982, 234). This is also supported by Nowak (1987). Gartrell argues that there is the "need for dynamic approaches to innovation that represent the relational nature of diffusion in rural social structures" (Gartrell, 1983, 665) using case studies.

Clark also observes that "innovations costing large amounts of money have to be repaid before any change of enterprise can be considered...a bulk milk tanker and mechanical milking allow much large dairy farms but they also lock the farmer into dairying..." (Clark, 1986, 85). Innovations may therefore increase the risk of farming, and this may be taken into consideration in decision making.

iii) The speed at which an innovation is diffused is also related to the existence (or otherwise) of communication channels. Mass media tend to be important in the early stages, whereas neighbours and friends are more significant in the latter stages. The usefulness of a particular source of information varies at the stages of the adoption process, and between individuals at different positions in the process (Rogers, 1961, 66). For example, extension officers rely on scientific

papers and journals, Farmers rely on field days, agricultural bureau meetings or an individual meeting with extension officers, other farmers and so on. Later adopters certainly rely heavily on their farming acquaintances, and certain farmers may be looked upon as community leaders from whom advice can be sought (e.g. Lionberger and Coughenour, 1957, 107; Sheppard, 1960, 118; Wilkening, 1950, 19-30).

These observations support two interconnected theories regarding the operation of communication media related to disseminating information on farming innovations:

a) as an increased number of farmers adopts a particular practice, interaction between them and those who have not yet adopted it has a cumulative effect on spreading that innovation (Coleman et al., 1957, 253-270; Havens and Rogers, 1961, 409-414); this results in the s shaped curve.

b) Katz and Lazerfield (1955) argue that the original sources of information are influential only on particular leaders. These people then become the sources of information for the majority - a trickle down effect. Wilkening had come to a similar conclusion five years previously (1950, 19-30).

The personal and sociological characteristics of adopters can also be highly significant. Important factors

influencing adoption include the farm size, income of the adopter, age, education, status and social origin. Generally, the higher the income, status and level of education, the earlier the adoption will take place.

Clark (1986, 89) indicates how "complex and irrational decision making really is since factors such as avoiding being seen as behind the times, independence and social prestige are very important". Education and economic status are often important variables in the effective dissemination of information.

4.4 Influences on conservation and sustainability

For a system to survive it must resist entropy; in the context of dairying, the milk producing system must be in long-term equilibrium with the biophysical systems with which it interacts as well as the social/political and economic systems already referred to.

Sustainability and conservation are terms usually used in relation to the biophysical systems but the sustainability of a system is really a consequence of the interaction of the decision maker and the environment. In this context it is important to consider what motivates farmers to make certain decisions regarding the sustainability of farming properties. Do they take into consideration economic principles, costs and benefits in their decision making? How do they perceive conservation? Is it a necessary evil, or of practical significance, or

just a waste of the farmer's already tight finances? Decisions concerning sustainable management will reflect how the farmer perceives the physical and economic environment, and the degree of emphasis he/she places on long term sustainability. Certainly the more traditional analyses based on the farmer choosing to undertake only those management practices leading to profit maximization (in a purely 'rational' fashion) have been found inadequate.

Many original theories have "now been expanded to include various characteristics of farmers that might account for adoption behaviour not accounted for by profit maximisation" (Batie, 1986, 7) including many already considered in this discussion on the decision maker. The main objective of much agricultural research has been the increase and stabilization of farm income - "conservation impact has not been particularly relevant to this goal" (Batie, 1986, 10). There is also a difference in the time frame over which 'efficiency' is measured. In the context of economics, efficiency is looked at over a relatively short time span, whereas ecological efficiency is intergenerational. In other words, what is best even in purely economic terms depends on the time period over which "best" is measured. The capitalist economy drastically discounts future returns so there is strong pressure against conservation measures the pay-off for which is well in the future.

However, given that explanations for declining productivity may be closely related to declining soil fertility and/or erosion (or other types of landuse abuse), the impact of a farmer's decisions in this area can be of great significance.

There are two main approaches to discussing adoption of agricultural conservation technologies: economic, whereby costs of most conservation techniques exceed the benefits in the short term (for example, Lovejoy and Parent, 1982; Pampel and Van Es, 1977; Van Es, 1982; Nowak, 1987), and diffusion, whereby the farmer must be aware of "the need for the technology, be able to obtain valid agronomic and economic information regarding possible consequence and receive assistance in transferring technology and adapting it to the unique environment" (Nowak, 1987, 208; also Heffernan and Green 1982, Nowak, 1982, 1984, Nowak and Korsching, 1983, Taylor and Miller, 1978).

Others argue that the two are complementary. Buttel and Swanson (1986, 31) cite the generally agreed thesis that "the immediate crux of the soil and water conservation problem is that practices to achieve conservation are often not privately profitable". Why? Firstly, a farmer's short term planning horizons due to price instability, economic insecurity, and cost fluctuations may cause "farmers [and society generally] to discount heavily the long term benefits of soil and water conservation" (Buttel and Swanson, 1986, 31); secondly, the high level

of risk associated with climate and other natural occurrences, and thirdly, the farmer's ability to externalise most of the cost of soil erosion and runoff will also impact on decision making. Some of the writers go even further by suggesting "the characteristics of production in agriculture that enable farm families to resist the oligopolisation and centralisation process that has affected virtually all other major industries are those that lead farmers to underemphasize soil and water conservation practices" (Buttel and Swanson, 1986, 32).

These writers argue that only by enlarging farms will farmers be making an income large enough to invest in conservation tillage, and other conservation practices. Even by increasing the farmer's income to solve the problem of short term planning horizons, they believe this "will exacerbate the...land related circumstances (capitalization of assets, enterprise and regional specialisation) which have contributed to agricultural resource degradation" (Buttel, 1984, 269-275). Whatever the case, it is suggested that the future will be influenced closely by public policy and technological change.

Coughenour (1984, 11) observes "unless the farmer perceives the resource as exhaustible or non renewable and important to performance of the instrumental system or long term adaptive strategies of the farm, incentives

to engage in resource conserving practices are limited". Conversely, other writers have indicated that large scale farmers might be "less concerned about the environment and therefore be less likely than small scale farmers to employ environmentally sound methods and practices" (Heffernan and Green, 1986, 31), or less able to manage appropriately large properties.

In testing this observation, Heffernan and Green devised an alternative hypothesis that "small scale farmers cannot preserve the environment as well as large scale farmers because of environmental and institutional factors" (1986, 31). Neither hypothesis was supported completely, with "large farms found to have a lower estimated soil loss than small farms, primarily because the land farmed has less potential for erosion" (Heffernan and Green, 1986, 31).

Ervin and Ervin (1982) took a more wide ranging perspective in their development of a detailed model of the decision making process leading to the use of soil conservation practices. Only education and erosion potential perception appeared as significant factors in decision making; no conservation attitudes exhibited strong statistical influences either. Younger (and less experienced) farmers were more likely to implement more conservation mechanisms. Economic factors could be interpreted as influencing management decisions regarding "crop rotation, tillage methods, and other conservation

practices, which in turn determine erosion reduction" (Ervin and Ervin, 1982, 287). The level of perception of an erosion problem (severe, moderate, slight, none) affected "his private cropland motivated erosion control efforts". The transfer of a farm to a child, off farm income and debt concern did not exert strong statistical effects on final decision making behaviour.

This was contrary to the findings of Buttel et al (1981) who found that education bore little relation to levels of concern about general and agricultural-environmental problems.

Ervin (1986, 105) discussed the hypothesis "that less erosion control is practiced on rented land than on comparable land operated by its owner". He argued that if insecurity of tenure, or problems with the incidence of conservation benefits and costs between landlords and tenants exist, this outcome is likely. Further, "the landlords and tenants may possess certain characteristics that discourage erosion control investments...in greater degrees than owner operators" (Ervin, 1986, 105). Both this theory and some empirical evidence suggest that erosion control decisions on rented land differ from similar decisions by owner-operators.

Swanson et al. (1986, 118) suggest a variety of factors is responsible for influencing the behaviour of farmers in the adoption of soil conservation measures.

Educational and information programmes (extension work) are normally the ways used to persuade farmers of the undoubted benefits of preventing soil erosion but Swanson et al (1986, 118) argue that such efforts "are not sufficient to motivate farmers to invest limited economic resources in practices that yield little or no short-run benefits". They believe that the only solution is to focus on addressing structural barriers (finance, government policy) rather than encouraging changes in landowner behaviour.

Nowak (1987, 218) concludes, in a most pertinent way that researchers "instead of stopping with legitimate deduction that economics are important in adoption of conservation practices, must go on to the equally important task of explaining variability among farmers in terms of their pursuing conservation objectives" the explanations for which must be based on diffusion and economic considerations.

4.5 The role of education

An important characteristic of farm decision makers which affects in a very profound way their perception of, and relation to, their environment is their education level.

Several industry representatives argue that before optimal decision making can be achieved on the farm, there needs to be an improvement in the education of the farmers. There certainly is no doubt that Australian

farmers do have a low level of tertiary education (20% of farmers), well below that of their New Zealand (50%) or European counterparts (90%) (Prior, 1990 in Small, 1991, 9) and recent studies concerning agricultural and related disciplines indicate "that most farmers and their organisations have little regard for the relationship between education and training and the profitability and sustainability of their industry" (Small, 1991, 9).

Even so, top level farmers do appear to spend a lot of time learning albeit in an unstructured and informal sense (Small, 1991, 9) due especially to distance and time constraints (Hutchings, 1991, 49). Further, it seems that many farmers subscribe to the old adage 'You learn farming from farming, not from professors and books' (Small, 1991, 9). They tend to be sceptical of research.

Instead there seems to be a great deal of emphasis on what the leading farmers are doing on their properties - group learning (or contact between farmers) seems to be more acceptable to farmers than book learning away from the farm situation.

The consensus appears to be, in the Australian context at least, that small group learning projects perhaps under the auspices of TAFE will be a preferred option to more formal education. Experience on the farm will continue to be significant.

4.6 Conclusion

This chapter reviewed the variety of theories and models developed to understand what characteristics of the farmer affect the kinds of decisions made. Advantages and problems with the behavioural approach are discussed, and the value of the concept of the family farm in decision making considered. Farmer attitudes towards innovation, technical change, conservation and sustainability are also discussed. All these areas have particular relevance to this study which focuses closely on the decisions being made by dairy farmers in response to continually changing circumstances and for this reason will receive considerable attention as results of the survey are considered.

In line with the systems model of the dairy industry presented in chapter 3 however, an assessment of the means by which the decision maker arrives at a decision would be incomplete without taking into consideration the decision making environment within which the decisions are being made. Chapter 5 discusses a variety of aspects of this environment of particular relevance to the dairy industry and confirms that the decision making environment has great impact on the eventual decisions made.

CHAPTER 5

THE DECISION MAKING ENVIRONMENT

The dairy farmer operates within the decision making environment illustrated in figure 3.12. this chapter looks at the role each aspect of the decison making environment, biophysical, economic, government, and urban development, plays in the process of decision making.

5.1 The biophysical environment

5.1.1 Introduction

Rutherford (1951, 179) commented that natural productivity and landuse management of the dairy farms on the lower North Coast of New South Wales were closely related to variations in certain critical geographic conditions, including the aspect and gradient of land surfaces, soil fertility and drainage, and the availability of stock water.

Holmes (1962) also indicated that soils and slopes were extremely influential in determining the pattern of dairying in New South Wales (1962, 207). Regional climatic variations were significant (Holmes, 1962, 207). Field studies "suggest that, on similar soils, north coast farms have lower stocking rates of poorer yielding cows and less reliable production than their south coast equivalents" (Holmes, 1962, 211). Variation in frequency and severity of spring droughts also contributed to the regional variations in productivity. Rainfall

unreliability was a major problem in the critical spring period in far north New South Wales (Bird, 1962, 14).

Overall, Holmes asserted

> "the fragmented coastal dairy pattern [in New South Wales]...has shown close adjustment to soils and slopes, modified in some measure by climatic variation and on more fertile soils, and by comparison to more intensive forms of landuse..." (Holmes, 1962, 220).

All too often, it was these physical resources which severely affected profitability and productivity. Gruen and Waring (1958, 7) reported that the most common reasons for low production were found in the nature of the farms, not in the farmers themselves although this contradicts other findings reported below (2.6.5). Indeed, a number of farms in this survey were located on land

> ...markedly unsuited for dairy farming and 57 of the 74 surveyed had certain deficiencies as farms. Of course, the actual size of the various properties surveyed could play a very significant role in whether or not a farm was profitable. 32 of the 74 farms were considered too small to be developed by known techniques to produce enough milk to provide the farm's labour force with remuneration equal to the basic wage
>
> (Gruen and Waring, 1958, 7)

Obviously then, the biophysical environment has a profound impact on the suitability of an area for dairying, and will play a major role in determining long term productivity and profitability. It will also have

great impact on the decisions made by the farmer, and for this reason, must be considered in describing the decision making environment within which farmers in the Adelaide milkshed operate.

5.1.2 Climate

The climate throughout the Adelaide milkshed is generally mediterranean, with definite seasonal rainfall distributions and relatively long dry summers. The average minimum and maximum temperatures for selected centres are shown on table 5.1. On the other hand, no where in the state is the rainfall higher than on the slopes of Mt Lofty and the associated ranges (Schwerdtfeger, 1976, 75).

There is a distinct rain shadow effect on the eastern side of the ranges, and rainfall drops off rapidly between the summit of Mount Lofty (which can receive as much as 1600mm per annum) to between 300 and 400mm along the Murray River itself (figure 5.1), hence the need for irrigation in that region. Rainfall in the Hills region is generally very reliable, falling mainly between late Autumn and early Spring, and is of a level ideal for dairying.

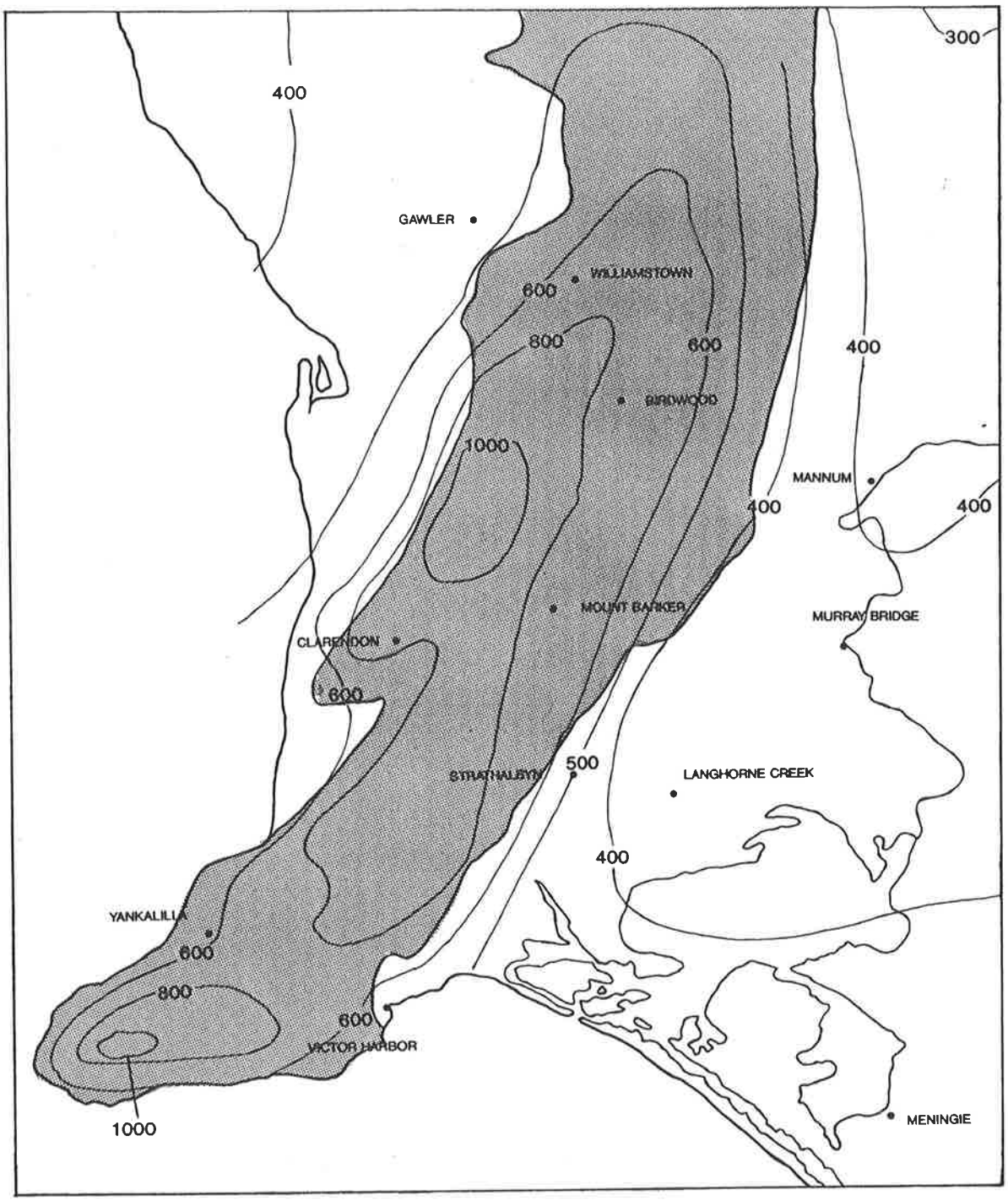
The level of effective rainfall plays an integral part in determining the length of the pasture growing season and hence milk production in the various regions. The growing season in the Hills and Fleurieu Peninsula

Table 5.1 Average minimum and maximum temperatures for selected centres in Adelaide milkshed

	Ave. min. temp. (C)	Ave. max. temp. (C)
Meningie	10	20.7
Murray Bridge	9.8	22.5
Strathalbyn	9.4	21.3
Victor Harbor	11.7	20.1
Mt. Barker	8	19.8

Figure 5.1 Rainfall and topography of Adelaide region

RAINFALL: AVERAGE ANNUAL ISOHYETS IN MILLIMETRES



Source: Bureau of Meteorology

Denotes: Land over 200 metres

therefore coincides with highest rainfalls between April and December, and in the Murray and Lakes regions, mid May to late December.

5.1.3 Topography

The Adelaide milkshed's topography is dominated by the Mount Lofty Ranges (highest point being 720m above sea level) and to the east, the River Murray. Both features are shown on figure 5.1. The landscape in the Adelaide Hills is generally undulating, varying between steep hills and gentle slopes (see also figure 5.2) whereas the irrigation areas consist of isolated strips of reclaimed swamps lying between the river and steep limestone cliffs on either side.

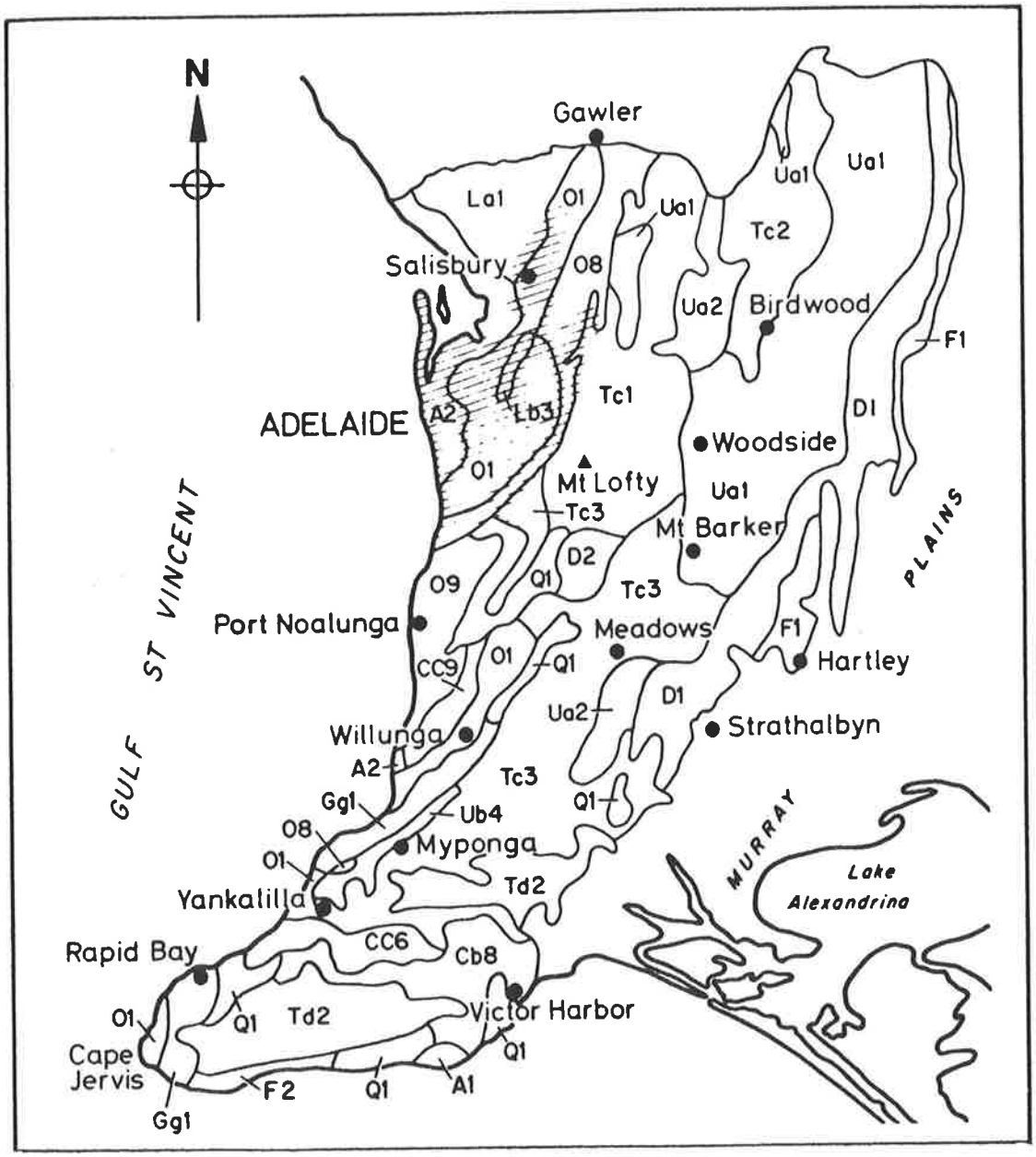
5.1.4 Soils

The soils in the Adelaide milkshed are many and varied, though they can be divided with reasonable accuracy into three sub-regions, the coastal (or plains) strip that follows the Gulf St Vincent along the western side of the Mount Lofty Ranges, the Hills sub-region, and the Murray Plains. These regions are illustrated on figure 5.2, showing the generalised soil-landscapes of the Adelaide region. The hills region is dominated by Podzols and Humus Podzols, Red brown earths, Yellow Podzolic soils, and solodized solonetz and solodic soils.

Figure 5.2

Generalised soil-landscapes of Hills subregion (Northcote, 1976, 63)

Cb8	Undulating	Uc2.3 Podzols and Humus Podzols Dy3.61 Yellow Podzolic Soils Lithosols
CC6	Undulating valleys & hills	Ug5.2, Ug5.3, Grey, brown and red clays Dy3.43 Solodized Solonetz and Solodic soils
D1 D2	Steep hills	Uc6.11 Lithosols Dy3.22 Grey-brown Podzolic Soils Dy3.41 Soloths Dy3.61 Yellow Podzolic, Lithosols, Podzols
F1 F2	Steep hills	Um5.41 Lithosols Dr2.22 Non-calcic Brown Soils Dr2.23 Red-brown earth
G1	Rounded hills	Um6.2 Terra Rossa-Rendzina-like soils Dr2.23 Red-brown earth Uc1.1 Calcareous sands (along coast)
Q1	Hill slopes	Dr2.22 Non-calcic Brown Soils
Tc1 Tc2 Tc3	Hills and valleys	Dy3.41 and .42 Soloths Dy3.21 and .22 Yellow Podzolic Soils Dy3.51 Uc6.11 Lithosols Dr2.22 Non-calcic Brown Soils Dy3.43 Solodized Solonetz and Solodic Soils Dy5.43 Solodized Solonetz and Solodic Soils Uc2.2 and .3 Podzols and Humus Podzols
Td2	Dissected tableland	Dy3.61 Yellow Podzolic Soils, Lithosols, Podzols Dy3.41 and .42 Soloths Dr2.22 Non-calcic Brown Soils Uc2.2 and .3 Podzols and Humic Podzols
Ua1 Ua2	Hills and valleys	Dy3.22 Grey-brown Podzolic Soils Uc6.11 Lithosols Dy3.61 Lithosols, Podzols, Yellos Podzolic Soils Dy3.43 Solodized Solonetz and Solodic Soils Dy5.4 Solodized Solonetz and Solodic Soils
Ub4	Rounded hills	Dy3.42 Soloths Dy3.43 Solodized Solonetz and Solodic Soils


N
Gawler
La1
O1
Ua1
Ua1
Ua1
Tc2
Salisbury
O8
Ua2
Birdwood
F1
ADELAIDE
A2
Lb3
Tc1
D1
Woodside
O1
Mt Lofty
Ua1
Tc3
Mt Barker
D2
Q1
Tc3
O9
Port Noalunga
Meadows
F1
Hartley
CC9
O1
Q1
D1
Ua2
Strathalbyn
Willunga
A2
Tc3
Q1
Gg1
Ub4
O8
Myponga
O1
Td2
Yankalilla
CC6
Cb8
Rapid Bay
Victor Harbor
O1
Q1
Td2
Q1
Cape Jervis
F2
Q1
A1
Gg1
GULF ST VINCENT
MURRAY
Lake Alexandrina
PLAINS

The soil of the Murray swamps is primarily a deep black peaty loam, which is very suitable for lucerne and mixed pasture growing.

The majority of soils are naturally deficient in phosphate and can be deficient in trace elements; lack of molybdenum is a particular problem in parts of the Adelaide Hills.

5.2 The economic environment

5.2.1 Introduction

> "There is no sin in having problems: the sin lies in knowing you have problems and then ignoring them...because you are unsure whether you want to tackle them and find solutions..."
> (Australian Journal of Dairy Technology, 1970)

Pressures to restructure the dairy industry are not a recent phenomenon. For decades, the dairy industry seems almost constantly to have been under stress and undergoing "adjustment".

A review of these economic pressures since the 1950's will place the present economic environment into historical context.

5.2.2 The 1950's and 1960's

It was during the decades of the 1950's and 1960's that farm management was seen to be becoming more complex. Economic theory as a tool for maximising profits and production was being developed by agricultural economists

and to test the concepts, several studies into management and restructuring in the dairy industry were undertaken. These provide an invaluable insight into the dairy industry at the time.

According to an editorial in the Review of Agricultural and Marketing Economics (1953, 163) there was widespread uncertainty over the future of the dairy industry in Australia during the 1950's "arising largely from the industry's high cost structure". This high level of costs per unit output was said to have resulted from (i) dairying developing in areas in which the physical resource base (climate, soil, slope, drainage) was ill-suited to efficient milk production and (ii) many farmers failing to utilize fully their resources by adopting the most efficient forms of management (edit., 1953, 163). Little has changed. On an Australia wide scale, concern over the future of the dairy industry into the 21st century is based on the very same problems, though to an extent which varies with the degree of dependence on the liquid milk or the manufacturing milk markets.

The 1953 editorial continues "from a national standpoint, long run stability and maximum efficiency of the dairy industry will be attained only when the industry concentrates its attention on those areas which present the most attractive soil and water supply conditions" (edit., 1953, 163). Surely too, any farms producing liquid milk would have to be reasonably close to the

market for that milk. Furthermore, while a farmer's ability in the 1950's to expand or shift the enterprise to a more viable region may have been greater because of more available and often cheaper land, already there was concern that some of the best land was being taken up by urban expansion on the fringes of Australia's capital cities.

A decline in the number of dairy farmers, and an increase in the size and carrying capacity of many farms occurred throughout the 1950's (for example, compare figures 1.1 and 1.2, and also figure 1.3). Whatever the location, with average herd size only approximately thirty milking cows, Lloyd (1956, 126) argued that "the industry is overmanned [and that] more attention should be given to devising and publicising labour saving methods". At the time, it was suggested that innovations were less quickly and less fully adopted in dairying than in any other agricultural enterprise in Australia.

Clark (1958, 79) observed that "patterns of living on dairy farms have been changing [and] the element of risk and uncertainty is one of the strongest influences in shaping farmers' attitudes and is apparent in reactions by farmers to many extension recommendations". Further, he noted that there were some farms not capable of improvement. This comment was reinforced in extensive regional studies of dairying in New South Wales being carried out at the same time (for example, Rutherford,

1951; Rutherford, 1952; Anon, 1954; Rutherford and Dillon, 1954; Gruen and Waring, 1958; Bird, 1962; Musgrave and Bird, 1966).

The solution proposed by agricultural economists to solve the problem of low remuneration was "to increase efficiency and thereby reducing costs...[by] raising the volume of production on small farms" (Editorial, Review of Marketing and Agricultural Economics, 1955, 109), through increasing cow numbers. However, this required considerable capital outlay and many farmers were unable to meet these costs.

For some economists, the best way to overcome this lack of finance was rationalisation. Many farms were too small to be viable, and the Bureau of Agricultural Economics perceived the need for action to achieve some form of farm consolidation. This consolidation policy has continued over the last forty years, based very much on the same economic rationale.

The Dairy survey of 1953 was based on these principles and assessed the profitability of dairy farms in South Australia. The resulting report emphasised the efficiency of the swamps along the Murray in comparison to any other dairying area in Australia. Why was this the case? "The swamps are one of the few areas where landuse is more suited to pure dairying than to other enterprises, and where there is little scope for alternative landuse"

(B.A.E., 1956, 1). Of course, this may not necessarily be an advantage.

Gruen (1955) undertook a survey of the incomes of dairy farmers in the Richmond-Tweed region of New South Wales. He argued that "factors other than the type of land used seemed responsible for most of the differences in incomes..."(Gruen, 1955, 178).

Further, he observed that the relationship between net incomes and cow yield was obscured by the tendency of some farmers to milk a large number of cows per person, at the expense of cow yields and the feeding of concentrates. It was concluded that it might be more economically sound to concentrate on milking the optimum numbers of cows, despite the resultant fall in yield per cow.

Any farmer milking 25 cows or less was earning less than the basic wage and Gruen emphasised "that the prevalence of small scale producers is the cause of the high cost problem in the dairy industry" (Gruen, 1955, 178). The solution, intensify, get bigger, or get out.

Schapper and Mauldon (1957) developed a theoretical production function for farms in the wholemilk region of Western Australia, to maximise productivity, then tested it by surveying a sample of farmers: the survey indicated that better managerial ability was associated

with farms producing at higher levels of output and using higher levels of input. The authors suggested that there was considerable scope for the reorganisation of various inputs within each farm; for example "all farms that were underspending on fertiliser appeared to be overspending on purchased feed" (1957). Contrary to the research done in New South Wales, they emphasised that even without any new technical developments, "it is possible to expand production by the readjustment of existing expenditures..." (Schapper and Mauldon, 1957, 59).

Research into the economic viability (and other aspects of dairying) of farms continued apace during the 1960's. The era was one of great change within the industry as it struggled to survive within the context of declining markets (especially overseas) and increasing costs. In other words, the industry was almost continually under stress.

Drane and Edwards (1961) in their comprehensive look at the economics of the Australian dairy industry, underline those aspects causing reconstruction within the industry. "Costs have been rising relative to demand price, the industry's returns are generally comparatively low [and] rather below the normal returns accruing to other farmers" (Drane and Edwards, 1961, 17). Not only that, demand for milk products tended to be income inelastic: Changes in income of milk consumers had little impact on

the actual quantity of product consumed by them, varying only marginally over time.

They argued further that the main contributing factor to changes in output produced by a farmer was the level of profit. On the other hand, when there was a decline in the profit margins, a change in capacity and output by the industry tended to be "difficult and protracted" (ie. slow to adjust to changes in the market, an inelastic supply response). Any increase in output came either from increased production on each farm, or from newly established farmers who, of necessity, were located in marginal dairy areas, and whose costs were highest.

The difficulties of increasing output were arguably largely due to the limited size of the farms and the necessity either to increase exploitation of the land (and face additional costs) or to expand.

The writers indicated that

> ...dairying will, in the absence of rapidly growing demand, become progressively less and less profitable, and must inevitably contract in size... if dairying cannot change cost conditions to suit it, it will suffer a disadvantage...remain in a position of comparative disadvantage...and find itself in an increasingly unfavourable situation...
> (Drane and Edwards, 1961, 20-21).

There can be no doubt that the pressures of the cost price squeeze existed in the 1960's as much as they do at the present time.

As an example, South Australia pursued this phase of increasing output and had an oversupply of whole milk during 1960-61, mainly as a result of marked increases in productivity (Dragovich, 1968, 95) achieved by increased irrigation, feeding concentrates, conservation of own hay, new pasture species and increased fertilizer use (Dragovich, 1968, 97). The increased production was largely diverted to manufacturing, meaning that farmers received the lower basic price for a larger proportion of their milk (from 47% of output, to 58%)(Dragovich, 1968, 97).

As a result, as many farmers as possible attempted to increase the size of their farm and increase labour input (mainly from the farm family). This increased labour helped underwrite the increased capital costs resulting from new equipment and herd improvement.

5.2.3 The 1970's

This decade, like the previous twenty years, saw extensive restructuring occurring in the dairy industry, but particularly in dairy processing (butter and cheese production). This change, according to Powell and MacFarlane (1972, 259) was "primarily a result of economic forces". Prior to this decade, export markets had provided a significant proportion of farmer income, particularly through sales to Europe. With the formation of the European Economic Community however, overseas

demand dropped markedly. As a result, the B.A.E. (1975, 47) predicted further adjustment of dairy farms in the long and short term. McGowan expressed the situation graphically, saying the dairy industry in the mid 1970's experienced a very traumatic shock "with return from both milk products and all animals falling to levels well below those...[able] to provide a standard of living and return to investment comparable with other standards in the economy" (McGowan, 1982, 73).

The impacts of this change were documented in a 1975 report from the B.A.E. concerning structural and farm adjustment in the Australian dairy industry. Their survey of 2700 individuals who had left the dairy sector between 1971 and 1974 provided an invaluable insight into structural change at the time.

Several major conclusions were reached in the study, many of which may be closely related to the current research:

i) whilst farmers from small farms tended to leave the industry in greater numbers than their larger counterparts, there was substantial movement among all size groups (B.A.E, 1975, 3).

ii) the pattern of exits from the industry was related to income level,

iii) the population of dairy farmers (and their families) tended to decrease when incomes were relatively low,

iv) the significance of family labour in the management of the property increased substantially after 1964,

v) there were no significant differences in operator characteristics (age, education, net worth, equity, years of experience) between those who remained in, or left, the industry,

vi) there was an increased tendency over the time span for dairy farms to increase in area, have larger proportions of improved pastures and increased irrigation, herd size, output per farm, and output per cow,

vii) the average capital value of farms had increased substantially, but mainly due to the increasing value of land,

viii) the hypothesis that transferring to beef production was a means of adjustment was supported in all three surveys,

ix) off farm work was also a means of adjustment,

x) the Marginal Dairy Farmers Reconstruction Scheme and Dairy Adjustment Programme played important roles in the restructuring process, either by assisting relocation, re-establishment, or development of already existing properties (through credit to fund expansion, establish refrigerated facilities in the on farm dairy, diversification and/or amalgamation).

It can be concluded from the above that the kinds of adjustment occurring, and the reasons, are not simple,

and certainly not straightforward. For example, small non viable farmers may leave farming partially or fully, large viable farmers may leave the industry by shifting to more profitable enterprises. This means that a 'marginal' dairy farmer can be marginal for many different reasons, and it is important to note that the most 'marginal' dairy farmer may not be the smallest and least profitable.

Further to the above conclusions, the Bureau predicted "that future adjustment patterns may be expected to be largely determined by the level of overseas and domestic demand for dairy products, and the manner in which these demands are reflected at farm level" (B.A.E., 1975, 6). Gargett (1983, 84) observed that "farms leaving the dairy industry during the 1970's were dissimilar to farms that remained in the industry. Significantly, they were smaller, less intensive, less specialised, less profitable, and more likely to be cream producers".

5.2.4 The 1980's

By the early 1980's the B.A.E. could report that the dairy industry had "...consolidated its position of above average profitability relative to other rural industries" (1984). Structural adjustment had been the most important factor in achieving this. The Bureau also asserted that "the high costs associated with market milk seem to be direct consequences of specific government intervention,

[intervention which could] no longer be considered justifiable on economic grounds" (B.A.E., 1984, 3).

A number of other significant points raised in this 1984 study included a) that it was not clear that a year round flow of market milk needs to be guaranteed by a group of farmers when the guarantee entails significant costs, b) that artificial geographical limitation on market milk production entails significant costs, c) that industry and consumers should directly confront the higher costs associated with winter milk production and allow for seasonal fluctuation in market milk prices, d) that the manufacturing milk sector faces significantly increased costs as a result of arrangements which artificially stabilize market milk demand, and e) that uneconomic production therefore exists in both market and manufacturing milk sectors.

On this basis, the Bureau recommended that all assistance measures be removed (over time) so that inefficiencies in the industry would be removed, and the resources could be used more efficiently.

The submission from the B.A.E. to the Industries Assistance Commission (I.A.C.) resulted in the development of the 'Kerin Plan' (the contents of which are detailed in appendix 2, Dairy Legislation (Transitional Provisions and Consequential Amendments Act(1986) and Dairy Produce Act (1986)).

Taylor (1982, 74) supports the Bureau's viewpoint, emphasising that "the farmers are either getting out, or preparing to be dairy specialists, increasing herd size and milk production". Fraser (date unknown, 1) considers in even greater detail the cause of change in the dairy industry. He develops three categories of contributing factors: economic, technical and institutional forces:

i) economic: rising input prices, lower prices received on exports, prices for substitute enterprises increasing, rising level of non-farm income, and poor demand,

ii) technical: pasture improvement, disease control, improved milking techniques, herringbone and rotary dairy sheds, and bulk transport, and

iii) institutional: exchange rates, protection, bounties, subsidies, regulation of production techniques and so on.

Fraser believed improved efficiency required increasing the herd size per farm, increasing the levels of fertilizer applications, and "developing further extension services available to farmers so they can improve their managerial ability, while making management ability a consideration in deciding the applicability for farm assistance" (Fraser, date unknown, 62).

These conclusions fail to consider those farmers who are involved in dairying as part of a diversified farming operation, that is, in conjunction with other enterprises

such as horticulture, cropping and extensive livestock. Such diversification may be the best means of maximising use of available resources and this approach may well be a means by which some farmers remain viable in the long term. It seems inappropriate therefore that dairy specialisation is promoted as the primary means of counteracting changing environmental conditions within the industry, apart from leaving the dairy industry totally.

5.2.5 Non specific studies of dairy farming

5.2.5.1 Introduction

Several general survey based studies of dairy farming and farmers in Australia were also carried out during the 1950's and 1960's. A great many of these studies occurred in New South Wales, and there was a very noticeable lack of research interest in the South Australian section of the industry.

Of particular interest to the current study is a series of very comprehensive surveys undertaken by agricultural economists of the New South Wales Department of Agriculture during the 1950's and 1960's.

5.2.5.2 Methodology

Research methods and the questions asked varied only slightly between surveys (Rutherford, 1951; Rutherford, 1952; Anon, 1954; Rutherford and Dillon, 1954; Gruen and

Waring, 1958; Bird, 1962; Musgrave and Bird, 1966). Integral components of each study included

- physical conditions and their relationship to dairy-farm organisation,
- farm size, acreage of total farm, size of herd (milking cows, breeds, milk herd replacement stock, bulls, pigs, non dairy cattle,
- pastures: types, management practices, supplementary feeding practices, fodder conservation,
- farm mechanisation: milking practices, farm machinery and implements,
- other commercial enterprises on the farm,
- stockwater facilities
- production levels of survey farms (and statistical comparisons between regions) for a three year period,
- farm labour, whether full-time, part-time, family
- land tenure,
- experience/age of farmer/s
- means of acquiring farms and
- financial analysis.

Results related to the economic environment are summarised below.

5.2.5.3 Development potential and adjustment

The possible roles of increased farm size and of alternative enterprises varied between the surveys.

The survey of dairy-farming in Richmond-Tweed region (Anon, 1954, 56-57) indicated that farmers regarded grazing control greater subdivision and more pasture improvement as the most important means of increasing production. Only three farmers claimed insufficient land as the primary obstacle to increased output. Of considerable significance was that only one third of the farmers surveyed indicated they "intended to carry out, in the immediate future, any part of the development programme which they considered necessary to increase output" (Anon., 1954, 57). Problems hampering a farmer's ability to undertake improvements were:

- lack of finance (40%)
- age - some farmers were past retiring age, and had no reason or desire to develop the farm further (13%) or suffered ill health (10%),
- a belief that the farm was being operated at optimum level of production in the present circumstances, and that further effort was not warranted (21%),
- farm tenure or tenure complications inhibiting development work (family relationships 10%, non-family 20%).
- inadequate, insufficient labour (10%)
- need to wait for satisfactory pasture improvement techniques (9%)
- other reasons (11%).

In the study by Gruen and Waring (1958) on small dairy farms development, development potential on each small property was often extremely limited. In 35 (out of 74) cases, the amalgamation of two or more properties into larger units appeared to be the only feasible means of improvement (Gruen and Waring, 1958, 7). Those farmers who did decide to sell normally made capital losses in the transaction. Indeed, 5/6ths of the surveyed farmers had no definite development plans, with one third of the surveyed farmers facing problems of age and/or infirmity (Gruen and Waring, 1958, 8) One sixth of the surveyed farmers derived more than one third of their income from non-farm work. Most part-time farmers had turned to off farm work "because their farms were too small to provide a reasonable living from dairying or any other farming activity" (Gruen and Waring, 1958, 8). Bird (1962, 14) and Rutherford (1951) reached similar conclusions.

Dairy farm amalgamation was recommended throughout the 1960's as the best means of adjustment within the industry resulting in many farmers leaving farming all together. McCarthy et al. (1966) undertook a study of the relationship between amalgamation and increased farm output in Boonah Shire, New South Wales. It was found that "compared to similar farms in the district about 1/3rd of farms adding land has increased production significantly. However, the number of farms concerned was small" (McCarthy et al., 1966, 35). It was estimated that in order for the remaining farmers to obtain an adequate

income one farm in three would need to be absorbed by the surrounding farms.

Despite this emphasis on adjustment through amalgamation, Laut (1970, 36) argued that "there is no relationship between the scale of dairying activities and the decline in ...dairyfarms". He suggested that two types of producers tend to leave - the smallest and the largest (who could afford or were able) to abandon dairying in favour of some other enterprise. Both types were marginal, but for different reasons.

Gruen and Waring (1958, 7) suggested a variety of solutions to make their surveyed farms viable:

- add horticultural or crop sidelines (4 cases)
- improved management (8 cases)
- change to agriculture or horticulture (8 cases)
- increased investment (10 cases)
- amalgamation to larger farm (20 cases)
- amalgamation to form grazing property (15 cases)
- no possibility of increasing income (9 cases)

Musgrave and Bird (1966, 21-22), and McCarthy (1965, 108) focused on off farm work and sideline enterprises as significant means of increasing income levels. The

former's analysis of farming situations using alternative enterprises suggested that cropping should play a greater role than it did, and pig production a lesser role. They concluded that the main hope of adjustment still lay in farm enlargement, amalgamation and accelerated off-farm migration.

McCarthy (1965, 108), in an evaluation of sidelines as a method of raising net incomes of dairy farmers, indicated that gross cash returns from sidelines could be substantial. He concluded however that with current organisation and management, the average non-sideline dairy farmers cannot expect to earn such additional income "because those farmers working with sidelines appear to have superior managerial ability, and non sideline farms have significant resource limitations which restrict their ability to pursue sidelines anyway" (McCarthy, 1965, 108). Laut, in his 1970 study on dairy industry trends in New South Wales 1946-67, observed that the greatest rate of decline in the number of registered dairy-farms occurred where opportunities for alternatives were greatest (1970, 36).

5.2.5.4 Other factors affecting farm productivity and profitability

Rutherford (1952, 83) indicated that herds were significantly larger on non-owner operated than owner operated properties. In such cases tenure may bear some relationship to productivity although the traditional

wisdom is that productivity is greatest when the property is owner operated. In single farmer operated farms, the scale of operations (herd size, output, management intensity) tended to be associated with the age of the farmer. Smaller herds were associated with a greater output per cow (Rutherford, 1952, 83).

Taxation, interest rates and industry regulation received little consideration in any of the studies. Indeed, in all but Holmes (1959), institutional factors are conspicuous by their absence in descriptions of factors influencing productivity and profitability.

A variety of economic, social and technological factors influencing overall farm profitability was very significant, but their impact was felt on most, if not all, farms (though to a greater or lesser degree). Holmes (1961, 191-92) observed that "[they] in association with individual characteristics could be contributing factors to farm closure. However, these were not sufficient causes for closure, but could only take effect in combination with individual characteristics, even if only personal factors".

5.2.6 Research into the South Australian Dairy Industry

Research into the economic status of the South Australian dairy industry is extremely limited.

Bennier (1953) undertook a broadly based study on the milk supply of Adelaide in 1953. Her research, apart from discussing the structure of the dairy industry, concentrated on major problems within the industry at the time, and potential for the industry's expansion. Seasonal fluctuations in production, regional differences in farm management, and the collection and transport of milk were identified as difficulties most likely to threaten Adelaide's milk supply. She argued that increased supply would be needed in the future which could be achieved by (1) an increase in the number of licensed producers, with producers to be limited by the amount they produced in their leanest period to improve balance in the industry, and (2) increased production by already licensed producers, particularly through the irrigation of summer pastures (Bennier, 1953, 66-68).

Guiliani (1975) undertook an economic analysis of Adelaide's milk supply industry encompassing the role of the Metropolitan Milk Board, the Price equalisation scheme, zoning and distribution of milk, and trends in the production of milk. Observations of significance correspond closely to those observed on a national level, and other research surveys: the move away from the smaller farm, an increase in the overall number of cows, and in the number of cows per farm, and an increase in average production per farm, due to improved breeding, feed and management techniques. She suggested that the

efficiency of producers had improved significantly in the decade between 1963/64 and 1973/74 (Guiliani, 1975, 70).

Chesters (1977) undertook a detailed analysis of dairy farming in the Monteith irrigation area, 1971-1977. He argued that the cost/price squeeze and technological advances would cause rationalisation and small and/or inefficient producers to leave the industry.

A dairy farm survey was conducted by the Department of Agriculture throughout South Australia during 1988 of 102 randomly selected farmers, using financial and physical data for the year ending 30 June 1987 (Dept. Ag. Fact Sheet, 8/89). It showed farmers along the River Murray and in the Lakes region were most profitable, despite higher production costs.

5.2.7 Conclusion

From the preceding discussion, and from a perusal of appendix 3, dealing with the economic status of dairying in other Australian states, it can be seen that there has been continual adjustment in the Australian dairy industry since the 1950's resulting from a variety of elements in the economic environment. These included inefficient use of resources, the cost-price squeeze, inelastic demand for and supply of milk and its products and farm location at an 'uneconomic' distance from processors or markets. In the 1970's came a dramatic decline in markets for manufactured milk products, with a

tendency for small, less intensive, less specialised and less profitable dairy farmers to leave the industry.

In 1984 the then Bureau of Agricultural Economics reported a case for further extensive change in the dairy industry through the removal of all assistance measures to farmers and processors. It was argued that industry and consumers should directly confront the higher costs associated with winter milk production, that year-round supplies of milk by a group of farmers need not be guaranteed when the guarantee entails significant costs and that artificial geographic limitation of market milk results also in significant costs.

In their view therefore, production of milk in Australia was inherently uneconomic in its present state, a sentiment still argued strongly in the latest Industries Commission report, and echoed in recent changes in state and federal legislation concerning the dairy industry. These aspects of the decision making environment are discussed in the next section of this review.

5.3 The institutional and regulatory environment

5.3.1 Introduction

The dairying industry is one which is highly (and complexly) organised in this state, extremely regulated and controlled, and this level of control inevitably has an impact on the farmers working within the 'institutional' and regulatory constraints.

5.3.2 Industry structure

5.3.2.1 Farmer groups

The South Australian Dairyfarmers Association (S.A.D.A.) is based in Adelaide, and is the body representing the interests of all dairy farmers both within, and outside the milkshed. The Association is managed by an Executive Officer, and has members on the Metropolitan Milk Equalisation Committee and in other agricultural bodies. It is a powerful lobby group.

The United Farmers and Stockowners also has a dairy industry section, again representing the interests of South Australian dairy farmers. The S.A.D.A. and dairy section of the U.F.S. have attempted to maintain separate identities until the recent past, with the dairy farmers appearing reluctant to give up their current state of independence and autonomy. However, discussions are currently underway between the two groups with a view to amalgamation in the near future, in order that their political power be strengthened.

At a national level is the Australian Dairyfarmers Federation which is the umbrella group for all state level dairy farmer organisations. It is closely involved with the Australian Dairy Corporation and the National Farmers Federation.

5.3.2.2 The processors

Milk is collected from farms usually every two days by refrigerated tankers. The collection for the Adelaide region is managed by South Australian Milk Haulage Company (SAMHC) based at Littlehampton, in the Adelaide Hills. Tankers are used on contract and up to three collection runs a day are made, seven days a week.

The milk is delivered to the Farmers Union factories at Mile End, in Adelaide, and Murray Bridge, and to Dairyvale factories at Caulfield Gardens, in Adelaide, and to Mount Compass and Jervois.

Collection routes are determined by the proximity of a farm to a main access road. Twelve tankers are in operation at the present time.

Milk outside the Adelaide milkshed is collected either by Golden North tankers (in the mid north of the state) or by the relevant companies located in the South East.

Coordinating decisions by SAMHC are made from Littlehampton, though there are supervisors located at Murray Bridge and Mount Compass. These ensure collections are made on schedule, and that all milk has been collected.

The Farmers Union plant at Mile End (which also owns Golden North processing plants) processes cream, yogurt,

flavoured milk and some butter, as well as whole milk. The Murray Bridge plant producers Frusche, cheddar cheese in addition to whole milk. It also operates plants at Port Pirie and Laura in the mid north of the state. The company's headquarters are located in Victoria.

Dairyvale has factories at three locations, Caulfield Gardens (for whole milk, cream, custard, yoghurt and flavoured milk preparation), Mount Compass (the location of speciality cheese production), and Jervois, where cheddar cheese is manufactured.

The Riverland obtains fresh milk from G.W.Falland Pty. Ltd. situated at Renmark, drawing its supply from the four dairies located in the region. The company is the responsibility of Dairyvale.

COSMO, located at Gepps Cross is a producer of cottage cheese, and AMARAINA, at Marion, specialises in the production of health foods, including milk based products.

There are some small scale ethnic cheese manufacturers located in Adelaide, but the vast majority of speciality cheese, and butter, is made in Victoria, and 'exported' to South Australia.

The main exception for manufactured milk product processing is in the South East of the state. KRAFT has

four factories in Mount Gambier, one at Mil Lel and another at 8 Mile Creek. Mount Gambier is also the location of the Mount Gambier Co-op Factory, and Lakeland dairies. All these operations obtain their milk from the surrounding regions in South Australia and Victoria.

5.3.2.3 Government regulation

State Government of South Australia

The primary function of the South Australian Government in relation to the dairy industry is the enactment of legislation responsible for ensuring milk supplies to the state of South Australia. Very recent and current legislation will be outlined shortly.

Two departments also have major responsibilities for the industry, the Department of Agriculture (now known as the Department of Primary Industry) and the Department of Environment and Planning (now known as the Department of Environment and Land Management) (DELM).

The Department of Agriculture has two main roles:

a) the provision of an extension service to farmers, and the carrying out of regular surveys of farmers to monitor changing productivity, profitability and farming techniques, and

b) until July 1 1993, the control of dairy farms and factories outside the jurisdiction of the Metropolitan Milk Board (i.e. those farms located in the Mid North, Riverland and South East).

The DELM is responsible for monitoring pollution levels on properties (e.g. effluent), and has a primary role in the implementation of the Mount Lofty Catchment Review and Supplementary Development Plan, which has been developed to protect the quality of water being supplied to Adelaide and towns in the hills catchment area, subdivision of rural land, control of expansion of primary production in the catchment, and a variety of other development controls. The Engineering and Water Supply Department is in charge of water supply quality maintenance (of significance to dairy farmers seeking the most appropriate means of disposing of effluent), and is the provider of irrigation water supplies and licences to producers along the River Murray and surrounding Lakes Alexandrina and Albert.

5.3.2.4 State legislation and controls

Metropolitan Milk Supply Act, 1946-1974 (repealed 30 June 1993)

The Metropolitan Milk Supply Act established the Metropolitan Milk Board, and implemented a number of controls relating to milk supply under the Act:

i) the board can declare any area/s to constitute the metropolitan producing district (otherwise known as the Adelaide milkshed) and may from time to time alter the metropolitan producing district (s.28),

ii) a producer cannot sell milk or cream to vendors or retail consumers in the metropolitan area without a milk producer's license (s.29),

iii) no person can treat milk/cream unless the person holds a milk treatment licence, and only on the premises specified in the licence (s.30). Milk vendors must also be licenced (s.30a).

iv) the MMB must undertake quality assessment and control through the provision of laboratory testing (s.30c).

v) a licence is suspended if the act is contravened twice,

vi) the board may, from time to time, make regulations concerning prices to be paid to holders of milk producers' licences or to wholesale or retail vendors either specifically or by references to minimum and maximum prices for milk and cream to be sold in the metropolitan area. Prices may vary according to differences in grade, quality, description or quantity, or the condition or place of delivery, distribution or sale.

vii) S.43 allows the setting of quotas on the percentage of any milk/cream, produced to be sold for consumption as milk or cream.

The Act was amended significantly in 1986, with s.32(3a) changed to

> ...where the Minister, after consultation with the Dairy Industry Advisory Committee is of the opinion that the issue of further licences would result in lower returns to licenced producers thus rendering milk production uneconomic, the Minister may direct no further licences be issued...

Metropolitan Milk Board

The Metropolitan Milk Board, established in 1947 under the Metropolitan Milk Supply Act, served a variety of purposes:

i) the regulation of production, treatment and storage of milk and cream,

ii) the regulation of supply and delivery of milk and cream to vendors and retail purchasers,

iii) the control of laboratory services,

iv) the control and zoning of retail vendors,

v) the fixing of prices to be paid to milk producers, wholesale retail delivery vendors and shops for milk and cream, and

vi) the promotion of milk and cream.

The Board could redraw the boundaries of the Adelaide Milkshed when demand necessitated increased supply and consisted of a full time chairman and 2 part-time members. All members were completely independent of the industry, and did not represent any section of dairying either directly or indirectly.

The Metropolitan Milk Equalisation Committee

This committee was established under the Metropolitan Milk Supply Act, and comprised representatives of the

S.A.D.A., the MMB, Farmers Union and Dairyvale and was responsible for ensuring equality in payments made to all dairyfarmers under the jurisdiction of the MMB. The means by which this scheme operated is detailed below.

Pricing in South Australia

Up to July 1, 1993 the following conditions applied. The basic price per litre of milk was set by Farmers Union and Dairyvale and was known as the manufacturing (or basic) price. It was paid based on the butterfat and protein content of the milk supplied by the farmer, but the actual margins to be received by the farmer were set relative to a cost of production survey undertaken by the MMB.

Producers in the Adelaide milkshed received this manufacturing price for about 60% of their production in a given year. The remainder of the milk (i.e. 40%) was sold as market milk, and receives a higher price, known as the milk bonus. This was part of the milk equalisation scheme mentioned earlier.

The equalisation scheme equalised the price that all producers received for their milk, and has an inbuilt mechanism, the milk bonus, which provided both an incentive and disincentive to production. The scheme was deemed necessary because at the pick-up point on the farm, the milk is not divided into two parts, one part for market milk, the other for manufacturing purposes,

but is kept together in the tank. This means that in one week one farmer's milk might be used for market milk, and in the following week, for manufacturing purposes. Rather than develop a complex scheme to allow for varying rates of payment over time, and to ensure the farmer has a reasonable income level, the equalisation scheme could overcome the inherent inequalities in such a system, and ensures that each farmer gets a guaranteed share of income from production.

The milk bonus was added on to the manufacturing price and provides for extra payments to farmers during the time of traditionally low production during the year (i.e. especially in autumn and winter); it allows producers to follow seasonal patterns of production and therefore allows them to operate with lower costs. It also enables transport costs to be kept to a minimum. The bonus is calculated on protein content of the milk, and fluctuates according to the amount of milk sold as market milk during the month.

In addition to this 'bonus' an autumn incentive scheme is operated by Farmers Union, and is paid at the rate of an extra 50c/kg protein on all manufacturing milk. It will hopefully induce farmers to produce more milk in autumn and is aimed at ensuring supplies do not need to be brought in from Victoria during what is traditionally the period of least production.

The remainder of South Australian producers received the manufacturing price plus, for farmers in the south east, a bonus known as the South East Equalisation Scheme. This puts prices received by farmers in that region more on a parity with Adelaide region producers.

Payment is made to the farmer on a monthly basis.

A brief discussion of pricing arrangements in other states can be found in Appendix 4.

Dairy Industry Review White Paper (July 1992)
Draft Legislation - Dairy Industry Bill (1992)
Under the new legislation, which came into effect on July 1, 1993, the Metropolitan Milk Board ceases to exist, and is replaced by the Dairy Industry Authority. This authority will by responsible for all dairy farmers in South Australia, and its establishment is based on recommendations made in the Dairy Industry Review White Paper prepared by the Government of South Australia. The Metropolitan Milk supply area (otherwise known as the Adelaide milkshed) also ceases to exist in the context of the new legislation, and the Prices Equalisation Committee meets a similar fate. The farm gate price for liquid milk will be identical throughout South Australia.

The White Paper raised several concerns inherent in the pre-1993 pricing system for liquid milk, and recommended, in line with policies of other Australian states, that

deregulation in pricing should take place. A consequence of that, it is predicted, would be interstate trading of milk, a fall in farm gate price, and a loss of dairy farmers. To reverse this trend, the Paper recommends that national legislation be enacted to prevent sale of manufacturing milk over the state borders as market milk.

Furthermore, it suggests that cost of production surveys, with their "inherent inaccuracies" and the problem of whose cost of production should be used) should not be considered in setting the farm gate price, instead preferring to relate the price to the market place. How this is to be achieved is not discussed in the Paper, nor clearly spelt out in the legislation itself.

Whatever the ultimate results of the changes in legislation on the institutional environment of the South Australian dairy industry, there can be no doubt that 1993 will be a year of profound change. It must be remembered however, that this study was based solely on farmers within the original Adelaide milkshed region, and that the results were obtained well before this White Paper and the subsequent legislation, although in their attitudes and responses many dairy farmers were clearly aware of the imminent changes.

Commonwealth Government

The Commonwealth Government also has a major legislative role in controlling the dairy industry, but is mainly concerned with adjustment, equity in pricing and protection of dairy processing industries, and the marketing of manufactured products, rather than with liquid milk supplies. In conjunction with this, it is responsible for the establishment of the Australian Dairy Corporation, whose role it is to carry out many of these functions. A past Minister for Primary Industry, Mr John Kerin, was responsible for the legislation that led to the implementation of the 'all milk levy', otherwise known as the Kerin Plan, which impacted on all Australian dairy farmers involved in any way with producing milk for manufacturing purposes. The corporation was funded by an all milk levy imposed on all milk production and paid by the processors. The plan is detailed in the Dairy Produce Levy (no 1.) Act (1986) in Appendix 2.

5.3.2.4 Industries Commission Report into the Australian Dairy Industry, 1991

In its report, the Commission made several recommendations aimed at

- removing price distortions, particularly the artificial distinction between market and manufacturing milk, and the unnecessary costs they impose on society
- ensuring milk is produced in the least-cost location relative to market outlets

- reducing the extent of unnecessary government intervention in the industry and
- ensuring the industry has the flexibility to adjust to changing circumstances - to capitalise on market opportunities (Industries Commission, 1991, xiv)

The recommendations based on these observations included considerable amendments to the current roles of state governments, whereby they should retain responsibility for ensuring public health and safety of market milk, but have state controls over supply and pricing of the market milk removed. This would be achieved by removing restrictions on interstate trade, controls over supply and pricing of market milk beyond the farm gate and supply quotas and administratively set farm gate prices.

Many of these recommendations were implemented in the legislative changes made in 1992 upon the conclusion of the 1986 'Kerin' Plan, alterations supported by Simon Crean, Primary Industries Minister in the Commonwealth Government.

5.3.2.5 Dairy product promotion

An important function of the MMB in South Australia was the promotion of milk and cream, and was the responsibility of the MMB's milk and cream Promotion Advisory Council. Media advertising and other promotional activities were used on a regular basis.

The individual processing companies also undertake their own advertising campaigns for a variety of products.

The Australian Dairy Corporation coordinates a national dairy produce marketing campaign and many of its other functions are aimed at facilitating improved marketability of the many dairy products produced in Australia.

5.3.2.6 Vending and retailing of market milk

Milk vending (milk delivery to dwellings) in Adelaide has declined in recent years while sale of milk delivered to shops and supermarkets has increased significantly. Some of the smaller retail rounds have merged with adjacent retail rounds resulting in the development of more viable businesses. Further amalgamations have been predicted by the MMB, which issues licences to all vendors. Increasing costs and declining demand for household deliveries are the two main explanations for the fall in numbers. Very few vendors are able to deliver at the minimum price delivering on a day to day basis, and in order to remain competitive with supermarkets, some vendors have reduced the number of delivery days. Despite this (or perhaps as a result) sales through supermarkets continue to increase.

5.3.3 Conclusion

At the time of the surveys therefore, the dairy industry was highly regulated in terms of price and the level of government intervention, and these regulations placed considerable pressure on the decision maker acting in a highly volatile situation.

5.4 The rural urban fringe

5.4.1 Introduction

One of the main reasons proposed by representatives of the South Australian dairy industry to explain the increasing number of farmers leaving the industry is urban expansion into regions traditionally supporting dairy farms. As the discussion of economic theory in chapter 3 indicated, dairy farms have always located close to urban areas, and they should theoretically be most vulnerable to urban growth.

Certainly, over the last three decades, studies of the rural-urban fringe, that illdefined area between city and country, have abounded, and to many researchers, agriculture appears to bear the brunt of the negative aspects of urban expansion. The result of this urban growth, in theory, is farms being sold to developers and hobby farmers, and the loss of production from those properties. Most recent research has tended to widen the perspective, arguing that even in the urban fringe there are many other forces influencing agricultural change and

restructuring, and that urban expansion is but one factor influencing agricultural change.

The following discussion considers these viewpoints, and looks at the relative significance of urbanisation of the countryside as compared to other forces leading to agricultural change, particularly with regard to dairying.
It also reviews briefly the impact that operating in a fringe region may have on farmer decision making.

5.4.2 Definitions of the rural urban fringe

The difficulty of many definitions of the urban fringe is their reliance on descriptive words and phrases. Never the less, a brief discussion of what consitutes the rural-urban fringe is a necessary preliminary to considering the implications so far as dairy farming is concerned.

Wehrwein (1942, 217) defined the rural-urban fringe as the area of transition between well recognised urban land uses and the area devoted to agriculture. Golledge (1960, 242) saw the rural-urban fringe as:

> areas marginal to big cities...with the following features: a constantly changing pattern of land occupance, small farm sizes (because of the inflation of land values as a preliminary to urban development), intensive production, a mobile population of low-moderate density, rapid residential expansion, incomplete provision of services and public utilities, speculative subdivision and building...

Pryor (1968, 206) argued that

> ...the fringe is the zone of transition in landuse, social and demographic characteristics, lying between a) the continuously built-up urban and suburban areas of the central city, and b) the rural hinterland, characterised by the almost complete absence of non farm dwellings, occupations and landuse...

and Russwurm (1971, 108) stated "the urban fringe should be viewed as a zone of rural countryside extending beyond the continuous suburbs under active competition from urban land uses and activities..."

Fesenmaier et al. (1979, 255) suggested that the rural urban fringe "is a zone of more or less continuous transition between extremes [that] cannot be delimited or segmented by sharp boundaries".

Troughton (1981, 219-222) observed that there was often an urban bias in fringe studies because the fringe begins on the city edge despite there still being a "general recognition of the transitional and extensive nature of the fringe...an interface zone". In this context the fringe could be seen as a system "which represents the process of urbanisation and the response in terms of rural transformation or adaptation" (Troughton, 1981, 238).

Although these definitions differ considerably in their wording, the basic concept remains similar; the fringe is a zone of transition between areas totally urban and

totally rural. It is this region of transition that will be the major concern in the remainder of this discussion.

5.4.3 The significance of the rural urban fringe - theoretical perspectives

Sinclair (1967) developed an economic locational model closely related to urban sprawl, and therefore, the fringe region. This model was detailed earlier, in chapter 3.

A great deal of research has been carried out since the publication of this paper and as a result Sinclair's original thesis has undergone considerable revision.

Munton (1974, 202) identified three processes important to agriculture in these fringe locations:

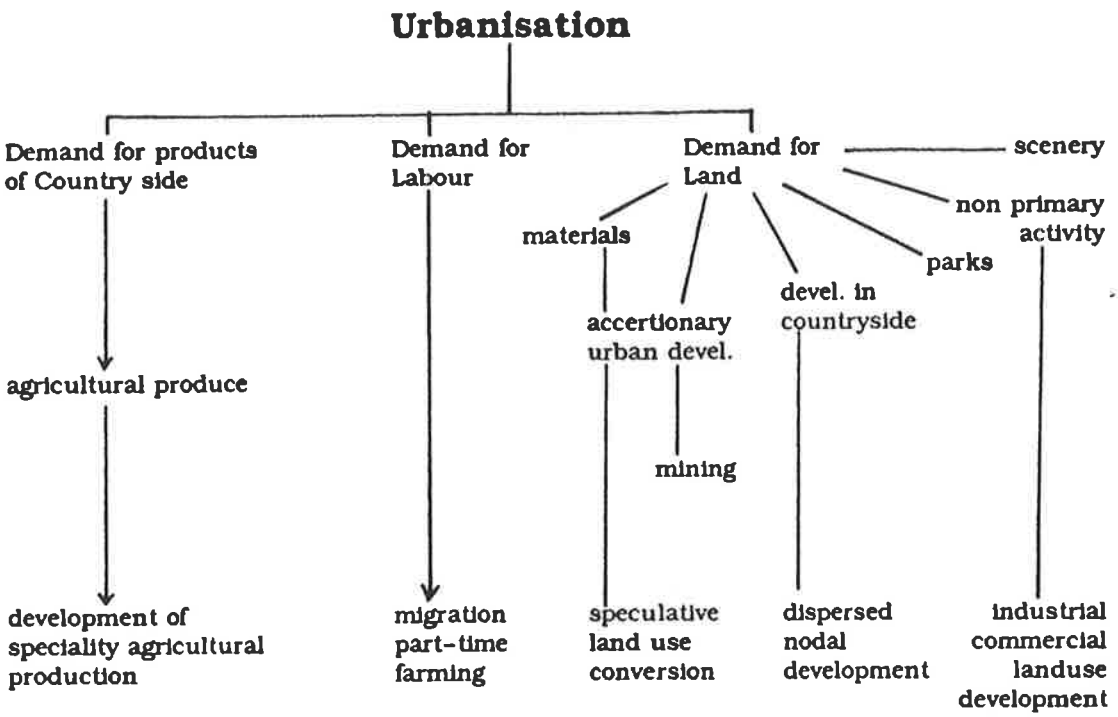
a) the uncertainty in land transfer and competition between users,

b) the rising level of mobility due to increased employment opportunities for farmers (and hobby farmers), and

c) new market opportunities for farmers.

Bryant et al. (1982) identify the variety of forces of urbanisation and countryside (figure 5.3) and summarise their relationships with each other. It is argued that "the use of land for production in the city's countryside is...at the heart of landuse activity conflicts...(ie. between users interested in the production function of

Figure 5.3 Forces of urbanisation and countryside



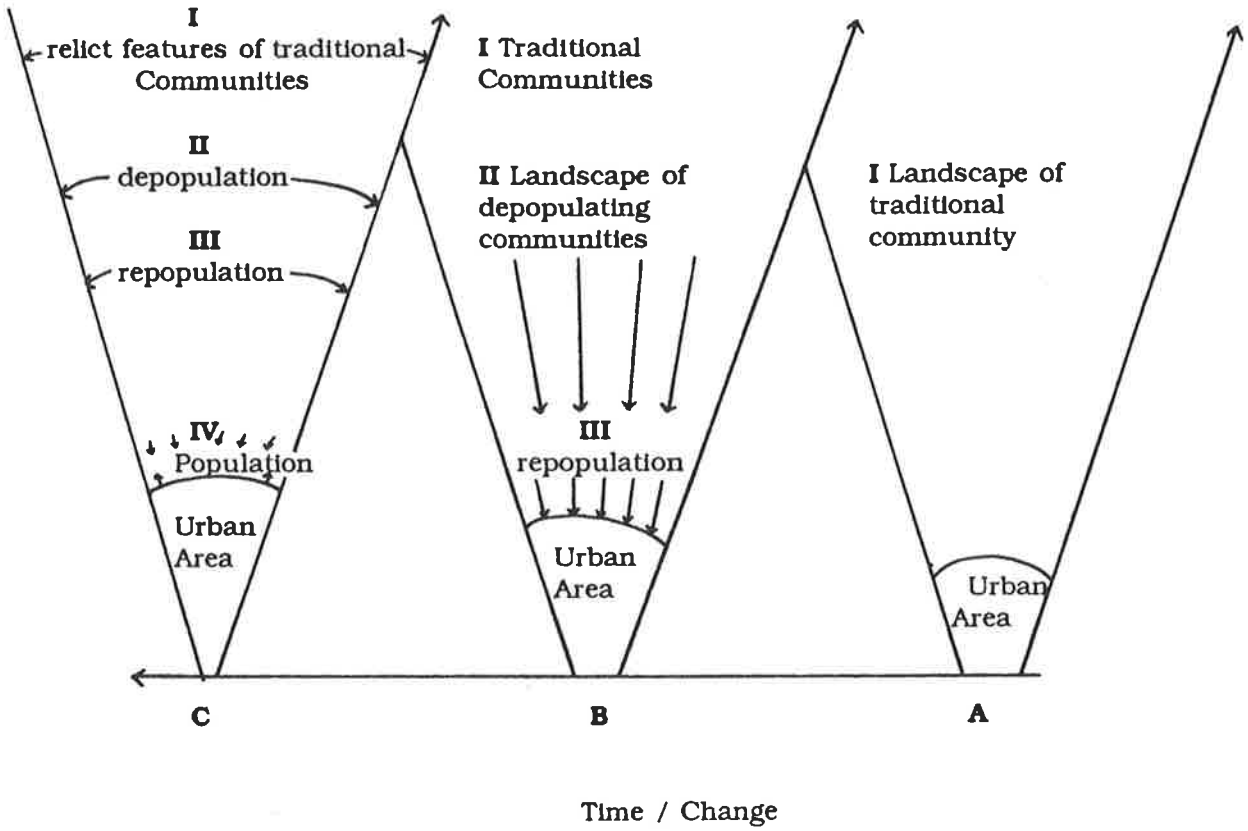
Source: Bryant et al., 1982, 7

the land)" (Bryant et al., 1982, 26). Theoretically land in capitalist society is allocated to the use which will provide the greatest net return - the market "allocates land on a short term basis according to demand and supply at a particular place at a particular time" (Bryant et al., 1982, 27) resulting in land speculation or use of land for short term individual benefits. This concept is illustrated in figure 5.4 which looks at the hypothetical relationships between distance from the urban area and the value of land for agriculture.

Theoretically this market pressure will have an impact on the agricultural resource base (usually in a negative way) through land conversion (of usually high quality land), residential impacts (especially part time farming), and recreational use (the idling of land). It is assumed that land prices will rise, and that the farmer will choose to sell his/her land at the higher price, will 'mine' (use intensively) the land to gain maximum revenue before selling and/or will be forced to leave the property because of an inability to expand the farm (which is necessary to overcome the cost-price squeeze) because of the higher land prices.

More recent theoretical work argues that potential positive impacts may override any negative impacts (which, in reality, may not even exist): The creation of off-farm employment may supplement incomes of farmers and family sufficiently to enable them maintain a smaller

Figure 5.4 A Time space order of urbanisation



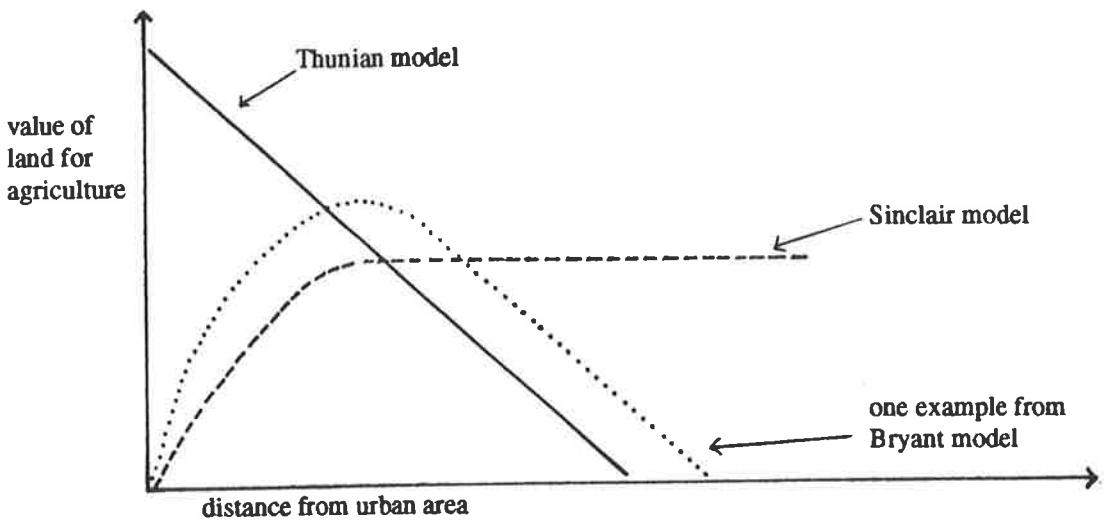
Source: Lewis and Maud(1976,22)

property or purchase additional land; on the other hand, it may release land for other farmers. The growth of hobby farming may cause the development of different types of farming systems. New 'on farm' business opportunities may develop by supplying the increasing population. Non farm land ownership may also encourage increased farm land rental and thereby provide opportunities for farm expansion (Bryant et al., 1984, 16).

Communities may also change over time as the ownership of the land in fringe areas changes. Lewis and Maund (1976) illustrate this 'time space order of urbanisation' in a model, reproduced in figure 5.5.

Even with the identification of these more positive aspects of fringe development the negative perspective still dominates many studies. It is a major fault in studies testing these theories that many fail to take into account other influences which may be contributing to structural change in agriculture. Non urbanisation forces leading to the restructuring include the effects of interregional competition reflecting changing patterns of comparative advantage, government policies and technical change. Munton et al. (1988, 324) argue that in most studies there "is little recognition of the fact that farmers act within a range of technological and financial imperatives quite unrelated to their urban fringe location". There is also little or no emphasis on

Figure 5.5 Hypothetical relationships between distance from urban area and value of land for agriculture



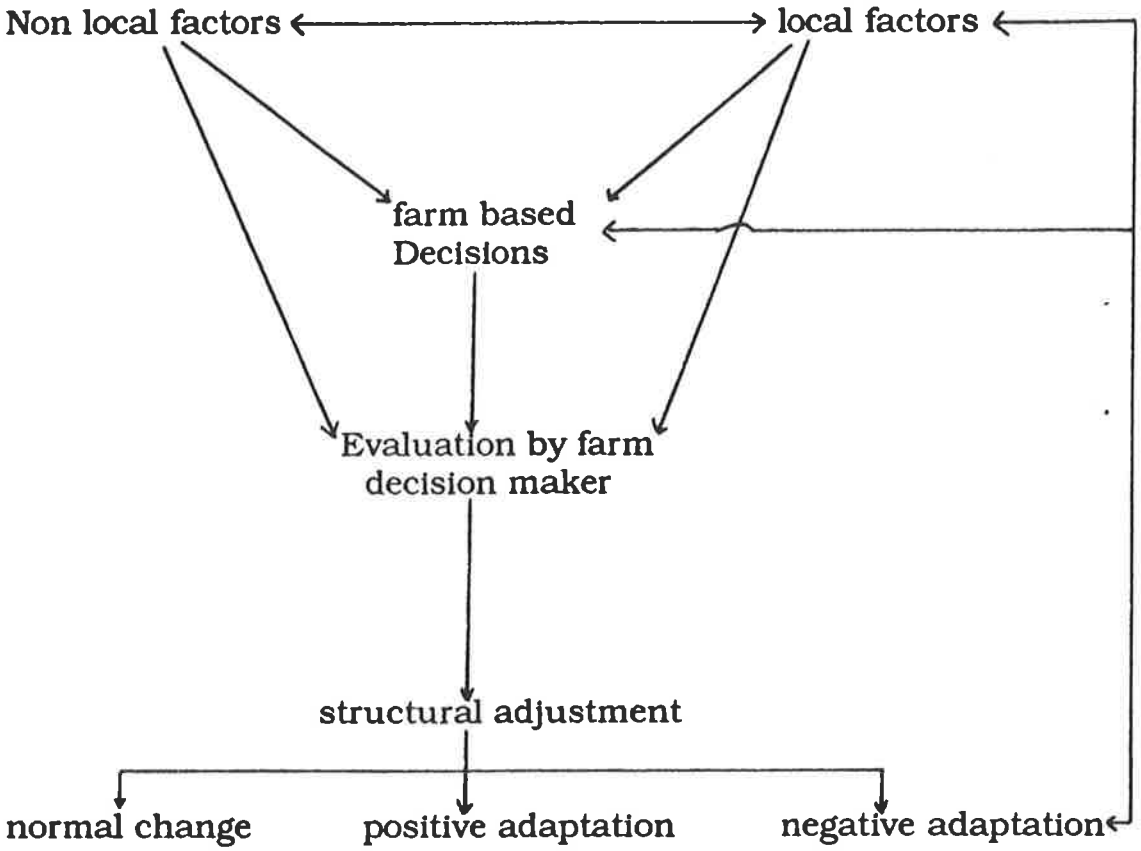
Source: based on Bryant et al., 1982, 103

comparing farming in the fringe and in the 'deeper countryside'.

Bryant et al. (1984) and Johnston and Bryant (1987) take the view that the only way to understand agricultural structure and adjustment in the urban field "lies not so much in identifying which set of forces is dominant but how the different forces combine" (Bryant et al., 1984, 15). Geographically, "the various combinations of urbanisation and non urbanisation forces may result in a differentiation between areas within the urban field as well as between different urban fields" (Bryant et al., 1984, 17). This is no more obvious than in the Adelaide Hills, where the region also functions, as a water catchment for the metropolitan area.

Johnston and Bryant (1987) provide an alternative explanation for the continued maintenance of agriculture in fringe areas. Change (or lack of it) "must be linked to decisions taken by the individual farm operator...individual behaviour is central in shaping the evolution of [the fringe]" (Johnston and and Bryant, 1987, 10). These concepts are summarised in a 'partial' model of agricultural evolution in areas near cities - "it represents a form of agricultural change that is often overlooked because of a lack of attention commonly given to the role of the farm entrepreneur" (Johnston and Bryant, 1987, 10) and is illustrated in figure 5.6.

Figure 5.6 A 'partial' model of agricultural evolution in areas near cities



Source: Johnston and Bryant, 1987, 11

The model is linked closely to the innovation/ diffusion tradition. In the context of the model, the definitions of change and adaptation are as follows: (from Johnston and Bryant, 1987, 12).

1) normal change: adjustments that are typical, characteristic, or predictable rather than specific to a particular situation or location (ie. resembles the farm sector as a whole),

2) adaptive change; those adjustments specific to a single farm or relatively small group of farms, linked closely to local forces, the unique circumstances of an individual decision maker and how those circumstances are perceived.

3) positive adaptaton: intended to improve the farm's economic prospects and property's continuance and

4) negative adaptation, with the ultimate aim of dissolving the farm business.

An analysis of the framework identifies two types of impacts, direct (the removal of agricultural resources, land conversion and consumption rates) and indirect, (the effects on ongoing agricultural structure including the impact that expectations of urban growth might have on agricultural investment, the effect of the atmosphere of uncertainty following rapid urban development, and a decreased time span for planning and investment). These impacts must be taken into account in conjuction with

other urbanisation forces and other pressures on agriculture in explaining agricultural change.

The framework was expanded in a further model which assesses the relative significance of urbanisation forces to other pressures on agriculture on the rural-urban fringe (figure 5.7).

What follows this outline of urban fringe theory is a more detailed discussion of several aspects of agricultural change already mentioned.

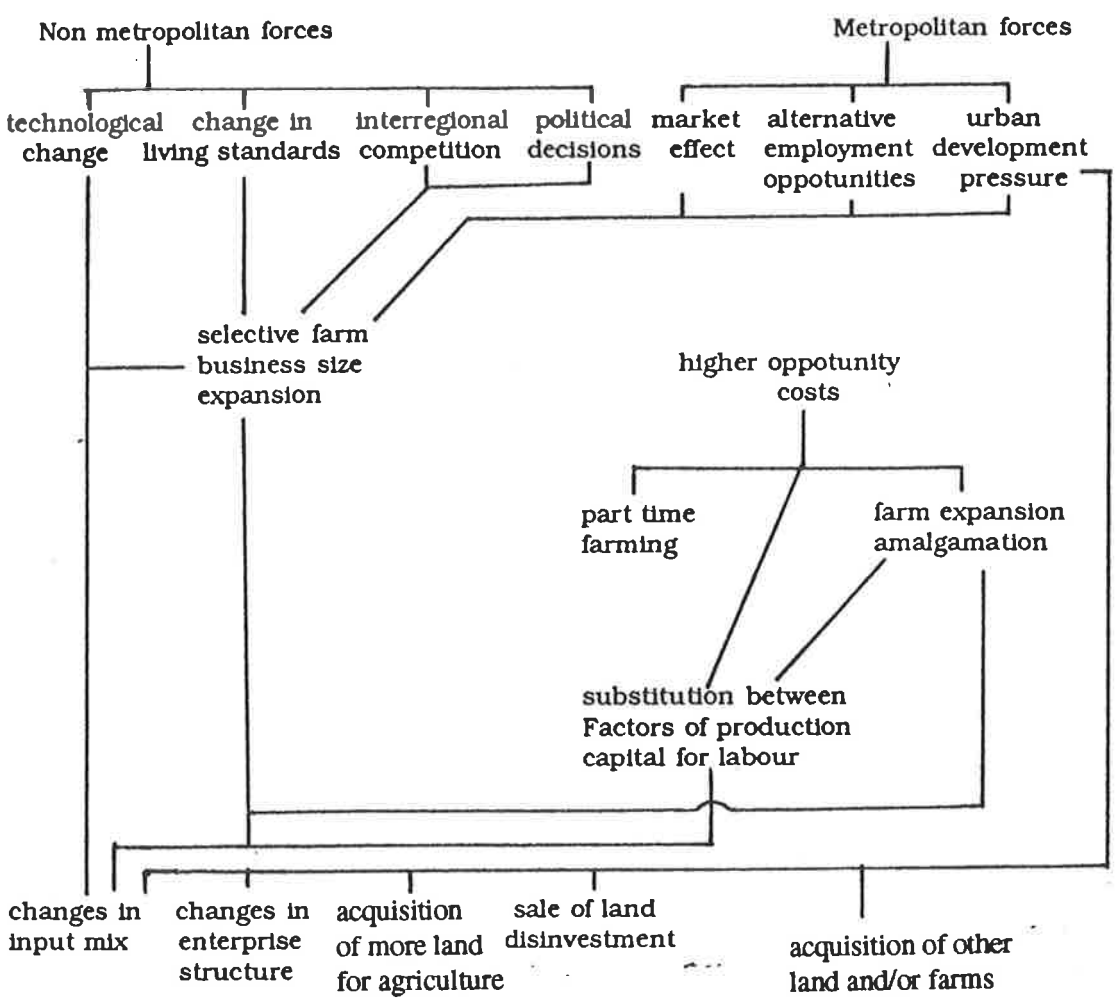
5.4.4 The responses of land values and markets to urban fringe development

5.4.4.1 Introduction

What is the 'rural land market'? Healy and Short (1981, 102) suggest it is "a series of interconnected local markets, segmented geographically and by type of land, and joined together by fitful and imperfect flows of information and capital...".

Who are the sellers? Pyle (1985, 36) identified four main categories of persons involved in selling rural land - the farmers (mainly to other farmers), speculators, (only a small number but extremely active, close to and in the urban fringe), crisis managers (where the need to sell is caused by financial strains), and individualists (transferring land for personal reasons other than

Figure 5.7 Pressures in agriculture



Source: Bryant et al., 1982, 94

finance or retirement). Another study by Pyle (1986, 343) identified four distinguishing characteristics of those selling land - occupation, with the majority of farmers not being sellers, the size of the land holding (non sellers generally had the largest parcels of land), recent acquisition, and a greater interest in selling land (with sellers being more likely to be investors).

It is commonly acknowledged that land market trends in rural areas have altered quite markedly in the last two decades and the generally accepted reason is the changing demand for rural land. Several trends have been documented (and some have already been mentioned in the previous section concerning the theoretical background for urban-rural fringe areas), in particular rising land prices due to increased demand for land (by non traditional owners), particularly in fringe areas. It is also notable that during the same period of time, there has been a collapse in land prices outside the urban fringe. These new owners may be engaging in speculatory land purchase, be utilizing the land as an inflation hedge, be seeking primary or recreational house sites (attracted by pleasant landscapes, cheaper land, the space and so on), and/or be seeking to retire in the country, or be foreign investors (Healy and Short, 1979, 305).

In periurban areas, considerable amounts of land are passing into the hands of non farmers, or to non

residents (or both). There is a great concern that as a result, there is a declining quantity of farm land, and that subdivision is becoming more dominant. Both Boal (1970), and Pyle (1986) identify these trends in field surveys, around Belfast and Rochester respectively.

Martin (1975) developed a model of the land conversion process in an urban fringe, bringing together changing demands for land, and those most closely involved in decision making regarding land sales. The model provides a useful basis for comparing different regions by providing the means by which certain phases in the process of land transfer can be identified. This is illustrated in figure 5.8.

5.4.4.2 Determination of land prices

The predominant arguement concerning the setting of land prices in fringe areas is that the price is determined by the market. This price may bear some resemblence to what the land is worth to the seller, but it is also argued that there is no fixed relationship between the land's characteristics and its price (Martin, 1984, 188). As Healy and Short (1981, 111) observe "land prices are set by what the land is worth to individual buyers and sellers in the market, not on the basis of value to the average farmer". Sinclair (1967, 72-87), Found (1974, 75-79) and Nelson (1986, 309) also noted that there is more emphasis on location and residential attributes rather

Figure 5.8 Land conversion processes

	no urban use	no urban use pressure for change	urban interest seen in land purchase: land use transitional	active purchase raw land	active development	active purchase of developed land
Primary decision agents	farmer	farmer / land dealer	farmer land dealer developer	developer	developer builder	builder households industries, firms
Secondary decision Agents		financier	financier	financier Lawyer realtor Planner Politition	financier Lawyer planner Politition	financier Lawyer realter

← actual stage of conversion → not necessarily evident

Source: Martin, 1975; modified in Bryant et al., 1982, 56.

than productivity. That is, the value of the land is not related to its role as an input to the farm system.

These features of price setting have been observed in several studies of regional land prices. Chicoine (1981, 360) stated that the uses of land neighbouring the land being sold had a significant impact on urban fringe farmland prices, as did the locational attributes of the land. Both aspects overshadowed the land's soil productivity and accessibility to large water bodies. However, Pyle (1985, 32-43) dismisses the idea that land is sold for vast profits and argues that the speculator is not dominant. Boal (1972, 79-82) indicated that wherever urban land demand exceeds supply, prices of land rose. In rural Canada, Martin (1984, 188) observed that in some rural fringe regions, the land's value comes from the urban services that are or might be produced on it.

The response of farmers to this increased demand and higher prices for rural land, will be dealt with in greater depth in the following section.

5.4.5 The farmer's response to peri-urban change

5.4.5.1 Impacts

Before assessing the farmer's response to the changes resulting from peri-urban development, impacts of the change can be categorised as being direct or indirect, positive or negative. Direct impacts include land sale and conversion of farm land; indirect impacts encompass

uncertainty in investment, planning, land management changes and nuisance problems. Negative impacts, given by far the greatest treatment in the literature, include on-farm problems, high land prices, and the uncertainty; positive impacts may be improved markets, availability of off farm work to supplement income, and the ability to obtain a good return on land if it is sold. Of course, whether an impact is positive or negative depends upon the perceptions of the farmer being affected, and under what other exogenous forces the farmer is operating.

5.4.5.2 Factors influencing farmer response

There are several factors which influence the farmer's response to urban expansion. Berry et al. (1976) assert that impacts and therefore decision making will vary with distance from the city. In their study they identified four distinct types of regions, an already built area (city and suburbs), sectors and nuclei of rapid development and population growth (with some land still in agricultural use), with most farm land idle, a semi-rural area, which is substantially agricultural, but where spill-over effects of urban sprawl exist and, rural, with no impact from urban sprawl (Berry et al., 1976, 47).

One of the greatest problems faced by farmers living in areas surrounding the urban fringe is uncertainty, which in turn affects decision making and short and long term planning. This problem is covered in many discussions

concerning fringe development. Berry et al (1976, 47) argue that in the mid Atlantic region of the United States, "the uncertainty created by the possibility of urban development and leapfrogging of housing coupled with spillover effects and passive land speculation lead farmers to make decisions based on short-term expectations and investment". Bryant (1974) suggests that the cost of relative choices of management is influenced by the possibility of future urban expansion. Munton (1982, 230) agrees that uncertainty is paramount in areas where the urban fringe is expanding actively. The latter writer, in his study of the London Greenbelt observes that farm tenure characteristics are important in accounting for land maintenance and management standards. "They are especially significant when the land is owned by non farming companies and let short term" (Munton, 1982, 230).

Parallel changes in social and economic structure are usually occuring at the same time as urban expansion and the farmer will probably take these changes and forces into consideration in decision making. For this reason, the researcher must be careful not to presume any change in industry in a fringe area is purely the consequence of urban forces.

Finally, farmer characteristics and perspectives may play a large part in determining the level of impact of urban

expansion and the farmer's eventual response/s to the situation.

5.4.5.3 Farmer response to periurban forces: adjustments in land holdings, income and farm management

Reaction to rising land prices

In some cases, the farmers will choose to sell their land. Blair's 1980 study of urban influences on farming in Essex recorded that during the study period "farmers...[lost] 2740 ha or 2.3% of the sample area...27% of farmers in the survey had some personal experience of at least one land conversion" (1980, 375). Areas surrounding major urban centres lost land at more than twice the country average. Similar experiences were noted by Gallusser and Smailes, 1988). Taking an overall perspective however, Blair observed that "land loss is seen to be fairly minor in extent [though the farmers have the]...impression that land is being lost at an alarming rate" (Blair, 1981, 376). Bryant (1982) identified a great variation in the amount of land sold between areas close to cities and those more remote. He also commented on the high level of interdependency in the land market in that farmland sales to intermediate actors tend to be higher in areas earlier experiencing intermediate actor activity, higher land prices and non resident purchasers of land (Bryant, 1982, 124). Bryant (1982) and Pyle (1985, 1986) note that the level of transactions between farmers increases steadily with distance from the town/city while "the percentage of

transactions from farmer to other types of user decrease" (Bryant, 1982, 124). Bryant continues (1982, 124) "the positive relationship between farmer sales to non farm individuals and distance from urban areas reflects the move outwards from the urban area".

Changes in management.

It could be argued that being caught up in the rural-urban fringe results in a declining level of managerial control. Nevertheless, if farmers choose to remain on their properties, adjustments may need to be made in systems of production that result in greater output or lower production costs. These would enable the farmer to remain in the most competitive position against other landuses.

One such mechanism is the cutting of input costs (Blobaum, 1987, 5) or adopting low input methods of management. Obviously too, it is necessary to make production (and enterprise) choices that ensure a profit.

Other farmers are forced to accept lower returns, to increase output, or to increase the returns of their managerial and labour efforts by some other means (Smith, 1987, 81).

Intensification may also be implemented (that is, increasing inputs and/or pursuing management techniques to increase production on the same amount of land, or

increase per unit value of output); this mode of production has been identified by Bryant (1974b), May (1981), Moran (1982), Lockeretz (1987), Smith (1987) and Gallusser and Smailes (1988). In the case of Bryant's study of the Paris agglomeration, there was a shift in orchard cultivation away from the urban area leading to a diversification and intensification of agricultural land use, at some distance from the intermediate urban fringe (Bryant, 1974a).

Another alternative management strategy is the displacement of purchased inputs with the farmer's own management and labour (Smith, 1987, 83). In the vineyards surrounding Auckland, New Zealand, Moran observed that "not only is there no evidence of decreasing inputs with the anticipation of urban encroachment...but vineyards have managed to survive...part of the reason is the capital intensity of viticulture" (Moran, 1982, 172). He identified another reason for maintaining such an intensity, in that if farmers believe that farming will continue only a short time, it is "rational to maximise their short run returns...the application of short term capital investment result in maintaining or increasing income in the immediate future" (Moran, 1979, 172).

An alternative to intensification is extensification: the purchasing of additional land to increase productivity and revenue. Bryant (1974), Smith (1987), Johnston and Bryant (1987) and Gallusser and Smailes (1988) have all

observed this strategy in operation. In the case of the Paris agglomeration Bryant (1974, 114) found that urban expansion had led to an increased demand for fruit produced in the area. In order to increase production in response to this demand, "certain farmers have had to acquire the necessary 'virgin' land at considerable distances from their original farms" (Bryant, 1974, 114) leading to increased fragmentation. He also observed that the smaller farms were the most fragmented. Smith (1987, 81) takes the same view whilst adding that leasing or sharefarming land may be an alternative solution. Ross (1981) and Vail (1987, 36) make similar observations. As noted earlier in this discussion the purchase of land by non farmers who are non residents may lead to an increased amount of land available for rent. In other words, farmers once constrained in their ability to expand are no longer bound in this way. As Johnston and Bryant note "the adaptability of some farm entrepreneurs underscores their resiliency" (1987, 17).

Adjustments made to marketing systems

Johnston and Bryant (1987, 14) identified a number of adaptations made to the means by which produce was sold, including 'pick-your-own' operations, and the establishment of retail outlets on the farm itself.

Adjustments to increase non farm income.

Urban employment opportunities may be taken up to boost family income - either the farmer or other family members

will take up this opportunity, and the farm may revert to being only a part-time enterprise. In this way, not all farmers are adversely affected by rural-urban change and some will have their opportunities "enhanced by the fringe location" (Blair, 1980, 381).

In Blair's study of Essex "20% of the sample were defined as part-time farmers (i.e. farming not the sole source of income of the farmer) - of these, 59% had local occupations working in the same or adjoining parish, and a further 22% commuted to local urban centres in Essex." (Blair, 1980, 378). Ross (1981) observed that where the urban fringe was static, off-farm work was very attractive, as did Hyslop and Russwurm (1981, 257-267), Smith (1987, 90), Vail (1987, 24,32) and Johnston and Bryant (1987, 14). Smith (1987, 81) found "by sheer numbers, the family farm...is swamped by farmers not relying on farm production for most of their income". Of course, it is important not to associate this trend only to urban expansion, as other forces of change may also be affecting the farmer and his or her family. Vail (1987, 24) argues that urban expansion has had beneficial economic effects on small scale farms. Why? "Revival...seems to owe much to predatory non-farm development [attributed to] their financial ability to bid land away from full-time farmers" (Vail, 1987, 32). This contradicts Johnston and Bryant (1987, 17) who argue that through expansionism, changing market strategies and off farm employment, sustaining agriculture, (especially

large scale, intensive cash crop operations), appears quite possible.

There may of course be other positive benefits to farmers remaining in urban fringe areas, especially improved educational and job opportunities for family members and access to services. There may be also some mutually beneficial relationships between small and large farms (Vail, 1987, 33), and some income can be made from providing horse agistment opportunities.

Problems with nuisances, management of adjacent properties.

A great many studies have identified several nuisance problems on farms resulting from their proximity to the urban area - trespassing, damage to farm capital, injury to animals, crop damange, pests, damage or theft of farm equipment, pollution, interference with management (especially if the farmer is using chemcial pesticides and herbicides) by complaints from neighbours, or through poor land management of adjacent hobby farms (where lack of weed control can be a significant problem). Examples of these are covered in several studies (for example, those by Blair (1980), Feaver (1982), Phipps (1983) and Lockeretz (1987).

Adjustments in social structure.

Changes in social networks, community and so on are often experienced in farming communities during urban fringe

expansion. While it is often relatively easy to alter farm management strategies, the means of adjusting to social change is often very difficult and stressful to farmers and their families.

Stoeckel and Beagle (1969, 56), Harper (1987, 284), and Vail (1987, 24) also identified this change in community and a trend towards polarization of settlements along lines dictated by class (Harper, 1987, 284). Thomas (1974, 27) notes the intermixture of different social groups and Wibberley (1972, 263) graphically describes rural areas as becomming like shells, inhabited by creatures of another world. A decline in the political influence of farmers and the 'rural' community as a whole is observed by Lockeretz et al. (1987, xvii), with urban influences having a greater impact on community decision making.

5.4.5.4 Periurban impacts on the dairy industry

The dairy industry has its traditional location in peri-urban areas and could be expected to experience the pressures of urban growth. Indeed, there appears to be no contradiction in the literature to the statement that the dairy industry is most likely to suffer the adverse consequences of impacting urbanisation forces. Berry (1979, 170) and Lasley and Shaw (1970) note the relative decline of dairying during the 1950's, 1960's and early 1970's in those counties in America subject to urban pressures (Berry, 1979, 170). Berry suggested this may be

due to "characteristics of both capital and labour inputs" - because of the daily attentions to cows needed in a dairy enterprise, fewer farmers are able to work off the farm than their copatriots in other farming enterprises and they may finally choose to transfer their resources to other farming enterprises. Dairying is an industry requiring long time horizons "of relative certainty and heavy investment in barns, equipment, livestock and so on" (Berry et al., 1976) and this also contributes to the industry's difficulty in coming to terms with urban expansion.

Research indicates "dairying exhibits a relative decline in semi-rural areas and a relative increase in more remote, slower growing non metropolitan [regions]" (Berry et al., 1976, 48). It is the experience of these authors that this does not mean that the dairyfarmers will immediately relocate, but that when the owners retire or switch enterprises, nobody will take their place as dairyfarmers. Moran (1979, 164-176) makes similar observations on the dairy industry in New Zealand.

Whereas other farmers in peri-urban areas are able to add markets and value to their products (especially horticultural produce) to improve their income, there is very little a dairy farmer can do to add on-farm value to milk (Smith, 1987, 87). This again restricts the ability of dairy farmers to adapt to change in peri-urban areas.

In Berry's detailed 1979 survey of Illinois dairy farmers, he identifies many of the results of these difficulties, - "moderate urban pressures are associated with a modest fall in dairying, and strong urban pressures are associated with a major decline in dairying" (Berry, 1979, 172). Much capital on a dairy farm is relatively immobile and farmers are obviously unwilling to make large scale investments where the future of the farm is uncertain. They would also be less likely to be able to recover the value of the capital if the farm was to be sold.

Berry concludes that where "urban pressures are moderate, dairy farmers may find themselves outbid by...farmers whose risk factor is lower...where urban pressures are strong, all farm uses may be outbid by speculative development" (Berry, 1976, 175).

5.4.6 South Australian studies in peri urban development

There has been only a small number of studies concerning the impact of peri-urban development undertaken in South Australia. This section will briefly summarise the results and conclusions of this research.

May, in his 1981 honours thesis on the consequences of rural land use conversion in Adelaide's peri-urban areas described land prices rising above the actual value of agricultural production (in the eyes of the farmers). In response to this, many farmers chose to either increase

the intensity of their land use, or were seeking off farm work to supplement their incomes.

An in depth study of peri-urban development in the Adelaide Hills was undertaken by Menzies and Bell, also in 1981, on behalf of the South Australian Department of Agriculture. The study identified very significant population growth in the region between 1970 and 1979, particularly in small towns. A great diversity in the size of land parcels sold, and the prices paid was very noticable. An increase in hobby farming was also evident.

A more recent research project was carried out by Gallusser and Smailes in the mid 1980's, the results of which were published in 1988. This work had three main aims:

i) placing the study area (the Willunga Basin) in the context of recent state and metropolitan wide demographic trends and planning proposals for metropolitan expansion,

ii) to examine changes in agriculture and landuse in the Willunga Basin, and the development of a planning policy to deal with them, and

iii) then report briefly on the "attitudes of actual decision makers...to landuse and rural change" (Gallusser and Smailes, 1988, 37).

Landholders were perceived as having a variety of options in land management: intensification, extensification,

maintaining the present system, selling off part of the farm and supplementing income by off farm work, maintaining the present system but ceasing long term investment until the owner/s retire, then sell the land or, to sell the farm to non farm interests, and invest elsewhere.

These decisions were found to be influenced by the farmer's view of the future, of community, of lifestyle, the district council, the effectiveness of cooperative organisations, and support from planning authorities.

In their opinion, agriculture will only survive if the returns are adequate, and zoning regulations appear insufficient in trying to ensure the desired agricultural landuse.

The study concludes that "natural market forces are converging on a combination of hobby and part-time farms around a core of residual full time farms, with purely recreational rural living and rural retreats concentrated into defined zones" (Gallusser and Smailes, 1988, 56).

5.4.7 Loss of agricultural land, conservation mechanisms

The degree to which valuable farm land is being lost through urban expansion is a rather contentious issue. What is the role of agricultural land in an increasingly urban society? As Bryant and Russwurm (1982, 501) observe "the debate over the significance of land actually lost

to urban development and the negative externalities created by non farm development...has never been resolved...partly because of the existance of the many values held in agricultural land resource and partly because the values are difficult to quantify". What are these values? - The capitalised value of net agricultural returns? The economic potential of the land? Societal values? Residual value? Historic heritage? As farmland considered with other uses in line with a cost benefit analysis?

Krueger (1978) and Plaut (1980) argue that there will be a definite shortfall in prime agricultural land in the USA if urbanisation continues at the present rate, and a similar concern has arisen in Australia in the last two decades.

On the other hand (as the questions posed earlier would indicate) there are continuing to develop underlying changes in attitudes to, and structure of, farming. Profit is arguably becoming more important than independence and love of farming in the eyes of many, including government policy makers, planners and urban dwellers.

Whether there is a significant loss of agricultural land will probably ultimately be dependent on the variety of values and perceptions used in considering the issue. Farmers are concerned, as are conservationists, about any

land lost; on the other hand, speculators, realtors, builders, planners may view the situation as no problem at all.

In many countries (and smaller political regions), there has been recognition of declining availability of agricultural land, and a variety of conservation mechanisms have been implemented at differing degrees of intensity. Local planning regulations, including zoning, are the easiest to put in place. These will generally only be successful in maintaining farming if farming is a viable system in that region. Otherwise, it is unreasonable to expect farmers to remain in an area, loosing significant amounts of money, in order to appease the environmental lobby. Despite these problems, Krueger (1978, 192) states that "hope for limiting urban expansion lies in slower metropolitan growth and appropriate planning policies...to direct urban thrust from fruitlands and to prohibit all further severences for non farm purposes". The extent to which this occurred would be dependent on public concern. Pryde (1982, 533) argues that zoning regulations should be put in place before urban pressures become intense. McNab et al. (1982, 20-21) also emphasised the important role of planners in the situation, because "the relatively free play of market forces in the urban fringe is producing problems".

If planning is to be used as the main weapon against urban forces causing loss of farming land, Bryant (1986,251-70) suggests that the planners recognize the limitations of dealing "with significant exogenous forces of change: as long as some form of family based economic production system is opted for, it is important not to constrain the farm entrepreneur from making decisions that maintain their competitive position".

An alternative government implemented policy for land retention is the purchasing of the development rights of fringe land by the state. Such a policy was undertaken in King County, Washington State (US) (Dunford, 1981, 19) when development rights on 10000-15000 acres of farmland was purchased.

The United States Government also implemented several schemes to protect farmlands; the most memorable of these attempts was the National Agricultural Lands Strategy which was hampered very significantly by its confusion over objectives, semantic problems, unreliability of land conversion data, and excess capacity in the American farm economy (Platt, 1985, 433). The same author accepts state and local programmes are more valuable, and justifiable "in terms of landuse planning objectives, maintenance of a viable local farm economy, and avoidance of undue reliance upon marginal lands requiring costly technical inputs" (Platt, 1985, 433).

Lapping and Fitzsimons (1982) suggest that a lands policy is inadequate in itself, and that it must be accompanied by an agricultural policy that supports rural development in fringe areas, not that contradicts it.

Conklin and Lesher (1977) argue for farm value assessment (for taxation purposes) as a means for reducing premature and excessive agricultural disinvestment in urban fringes. In the United States, the "usual process for allocating taxes discourages the continuance of agriculture wherever efficient farming required large real estate improvements that must be maintained and occasionally replaced, but which lack value for non farm purposes" (Cocklin and Lesher, 1977, 755).

The rural-urban fringe - a summary

The previous pages have considered the role of urban developmental forces in changing agriculture. The farmer's response to these forces has been considered, and the dairy industry has been looked at as a special case. The information gathered here should provide a satisfactory base for the assessment of urban impacts on the South Australian Dairy Industry which, due to its predominantly peri-urban location, has been subject to many of the influences outlined above.

5.5 Conclusion

From the preceding discussion, it can be seen that there has been continual adjustment in the Australian dairy

industry since the 1950's as a result of a complex combination of biophysical, economic, political and rural urban fringe changes and forces. Furthermore, recent research into the future of the dairy industry indicates that these forces have not abated. This leaves the dairy farmer exposed to a constantly changing external environment which can have an immense impact on the productivity and profitability of the farm business, and over which the farmer has only limited control.

How the farmer chooses to react to this situation of stress and disequilibrium within the farm system is the focus of the next chapter.

CHAPTER 6

RESPONSES TO STRESS AND DISEQUILBRIUM

6.1 Introduction

There is a range of responses which farmers may adopt in a situation in which individual decision makers (chapter 4) in a particular environment (chapter 5) are subjected to stress and disequilibrium within the farm system. As stress increases, the magnitude of change also rises, although the responses are not mutually exclusive.

6.2 Slight adjustment to farming system

It is reasonable to assume that in stress situations the first strategy will be adjustment of the farming system in some way and the final one will be to cease farming altogether. Slight adjustments may take the form of changed management strategies, perhaps in pasture maintenance and development, improving feeding, improved breeding and a wide variety of other practices which seek to maximise productivity and profit levels. Cutting living expenses and other expenditure (particularly capital) to the lowest level possible is also an alternative and one which is common to family farms during difficult times, especially in the short and medium term.

6.3 Changing the enterprise mix - reallocation of resources

Diversification on a farming property may be pursued for a variety of reasons, one of which may be the desire to remain in farming when prices or other circumstances for a single enterprise based farm would otherwise make it unsustainable. The farmer may choose to move into other enterprises which complement the schedule of dairying or make use of other available resources on the property, thereby increasing the level and stability of the farm income.

Pig raising used to be a prime example of this, with many Australian dairy farmers pursuing this sideline to their dairy enterprise. This is no longer the case, and other alternatives have become more popular, with horticulture the most dominant.

In other cases, dairying may have been long established as part of a mixed farm enterprise, and not ever have been the sole source of income for the farm. This will occur where biophysical resources are inappropriate for a large herd, and or where there are other land uses equally as profitable available for the particular property.

Some research indicates that "farm size is inversely related to specialisation and directly related to

diversification decisions..." (Anosike and Coughenour, 1990, 1) - in other words, diversification is significantly related to farm size, human capital and environmental resources, with larger farms being more diversified.

6.4 Expanding the farm size

Another solution to the problems of stress is the purchase more land. This may mean the farm is able to carry more stock, improve production levels of already held stock by improved biophysical resources and pasture management, or alter the enterprise mix of the property, all of which could increase production and profitability.

6.5 Changing location

If it is not possible to purchase additional land (perhaps the cost is too high, or there is simply none available) or available biophysical resources have become inadequate (for example, declining water supply or quality) the farmer may choose to move elsewhere and either remain in dairying or pursue some other type of agricultural enterprise.

6.6 Off farm work for family members

The obtaining of off farm work by farm family members can be a further response to disequilibrium in the system. Family members can provide income which supports the farm enterprise, or provides for living expenses. Alteratively

the money may be used as a personal source of income which means that person is no longer 'kept' by the farm itself.

6.7 Off farm work for the farmer

Off farm work for the farmer may also be a viable management strategy. This may mean that the farmer continues to work full time on the property and also works off the farm, or reduces the number of hours devoted to farm work, and works off the farm, as a part time farmer. Education and experience will often play an important role in determining whether such a response is practical or possible.

Part time farming may be preferable to leaving the farm completely, even when economic circumstances are totally against remaining farming. Some writers argue that part time farming is pursued 'to save the family farm' while others suggest that they are just trying to save the lifestyle.

Albrecht and Murdock (1984) take an human ecological approach to the situation and propose a variety of hypotheses which are supported in their study of farmers in the United States; 55% of the variance in the relevance of part time farming could be explained by ecological indicators (1984, 404-405) (i.e. the non farm labour force, % total acreage harvested, farm

mechanisation, farm diversity, non farm technology and sustenance diversity): "counties with the highest prevalence of part time farmers are those with a marginal environmental base for agricultural production and a diverse non farm sustenance base" (1984, 406). The value of such a study could be enhanced by "analysis of other time periods, additional ecological concepts, regions in comparison to other explanations and theory" (1984, 406).

Bartlett's 1986 study of part time farmers in Georgia indicated the majority had "rejected full time farming early in life, made a commitment to completing sufficient education to get a stable off farm job and added a farm in later years" (Bartlett, 1986, 289), primarily reflecting a desire for extra income. Only a small percentage of farmers had turned to part time farming (and off farm work) to pay off debts.

Brooks et al (1986) argue that part time farming represents a way of maintaining the farming lifestyle despite low returns. In this case, economics takes a 'back seat' to lifestyle preferences, and the latter appeared, in this case, to be better indicators of why farmers are likely to struggle through financial crises.

Of course part time farming may well be influenced by the non farm environment, and assessment of the adoption of part time farming must also include macroeconomic and

regional development policies (Albrecht and Murdoch, 1984, 407).

6.8 The ultimate decision - to leave the system

Many questions can be asked about why such significant numbers of dairy farmers are leaving the dairying industry in South Australia. For many this final step may represent the unfortunate end to a lifetime's work on a farm perhaps built up over generations; to others it may be a great relief. Whatever the reason, leaving the farm can be seen as the ultimate decision - to abandon the lifestyle and environment to which one has belonged. It is generally viewed as a dramatic or even drastic step.

Much research on farmers who leave farming focuses on the relationship between levels of stress and the reasons finally influencing the decision to leave. These studies may be able to provide some insight into the present situation in the South Australian dairy industry.

Guither (1963, 569) considered factors affecting farm operators' decisions to leave farming in a large survey of farmers in the United States who no longer farmed. Most respondents indicated that they had enjoyed farming and would not have left if "they could have continued under conditions satisfactory to them" (1963, 569).

Major family or other sociological problems were also important decision making factors in Guither's study (1963, 570) which also identified the cost/price squeeze, low incomes, tenure problems, health problems and retirement, along with the effects of government policies. Many leaving farming moved only a short distance from their previous property, for two reasons, 1) they knew little about any alternatives, and 2) the transition to a new life was made somewhat easier with the support of family and friends (Guither, 1963, 575).

Salmon et al. (1977) in their study of the human impact of the restructuring of the dairy industry in Victoria noted that changes to the industry had led to grossly inadequate incomes for some farmers, especially when compared to the rest of the Australian workforce. It was argued that extreme economic downturn led to the development of extreme psychological stress. In response to this, some sought off farm work, other sank into deep depression and did nothing, while others chose to leave the farm altogether. All of these responses were found, on average, to further increase stress levels, resulting from the need to change further, or readjust.

A further study by Weston and Carey (1978, iii) on a sample of Victorian dairyfarmers supported these conclusions, while indicating many individual differences in financial and psychological factors. Farmers could be

divided into one of two groups according to their level of stress indicated in the two surveys, one carried out in 1976 (at the height of the dairying depression), and the second in 1978, by which time a considerable recovery had occured. Major differences existed in levels of financial aspiration, reported coping styles, income levels, perceived health status, level of optimism, and various factors associated with non farming roles, such as off farm work. Further, attitude to stress can have an importance moderating influence upon the effects of stress.

Bultena et al. (1986) and Rathge et al. (1988) undertook surveys on Iowan and North Dakota farmers, respectively, seeking to contrast the characteristics of a sample of displaced farm households with a sample of producers who were still operating their enterprises, and to explain the differences.

Certain categories of farmers were expected to remain in the industry; those with large capital intensive operations (favoured by agricultural policy makers and therefore by government regulations), and others more likely to adjust to changes in agriculture (i.e. farmers who are younger, better educated, more innovative and so on), those characteristics identified earlier as being most likely to speed the adoption of an innovation.

Surprisingly, it was observed by Rathge et al. (1988, 349) that the types of enterprises worked by farmers who left the industry were not significantly different from those who had remained in farming. Similarly, size, tenure, type of farm, organisation structure and gross farm income appeared to have no significant impact on whether the farmer left farming. The only structural indicator that did reveal a significant difference was the level of off farm labour, whereby the greater the degree of work off the farm, the more likely the farmer to leave farming totally.

In Bultena's study (1986) larger scale operators were more likely to have left farming.

Personal characteristics were significantly different between former and current farmers (except for gender) "displaced farmers were on average, younger, married, had large families and were more educated; 54% of displaced farmers began operating in the 1970's whereas less that one third of current farmers did" (Rathge et al., 1988, 352), fully supporting Bultena's earlier observations.

Rathge et al. (1988, 352), whilst identifying these more personal factors, noted that "failure rates among operators...correspond closely with volatility in the external economy" and concludes "the operators most at risk are those who began their operation during the best

of times" (see also Bultena et al, 1986, 436). In other words, it is necessary to consider the environment and the personal characteristics of the farmers. Economic success in the national economy, rising land values and low interest rates encouraged normally conservative farmers to expand, and/or update and enlarge the capital base of their farm; these were the people to suffer in economically depressed times.

Whatever the case, theories that the older farmers, the less educated, and the most conservative would leave the industry more speedily than the younger generation were not supported. Rathge et al. (1988, 354) concludes

> ...current restructuring in agriculture affects farm households differently to anticipated...more complex than traditionally thought...[research needs to] reexamine the adoption diffusion model of controlling for operator's period of entry [and] focus on identifying which operators were more willing to adopt risk-taking philosophies and how macrolevel events influence the diffusion process...

6.9 Conclusion

It has become obvious in this discussion that consideration of the behaviour of individual farmers is useful in understanding responses to stress and disequilibrium within the farm system and how this leads to restructuring within the dairy industry. However, individual behaviour cannot be understood itself in isolation from the environment - biophysical, political, economic and social. It is clear too that environmental

circumstances will not affect all farmers in the same way. For these reasons it is appropriate to use an integrated systems approach to assess the overall situation of change within a specific agricultural system, in this case, dairy farming in the Adelaide milkshed. In this way, the many varied relationships between the environment and farmer can be clarified and assessed on their relative significance to the debate on restructuring.

CHAPTER 7

ON FARM RESOURCES

7.1 Introduction

In order to discuss how the dairy farm system functions using the theoretical framework outlined earlier, it is first necessary to establish what resources are available within the system. As already mentioned, resources can be divided into three primary categories - human, land and capital, and this chapter is directed at establishing the level of available resources on surveyed properties.

7.2 Human resources

Human resources provide the labour force for the farm, and are usually also the primary source of management. As such they are at the heart of the farm system. In the context of this study therefore, it is necessary to develop a profile of human resources that exist on the surveyed dairy farms.

Note that where mention is made of person 1, this is referring to the full time owner operator whose name was placed first in the questionnaire. Generally this person was male. Person 2 was usually an owner, and the spouse of person 1. Persons 3, 4, 5 and so on refer to other family members listed in the questionnaire.

7.2.1 The farm household

The vast majority of farms are essentially family households, comprising parents and children; 90% of farm owners are married. Only 20 of all 161 farm households do not contain any children (at least living/working on the farm). Few families have more than two children, and very few, more than three. This trend conforms to the general trend of declining family size in the Australian population as a whole.

Extended families, and families with large numbers of children, perhaps traditionally associated with farm family structure are not much in evidence in the sample. The largest family size is 13 (including 2 grandparents, 2 sons, their wives and children), but this was a very obvious exception. Only 10 of the 161 surveyed households had seven members, and these households, with the single exception above, were the largest in the sample. There are 27 families with 6 members, 36 with 5 members, and 83 with 4 members.

With older children (18-25 age group) it is interesting to note a marked difference between the number of sons (62%) to daughters (16.5%) residing on the farm. This may be a reflection on the documented trend for daughters to leave farms for reasons of employment and/or marriage.

7.2.2 Family labour availability

It is important to ascertain which family members residing on farm provide a labour input into the farm system, and the form it takes. The primary form of farm ownership is the husband-wife partnership, which is the main source of labour.

7.2.3 Hours worked

All families had at least one member working full time on the farm; as already mentioned, husband-wife relationships predominate in farm households, and these partnerships remain dominant when considering actual labour input into the farming enterprise. Of these, 135 work the farm together in some capacity, 57% both working full time, and 42% have one spouse working full-time and one part-time. (In the latter situation, in all but one case, it is the wife who works in a part time capacity). Of those women working part time, 18 work fewer than 20 hours a week, 6 between 21 and 30 hours, and 7, above 30 hours. The majority of these wives are also responsible for household duties, even those working full time.

A great many children assist on the farm in some capacity; the degree to which this occurs is often closely associated with age, school attendance, and in many cases, the gender of the child. In other words, children under 10 years of age have only a limited input (if at all) and school-age teenagers provide after-school and weekend assistance. Those aged below 17 provide

either part-time or casual assistance, rarely more than 20 hours a week, with many working between 5-10 hours; actual work on farm tends to increase with age, and males may work slightly longer hours on farm than their female siblings.

Children who have left school provide some assistance, the males tending to be full time, the females, who are also working/studying off farm, part-time or casual (always less than 20 hours a week, usually below 10 hours). Sons pursuing other forms of education or careers provide similar levels of labour to their sisters.

Other male family members residing on the farm generally work full time, but with a declining contribution by those over 60 years of age.

Overall the dairy farm can be seen as an enterprise relying on at least one full time labour 'unit' with many other members of the family contributing on a full time, part time or casual basis, depending on their age and gender, the size of the farm, other responsibilities, and their level of interest in the farm. In this context therefore, an integrated (though not necessarily efficient) approach to labour provision, encompassing the entire family, exists within the farm system. There is no doubt that this structure provides a considerable degree of flexibility in management, and enables labour costs to be kept to a minimum. As suggested earlier in

the literature review (chapter 4), this is one of the greatest advantages of the family run enterprise and may enable it to continue even under difficult circumstances.

7.2.4 Quality of family labour resources

7.2.4.1 Age

The age structure of the labour force can affect its efficiency and effectiveness and thus the long term survival of the farm system and industry as a whole. As examples, are older farmers being replaced by younger ones? Large numbers of younger farmers may also tend to indicate a healthy, more dynamic industry.

The literature would indicate that the dairy industry is currently dominated by middle-aged and elderly owner-operators and the population of surveyed owner operators support this observation. The age breakdowns of the primary owner and his spouse (that is, the majority of owners) are found in table 7.1.

It is particularly important to note that only 27.1% of male owners are aged under 40. In other words, 73.9% are 41 years or over, with 41.1% of the total over 51 years of age, and 16.3% over 61 years. If the time to leave dairying is at retirement age, and if the younger generation is not interested in carrying on, then given the age structure, some dramatic pressures are about to be unleashed. A lack of interested younger dairy farmers

Table 7.1 Ages of person 1 and person 2 (primary owners)

Age (in years)	Person 1	Person 2
0-29	3	13
30-39	33	33
40-49	42	57
50-59	39	25
60-69	23	10
70+	4	5

may cause even greater problems in reversing declining farmer numbers.

Table 7.2 indicates the ages of the remaining family members, the vast majority of whom are below the age of thirty, and many of whom are under 20.

While this indicates a considerable number of young people residing (and in many cases working, in some capacity), on the farm, it is important for the long term interests of the dairy industry to determine how many of these children are going to remain, or are at least interested in remaining, in dairying.

7.2.4.2 Education

The level of education of the farm labour force has been shown to have a strong impact on its efficacy and efficiency. In the context of farmer decision making, education has been related to willingness to try new management techniques, be more innovative (recall, for example, Pred's behavioural matrix), and has been linked to levels of productivity, as well as having an impact on how and why farm decisions are made as they are. In other words, education has generally been viewed as having a profound impact on management decisions.

In this context, there has been considerable concern raised over the lack of education of Australian farmers. How do the surveyed farmers fare in comparison?

Table 7.2 Ages of surveyed persons - farm family members resident on farm

Age	Person 3		Person 4		Person 5		Person 6		Person 7	
(Years)	Freq	% of tot per	freq	%	freq	%	freq	%	freq	%
10 years & Under	15	12.4	16	18.8	19	50	13	52	5	45.5
11-20	42	34.7	39	45.9	12	31.6	5	20	2	18.2
21-30	32	26.4	13	15.3	1	2.6	1	4	1	9.1
31-40	13	10.7	6	7.1	1	2.6	2	8	2	18.2
41-50	4	3.3	2	2.4	2	5.3	-			
51+	15	12.4	9	10.6	3	7.9	4	16	1	9.1
Total	121		85		38		25		11	
No response/answer	40		76		123		136		150	

The vast majority of all farmer respondents have attended secondary school at some time. For example, 131 (82.9%) of male owners attended secondary school, 31 of whom had left at or below the age of 14, 29% left at 15, 33 (23.9%) at 16, 25 (18.1%) at 17, and 9 (6.5%) at 18 (see table 7.3). Those who did not attend secondary school fall into the older age groups.

The situation is very similar for their wives. There is a slight difference between the number of these (in comparison to their husbands) attending secondary school (see table 7.3). As the table also indicates, a greater proportion of these women remain at school longer, the most noticeable difference being the higher percentage of males leaving at age 15 (29%) compared to 23.5% (women), and leaving at age 16 (23.9% for males, and 34.1% for females). Females tend to remain at school slightly longer than their male counterparts, and, as will be shown shortly, this is reflected in the female's higher level of post secondary education.

There has been some suggestion in rural media that farmers, their wives or children leave secondary school significantly earlier the rest of the Australian population, but this is not supported by the study. Results indicate that children are remaining at school at least to age 16, and often beyond. Perhaps this tendency to stay at school longer compared to farmers in general

Table 7.3 Age when farm family members left school

Age left (years)	Person 1 Freq	%*	Person 2 Freq	%	Person 3 Freq	%	Person 4 Freq	%
10	1	0.7						
11	-							
12	1	0.7	1	0.8			1	4.0
13	4	2.9	2	1.5	3	4.2		
14	25	18.1	17	12.9	7	9.9	3	12.0
15	40	29.0	31	23.5	16	22.5	3	12.0
16	33	23.9	45	34.1	20	28.2	10	40
17	25	18.1	29	22.0	20	28.2	7	28
18	9	6.5	7	5.3	4	7.0		
Total	138		132		71		25	

* % of total respondents

may reflect the location of the milkshed - closer to the centre of the South Australian space economy where access to education at all levels is easier and cheaper.

Despite the encouraging figures for secondary school participation, levels of post-secondary school training and/or education remain of concern. However, the levels of post-secondary training appear to be higher in dairying than in other agricultural industries in Australia. (This would not be difficult considering Australian farmers have the lowest level of formal qualifications of farmers in the western world, with an average 20% of farmers with post secondary education of some form (Small, 1991)). Of male owners for example, 64% have had no post-secondary education. That is, only 36% have had some form of training after leaving school. Of total male owner/operators 8% have received agricultural training at university or college level, 14.3% of the total have undertaken TAFE run dairy courses (milk testing, AI and so on), and a further 3.1% of total male owner/operators, other TAFE rural courses. Table 7.4 illustrates in greater detail, participation in post secondary courses. Of their wives, 63% have had no further post secondary education, nor has 80% of children in the 18-25 year age group.

The most obvious observation from the data is the strong gender differences in types of training and education pursued. For the males TAFE agricultural courses

Table 7.4 Post secondary education of farm family members

	Person 1			Person 2			Person 3			Person 4		
	Freq	%(a)	%(b)	Freq	%(a)	%(b)	Freq	%(a)	%(b)	Freq	%(a)	%(b)
Agriculture/Ag Science	13	8.07	22.4	7	4.58	11.87	4	3.31	13.79			
Other Uni/CAE	2	1.24	3.45	20	13.1	33.89	4	3.31	13.79	2	2.3	16.6
TAFE on farm training	-	-	-	1	0.65	1.69	3	2.48	10.34	2	2.3	16.6
TAFE other dairy	23	14.29	39.66	2	1.31	3.39	5	4.13	17.24	2	2.3	16.6
TAFE other rural	13	8.07	22.41	5	3.27	8.47	3	2.48	10.34	2	2.3	16.6
Apprenticeship	7	4.35	12.07	1	0.65	1.69	2	1.65	6.90	1	1.18	8.3
Clerk/Nursing	-	-	-	19	12.41	32.20	4	3.31	13.79	2	2.3	16.6
Other TAFE	2	1.24	3.45	5	3.27	8.47	6	4.96	20.69	1	1.18	8.3
Other	1	0.62	1.72	1	0.65	1.69	1	0.83	3.45	-		
TOTAL	*58			*59			29			12		

* Some have joint qualifications

(a) % of all person 1's (or 2's, 3's, 4's)

(b) % of those person 1's (2's, 3's, 4's) with post secondary education

predominate strongly, and apprenticeships are an important though secondary category. Thirteen male owner/operators have qualifications from CAE or University in agriculture or agricultural science and 49 of the 58 male owner/operators with post secondary education have had some form of agricultural training.

Females exhibit a completely different pattern - a large proportion (12.4% of the total and 32.2% of those with further education) are trained in the more 'traditionally' female clerical, teaching and nursing occupations. 33.89% of post secondary educated wives have been educated at university, teachers college or CAE. Most in this group are trained primary or secondary teachers. The category appears to be markedly higher than their male counterparts (13.1% of those with post secondary education), of whom only two have pursued non agricultural tertiary study. Three have undertaken tertiary agricultural studies, and four, farm managerial/secretarial courses run by TAFE. Whatever the situation, females have attained a higher level of education on average, than males in the sample.

The situation for other members of the family is difficult to assess, with only small numbers of people involved in all cases. Those who have had some form of training are those in their late teens and 21-30 age category. The training for males is primarily in trade

apprenticeships or rural related courses, and for females, in education, nursing or clerical occupations.

7.2.5 Prior occupation

The quality of the human resource within the farm system, in relation to both labour and management inputs, may also be affected by previous agricultural (or other life) experiences off the farm. For this reason, establishing occupation prior to running the dairy farm is of potential relevance in assessing farm management efficiency and success.

Those farmers who had purchased their property (not inherited it) were asked to give details of their occupation prior to assuming ownership of the dairy farm. It was presumed that sons who inherited a farm had at least some experience working on that property. The responses are listed in table 7.5; 68.7% had at least worked in a farm environment before commencing dairy farming on the current property.

7.2.6 Role of family in on-farm work

There appear to be distinct 'on-farm' roles played by each member of the farm family; While the vast majority of family members over the age of twelve are assisting in some capacity on the farm, there are differences in the tasks being performed by different age groups and by gender.

Table 7.5 Male owner occupation prior to assuming ownership of dairy farm

	Freq.	%
worked on family farm	24	24.2
worked as farm hand	18	18.2
owned another farm	15	15.2
were sharefarmers	11	11.1
were labourers	9	9.1
involved in profession	9	9.1
student	6	6.1
semi-professional	4	4.0

Out of 157 male, full time owner/operators, 149 (94.9%) indicated they are involved in all types of farm work ('the lot', as several respondents adequately described the situation), incorporating milking, husbandry, feeding, pasture management, maintainence, cleaning and so on. However, a frequent omission from their list of duties was the accounting function. Two of the older respondents are involved only in accounting and budgeting, with a further three indicating they include accounting with all other farm tasks. Only two other respondents gave more specific job descriptions.

Although many wives do work full time on the farm and are engaged in all types of farm work, the majority still undertake clearly deliniated roles in farm management, with most having two or three specific tasks to perform. Combinations of these vary considerably, but accounting, calf raising and milking predominate. Forty seven (34.5%) indicated they are responsible for accounts and bookkeeping for the property. For 12 of these, this is their sole function. 45 are involved in milking, and 44 in calf raising, with 83 (61% of all wives) involved in one or more of these three tasks.

It may well be that the role of women on the farm tends to be underestimated, not least their part in keeping the household running smoothly thereby reducing the stress on their husbands. This role may be just as important in mainintaing farm productivity as is the provision of

labour, but it is something which can be easily overlooked. As one woman replied "my husband does everything, and I do everything else". Another saw her role as keeping her husband "happy and healthy...a comforter in times of crisis" - traditional perhaps, but no less important for that.

There appears to be a correlation between the part time hours worked and the more part-time tasks undertaken by the respondent with the various functions being very clearly defined, particularly in account/record keeping, milking, feeding, and calf raising.

For those older children and siblings of the first owner (male, full time owner) providing data concerning their role on farm, 58 (63.7%) indicated they are involved in all farm jobs. Children tend to perform only one or two tasks, unless of course they are employed full time on the farm, - milking, feeding, calf raising, or stock shifting, the younger members being involved mainly with the latter two.

7.2.7 Sources of information

The degree to which the farm utilises outside sources of information may reflect several aspects of the farm decision making process, and therefore, management strategies. For example, it may show how aware the farm manager is of changing practices within the industry, and how likely they are to be adopted on the farm property

(i.e. how innovative the farm is), the role other farmers have on decision making in a particular farm system, how effective is agricultural extension, and outside influences on the farmer's primary goals and objectives. Of course, a decision whether to use an information source may also reflect its accessibility (perhaps either spatially or economically (i.e. cost) to the farmer). Again, Pred's behavioural matrix is important here (chapter 4). Level of education may also, theoretically, be an important guide to the use of external information sources.

Whatever the case, level of useage of outside information sources may reflect how efficiently the farm system is being run, and perhaps, how management could be improved. For this reason utilisation levels are an important component of assessing the overall farm system.

Agricultural extension

Forty nine (33%) of 150 respondents use agricultural extension services provided by the South Australian Department of Agriculture on a monthly basis, and a further 29 (19.3%) every six-months. On the other hand, nearly half of the farmers rarely or never make use of the services. This could well be quite significant, again bearing in mind the location of the milkshed with its ready access to the sources of most of this kind of information.

Soil/plant testing

Forty three (28%) respondents indicate they use soil and/or plant testing at least at 6 monthly intervals. It is of concern that 57.3% (86 farmers) only do it rarely, and a further 14% never, as they are both efficient cost effective means of testing soil fertility and with appropriate remedial action, improving pasture production.

Veterinary assistance

Veterinary assistance is used regularly and frequently, with the majority of respondents (67.5%) seeking help at least monthly, and a further 22% at least 6 monthly. This is probably a less valuable indicator of innovativeness in that even the least progressive farmers must call in the vet to a seriously ailing cow.

Neighbours and other farmers

Farmer contact with immediate neighbours is extremely high, with 49% in contact on a weekly basis, and a further 30% on a fortnightly or monthly basis. All the same, 22 farmers rarely come into contact with their neighbours, at least in the context of farming. 68.5% of respondents use other farmers (not neighbours) as sources of information or assistance at least monthly. This is what has generally been found in other studies, with farmers preferring to seek advice from other farmers.

Farmer organisations

Participation in the Agricultural Bureau varies considerably with a group of 'diehards' attending meetings regularly and the remainder attending rarely if ever. Over 40% of respondents never attend Agricultural Bureau or other agriculturally related meetings.

The South Australian Dairy Farmers' Association (SADA) is generally called upon when there is a problem affecting the industry as a whole rather than specific individual enquiries. All the same, 25% of farmers contact SADA monthly and 27% 6-monthly. The SADA journal has an extremely high level of readership (which it should have since all participants in the survey are members of SADA and therefore at least receive the journal).

Other media

The Stock Journal is read widely, with 79% of respondents reading it on a weekly basis, with only 9 (5.7%) and 6 (3.8%) farmers reading the publication rarely or never. On the Land, the rural supplement to The Advertiser has a different pattern of readership with 52% reading it weekly, and 39.9% reading it rarely or never. The Farmer and Stockowner is published fortnightly and 63.8% of respondents read it on this basis. 16 persons (10.3%) never read the publication.

Over half of farmers (59.2%) rarely, if ever, listen to the ABC's Country Hour, while 28.6% of farmers do tune in at least weekly.

Field days

Field days are obviously relatively popular, and only 15 respondents never attend them - the majority attend them either 6 monthly or occasionally.

Other information sources

Thirty five farmers (21.7%) use sources of information in addition to those cited above. The most common of these is participation in various farmer groups, including local discussion groups (19 respondents), six in land management groups, and 6 in dairy politics and advisory boards. Five farmers receive other rural periodicals, including the Victorian 'Weekly Times' and 'Australian Dairyfarmer'.

There appear to be no specific characteristics which lend themselves to describing who and how often a farmer uses a certain information source. Hypotheses that younger, better educated farmers will call upon outside information sources than their older, less formally educated counterparts cannot be supported by the data, and a relatively even spread is found when comparing information use with age, attendance at and the age of leaving secondary school, and post-secondary education.

There are no significant differences between regions either.

7.2.8 Non family farm labour

Given the well documented tendency for farm firms over many years to shed non family labour as a response to the cost-price squeeze, a surprisingly large proportion of farmers (60%) employ some form of non family labour on the farm. However, well over half of these are casual employees, involved in relief milking (i.e. filling in for the farmer when on holidays), or contract farm labouring (hay carting, and in the case of mixed farms, shearing, fruit picking and so on). On the other hand, it means 40% of farmers never take a break from milking for a variety of reasons, which appears to be a contributing factor to job dissatisfaction in the dairy industry.

Eight respondents employed full time share farmers. Casual labour is more predominant however, with 77 farms employing, at some time during the year, one person; 24 farms employ a second person, 23 a third, and 5 a fourth.

The majority of first persons are employed on a casual basis (62%) and are engaged in relief milking or casual farm work. Over half of these people are working fewer than 20 days per year. By the same token however, there are 19 full time farm workers employed, 8 of whom are share farmers, and the remainder who are involved in

general farm work. The latter occurs on the larger scale properties (those with greater than 200 cows).

Sixteen of the 23 second persons employed on the farm are also casual workers with half working fewer than 10 days a year. Some of thse were relief milkers but many provide contract farm labour - fruit picking, processing, and hay carting.

Those properties employing more than two non-family members were generally owners of farms combining horticulture and dairying, or which are larger dairies, with over 200 cows.

Twenty six farms have ceased to employ non family farm labour in the last ten years, 17 (65.35%) since 1989. The reasons for this cessation are varied, but the dominant explanation is the cost of employing farm labour. Several respondents indicated Workcover (a compulsory work related insurance scheme) has been a particular deterrent since 1989, while for others, high overall costs were responsible - holidays, leave arrangements and paperwork meant that employment can not be justified in most cases. In some other situations howvever the employee was 'no longer required', often as a result of children returning to full time farm work after completing their education.

7.3 Land resources

Obviously, the quality and quantity of the land resources a farmer has at his/her disposal and how they are managed will have a major impact on productivity of the property. Consideration of available land resources is therefore obviously an integral component of assessing a farm management system.

7.3.1 Tenure

Tenure has been shown to influence access to the land resource and its product, and the management of that resource.

Of all 158 surveyed primary blocks (containing the homestead), 117 (74.5%) are held freehold, a further 14% are held on perpetual lease, and 10.2% are rented from another land holder. Almost all those held under perpetual lease are located in the River/Lakes region.

7.3.2 Ownership/Business partnerships

The vast majority of farms are operated by their owner/s.

It is obvious from the data that family farming is the predominant form of farm ownership in the dairying industry. Over 50% of respondents farms are owned by a husband-wife partnership and only one property is non family owned. The second highest proportion are those farms owned by a single owner (8.7%), and third highest, (8%) is parent/s-son-daughter in law. The complete

breakdown on ownership relationships is shown in table 7.6.

7.3.3 Inheritance of the farm

Only 32.3% of farms have been inherited from other family members, with the remainder of surveyed farmers (107, 67.7%) having actually purchased the property (though sometimes from family members).

There appears to be a distinct regional variation in whether or not a farm has been inherited. Farms in the Fleurieu region are most likely to be inherited unlike properties in the River/Lakes regions, perhaps because many in the latter have been established more recently, and have less of a family history.

Those who did not attend secondary school are (as a percentage) more likely to have inherited the farm than their more formally educated counterparts.

7.3.4 Year ownership changed

Year ownership changed is illustrated in table 7.7. Of those properties inherited, the greatest number changed hands during the 1980's.

7.3.5 Year of purchase

The majority of property purchases took place between 1970 and 1984, with only 12 farms bought in the 7 years since 1985 (table 7.8).

Table 7.6 Ownership of property

Relationship	Frequency	% of total responses
husband, wife	83	55.55
self	14	8.70
father, mother, son, daughter in law	23	14.28
father, mother, child	7	6.21
siblings	5	4.35
extended family company	4	3.10
self, wife, parent	2	1.24
non family p'ship	1	0.62
other	2	1.24
no response	20	12.42

Table 7.7 Year ownership changed

Year Changed	no. of farms handed over
prior to 1960	5
1960-1969	9
1970-1979	16
1980-1989	18
1990 +	2

Table 7.8 Year of purchase: number of properties purchased

prior 1960	11
1960-1969	9
1970-1974	19
1975-1979	21
1980-1984	21
1985 +	12

Of all these properties, 73.5% (72 farms) were already dairies. 25 properties (mostly located in the more extensive farming areas of the Barossa and Lakes regions) were changed from other uses, namely sheep (10 farms), beef (7 farms), mixed (5 farms) and horticulture (2 farms).

7.3.6 Farm size

Average farm size is 246 ha. However, the sizes of farms vary dramatically, from 27 ha. in the Adelaide Hills to 2169ha. in the Lakes district (see table 7.9) with just over half the properties (51.55%) under 149 ha. in size. As figure 7.1 indicates, the greatest number of the smallest farms (<99ha.) are located in the Hills region. Larger farms (500-999ha.) are situated in the River/Lakes region especially around Meningie.

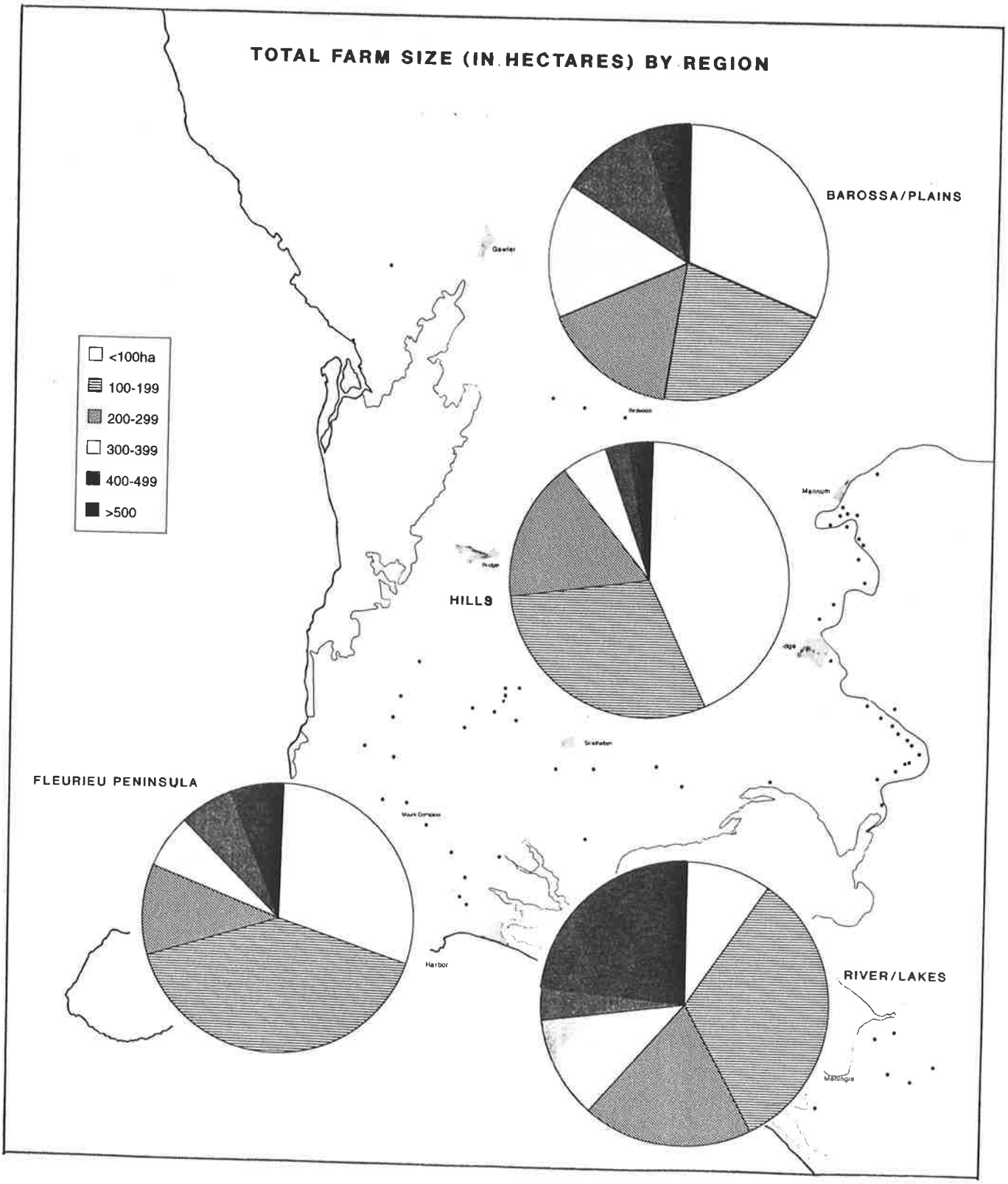
7.3.7 Consolidation of farm fragmentation

The degree to which a farm is fragmented may have some impact on the efficient running of the farm system. If the farm is highly fragmented and the components are separated by considerable distance/s it may be difficult or inefficient for movement of capital (i.e cows, machinery) and labour, and may increase management problems generally. In fact fewer than 50% of surveyed farms are single blocks, with 56 farms (35%) made up of two blocks, and 28 farms of three or more separate blocks.

Table 7.9 Total farm size (ha) sampled farms: number of properties

Ha	Freq	%
<50	11	6.9
51-99	34	21.38
100-149	37	23.27
150-199	16	10.06
200-249	15	9.43
250-299	9	5.66
300-399	12	7.55
400-499	8	5.03
500-999	14	8.81
1000 +	3	1.89

Figure 7.1 Total farm size (ha.): regional averages


TOTAL FARM SIZE (IN HECTARES) BY REGION
BAROSSA/PLAINS
HILLS
FLEURIEU PENINSULA
RIVER/LAKES
<100ha
100-199
200-299
300-399
400-499
>500
Gawler
Mannum
Strathalbyn
Mount Compass
Harbor
Meningie

The size of the first (or house block, containing the homestead) varies quite considerably, with the majority less than 99ha (table 7.10) in size. The largest of the single blocks are located in the River/Lakes region, and the smallest in the Hills region.

Additional blocks

By far the majority of additional blocks are 49ha. or under in size, with 25% less than 25ha.

The most fragmented farms occur in the Fleurieu Peninsula.

Most detached blocks are fewer than five kilometres apart, though there are some exceptions, especially along the River Murray, with some farmers owning a small river frontage, and larger dryland areas a considerable distance from this irrigated land.

7.4 Capital resources

A large proportion of the capital resources of a dairy farm is of course locked up in the dairy herd, the milking facility and farm machinery. All these 'items' are the capital resources of the farm and, in combination with human and land resources within the farm system, lead to the production of the milk itself.

Table 7.10 Size of houseblock (ha), sampled farms

Ha.	freq	%
1.49	46	29.1
50-99	43	27.2
100-149	21	13.2
150-199	13	8.2
200-249	12	7.6
250-299	3	1.9
300-399	6	3.8
400-499	2	1.3
500 +	12	7.6

Consequently therefore, any assessment of the dairy farm system must incorporate identification of the capital resources available to the farm, and the forms it takes.

In this context, the ensuing discussion considers the capitalisation levels of surveyed properties.

7.4.1 Size of herd

The sizes of farm herds vary widely, and range from the smallest at 20, to the largest at 500 cows. The breakdown in herd size is illustrated in figure 7.2, with the greatest number of herds falling into the 50-75 head category, the second highest at 100-149 head, with 38 herds.

The smallest herds are found in the Hills and Plains/Barossa regions - the largest herds in the River/Lakes region (fig. 7.3).

Figure 7.4 illustrates the mean number of milking cows per sample farm over time, and figure 7.5 the standard deviation of milking cows per sample farm over the same time span. Note the steady increase in average numbers over the decade from 78, in 1980, to 108, in 1990.

7.4.2 Breed

Friesians predominate in the surveyed dairy herds; 109 (68.8%) are solely friesian herds, and a further 19 farmers have a friesian component in their herds.

Figure 7.2 Number of herds by size of herd - surveyed farms

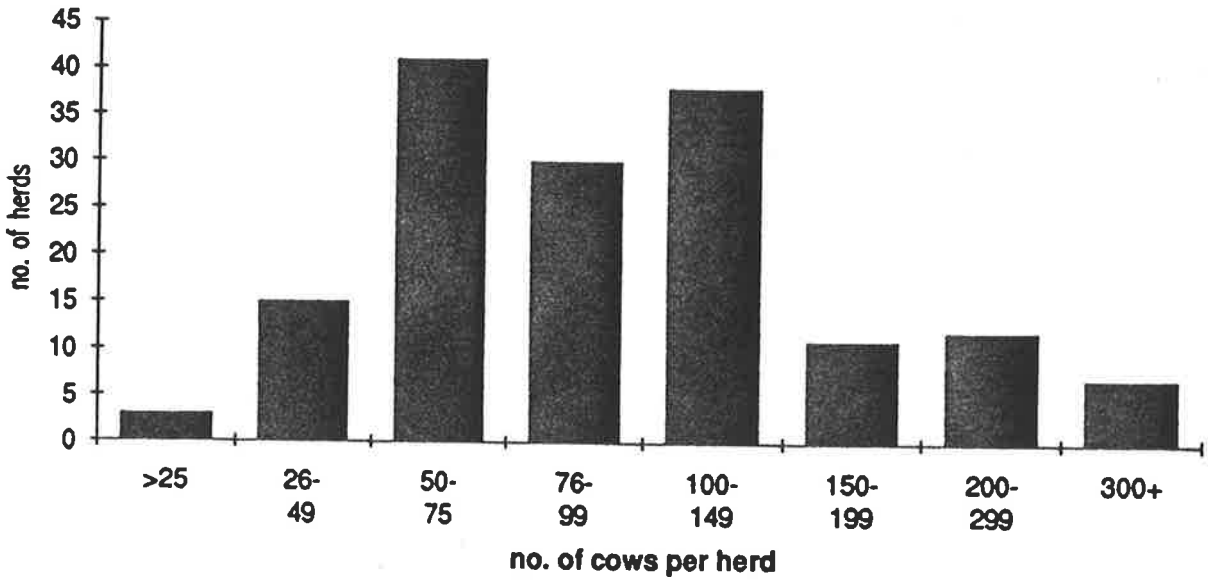


Figure 7.3 Size of milking herd by region

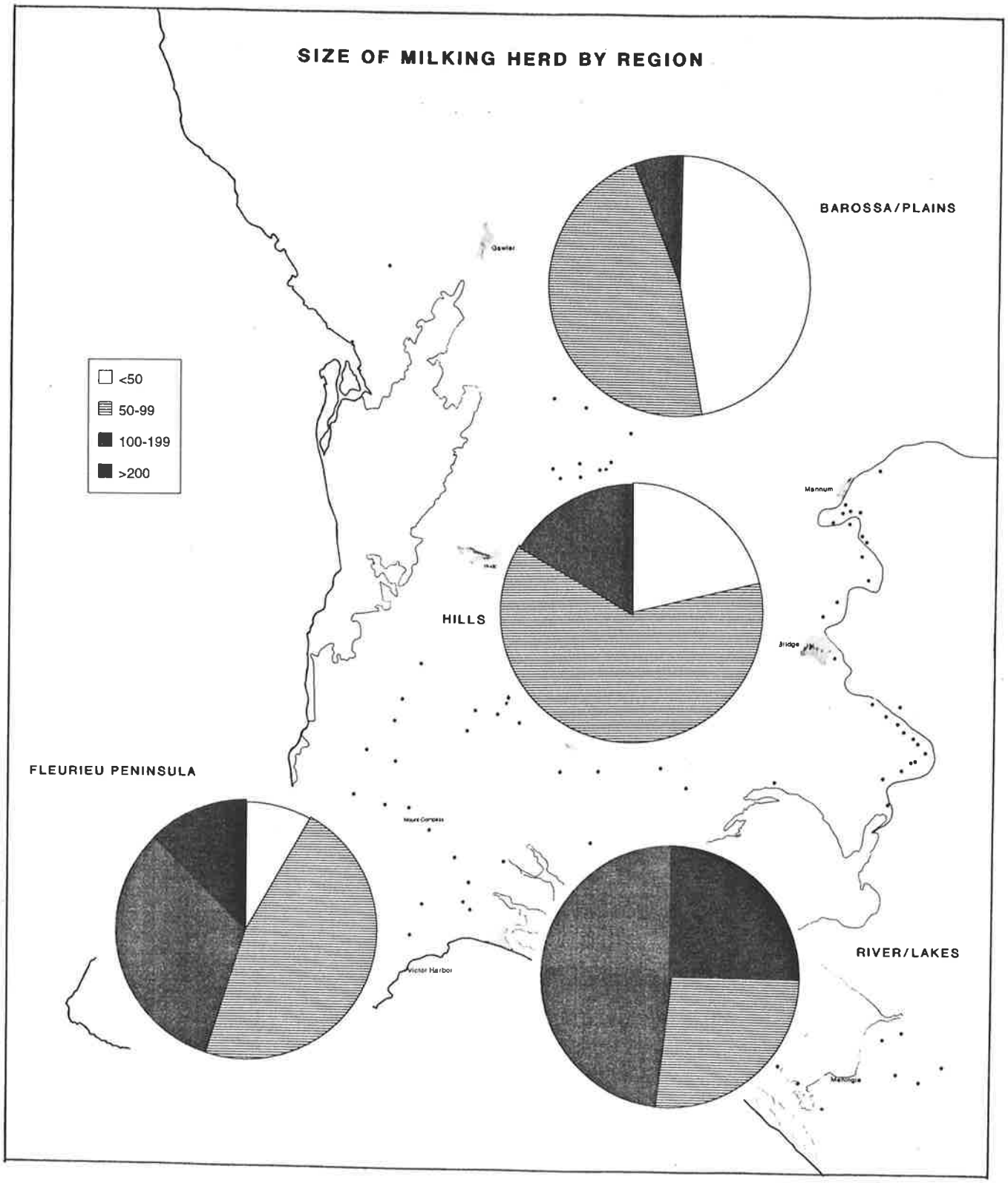

SIZE OF MILKING HERD BY REGION
BAROSSA/PLAINS
HILLS
FLEURIEU PENINSULA
RIVER/LAKES
<50
50-99
100-199
>200
Gawler
Mannum
Victor Harbor

Figure 7.4 Mean number of milking cows per sample farm

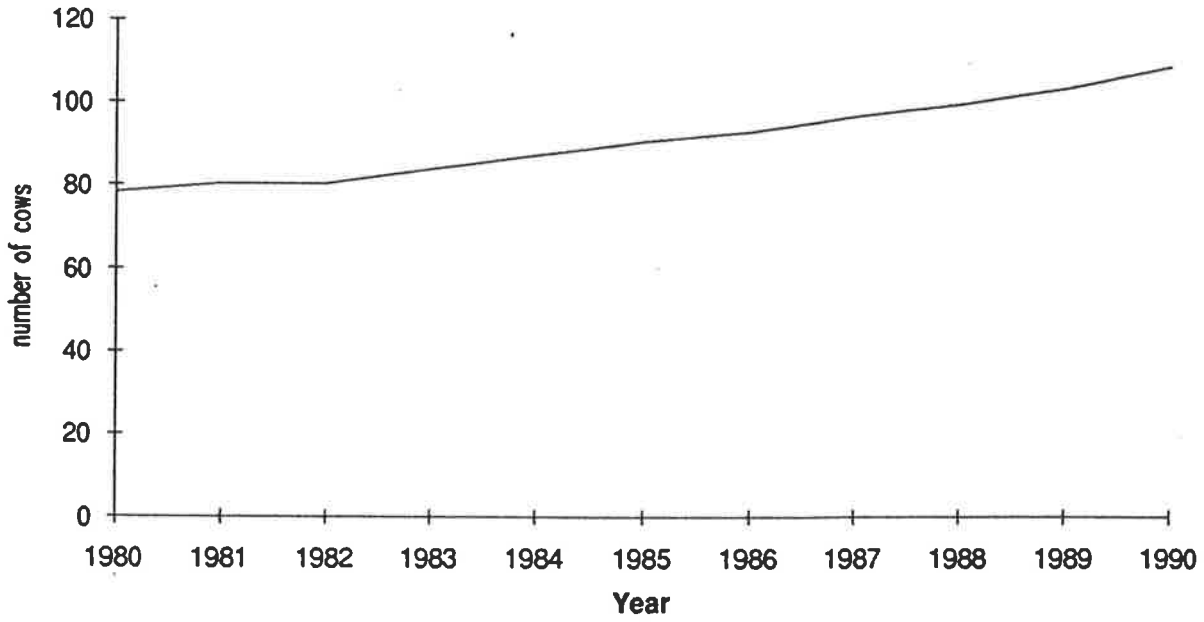
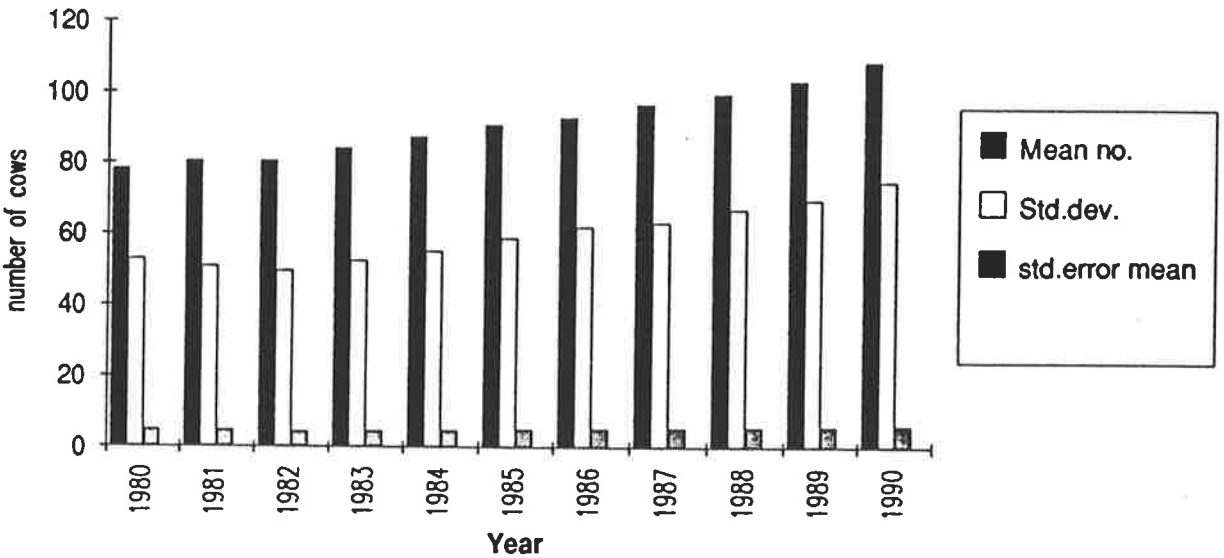


Figure 7.5 Mean number of milking cows, standard deviation and standard error of mean (sample farms)



Seventeen farmers run pure jersey herds, with a further 13 herds having a jersey component. Four farmers have Friesian/Jersey crosses, and 2 have Illawarra herds. There are two herds with some Friesian, some Ayrshire, and 2 herds, some Friesian, some Guernsey.

7.4.3 Milking facilities

Herringbone sheds are the most prevalent (on 95 farms), with 59 walk-in walk-out milking sheds, and 6 (3.8%) rotation dairies also in operation.

Forty nine sheds (mainly walk-in walk-out) were already on the property when the current owner purchased it; for those constructed subsequent to the present farmer's arrival, 81 (51.6%) indicated their chosen shed was the 'most practical', and a further 21 (13.4%) suggested 'it suited our needs at the time'. For five farmers there had been no alternative as they 'couldn't afford better'.

Year of shed construction

The majority of milking sheds have been constructed in the 1970's and 1980's - almost all of these are herringbones. Twenty two were built in the decade 1950-1959, and 25 in the decade 1960-1969. Eight sheds, all of the traditional type, and milking 2, 3 or 4 cows, were built prior to 1950 (see table 7.11). The majority of farmers can milk between 6-10 cows in their milking sheds at one time (see table 7.12). In contrast, 6 rotary milking facilities handle, at one time, 34, 40, 41, 44,

Table 7.11 Year of shed construction

Year of Construction	Frequency	%
Pre 1950	8	5.37
1950-1959	22	14.77
1960-1969	25	16.78
1970-1979	42	28.19
1980-1989	49	32.88
1990-	3	2.01
Unknown	13	8.72

Table 7.12 Number of cows milked simultaneously

Number of Cows	Number of Farms
<5	20
6-10	73
11-20	51
20 +	14

50 and 88 cows respectively and are all located in the River/Lakes region.

7.4.4 Capital equipment ownership

Levels of capital equipment ownership on surveyed properties are shown in table 7.13. These figures are not necessarily a true representation of the actual number of pieces of equipment owned by each farm as some farmers just indicated a yes/no response to the four pieces of equipment mentioned in the questionnaire (i.e. seeder, cultivator, tractor, computer) while others used the space provided to list their other types of equipment.

The younger farmers (less than 50 years of age) are more likely to own a computer than their older colleagues.

7.4.5 Adequacy of herd size

To what extent is capital within the farm system sufficient to enable management to achieve the objectives of the system?

Some 61.4% of farmers are satisfied with the adequacy of their current herd size - this still leaves 37.2% (59 farmers) dissatisfied. Sixteen of the latter believe they need a further 11-20 cows to make an adequate income, and another 10 farmers indicated they would require more than 50 additional cows (see table 7.14).

Table 7.13 Level of capital equipment ownership

Type of Equipment	% ownership cited
Tractor	100
Cultivator / ion	70
Seeder	87.6
Haymaker	91.3
Pasture maintenance	52.79
Irrigation Equipment	9.3
Frontend Loader/Truck	31
other vehicle	14.3
computer	18.6

Table 7.14 Extra cows required

Extra cow pref	No. of responses
0-10	5
11-20	16
21-30	8
31-40	6
41-50	3
51 +	10

There is no regional variation in satisfaction levels, though it appears that only farms in the River/Lakes region have the land resources to carry extra cows. Indeed, just under half of the farms wanting extra cows could carry them; 53.1% could not.

Not surprisingly, farm size and actual herd size appear to bear some relation to perceived adequacy in herd size. Farmers with farms 50-99ha, and 100-149 ha. are very definite overall that their herd size is insufficient (this corresponds with the herd sizes most likely to be found on farms of such an acreage). For those indicating that their herd is inadequate, the greatest percentage of dissatisfaction occurs in the 50-75 head group (35.6%), followed by 76-99 head (23.73%). Surprisingly, this still means two thirds of owners with herds below 75 head are satisfied with their herd size, despite their being below average size, and not considered to be profitable.

7.5 Land and herd management

This section considers the ways in which all these human, land and capital resources have been combined in the farm system to produce milk.

7.5.1 Pasture

Pasture is usually the primary food source for the dairy herd (in the context of the surveyed population), and is therefore fundamental to the system - no feed, no milk. Pasture is either unimproved (not regularly cultivated or

resown) or improved (regularly resown), and the majority of farms have a combination of both.

Unimproved pasture

109 of the 161 farms have some amount of unimproved pasture (that is, pasture not regularly cultivated or resown) Most areas of unimproved pasture are under 90ha in size; over 31% of farms have fewer than 30ha.

The River/Lakes region is least likely to have unimproved pasture but the area still exhibits the greatest area of native grasses of all the regions. The Hills region is least likely to have native grasses as pasture (i.e. there is more likely to be a clover/grass mix), followed closely in area by Fleurieu Peninsula.

The pastures are generally a ryegrass/clover mix (61.9%) with the remainder native grasses.

Much of the unimproved pasture is unirrigated, with only 6 farmers (6.3%) irrigating all of it. It is not cut for hay in the majority of cases. Where it is cut, the percentage varies from 1 to 25%. Fleurieu Peninsula farms have the lowest levels of hay cutting from unimproved pastures over all four regions.

Despite being 'unimproved' pasture, many farmers use at least some fertilizer on an annual basis, with ordinary superphosphate predominating. NPK and MAGPHOS:K are also

used in several cases. The amount of fertilizer used varies widely, with some farmers (11, 15%) using fewer than 40kg/ha, and others over 121 kg/ha, the latter being the most common (48 farmers, 31.6% of respondents). This three fold difference is surprising given that fertilizer is not cheap. Levels of usage may be related to the soil/vegetation characteristics of different paddocks but may also be a reflection of available finances and the personal preferences of the farmer. There is no noticeable difference between regions.

Improved pasture

One hundred and twenty eight properties have at least some improved pasture (pasture regularly cultivated and resown), the greatest areas of which are found in the Rivers/Lakes region. The Hills region has only a comparatively small proportion of improved pastures. Most commonly farms have less than 50ha. (34%) while a further 25.8% of farms have between 51 and 100ha.

A ryegrass/clover mix dominates these pastures (81.6% of improved pastures), with the remainder divided between other native grasses, lucerne and grain. Lucerne as an improved pasture is found only in the Rivers/Lakes region.

A single fertilizer is used by 99 farmers (81.1%) on the improved pasture, with another 23 using a combination of 2. Superphosphate or other super derivatives are most

commonly used, followed closely by NPK and other similar mixes. It is often applied at levels greater than 121 kg/ha (48%), with 11 farmers (9.8%), using less than 40kg/ha. This again is a big difference which transcends regional boundaries, age and education levels, and comes back to individual farm characteristics and personal preferences. However, it does suggest that possibly some farmers are wasting resources by applying too much fertiliser whilst others are below production potential by not applying sufficient.

Cutting levels for hay vary between regions, with the least cut in the River/Lakes region, and the greatest area (over 50ha) in the Hills.

7.5.2 Fodders

Oats and lucerne are the main fodder crops grown on the properties surveyed. 89 farms produced at least one type of fodder, with a further 37 growing 2 varieties, and 10, three varieties. Lucerne and oats predominate in the River/Lakes region while the lowest level of fodder growth is on Fleurieu Peninsula. This relates closely to the levels of available feed - along the River there is limited potential for growth of unimproved or improved pasture compared to the Hills and Fleurieu Peninsula where rainfall is generally reliable.

For the primary fodder type, the areas sown are generally comparatively small, with 44 (49.9%) under 10ha. (the

greatest number being located in the Hills region), and a further 13 (13.5%) under 20ha. 37% are growing oats, 36% lucerne, while maize, wheat, barley, millet, sorghum and sudax are also grown. Thirty properties have areas above 21ha. under their primary fodder crop, mostly found in the River/Lakes region. Fifty three farmers are irrigating none of the crop, and 32.6% irrigate it all. Well over half the fodder area is cut for hay. Superphosphate and NPK are the most commonly used fertilizers, predominantly at 121 kg/ha or more, but with 20 farmers using fertilizer between 81-120kg/ha, 11, between 41-80kg/ha, and 7, less than 40kg/ha.

Thirty seven farmers grow a second fodder; oats is most common, followed closely by barley with lucerne grown only by one farmer as a second crop. Oats are grown in the smaller acreages (less than 10 ha. in size), the barley in larger paddocks, greater than 21 ha. in size, mainly in the River/Lakes region. These crops are generally not irrigated, with 56.7% cut totally for hay, especially in Barossa region. Eight farms cut no hay from the crop.

Ten farmers grow a third fodder, and 4, a fourth type. The variety is broad, and includes lucerne, millet, sorghum, maize and sudax. Irrigation of the crops is not common, but fertilizer is used on all crops.

Overall, the growth of supplementary feed in the form of fodder crops is an integral part of the majority of dairy farming operations, though crops grown vary in relation to rainfall and soil conditions.

7.5.3 Feed supplement

Of the 161 farmers, 138 use some form of supplementary feed (that is, in addition to grazed pasture or fodder crops) on their farms, 48 using a single supplement, 74 two supplements, and 12, 3 or more. Types of supplement and levels of usage are indicated in table 7.15, with usage levels on a regional basis shown in table 7.16. Farmers on the Fleurieu Peninsula region use considerably more feed supplements than the other three regions, far in excess of that in the Barossa or Hills regions. This is perhaps surprising given the similar levels of rainfall received by the Peninsula and Hills regions and where adequate pasture growth might have been expected. Most farms in the region are of similar smaller sizes, so this cannot be used as an explanation for the regional difference.

The moderate level of supplement use is to be expected in the River/Lakes region given the reliance on irrigated land, and dependence on fodder and supplementary feeds to meet feed requirements of the dairy herd.

Nearly 70% of feed supplements are used continuously throughout the year, while 10% of farmers use supplements

Table 7.15 Type of feed supplement used

Type	Freq	%
barley	59	24.3
other grain	70	28.8
hay	70	28.8
mineral blocks	10	4.1
pellets/concentrates	19	7.8
linmix	14	5.7
molasses	1	0.4

Table 7.16 Type of feed supplement used by region

number of farms

	Fleurieu	Hills	River/Lakes	Plains/Bar.
barley	23	9	19	4
other grain	26	16	16	3
hay	26	12	25	7
mineral blocks	5	4	1	2
pellets/ concentrate	9	2	3	1
Linmix	5	1	6	0
molasses	0	0	0	0
TOTAL	74	29	49	17

during Autumn and Winter, the time of least pasture growth.

Barley is used slightly more frequently on Fleurieu Peninsula and in the Barossa region than in the remaining two regions, and use of hay and mineral blocks is more common in the River/Lakes region.

The primary reason cited for providing cows with this additional feed is to increase production (38%), with the need to make up the feed ration (31.4%) a close second. Other explanations include an inability to grow enough feed (especially in River/Lakes region), and to improve cow quality (most commonly cited by Fleurieu Peninsula farmers).

7.5.4 Grazing practices

Grazing practices vary greatly over the milkshed, with the majority of farmers indicating they move their cows according to available feed (68 responses, 42.8%). A further 43 farmers favour movement on a daily rotation, 21 (13.2%) to a new patch twice daily (a practice almost exclusively pursued by River/Lakes farmers), and 20 (12.6%) moving on a weekly basis. This variation is not unusual and is based on available feed, size of herd and farm, number of paddocks and their accessibility, and individual farmer preference.

7.5.5 Herd replacement rate

The predominant replacement rate for the dairy herds is 16-20% per year (by 44% of farmers); 12 farmers have a herd replacement rate above 26%, and 5 farmers between 0-5%. The average for the Hills regions is 6-10% (in the smaller herds), with the remainder of the other regions at a far higher level of 16-20%.

7.5.6 Artificial insemination

Twenty nine farmers (18.4%) use no artificial insemination (AI) in their herds. However, 32% (51 farmers) use AI on 90-100% of their cows, with 67.7% of farmers using AI on at least half their herd. River/Lakes region has highest usage levels, Plains/Barossa region, the lowest.

7.5.7 Management related to rainfall

Low rainfall areas occur along the River Murray and in the Lakes region, where land must be irrigated in order to sustain dairy farming. There are no farms in the River/Lakes region receiving more than 500mm of annual rainfall, and irrigation of pasture is an integral component of the maintainence of pasture.

Those properties located in the drier regions of the Plains and Barossa Valley generally run milk cows as a component of their total farm operation (i.e. in conjunction with horticulture, cropping or other more

extensive farming), and irrigation is not always essential under the circumstances.

Much of the unimproved pasture grown in the Milkshed is unirrigated, with only 6 farmers irrigating all their unimproved pasture.

Fifty eight (46%) of the properties have no irrigation of their improved pasture. Those that do are predominantly located in the lower rainfall regions, again in the River/Lakes region with only a small area irrigated in the Hills and Fleurieu regions.

7.5.8 Physical Production

The actual production of liquid milk is obviously the primary physical objective of the dairy farm system, and as such is an important determinant of the system's productivity and profitability. The milk is also the link between the farm system and the agricultural system within which the farm system exists.

The question concerning farm production in litres of milk per annum was particularly poorly answered, and confirms Chester's 1977 observation that farmers are very reluctant to reveal any information relating to production levels or income. While 40 farmers did not respond at all to the question, a further 74 responses (47.1%) were incomplete. Only 35 farmers filled in all ten years of production information requested, and as a

result there may well be a bias in responses. Many smaller scale farmers failed to provide answers, but larger property owners were equally as reluctant, suggesting in several cases that the information requested was not relevant to the study, or that records were too hard to come by. Six farmers 'had their records at the accountants'. It could not be said that willingness to answer the question was an indication of progressive farmers - indeed, several with plans for improvement appear reluctant to let other people know how well they are progressing. Smaller farmers are perhaps unwilling to share low production figures while others just haven't bothered to keep the figures.

The responses are graphed in figure 7.6 and 7.7, and show a steady increase in production over the decade 1980 - 1990. Milk production also varies seasonally, and there are marked differences between regions in this regard. Average production levels of whole milk on a monthly basis, for each region, are illustrated in figure 7.8. All regions reach a peak of production in spring where rising temperatures after good rains provide plenty of moisture for pasture growth. The River/Lakes regions maintains its output during summer whilst the other three regions fall away, especially on the Fleurieu Peninsula, which reaches its lowest point in February. During Autumn and Winter the Fleurieu Peninsula, Hills and Plains/Barossa regions all exhibit increases in output, coinciding with increasing rainfall and improved pasture

Figure 7.6 Mean of production in litres, sampled farms

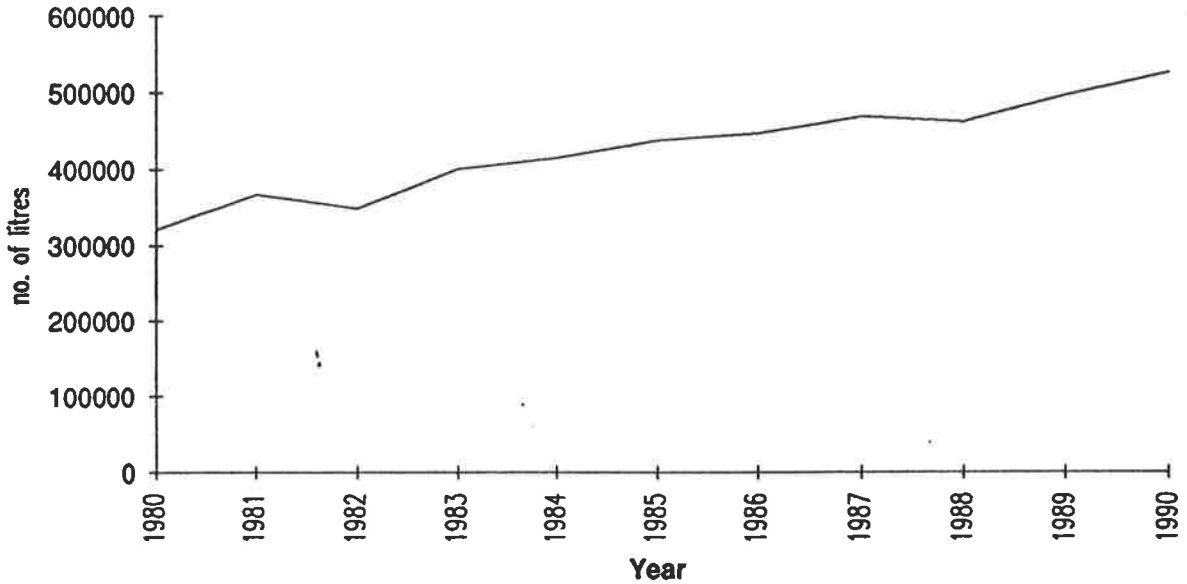


Figure 7.7 Mean, standard deviation and standard error of mean for production in litres, sampled farms

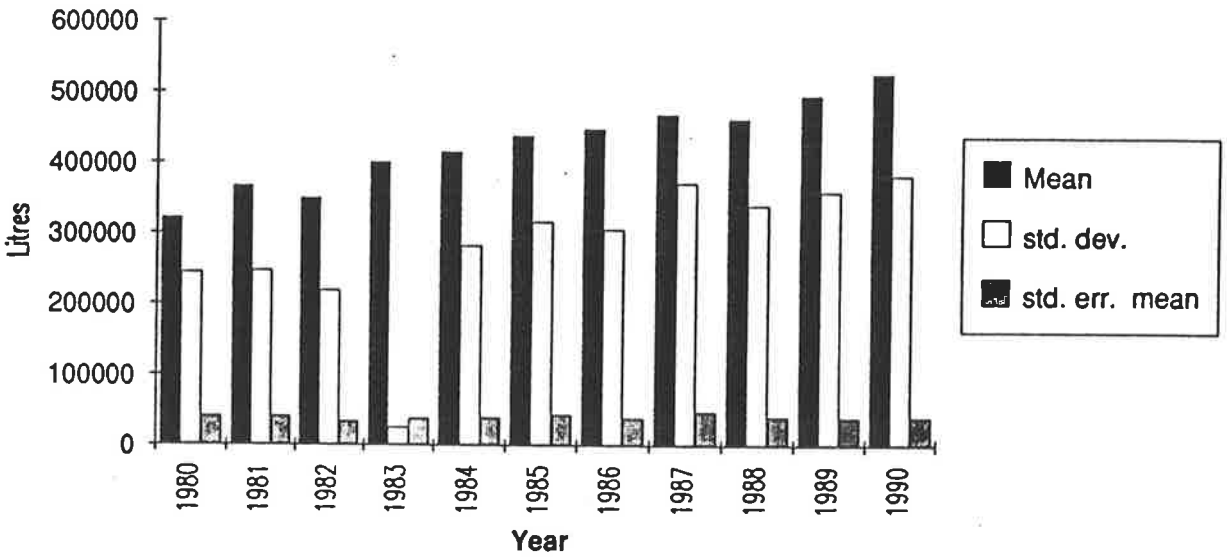
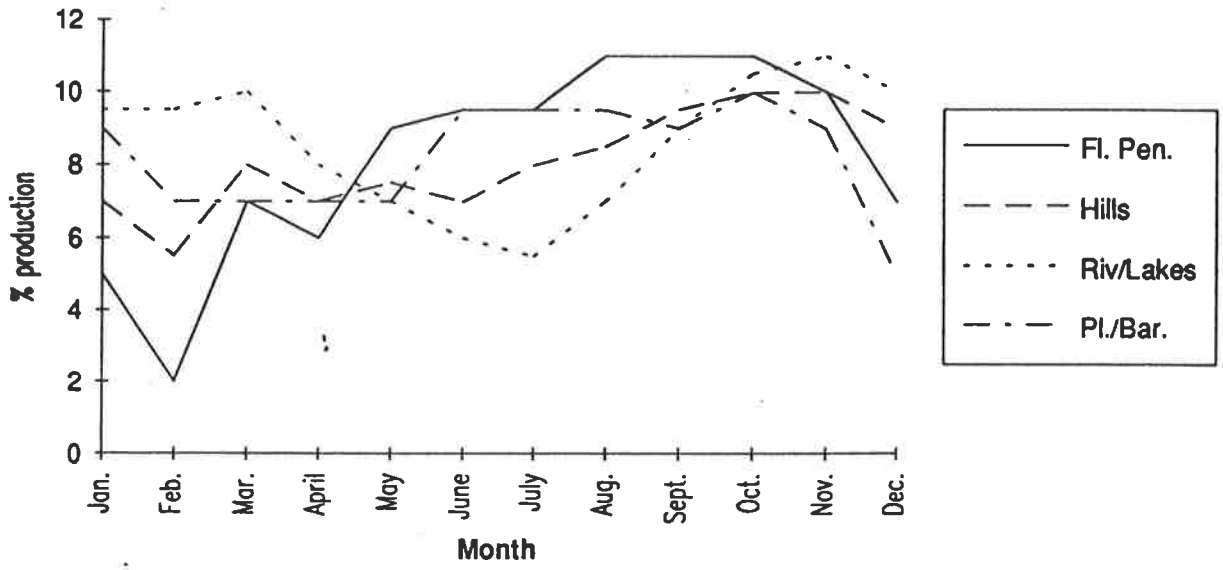


Figure 7.8 Average percentage of annual milk production per month by region, sampled farms



growth. The River/Lakes region reaches its lowest level of production during winter, as cows are dried off in preparation for the next production year. These variations help ensure year round milk supplies for the Adelaide market.

What causes this seasonal variation? There are several explanations put forward by the farmers with pattern of feed availability (37.5%) and seasonal calving patterns (29.7%) the most common. Others refer to the use of management intervention in the form of supplementary feeding (18.5%) and weather constraints, especially timing of opening rains (12.36%). With the exception of the weather constraints, the remainder of the above causes are deliberately arranged, presumably in response to resource availability, to the demand pattern for milk, or to obtain the benefits of seasonal bonus payments made during Autumn by the milk processors.

7.6 Diversification

Another on-farm management response to resource allocation, and a means by which a farmer chooses to combine resources to best meet the farm system's objectives, is diversification. In such circumstances, dairying is not the sole enterprise on the farm. This may be the way the enterprise is currently structured, and be most suitable to available land, labour and capital.

Thirty eight of the 161 farms currently operate other agricultural enterprises in conjunction with dairying, several with two or more operations. The once traditional enterprise associated with dairying, pig rearing, is no longer of any significance, being carried out by only 1 farmer in the survey.

The most common additional enterprises are horticultural (vegetables, grapes, flowers), mentioned by 18 farmers. Sheep (ten farmers), cropping (8), and beef (7) are also alternatives, often found together. These are predominantly located on the larger properties in the Barossa Valley region, and around the Lakes area.

7.7 Conclusion

This chapter has considered the available resources on surveyed properties, paying particular attention to how they are integrated to produce the final product of milk. The next chapter focuses on farmer perceptions of the external environment impacting on the decision making process.

CHAPTER 8

FARMER PERCEPTIONS OF THE EXTERNAL ENVIRONMENT

Before considering the strategies adopted by the farm manager it is necessary to assess how farmers perceive the level of impact of government and other external influences (i.e. that which is outside the farm system but within the agricultural system) on farm productivity and profitability.

8.1 Influence of government

In this context farmers were asked to assess the level of impact (on a scale of very important to irrelevant) of a variety of external factors, including several aspects of government fiscal and monetary policy, on the farm's productivity and profitability.

a) Exchange rates: over half (53%) of the 149 respondents indicated their belief that exchange rates are having a very important impact on farm viability, with a further 23.5% (35 farmers) suggesting they are important, and 16.8% indicating they are of some (that is lesser) importance. Overall, 93.3% of respondents believe exchange rates to be of at least some importance to profitability of dairying in the Adelaide region.

b) Protection: The government's protection policies (or in the eyes of many farmers, the lack of them), are also seen as having considerable impact on farm profits, with 42.8% indicating they are very important, 29%, that they are important, and 19.3%, that they are of some importance. Again, this amounts to over 90% over all respondents.

c) Farm reconstruction schemes: These are not perceived as very significant, though 73.9% of respondents indicated that such assistance was of at least some importance to productivity and profitability. 18.8% (26) respondents see the schemes as of only minor significance, and the remainder (7.2%) view them as irrelevant.

d) Adjustment schemes: These also met with a mixed response, though 75.7% of farmers indicated they are at least of some importance to the future profitability of the farm. Several farmers indicated they were unsure as to the meaning of an adjustment scheme.

e) Interest rates: Perhaps not surprisingly, these came in for a great deal of attention, with over 69% of all respondents indicating they play a major role in affecting the future success of the

farm, and 95.9% of all farmers indicating that interest rates are of at least some importance.

f) Other government policy: only a very small number of farmers mentioned any other aspect of Federal government economic policy as having a negative impact on farm profitability.

Federal policies were obviously less acceptable overall than state policies but 95.6% and 99.3% of respondents (regarding state and federal policies respectively) perceived that their non economic policies had at least some impact on farm profitability. No specific state policies apart from the Mount Lofty Catchment planning regulations and their potential consequences were mentioned by the farmers themselves.

8.2 Urban expansion

Given the study's interest in the role of urban expansion on the restructuring of the dairy industry, the responses to the question concerning its impact on farm profitability could be of considerable significance.

Opinions on the subject are divided particularly along regional lines. As might be expected those in the Hills and on Fleurieu Peninsula rate the impact of urban expansion more highly than those farming on the Lakes shore or along the Murray.

A distance decay function is clearly evident whereby the problems of urban expansion are viewed with less concern by farmers a considerable distance from the urban area, than by farmers closer to the city. For many of the former the issue is seen as irrelevant. Even so, perhaps surprisingly, some Hills farmers also view urban expansion as of neglible importance.

Farmers were asked to assess the impact of land prices on their operations. Some 51% (73 farmers) considered that land sales (encouraged by higher prices) are having a very important impact, a further 39 (27.3%) important, and 11.2% of some importance (a total of 89.5%). An even higher proportion of farmers (60.1%) consider high land prices restricting farm expansion as being a very important influence on continued success and profitability within the dairy industry. Farmers in the Hills region are obviously particularly concerned about this issue, and relates closely to their perceptions discussed in chapter 7 that their properties are of an inadequate size.

Farmers see high land prices as far more of a problem than urban expansion and to many there does not seem to be a relationship between the two. It could be argued however, based on the observations of other resarchers, that the two can be closely related in the sense that increasing demand for agricultural land for urban development does increase the value of that land over

that which it would be worth for agricultural purposes. The increased demand for land appropriate for dairying by those farmers wishing to relocate outside areas being affected by urban expansion may result in an increase in price in those areas. That is, the price of agricultural land suited to dairying increases as a result of a shortfall in available land. This change has both negative or positive consequences, and may be reflected in the management of the farm system (as will be seen later). Opportunities for off farm work and the sale of the farm at a value in excess of its agricultural worth may have positive implications for some farmers.

How farmers have reacted to government intervention, urban expansion and high land prices, in addition to all the other pressures on dairy farming already identified are discussed in detail in the next chapter on counteracting system malfunction.

CHAPTER 9

INTEGRATION OF RESOURCES; COUNTERACTING SYSTEM MALFUNCTION

9.1 Introduction

It is the way in which the dairy farm (i.e. the farm system) is managed that brings all the components of the system together in order that it might function to meet the system's objectives. Obviously the primary objective of a dairy farm is to produce milk but a farm decision maker will, in all likelihood, have other objectives the farm system is expected to meet i.e. it should make a profit, it must be able to survive economically; the farmer will probably want the system to be environmentally sustainable and it may be important to be able to pass on the property to future generations as a viable unit of production. A reasonably pleasant and satisfactory lifestyle which fulfils the personal needs and wants of the farm family may also be an important objective, and can be of particular significance when one considers the emphasis many farmers place on 'lifestyle' and 'rural living' as a motivation for remaining in farming.

Of course, there may be a conflict between objectives. What may be a very sound short term management plan in an economic sense may not be the ideal strategy for long term environmental sustainability - indeed, the latter

may not be financially possible at a given time, however much a farmer may wish to implement it.

How a farmer manages the farm system then will both reflect these objectives, and be aimed at meeting them to a greater or lesser extent, depending on their relative significance to the individual.

The system cannot be managed constantly at equilibrium as its components and the environment in which it operates change over time - there may be a short-fall in resource availability (for example, machinery breakdown, illhealth, drought), costs of inputs may increase, government intervention may change and any number of other external (and internal) pressures may be brought to bear on the system. In such situations the system can be said to be malfunctioning, or, where stresses are extremely severe, it may break down completely. The farm manager will either have management strategies in place to reduce potential impacts of system malfunction, may implement altered or new management techniques to return the system to meeting the objectives, or may choose to do nothing, in which case the system is failing to maximise its potential.

The general fluctuation in the biophysical environment constitutes risk, though the fluctuations do generally occur within predictable ranges. Changes in economic, political and institutional environments constitute

uncertainty and cannot be assigned a probability. The farmers still have some control of some aspects of these environments through their relationships with the processing companies and the South Australian Dairyfarmers' Association.

There are many ways the farm system may malfunction, leading to a failure of the system to meet one or more of the system's objectives. This chapter considers the various types of malfunction, discusses the symptoms of the problems, and the extent to which these are mainfest in the Adelaide milkshed, then goes on to show how farmers are dealing with the malfunction and breakdown. The same hierarchy of responses outlined in chapter 6 is used in this discussion.

9.2 Types of system malfunction

9.2.1 Biophysical malfunction

This may be manifest in a decline of land quality and sustainability of biophysical resources. Weeds, followed by problems caused by insects in pasture are the major environmental problems affecting farm productivity (see table 9.1). The table illustrates environmental problems in order of least impact on farm productivity, and shows too that soil and water erosion are considered only minor problems by the majority of farmers. On the other hand, declining soil fertility (28.4%) and increasing soil salinity (28%) are also identified as considerable problems, though they vary in significance between

Table 9.1 Environmental problems in order of least impact on productivity

Soil erosion	90.3%
water erosion	90.2
effluent	88.1
pasture diseases	83.7
overstocking	81.7
soil salinity	72.0
declining fertility	71.6
insects	54.4
weeds	44.0

regions. Weeds are of greatest impact on Fleurieu Peninsula (though not significantly so). Soil erosion is of concern to some River/Lakes farmers, and water erosion is a particular concern to several farmers on Fleurieu Peninsula. Soil salinity is a very obvious management problem being faced by farmers in the River/Lakes region.

Other physical management problems are those derived from the actual management of the dairy herd itself, especially related to health problems of the cows.

9.2.2 Economic malfunction of the system

Declining quality and quantity of capital resources, especially machinery and the milking shed are seen as major problems. For example, 49 farmers in the survey (26.8% of all responding farmers) indicated that their milking shed or associated facilities are inadequate, due mainly to their being 'inefficient'. Thirteen farmers in this group (30.2%) were more specific in their dissatisfaction, indicating the shed could be larger. The latter was particularly the case in the River/Lakes region. 'Operator difficulties' were cited by four farmers. Both lead to inefficient production, may limit herd expansion, and overall the farm system's ability to meet its objectives is hampered.

Increasing cost of inputs is another aspect of malfunction which is concerning many farmers. The increases continue to have considerable impact on the

profitability of many farms, with cost of feed and employing non family labour of greatest concern, and the cost of breeding to improve herd quality also of significance. While cost of seed, and transport, are shown to be somewhat less important, 88.6% (seed) and 91% (transport) of farmers indicate they are of at least some importance in their impact on profitability.

9.2.3 Social malfunction

The failure of the farm system to meet the social needs of the farmer and farm family is of immense importance. In many cases, farmers have indicated that they are receiving inadequate income (and other recompense) for the amount of resources, especially labour, they are putting into the enterprise. Income may be insufficient for the maintenance of a certain and preferable living standard.

Illhealth and advancing age can also be a problem. Indeed, retirement was given by 20 farmers as a primary reason for the original sale of the dairy farm to its present owners, and several other ex-dairy farmers have transferred to less labour intensive types of farming, more suited to age or health constraints.

It may also be that, due to the perceptions of the current lifestyle, children who might have been expected to remain in dairy farming become disinterested and

choose to pursue other careers, leading to a decline in available labour.

How the farmer chooses to respond to these system malfunctions is the subject of the next section of this chapter. They may select on-farm management techniques or pursue strategies outside the farm system (or a combination of both), and both options are discussed in some detail.

9.3 Farmer responses to system malfunction

9.3.1 Management change

Farmers, when asked to explain their increases (or decreases) in production over the decade prior to the survey indicated they have pursued a variety of practices aimed at counteracting systems malfunction.

Improved land/herd management and sustainability

A wide variety of on-farm management strategies related to improved land and herd management and sustainability are currently being pursued by many surveyed dairy farmers.

Weeds

Spraying is by far the most common strategy for controlling weed problems on the farm, with 111 of the 125 farmers using this method.

Spraying is used by 33 farmers in conjunction with other methods of control, particularly cultivation and 'appropriate' grazing management. Twenty three respondents mentioned cultivation as a management tool, 22 grazing management, 12 pasture renovation, and 7, crop rotation.

Five farmers use 3 different management strategies, and 40 use 2.

Soil erosion

Forty one farmers provided information on their soil erosion management strategy. The most common practice is improved cultivation (implemented by 20). Unfortunately, the means by which this improvement occurred was not given in responses. Avoiding overgrazing is favoured by 12 farmers and trees have been planted by 9, mainly by farmers in the Rivers/Lakes region, and on Fleurieu Peninsula, in order to reduce erosion.

Most of these practices have been implemented during the 1980's.

Soil salinity

58 farmers indicated they implement at least one strategy to control soil salinity problems, with 15 farmers combining 2 methods and 3 combining 3. Improved drainage and other earthworks are the most prevalent solutions (33 farmers), and utilization of salt tolerant pasture

species (12), planting of trees (7), and improved irrigation practices (7) are also important.

Again, the majority of these practices were adopted in the 1980's, while 11 of the 42 farmers indicating a year of commencement began their management strategies in either 1990 or 1991. This could well reflect the increasing emphasis on soil and land care conservation strategies.

Soil salinity is a particular difficulty along the Murray River on irrigated pasture more specifically, and amelioration management strategies, especially improved drainage, are far more prevalent in the River/Lakes region than elsewhere in the milkshed, for this very reason.

Water erosion

Earthworks (carried out by 24 farmers), including the construction of contour banks (18 farmers) and the rebuilding of drains (4 farmers) are the most frequently used means of controlling water erosion on surveyed properties. Tree planting (6), cultivation (5) and improved grazing management (2) are other options. Only 4 of the 39 farmers are combining two strategies.

As in all previous examples, most of these management methods were implemented in the 1980's, though the

earliest contour banking was constructed in 1950. Six farmers have made management changes in 1990-1991.

Declining fertility of soil

Fertilizer addition is the most common means of rectifying declining fertility (49 out of 79 farmers), with 28 using soil/tissue testing as another strategy, 14 in conjunction with addition of fertilizer. Legumes, pasture renovation and changed rotations are also used by some farmers. Out of the 71 respondents, 51 are using one control method, 17 are using 2, and 3, three methods.

These aspects of farm management have been adopted comparatively less recently than other management strategies. All the same, 24 farmers implemented specific fertility management techniques (generally soil/plant tissue testing) in the 1980's and 10 during 1990 and 1991.

Overgrazing

Reduction of stock or stocking rates is the most common means of overcoming overgrazing (22 out of 46 responses), with pasture improvement a close second (20 out of 46). Four farmers purchased more land. Why did 46 farmers commence overgracing in the first place? The responses give no reasons, but could be caused by the need to increase production to counteract declining incomes, too small a property to carry adequate stock, inadequate feed due to poor seasons, or overall inappropriate management.

Pasture disease

Implementation of a variety of management strategies to counteract pasture disease has occurred on 40 properties. Adoption of resistant varieties of pasture species is the 'normal' means of pasture disease control, and is carried out on 40% of farms. Spraying (carried out by 13 farmers) is the second most common practice, and crop rotation has been implemented by 6 farmers. Again, adoption and implementation of these strategies began primarily during the 1980's.

Insects

Spraying is by far the most common means of managing insect problems (86.8% of respondents).

Effluent

The use of spread gravity is the most frequently used option for managing effluent (by 7 farmers) but there were several other options put forward as solutions including the use of effluent ponds, improved water usage and milking shed design.

Only 15 farmers gave the date of implementation of these strategies, 7 occurring in the 1980's. Three farmers indicated they would be making effluent management changes in 1992, with the construction of effluent ponds and the use of spread gravity techniques. This level of effluent management seems inadequate given the extent of

the problem throughout the Hills and River regions, and must be of concern.

Apart from soil salinity control measures (already discussed) there are no major differences between regions with regards to levels of adoption of the above management strategies. Indeed, the variation is, perhaps surprisingly, very small. Comparisons of individual properties is a different matter, where variation is very marked. Compared to their smaller counterparts most larger properties (> 250 ha.) implement a broader range of the management techniques included above, aimed at improving the sustainability of the system.

9.3.2 Improvement in capital resources

This may also be an option for farmers seeking to reverse system malfunction. For example, the size of the milking herd can be increased, or the composition of the herd altered. Both alternatives have been pursued by many farmers in the Adelaide milkshed, with the former common to 95% of surveyed farmers.

A decline in the number of Jerseys in herds is very obvious over the decade 1980-1990. The main reasons for this are the trends towards

a) increasing production - Freisians are favoured over Jerseys which are smaller cows, and produce less milk, and

b) lower fat, higher protein content in milk - Jerseys are producers of high fat content milk.

It may also be possible to improve management efficiency by updating or upgrading other capital for example, the milking shed. Twenty nine farmers are planning improvements to their milking shed, with the majority planning to extend the actual shed. Nine others are planning to improve milking equipment, and 6 are anticipating improving the holding yards. Two respondents are planning to build new sheds.

The vast majority of farmers planning to undertake improvements are located in the River/Lakes region.

It may be that some farmers in the Hills and Fleurieu regions are reluctant to make such an investment because their future is threatened by urban growth. On the other hand, given the smaller size of herds in these regions, there is no real need to upgrade existing facilities unless absolutely necessary. The benefits of upgrading are completely outweighed by the costs of improving facilities.

9.3.3 Other preferred land and herd management practices

All the practices discussed above are currently being implemented. Many farmers also identified other preferred management techniques they would like to be able to adopt related to improved herd and land management, in order

that farm viability be improved, and sustainability enhanced.

Preferences are indicated in table 9.2 which indicates pasture renovation (i.e. recultivation and/or reseeding) is a particularly high priority.

There are several factors which are preventing the adoption of these practices and these are summarised in table 9.3. Lack of finance is obviously the greatest hindrance, and closely allied with this is the cost of removing land from production. The latter is a particular difficulty on a smaller dairy farm where there is less room to keep stock if one paddock is out of action. This means that the smaller farms which have the greatest need to increase unit area productivity are less able to do so.

Feed quality is also of great significance to overall production levels, and overstocking elsewhere on the farm may have a negative impact on productivity. The farmer needs to have adequate finance to manage on a lower income and sufficient feed reserves to maintain feed levels at a nutritional and productive rate. All these factors clearly have a greater impact on the smaller scale farmer.

Table 9.3 also shows no evidence that farm investment in the Adelaide milkshed is being seriously affected by a

Table 9.2 Preferred management practices

	No. of mentions
Pasture renovation	41
swamp drainage / irrigation	25
changed grazing practices	19
additional feeding	11
improved soil fertility	11
'other'	10
effluent disposal	8
improved genetics	7
more trees	3
fodder conservation	3

Table 9.3 Factors preventing adoption of preferred management practices

	No. of mentions
money	67
cost of removing land from production	30
other	8
not enough land	6
labour	5
just started	4
leasing land	2
unsure of farm's future	2
farm not economically viable	1

lack of assurance of the future of the region's dairy farms. However, it could be argued that smaller properties whose future is arguably less secure are not as likely to implement management improvements as their larger counterparts. Lack of finance transcends farm size and regional boundaries, and is a common problem to all regions.

The suggestion that a lack of assurance impacting on farm management strategies could be a consequence of urban expansion cannot be supported, as table 9.4 indicates. Had this been so, the data would have been expected to show that farmers in the Fleurieu and Hills regions, closest to the city, viewed an unsure future of the property as a factor preventing improved management. Only two farmers, one in each region, indicated that this was of particular concern.

9.3.4 Getting bigger

Compared to many other kinds of agricultural production, because of its labour intensive character, economies of scale are not easily obtained in dairying. However, "best practice" farms in this study have herds of over 150 cows and associated investment in larger sheds and equipment, and of course, land. Greater output at lower unit cost may therefore involve 'getting bigger' for many farms, and is a solution to problems of economic malfunction in the farm system.

Table 9.4 Factors preventing alterations in management strategy by region

	Fleurieu	Hills	River/Lakes	Plains/Bar.	TOTAL
time	13	4	11	1	29
money	24	19	19	3	65
not enough land	4	1	1		6
not viable economically	1				1
leasing	2				2
unsure future of property	1	1			2
cost of removing land	3		4		7
just started	1	1	1	1	4
other	1	2	3	1	7
TOTAL	**46**	**31**	**39**	**7**	

As already indicated in table 9.3, six farmers view inadequate land as a hindrance to preferred management. This level may somewhat understate the actual situation, as the ensuing discussion on the adequacy of present farm size indicates.

Adequacy of present farm size

Sixty four percent of surveyed farmers believe that their present farm is sufficiently large enough to maintain an adequate income. River/Lakes farmers are most satisfied with the present size, the least satisfied, Hills farmers.

For the one third of farmers who are dissatisfied with the size of their present holdings, 37% indicated that an increase of 81ha or more would be necessary to develop a more profitable property, half of these in the Fleurieu and Hills regions where farms are generally less than 150ha in size, and the remainder in the River/Lakes and Barossa regions, where properties are somewhat larger. This indicates that farms of all sizes would benefit from an increased land area.

Any land purchased would be used for one of four main purposes:

- growing extra feed (8 farms)
- grazing milkers (15 farms)
- rearing young stock (4 farms)
- resting dry cows (2 farms).

The main reason preventing such expansion is lack of finance (cited in 23 cases), with the remainder of farmers unable to purchase additional land due to its non availability. The latter is a particular problem in the Hills and Fleurieu Peninsula regions, though high cost of land is also a significant problem in the Hills.

Addition to property

As chapter 5 illustrated, 'getting bigger' has been always a dominant strategy for economic survival of dairy farms and farmers in the Adelaide milkshed are no exception. Nearly half (45.6%) of all farmers surveyed have added some land to their properties in the last ten years. Plains/Barossa farmers are most likely to have added to the farm in that time (70.5% of that region's respondents) though this may not necessarily have been for dairying purposes. In comparison, Hills farmers are the least likely to have made an addition with only 32.5% making such a change compared to 53.1% of farmers on Fleurieu Peninsula, and 53.9% of farmers in River/Lakes region. This means over half of all dairy farmers in the Adelaide Milkshed region have expanded their properties in the last ten years.

Furthermore, properties presently between 50-149ha in size are more likely to have made an addition. Closely related to this, a farm with herd size 100-149 cows is most likely to have added to the property; least likely 50-75 cows. It appears therefore that owners with small

herds are either happy with their herd size (that is they are 'hobby' farmers, or have a small herd in combination with other agricultural enterprises, such as flower or grape growing), or cannot afford an increase in size.

A total of 76 farmers had purchased at least one block of land during the previous ten years, 60 of these transactions occurring before 1988. The size of the block purchased varied greatly, with 19 (25.7%) over 101 ha. in size, mainly in the River/Lakes region, but with 45 under 60ha. (particularly in Fleurieu Peninsula). Fourteen farmers purchased land under 20ha. Some of the land purchased had been previously used for dairying (in 25 cases, 12.9%), or pasture (14 cases, 18.4%), but sheep (15.3%) and beef cattle (11.1%) had also been utilisers of the land.

Thirty one farmers have purchased a second block in the last ten years, 16 since 1988, and eleven farmers a third block. Again, the size of the purchase varies widely, but the majority are still under 60ha. Dairying (11 responses), and sheep (8 responses, mainly from Hills region) were the main previous users.

Sale of land

Twenty two farmers have sold parts of their property in the last ten years. None sold any land before 1984, with 20 sales occurring since 1986. Most land parcels sold were quite small, generally below 20ha (11 out of 21

responses). Indeed, farms 50-99ha in size were most likely to have sold land (corresponding to herd size, 50-75 cows) even though this size category was emphasised earlier as being most in need of extra land. This suggests a process at work such that farms below 100ha in size see little prospect of becoming viable so they move resources (land, labour) out of dairying. Other farms which are bigger but are still below optimum acquire more resources, such as land.

The reasons given for the sale were very varied, with the need for money the most common response (made by 5 farmers). The purchase of other land was the next most frequently cited explanation (by 4 farmers), with government acquisition (2), unproductive land (2), debt payment (1), subdivision (1), moving (1), surplus (1) and settlement of estate (1) proffered as other explanations.

Only two farmers have sold more than one block of land.

Fleurieu Peninsula has seen the greater number of land sales (30.6%, or one third,of that region's farmers). This is in comparison to 5.4% for the Hills, 5.8% for River/Lakes, and 6.25%, for Plains/Barossa.

9.3.5 Diversification

Another on-farm management response to a system which is failing to meet its objectives is to reallocate resources

between enterprises. This may help to overcome both economic and biophysical malfunction.

As already mentioned in chapter 7, dairying may not be the sole enterprise on the farm, and it is obvious that farms which are already diversified have greater flexibility in terms of supply elasticity.

Diversification may provide additional income, maximise use of resources or be the means of transferring production totally from one enterprise (for example. dairying) to another, such as beef cattle.

Over 30% (50 farmers) of the total farmers surveyed have seriously considered adding new enterprises to their current dairying operation in the last three years, ten of whom have only recently commenced operation of their alternative. The remainder are dairy farmers deciding on diversification for the first time.

On a regional basis, farmers in the Hills region are most likely to consider it, Plains/Barossa farmers are least likely, especially those with herds of less than 25 cows (perhaps because these are usually farmers who have already diversified).

Farmers with herd size 50-75 cows are also most likely to be contemplating the change, as are those farmers with 50-149ha properties. Smaller farms are seeking to

intensify their operations, while larger properties pursuing diversification are generally moving to less labour intensive farming operations.

There appears therefore to be a close association between herd size, property size and contemplation of change, with owners of smaller herds or properties most likely to consider making the adjustment. Further, such farmers are slightly more likely to be younger, between 30 and 39 years, and to have completed their secondary education.

Extra income was cited as the main reason for the farmer considering diversification. Overall, seven respondents indicated diversification would be necessary for the farm to remain viable, five suggested "it was personal preference", and for three "it would be less work", indicating social as well as economic malfunctioning within the farm system.

Beef cattle are the most likely addition (mentioned by 17 farmers), but there was a very broad range of other responses. Horticultural enterprises (either vegetables or flowers) are cited by 8 farmers (in conjunction with beef, sheep or deer in four cases), and deer and other livestock (excluding beef cattle and sheep) were mentioned 7 times overall.

A different type of farm based diversification encompassed the non agricultural alternatives,

contracting (3), tourism (2), farm consultancy (1) and mechanical repairs (1). This probably means the withdrawal of labour from the farm enterprise, and perhaps becoming a part time farmer.

There were several explanations for the farmer's preferred choice of enterprise/s, the main ones being the farmer's area of expertise (in 4 cases), and the enterprise's supplementarity to existing production in terms of labour availability (in 9 situations), for example ensuring drying off of cows coincides with grape harvest. Close behind, each cited by seven farmers, were the enterprise's suitability to existing land, (land suitable for grazing cattle and/or sheep, or growing horticultural produce) the extra income, and less work. Six farmers indicated the addition would suit available facilities, and five suggested it would 'allow for diversification', that is spreading the risk.

Eight farmers indicated that the hoped for diversification was likely, 8 that it was not; 13 (26.5%) did not know.

9.3.6 Consideration of total change of enterprise

A more fundamental response to economic and social malfunction, whilst remaining on the farm, is to consider making a complete change in enterprise, shifting resources out of dairying altogether. This of course would represent a major transfer of expertise, but

despite the ramifications of such a change, it is an option being considered by several of the surveyed farmers.

Thirty one farmers (19.9%) indicated they have seriously considered leaving dairying and changing to an alternative enterprise on their current property. The vast majority of these are farming in the Hills and Fleurieu regions.

The negative aspects of a dairy farmer's lifestyle, the lengthy hours, seven days a week, comparatively low incomes and extensive government intervention would appear to be the main impetus for this potential change. Social malfunction in one or more of these forms was mentioned by 15 (nearly half) of the respondents. A further 8 (24.2%) indicated dissatisfaction with farm lifestyle would be due to the dairy farm being uneconomic. Ill health/age constraints are major problems for four farmers. For one, the end of the lease is approaching, and for another, the cost of extra labour is a primary deterrent to remaining in dairying. Three large farms (with over 300 cows) are considering this total change in enterprise, but there is an even spread between the other farm size categories. This shows again that a marginal dairy farm can be thus for various reasons, small being different from large, but both marginal.

Beef is definitely the most preferred alternative, mentioned by 15 of the 25 responding farmers, with mixed farming the next most likely, cited by three farmers. Two others believe running horses is a possibility, and there were single responses for horticulture, sheep, heifer raising and retailing. Two did not know what they would prefer.

As already mentioned elsewhere, the desire for less labour intensive enterprises is the main reason for contemplating change (over half of the 27 farmers). Five farmers indicated the new enterprise would be more enjoyable and a further five said the change would result in more money. For two, who have already commenced the transfer, that they "had already started" was the explanation for the change.

For seven farmers (out of 30), this change is not likely within the next three years, but a further nine farmers expect the transfer to occur. For an additional twelve, it is a possibility. Only one did not know, and another "hoped not".

As with farmers considering diversification therefore, dissatisfaction with the lifestyle of a dairy farmer appears to be a primary motivational factor in contemplating change.

9.4 Off farm management responses

There are alternatives to changing management on the farm by seeking one of several off-farm options - taking off farm employment, relocating to another dairy, relocating to another type of farm, or making the ultimate decision, selling the farm, and leaving agriculture altogether. The last two alternatives will most likely occur once complete breakdown in the system is imminent, or has already taken place and there is no possible action by the farmer to return the farm system to equilibrium.

9.4.1 Family members with off farm work

A number of farms already have family members working off the property.

Very significantly, forty one male owner/operators (25% of all owners) are engaged in some form of off farm employment, 5 full time, 11 part time, 16 casual, and six unknown.

This means that 5 farmers are involved in two full time jobs, one, running the farm, and the second position. How the two are combined is difficult to envisage.

Half of the off-farm jobs are in fact on other farms, the remainder split evenly between professional occupations, paraprofessional / tradespersons, clerical/sales, and non farm labouring work. Of the 11 working part time, 5 work fewer than 10 hours, and 8 of the 16 casual jobs are for

less than 10 hours a week. Seven are working part-time, fewer than 20 hours a week.

Thirty four farm wives are engaged in off farm work. Given the present economic problems being faced by many farmers this is perhaps not surprising. Most of these women are engaged in professional occupations (10 as teachers or registered nurses), a further 8 are engaged in clerical or personal service jobs, and 9 others in other forms of farm work.

Wives also tend to work off the farm for slightly longer hours than their husbands. Out of the 18 part time workers, only 6 work less than 10 hours, 5 between 11-20, 4 between 21-30 hours, and 3 over 31 hours. Casual employees also tended to work more than ten weeks a year.

Sixty five other members of surveyed households are involved in off farm employment, generally the children (18-30 years of age) of the owners. Farm work and trades are the most common occupations of males. Teaching, clerical and personal service employment is most likely for the women, who are also more likely to be working full time or for longer hours (if part time or casual) than their male counterparts. Farm work is usually carried out on a part time or casual basis, the latter generally seasonally.

Wives of other family members may also work off the farm, again usually in nursing, teaching, clerical or personal service occupations.

Out of the 41 owners of farms who have commenced off farm work, over half have started since 1980 - 15 betwen 1980-1984 and 12 between 1985-1989 (27 in ten years). Three owners began off farm work in 1990. This trend in obtaining work off the farm coincides with the downturn in the dairy industry during the decade but may also reflect an increasing number of women entering or re-entering the workforce.

Farmers residing in the Hills region are more likely to have some form of off-farm work than the remainder of the sampled farmers, while Fleurieu Peninsula exhibits the total highest number of farmers with off-farm work.

The causes of this regional difference lie firstly on the demand side. That is, those regions most affected by urbanisation are likely to present more off farm job opportunities. Secondly, there is also the influence of the supply side, in that these two regions have a greater proportion of small dairy farms, and these are the farms which require extra income if the farm is to survive.

More people described their off farm work as providing non essential (22 respondents) than essential extra income (16 farmers). Six respondents out of the 22 above

(all but one of whom is female) indicated they are undertaking work as an outside interest and are all earning non essential income. Those earning non essential income indicate that the money obtained is used mainly to provide an improved standard of living on the farm. For those earning essential income, it is used to pay off mortgages and other loans, and generally keep the farm operating. Farmers on Fleurieu Peninsula are the most likely to be taking off farm work for this reason. Comments from farmers in this category indicate that without this off farm income, they would be forced to leave dairying.

Seven respondents get less than 10% of their income from their property, and 21 out of the 46 obtain less than 70% of their income from the farm. Those who work to obtain non essential income generally receive over 70% of income from their property.

This is the current situation within the dairy industry. How many other farmers have contemplated, or are actually contemplating, such a change?

9.4.2 Family members considering off farm employment

Seventeen of the surveyed farmers who presently have no off farm sources of income (10.6%) are seriously considering taking a job off the farm. The reasons for this vary little between respondents, revolving not unexpectedly around money, and a desire to work less for

more income. Six see it as an opportunity for earning extra income, three view it as essential for the farm's survival (their properties are currently not making adequate income), and another three argue it is "less work for more money". Age was given as a one word explanation by two respondents.

What type of off-farm job is the farmer contemplating? Three respondents do not know, and three would choose engineering/vehicular and machinery maintenance occupations for which they are suitably qualified. Becoming a stock agent is the preferred option of two farmers, and contract labouring, by another two. Shearing/shed handling and food processing were also mentioned. One would choose to work from home, one in Adelaide, four "as close as possible" to the farm, four "anywhere", and one, interstate.

Farmers in Hills and Fleurieu Peninsula regions are more likely to be considering this option (especially those on smaller properties, 50-99ha, with smaller herds, 50-75 head) than farmers in the other two regions. Overall however, farmers with 200-249 ha properties are most likely to be considering seeking off farm work. Younger farmers (in 30-39 age group) are the most dominant age group contemplating off farm work while farmers who did not attend secondary school, or who left before the age of 15 are least likely to be considering the option.

9.4.3 Relocation to another dairy

Twenty two farmers (13.8% of total surveyed) are seriously considering relocation to another dairy farm. Potential locations vary quite widely, with the South East (9 farmers) and interstate locations (by 5 farmers) the most commonly cited possibilities. Other alternatives were the Murray (2 farmers), Fleurieu Peninsula (1), Mid North (2), Riverland (1), the Murray Lakes (1), and the Barossa (1). Four farmers indicated two possible locations were being considered.

The main reasons given for considering leaving the current property are the availability of cheaper land elsewhere (11 farmers), urban pressure (mentioned by 5 farmers, 4 from Fleurieu Peninsula), lack of available land (4) and climatic, soil/land resource constraints (5).

The preferred location of the new dairy closely reflects these considerations, and many farmers gave two reasons why such a location would be appropriate. Again, lower land prices (10 responses) would be a primary consideration, closely followed by potential to expand (7) (i.e. there was sufficient accessible land); reliability of underground water (6), climate (4), cheaper feed (2), and better soils (1) were also mentioned at influential factors.

Interestingly, of the 23 respondents, 13 (56.5%) consider there is no likelihood of such a move taking place within the next three years. Six do not know, and only for four farmers in this group is the move a definite possibility. This would seem to indicate that there are a lot of less than satisfied farmers in the industry at present.

Farmers on Fleurieu Peninsula are more likely to be considering relocation, and River/Lakes farmers are least likely to be looking at the proposal. This is not surprising since overall levels of satisfaction in dairy farming are highest in the latter region. Furthermore, farmers considering relocation are slightly more likely than their counterparts to have attended secondary school, to have left after the age of 16 and be aged between 50-59 years.

There are no distinguishing characteristics of those who are more or less likely to **actually** make the move.

9.4.3.1 Possibilities for relocation

This section considers which part of the state, beyond the present milkshed, could be viable as suppliers of liquid milk to the Adelaide market. There have been two main locations, the South East and Mid North of South Australia, actively promoted by the milk processing companies who are concerned that the decline in milk production caused by the decreasing number of dairy farms will result in a short fall in milk supplies. Extended

liquid milk production elsewhere is one way to make up this short fall, and could be encouraged, along with productivity increase within the milkshed.

The South East

Both Upper (around Bordertown and Keith) and Lower South East (around Mount Gambier) of South Australia have been proposed as areas of potential for increased dairying, and the availability of suitable land would seem to make this a possibility. Although there are already many dairy farms established in the area, there are several difficulties with both locations which need to be considered before expansion on a large scale can be contemplated:

i) availability of water for irrigation

ii) water quality

iii) economic considerations, including establishment costs, and increased transport costs.

There are already 193 dairy farmers in the lower South East region, and 8 in the upper South East. At present these are low cost areas of milk production relying mainly on native pasture for feeding, keeping feed supplements to a minimum. However, it is expected that irrigation will become increasingly important in ensuring and extending feed supplies if dairy farmers switch to the Adelaide liquid milk market, especially in the lower south east of the state.

Water resources

In most areas close to the South Australian/Victorian border in the south east of the state groundwater is the only reliable source of water, and is used for irrigation, industrial purposes, and stock and domestic supplies.

> Under such circumstances large groundwater withdrawals on one side of the border could affect users on the other side, possibly interfering with their long term supplies. To prevent this, a joint programme has been set up by EWS (SA) and Rural Water Commission (Vic.) to share and manage the quantity and quality of the region's groundwater resources...
>
> (Source: Pers. Comm. E.W.S.Dept., 1992)

Large areas of dairying country in the South East come under the jurisdiction of these regulations, and any discussion of expansion into the region must take into account this agreement.

Since 1986 a strip of land 20 kilometres wide on each side of the border has been called the 'designated area' and has been divided into eleven zones. The amount of groundwater available in each zone is calculated and shared equally between the states. This is known as the 'permissible annual volume' and each state is responsible for ensuring extraction does not exceed this limit.

An extraction license is required if water is to be used for industrial or irrigation purposes. In South

Australia, the licence is issued by the EWS Department after consultation with the relevant proclaimed region advisory committee. The proclaimed regions are illustrated in figure 9.1.

All water resources have already been allocated in the Keith/Bordertown region, and if any further dairies were to be established in the area, the farmer would have to purchase a property already holding a licence, which is likely to be difficult and costly. There can be no further expansion in water extraction without jeopardising overall water supply in the region, both quantitatively and qualitatively.

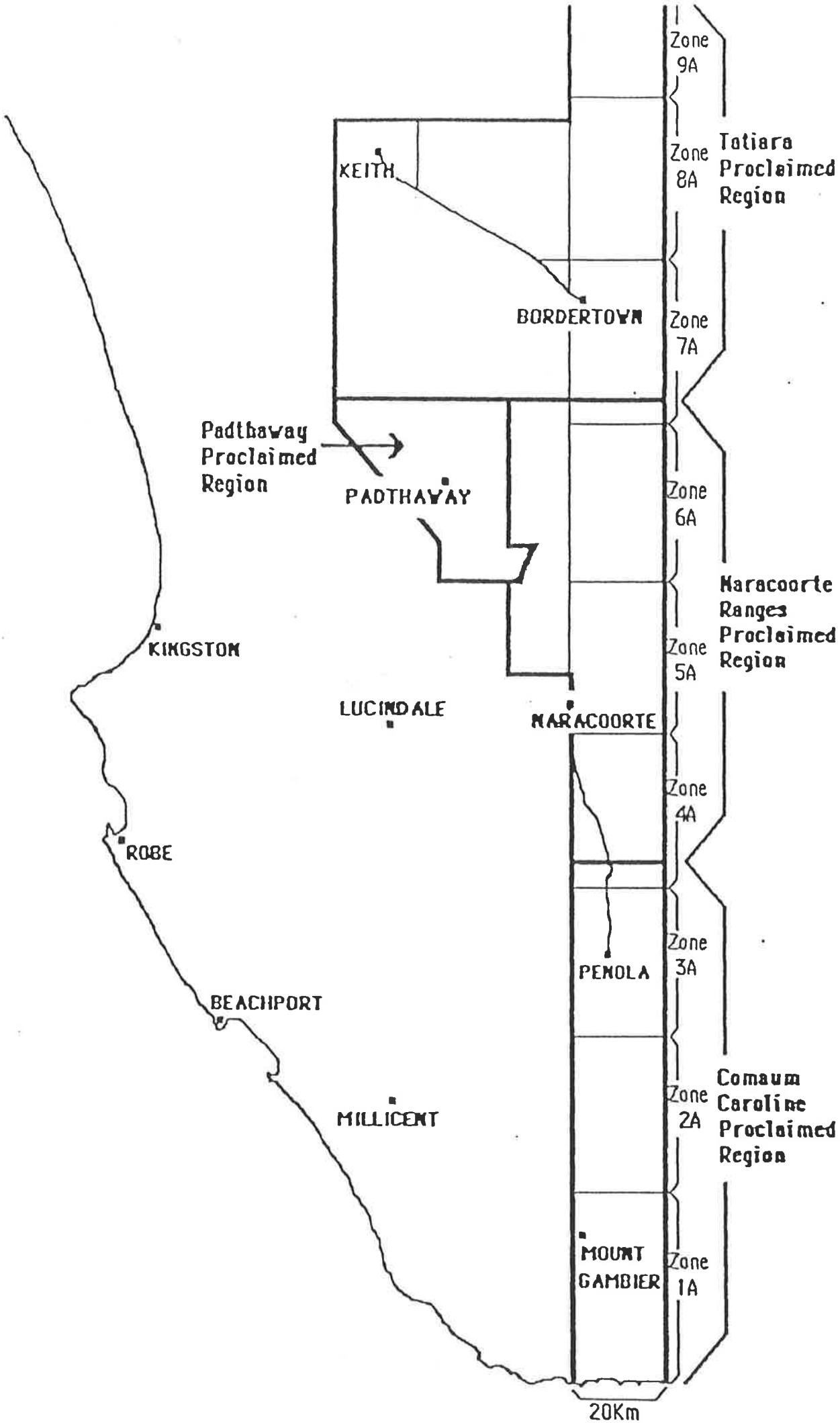
All licences in the Naracoorte Ranges region have also been granted, and Penola (region 3A) is currently being used to 70% capacity. It is in this region therefore that further expansion, from the perspective of water availability, is most likely to be able to occur.

In other words, water quantity and licensing restrictions associated with it will have an important bearing on possible locations for dairy expansion.

Water quality.

Salinity, related to rising saline water tables and high salinity levels in irrigation water, is a particular problem in the Upper South East, where in some areas irrigated pasture growth is already only possible using

Figure 9.1 Proclaimed regions - South East of South Australia
(courtesy SA Engineering and Water Supply Department)


Zone 9A
Zone 8A
Tatiara Proclaimed Region
KEITH
BORDERTOWN
Zone 7A
Padthaway Proclaimed Region
PADTHAWAY
Zone 6A
Naracoorte Ranges Proclaimed Region
Zone 5A
KINGSTON
LUCINDALE
NARACOORTE
Zone 4A
ROBE
PENOLA
Zone 3A
BEACHPORT
Comaum Caroline Proclaimed Region
Zone 2A
MILLICENT
MOUNT GAMBIER
Zone 1A
20Km

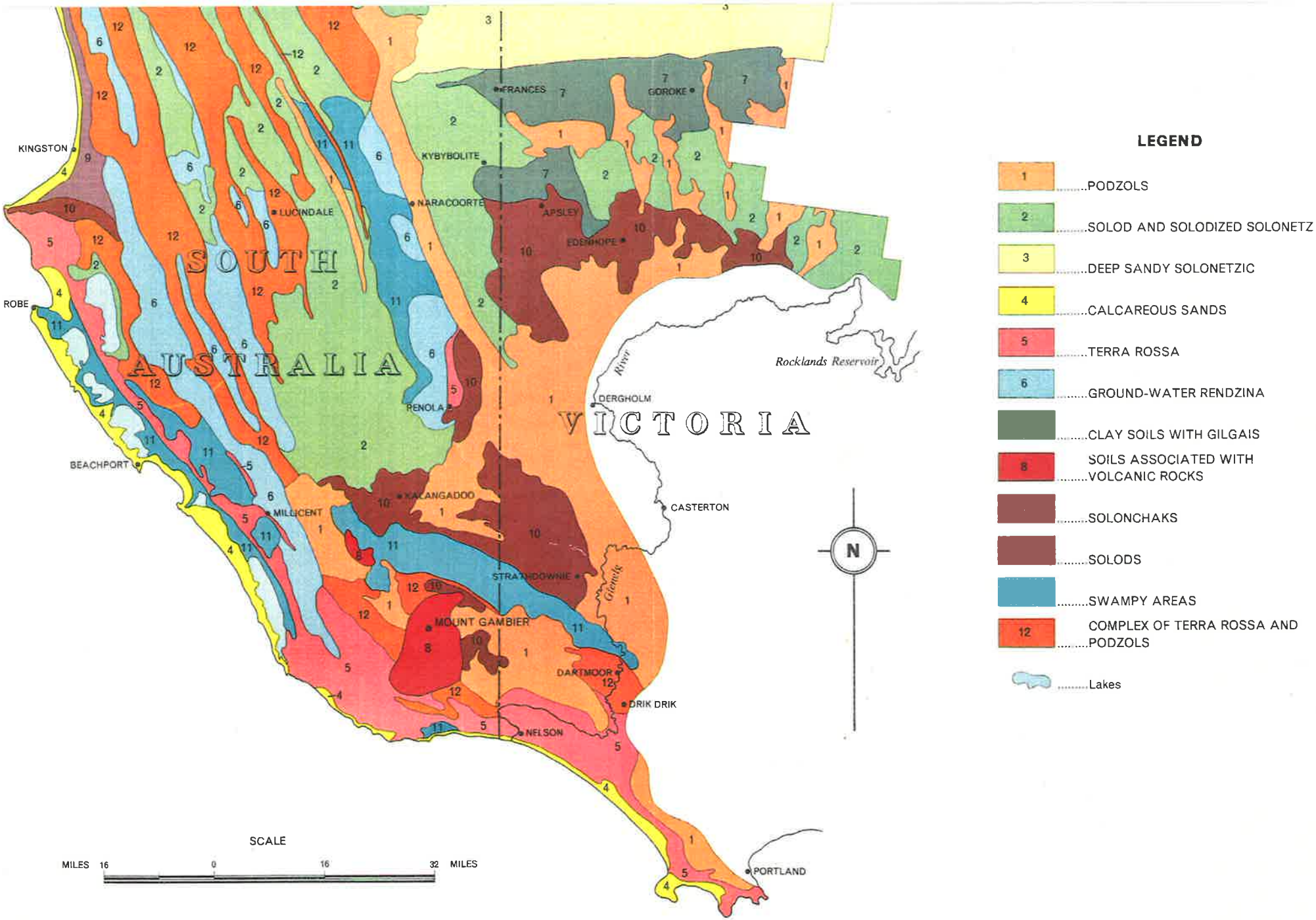
salt tolerant species. Improved productivity will occur only if more salt tolerant pasture species are used, with a trend towards high performance summer growing perennial legumes. Heifa (a medic species), the most commonly grown pasture species in the region is always going to be difficult to establish where water is too salty, and declining yields have already been experienced (pers. comm., Department of Primary Industry).

Soils

Areas with Terra Rossas (region 5), Solods and Solodised solonetz (region 2) and Solods (region 10) soils are best suited to further dairy farming expansion (figure 9.2); these areas also are the most fertile, and consequently are suitable also for other agricultural purposes (especially horticulture). This is likely to result in some competition for the use of land in these areas. It would be necessary to avoid the blacker, heavier soils (with poor drainage), favouring instead the better sand country. In the latter case, it would be necessary to increase fertilizer levels to maintain adequate nutrition levels for pasture growth. This might include some of the country to the east of Naracoorte and County Joanna which is very fertile but very wet in winter (which could cause some difficulties). The region around Kongorong s-sw of Mount Gambier could also support several more properties.

The South Australian Department of Agriculture has observed that there is a lot of similar country over the

Figure 9.2 Soil types in South East of South Australia
(couresty SA Department of Primary Industries)



Cartography by M. C. COULLS

border into Victoria, and that there is possible room for dairying expansion especially around Strathdownie (figure 9.2).

Economic and other considerations

Apart from increased transport costs, expanding the Adelaide milkshed to encompass the entire south east milk producing region should cause few other economic difficulties. If however, it is necessary to increase the number of dairies in the region by establishing new dairy farms, there are many costs involved.

The cost of establishing a new dairy in the South East is great, at approximately $800/acre, covering costs of fencing, dairying, pasture renovation, irrigation system and effluent disposal. This cost factor is a very important consideration as any further expansion of the dairy industry in the region will necessitate taking current grazing land into more intensive use (i.e. complete change in enterprise) creating the need for improved management techniques. Many farmers would be unable to meet these costs; The Department of Agriculture (Mount Gambier) believes that if the price for milk produced in the South East was equalised with the Adelaide price, migration into the area would be encouraged, but that at present few farmers could finance such an operation.

Current average herd size in the region is 96 milkers - a farm being established now run on a family farm basis would need to run about 150 milkers, a share farm, between 300-400 cows, to make a reasonable income. A hundred cow herd "would be struggling" especially if the farm had significant debts. Megaherds (over 500 head) would be unlikely as the physical resources of the region could not support such enterprises.

The Mid North

There are many successful dairies operating in the Mid North of South Australia and the physical resources are quite suitable for further dairying expansion, but, as with the Lower South East, there is considerable land use competition, as the region is an excellent area for cropping.

Feed lotting on a small scale may a possibility given access to the cheap feed which could be produced on the dairy farm (an advantage over farms in the south east), but there are environmental consequences such as effluent disposal which must be taken into consideration when contemplating such a proposal.

The cost of establishment of a new dairy farm is as much a hindrance here as elsewhere in the state.

In terms of physical resources, the South East, with its higher rainfall and irrigation water at shallow depth, is

most suited to dairying. However, the proximity to Adelaide of the Mid North may be a more important consideration in the medium term, especially if transport costs are lower.

The twelve months following the implementation of the new state government legislation (Dairy Industry Act, 1993, discussed in chapter 5) removing the boundary of the Adelaide milkshed region, and equalising prices will undoubtedly provide answers to these questions of expansion of dairying in the South East and Mid North of the state. As current dairy farms in these areas now receive the same price as their milkshed counterparts, and theoretically have access to the same liquid milk market, they may choose to switch from producing manufacturing milk to liquid milk. Ultimately then, there is a distinct possibility that there will be a dairy industry in South Australia which is directed almost entirely to the liquid milk market. The new legislation also provides ample incentive for farmers to move from the original Adelaide milkshed to other areas of the state, and the likelihood is this happening is quite high.

9.4.4 Considering non dairy relocation

Twenty six (26) farmers have seriously considered leaving dairying and farming elsewhere. This represents 16.4% of the total sample of farmers. For 19 of these, the lifestyle is the main reason for contemplating such a

major change. In other words, they are tired of the long hours, milking every day, the constant ties, and so on. One farmer wishes to leave because he is unable to get satisfactory relief milkers. For the remainder, 2 wish to leave for health reasons, the family is "just not interested" in a further two cases, and for the other, the farm is too small.

Farmers on Fleurieu Peninsula are most likely to be considering this option (22.4% of respondents to this question), with Hills farmers least likely (11.1%). On a more personal level, farmers in the 40-49 and 50-59 year age groups, who left school at 14 or 16 are more likely to be contemplating change. Those who did not attend secondary school are not.

Going into beef is the dominant preferred enterprise (6 out of 21), perhaps in combination with sheep (a further 4), cropping (2) or horticulture (1). Sheep as a sole enterprise would be chosen by two farmers, and continuous cropping by the other.

All were favoured because they would mean less work (14 responses), being less trouble (6) and more flexible (6) (i.e. lifestyle factors). Five farmers also "know the alternative enterprise well" in a management sense.

An unfortunate aspect of this is that eleven of the 26 respondents "don't want to leave but..." circumstances

are forcing them to think otherwise. This is particularly the case with Fleurieu Peninsula farmers.

For eight farmers such a move is likely; for ten it is not. The remainder (6) are undecided. On a regional basis, River/lakes farmers are slightly more likely to move; Fleurieu Peninsula farmers are the most unsure.

Throughout, lifestyle factors, the long hours all day every day, low incomes and little respite predominate as explanations for contemplating change.

9.5 The ultimate response to malfunction and breakdown - selling the farm, leaving dairying

9.5.1 Current dairy farmers in the process of selling

The ultimate response to the failure of the system to meet one (or more) of the farmers' objectives is to the sell the farm and leave the industry altogether - perhaps this could be termed the response to an irrevocable breakdown in the system. The remainder of this section looks at those farmers who are currently in the process of selling the farm, and considers characteristics of farmers who have left the dairy industry during the last two years.

At the time of the survey, 5 of the properties were for sale (3.1% of the total number of surveyed farmers). One of the properties has been on the market 6 months,

another for 9 months, two for 12 months, and one for 28 months.

The reasons for intended sale are varied, with one (located in River/Lakes region) choosing to purchase another property (a dairy in the mid-north of the state), one selling as a result of urban pressure and consequent inability to expand the property (located on Fleurieu Peninsula), two who cannot afford the labour requirements (one River/Lakes farmer, and one Barossa farmer) and one (from Fleurieu Peninsula), unable to meet loan repayments. The farmer selling up as a consequence of urban expansion also hopes to move to another dairy. The remaining three farmers are leaving the dairy industry totally, one of whom will continue farming sheep elsewhere in the state, and two moving to the South East, one for 'a change', and the other 'because I'm tired of it all'. They are uncertain as to how they will earn a living.

The sample above is very small and it is difficult to draw any major conclusions from the information.

9.5.2 Farmers who have left dairying and sold their properties

This section on system malfunction and management response considers, in some detail, responses to the survey of eleven ex dairy farmers (chapter 3 and Appendix 6) and seeks to determine whether there are any

predominant reasons for the taking of the ultimate decision to leave the dairy industry. These farmers have left dairying during the last two years.

Human resources

Personal characteristics

Three of the eleven properties were run by single males (aged 43, 47 and 50), a further two households were husband and wife combinations, and three had three or more members. Household size is generally less therefore than the larger sample of current farmers.

The second person involved with the farm was always the wife, and with the exception of the largest family, where the brother of the primary respondent also had resided on the property, and was a joint owner, the remainder of household members were children.

All properties, with the exception of the sole ownership properties are partnerships, 7 husband and wife, and 1 husband/wife/son.

Male owners worked full time on the farm prior to leaving dairying with the vast majority of family members also working on the farm on a part time or casual basis. Despite this however, labour resources on the farm may not have been utilised to fullest capacity as 9 of the 11 owners were obtaining at least some form of income from off the farm prior to the sale of the dairy enterprise.

Present occupation

The majority of ex.dairy farmers have remained in some form of farming, and one, who has relocated to Victoria continues on a dairy farm. Of the male owners, one is semi-retired, 2 are doing labouring/odd jobs; the rest have transferred to sheep/beef grazing on the same farm.

All but one of the wives were cited as involved in home duies; the other one was a clerk.

The children were either studying or had completed post secondary education (2 have done apprenticeships, 2 have tertiary training, and a third, one year at secretarial college).

The age breakdown of each family is shown in table 9.5. It is interesting to note 6 of male owners were aged 50 or under, and 6 of the 8 wives were also 50 or under at the time of leaving dairying. This provides some support to observations that it is not just the older person who is leaving dairying (on the contrary perhaps), with farmers wanting to leave while still comparatively young to make the most of a changed and improved lifestyle elsewhere.

Table 9.5 Ages of ex-farm family members

No. of Farm	Person (number of family members)						
	1	2	3	4	5	6	7
1	61	55					
2	50						
3	65	66					
4	43						
5	57	50	28				
6	48	50	25	23	23		
7	48	45	11				
8	52	48	45				
9	41	38	18	17	15		
10	47						
11	45	43	44	20	18	13	

Attendance at secondary school and post secondary qualifications

Of the 11 male owners, 2 did not attend secondary school, and 2 of their wives did not. As with the major survey, wives stayed on longer at school on average than their male counterparts, but leaving age overall in this survey was approximately 1 year lower than that of the major survey. Four male owners left at 14, 2 at 15, 1 at 16, 1 at 17 and 1 at 19. Children remained at school longer than their parents.

Only 1 male owner has any post secondary qualification - a partially completed science degree. One has qualifications as a wool classer, another as a builder. Two wives have completed teacher's training, and one other, a secretarial course. This parallels the education levels cited in the earlier survey results.

Off farm income prior to leaving dairying

As already mentioned, 9 of the 11 farms were obtaining some form of off farm income prior to leaving the dairy industry. The date of commencement of the work varied greatly (from 1974 to 1989) but all indicated they had commenced the work to obtain extra income, one for non-essential purposes, the remainder, for essential reasons (no other details were given).

The level of contribution made by off farm work prior to leaving dairying ranged from 99% to 1%; two at 1%, one at

5%, one at 25%, two at 50%, one at 95% and another at 99%.

Land resources

Most of the properties were, especially by today's standards, quite small (table 9.6), with 10 of the 11 held freehold. Interestingly too, only one farm was inherited - that is, all the rest were purchased, with only one obtained from a family member. Furthermore, with 3 exceptions, the purchase/s were made comparatively recently as table 9.6 also indicates. It could be argued that either a) they did not realise what they were 'letting themselves in for' in running a dairy farm and became dissolusioned, selling up, but b) because they went into it voluntarily they would be more dedicated to it, and be seeking to be very successful and be less willing to give up, even in difficult times.

The farmer's previous occupation (i.e. that before the farm was purchased) varied, with five engaged in agriculture (labouring, sharefarming, woolclassing), 2 carting contractors, 1 Marine/Harbours inspector, and another, straight from school.

Farm sale

Six of the surveyed ex-dairy farmers have sold their property (five have not), with sales taking place during 1989 and 1990. There were two sales to dairy farmers, one to a non dairy farmer, three to hobby farmers (in the

Table 9.6 Size and year of purchase - properties of ex-farmers

	Size (hectares)	Yr/s of purchase
1	64.7	1956
2	23.5	1964
3	49	1958, 1974
4	32	1974
5	60.7	1985
6	234.7	1978
7	75	1973/74, 1979
8	96	
9	123	1975, 1978
10	45.3	
11	182	1971

Hills), and one sale to a marina developer (on Fleurieu Peninsula). Two sales went to 2 different purchasers (i.e. to four different people).

The price received for the land varied greatly depending on the location and resource base - for example hills land was sold for approximately $6-7000/ha, highland along the river $750/ha and riverflats land $7500/ha. There were other values in between.

The one river property was sold for actual value (based on agricultural usage), the remainder were not (in the minds of the farmers at least), being well above the land's value for agricultural purposes (i.e. land in the Hills and on Fleurieu Peninsula).

Capital resources

The size of herd corresponds fairly closely to the amount of land of each property - herds were, with 2 exceptions, well below the milkshed's average (table 9.7). The two farms with larger herds were producing milk in quantity and quality very similar to their counterparts who are still dairying, and would seem to have been very viable properties.

Six farms had traditional milking sheds, five had herringbone; those in the former category were constructed between 1948-1964, the herringbones, in the 1970's and 1980's. One farmer was milking 8 at a time,

Table 9.7 Size of dairy herd at time of sale

farm number	size of herd
1	-
2	30
3	40
4	45
5	75
6	110
7	50
8	64
9	-
10	33
11	100

the remainder 6 or less, the smallest shed capacity being 3 (for a herd of 45). The 2 largest herds were being milked 6 at a time in older sheds, one traditional (constructed 1948) and one herringbone, (constructed 1956).

Five properties had seen little or no improvements undertaken in the five years prior to the cessation of dairying. For the remainder, in order of herd size

33 cows- new pumps, dams enlarged,

45 cows - new mower purchased,

50 cows - conversion of dairy, automatic feeders installed (to milk 16 at a time)

75 cows - conversion of dairy, automatic feeds installed

100 cows - new tractor

110 cows - roller mill, silos, laser levelled river flats, 4-WD tractor purchased.

The farmer with 50 cows must have been expecting to increase his herd size or it is difficult to see how a conversion to a 16 head milking shed could be justified, at least in an economic sense.

Decision to leave dairying

Very few people outside the farm family had any influence on the decision to leave the dairy industry. Advice was received by one farmer from the doctor, being told to leave dairying for health reasons, another farm was sold

as the result of divorce settlement; the only other advice was taken from the Department of Agriculture in Victoria, by one farmer who subsequently relocated to that state, on the grounds that dairying there was more viable. No farmer received government assistance on leaving the dairying industry.

Impact of various problems on decision to sell

For three farms, none of the problems given as examples (government regulation, economic policy, declining land quality, increased cost of inputs, urban expansion, high land prices, limiting ability to expand) were relevant, a divorce, ill health and lifestyle being the major contributing factors in these cases.

For the remainder, economic and location related factors appear to have had considerable impact. Interestingly government regulation (including interest rates) was only rated very important by three farmers, and of some importance by one other. For the rest, it was deemed irrelevant; economic policy of state and federal governments was also considered of little significance, as was land quality.

The increased cost of inputs was cited as a major concern for many ex-farmers, with six saying it was a very important factor contributing to their final decision to leave, especially the cost of labour and feed, hence the transfer to less labour intensive beef enterprises for

some. The three larger scale farmers would have liked to employ additional labour but were unable to do so because of the cost.

Urban expansion and its impacts were considered irrelevant by all but two respondents (both of whom sold to hobby farmers, and one, on Fleurieu Peninsula, also to a marina developer). This is perhaps surprising given that 8 of the respondents are/were farming in the Hills region. As mentioned elsewhere in this chapter high land prices could be related to urban expansion whether the farmers themselves make the connection or not. It may well be that they are perceiving the end result of urban growth as a problem rather than identifying its point of origin. How the farmer views a certain situation may be quite different from the way a geographer views it, although the ultimate consequences may be exactly the same (i.e. there are differences in perception and definition).

High land prices were considered as a 'very important' contribution to the decision to leave by 7 respondents, again predominantly by Hills farmers. For one other it was of 'some importance', so overall, these high prices could be said to be one of the more significant factors influencing the decision.

So how did the farmers explain in their own words the decision to leave dairying?

For three it was 'simple' - as already mentioned

"a divorce settlement"

"ill health"

"high value of land in our particular area" (on Fleurieu Peninsula, with a 100 cow herd), an advantage because the farmer was able to make a big capital gain.

For others, the situation was more complex:

"herd too small - transporting costs too much (under 200litres in truck cost $25.00 a pickup and testing). Too much money to be laid out for property size" (45 cow herd)

"long hours, lower returns, high electricity costs, costs for maintenance and improvements. Irrigation cost too much - in last 5 years, about 1/3rd of milk cheque went to ETSA" (75 cow herd)

"in long term one son would not have continued on the farm due to health problems. We were not ready to leave the dairy as it had been very good to us and we enjoyed it though it was a tie. But it's not often genuine buyers come along with the money to buy a dairy. So it sold!"

"farm too small to go into sheep or beef and so decided to sell and go to the South East where land prices are low so we could buy enough land to make a living from sheep with a few beef. Now with the introduction of such policies as the Mount Lofty Ranges Supplementary Development Plan, the decision to get away from more urban areas into the rural community is even more a priority than it was before we made the decision to shift. Our land adjoins land which is about to be sold in 5a allotments and this is another reason why we want to get out of this area, to get away from hobby farmers and their fire hazards, horses, soil erosion and roaming dogs"

"after buying the computer was able to get monthly printout of expenses and profit. After three years studying there printouts and seeing that expenses were increasing rapidly and income was down I calculated that I would make just as much profit from beef cattle, without the constant work that was involved in dairying..."

So how do these ex-dairy farmers view the future of dairying in this state?

> "no good, especially in the Hills, too hard - clear land, chasing water, shifting pipes, bores have to be developed, deepened, water getting salty" (herd of 30)
>
> "poor" (no herd size given),
>
> "suspect, due to deregulation" (herd of 50),
>
> "very limited" (herd of 33),
>
> "only rich farmers" (herd of 45),
>
> "only viable if milking 100 cows plus" (herd of 40).

Some can be a little more positive:

> "same as any other agricultural industry at present" (herd of 100)
>
> "can't see any immediate change and as a means of achieving something we did it faster with cows than we could have done it any other way in primary production" (herd of 64)
>
> "in some areas is chance, but in general will need quite an increase in price to repay the amount of hours worked. I would like to point out that we didn't dairy for very long, but we were on the right management, but costs were far too high for profits" (herd of 75)
>
> "dairying has been looking good for a few years and I'm sure it will continue to do so. Dairy farmers who remain in the industry are by and large very efficient and very hard working. The inefficient ones have been weeded out a long time ago" (herd of 110).

It is the farmers who had larger herds who are definitely more positive about the industry in the longer term.

How then do these opinions compare with those of farmers who remain in dairying?

9.6 Future of the dairy farm

Only 60% (89) of current farmers view their farm's future positively. 28.7% have negative opinions, and a further 12% are pessimistic. Farmers in the 40-49 age bracket are least positive about their farm's future, those under 30 and the four farmers aged over 70, the most positive.

There are marked regional variations in farmer attitudes (table 9.8). Farmers in the Rivers/Lakes region are more positive than their counterparts elsewhere, with Hills and Fleurieu tending to have negative or uncertain views of their future. Some examples of actual farmer responses provide insight into their perceptions and give added credence to many of the management strategies which have been implemented or at least are under consideration by the farmers, and which have been discussed throughout this chapter.

Some of the negative responses include:

"very limited future"

"short"

"limited - five more years"

"going, going, gone..."

"not long term - say ten years"

"bleak"

"not good, not due to our farming practices but due to the system which we'll be in (centralisation, rationalisation and so on)"

"depressing"

Table 9.8 Farmer opinion on future of their dairy farm, by region (number of farmers, and percentage of total opinion category)

	Good	Bad	Don't know
Fleurieu	23 (26%)	18 (43.9%)	6 (35.3%)
Hills	13 (14.9%)	16 (39%)	6 (35.3%)
River/Lakes	38 (43.7%)	5 (12.2%)	4 (23.5%)
Plains/Bar.	12 (13.8%)	2 (4.9%)	1 (5.9%)
TOTAL	87	41	17

Most concern is voiced over government economic policies, overall financial pressures and externalised environmental concerns related to the impact of policies to protect the environment. Of particular concern are regulations over the Mount Lofty catchment area and pollution in the River Murray. Achieving ownership of a farm of adequate size is a problem for many farmers.

There were many comments from Hills farmers concerning the Mount Lofty catchment area:

> "our dairy is in a zone 1 watershed - with this and Mount Lofty Review restrictions we are very reluctant to put money into upgrading our dairy and so on as we do not feel anyone will buy it as a dairy in the future. We think it will probably eventually be sold to new owners as grazing blocks",
>
> "[future is] limited because it is a small property, and with urban sprawl into the Hills and government regulation in the Mount Lofty Ranges",
>
> "in the next 10-15 years I can't see too many dairies in the Hills at all due to the running costs of properties, EWS and other government restrictions",
>
> "...too close to Adelaide, but would like to dairy here if we are allowed",
>
> "hopeless in this area because of urban pressure",
>
> "limited future in the Adelaide Hills while governments allow rural subdivisions. Too much good agricultural land has already been lost to housing...".

Others saw problems with economic and government policy:

> "limited! we can't expand, don't want to move, can't afford to quit, and face many external

challenges (eg. deregulation, interest rates) over which we have no control"

"no future - property too small, O.K. for us, but not for a large family or anyone with large mortgage"

"under pressure from economic pressures and government policy in this area",

"poor - can't expand without employing labour and labour is too expensive to gain a profit from...".

However, many farmers can still be positive:

"future seems very stable - expect to expand present farm in a few years"

"if we can keep increasing production we should be able to survive"

"very good, if costs can be contained, milk prices increase to at least inflation levels, and if salinity isn't a problem".

Positive opinions with qualifications of "as long as the price is fair", or "reasonable", or "keeps up with inflation" are quite common:

"farm has a good future - is room for improvement in pastures, extra irrigation and a few more cows if we want. Seeing it is fully paid for, I think we should be able to make a good living well into the future"

"it is a good well developed dairy farm, and should stay as such"

"situated between Lake Albert and Dodds Landing on the Coorong, this property is in the heart of what I see as excellent dairying country and is of, I consider, optimum size for efficiency. Like all facets of the rural industry a lot of dedication and enterprise is required to extract the best results - I believe this property has that in abundance."

"exciting - with new dairy shed and big potential to increase herd size at minimal additional cost we can look forward to a good future"

"secure as long as changes keep happening on my farm to keep up to date with technology, reduced labour input, grassfed cows and sustainable land use"

"given improvement of current practices (eg tighter calving patterns) centralised and better dairy, on-going weed control and pasture improvement) the future should be very good"

"a very viable and profitable farm for amount of money we have invested in milking shed, dams, dairy cattle, yards, plant, machinery, in the last ten years. The next ten years should be very profitable if government interference keeps out."

Others are doubtful:

"time will tell"

"probably for sale at some future date"

"will depend on prices received for milk and ability to increase production whilst lowering unit costs of producing a litre of milk"

"still viable but not big enough to support sons and/or retired parents",

"with adjoining land could remain profitable into the foreseeable future - without this facility and current trends of prices not keeping up with costs, realistically the future seems doubtful...",

"depends on availability of jobs when children leave school",

"impossible to predict",

"limited in time with herds expanding to 200-300 cows interstate and in other areas of the state"

"for the last few years I have been almost constantly thinking about selling/moving/giving up dairying. It is possible we could stay here if work being done to increase production is successful, and we retain the land we are leasing. Original plan was to buy the farm but when interest rates increased the year after we bought it the improvements were delayed and we went backwards financially. Are now stuck here not really viable but not really able to move..."

> "major part of the land is owned by parents and may have to be sold so they can retire off the farm. In that case, it will no longer operate as a dairy farm"
>
> "limited future because I believe that the average herd size in the not too distant future will have to be in the vicinity of 150 cows or more".

Clearly, many factors impact on the viability of individual farms so that generalisation is very difficult. One respondent summed up the situation more than adequately:

> ...farmers in the past treated dairying as a lifestyle. This lead to many inefficiencies. Over the past 10 years dairying has had to become a business. During this time stocking rates increased, production increased and these more than covered cost of production rises. Once most of these inefficiencies were overcome and costs continued to rise, farmers began to cut back on plant replacement. This has now meant the farmers in general are coming to a crunch time:
> 1) costs are rising
> 2) production increases are becoming increasingly hard to achieve because of current high levels
> 3) machinery and plant don't last forever and those short cuts of not replacing are hanging like a noose around farmer's necks (i.e. replace at huge costs or face extreme repair bills on already outdated plant)
> 4) possible fall in income
> 5) viable increases in enterprise size is becoming impossible due to interest rates and land prices
> 6) change in enterprise needs cash - if had cash wouldn't need to change
> 7) sell up or be sold up!....

9.7 The future of the dairy industry in South Australia: the farmer's perspective

From an overall perspective views on the future of the South Australian dairy industry are, on the whole, more positive than opinions on the viability of individual farms, with 100 farmers (73%) seeing a promising future

for the industry. 15% (21) do not know, while 12% of farmers remain negative.

Those belonging to the 60-69 year age group (with an 85% positive response) are more enthusiastic than their more 'educated' counterparts. Further more, 50-59 year old farmers are also positive, whereas younger farmers aged below 40, appear to lack enthusiasm by comparison (with a 66% positive response rate). It appears likely that the younger generation are less willing to accept the life style and income levels which older farmers accept.

Regional differences in responses are illustrated in table 9.9. Again the differences are far less marked between regions, than between individual properties.

Those responding positively generally focus on the need for continuing improvement in management and technology and consider the certainties of the local liquid milk market as being significant. Those unsure about the industry's future, or who have negative opinions, concentrate on deregulation, negative aspects of government policy and economic constraints, with some mention made of changing environmental conditions. All of these aspects are considered below, in the context of the dairy farming system.

On economic issues, related to the future of the dairy industry:

Table 9.9 Farmer opinion on future of South Australian dairy industry by region (number of farmers, and percentage of total opinion category)

	Good	Bad	Don't know
Fleurieu	31 (31.6%)	6 (37.5%)	6 (37.5%)
Hills	19 (19.4%)	4 (31.3%)	6 (37.5%)
River/Lakes	37 (37.8%)	3 (18.8%)	5 (31.3%)
Plains/Barossa	11 (11.2%)	1 (6.25%)	2 (12.5%)
TOTAL	98	16	16

"if costs could be contained, [the future is] very good"

"larger farms will probably survive decreases in income, but eventually interstate whole milk may be a problem"

"OK, as long as milk doesn't come across the border"

"good, costs of transport to this state are too much to make other states intrude"

"dairying will continue but farms will continue to get bigger and move out onto cheaper land where water for irrigation is available, or where dry grown lucerne is a possibility",

"economics of the South Australian dairy industry is likely to become more closely linked to the Australian dairy industry generally, but there is no reason why that should too adversely affect the efficient well run dairy of reasonable size",

"there should always be a suitable domestic market in Adelaide, but the industry may scale down to a point where this is all. Victoria and New Zealand competition...may compete too strongly for South Australia to continue supplying export markets"

"good if interstate milk is kept out" (a comment made by 15 farmers)

"urban expansion and its demands are certain to impinge on many fertile dairy areas in South Australia, making it harder to produce milk on a cost effective basis from higher cost areas further from the city..."

"the future is good...for large farms, with large herds".

At a social level:

"we are pessimistic as no (or very few) young people want to milk 7 days a week",

"for young people the industry is over-priced and almost impossible to buy a farm. So unless farms are left to offspring where is the long term future?"

"the dairy industry will always lend itself to the family farm situation. Farms are just likely to become bigger and farmers better educated and more business like in attitudes"

"bleak - who would take on working very long hours per week for poor returns i.e. milk volume will decrease"

"many farmers are not prepared to cope with herds 200+, and with breakdown in family life"

"bright with the right breed of farmers to take initiative and work efficiently with good management skills and sound knowledge of dairy farming..."

Several others are concerned with increasing government intervention into the industry:

"[future] depends on government interference"

"if there are not too many government regulations and factories give a fair price at the farm gate there should be a viable future for dairying in South Australia"

"future is purely in government hands. I can make all the right business decisions, I can work hard, invest wisely, and at the end of the day the government can make one decision which wipes out all of the above. Dairy farmers are the end of the line. We are expected to absorb all cost rises while receiving little benefit from price rises. This is due to the fact that milk is perceived by politicians to be an essential foodstuff and it is in their interest to keep a tight control on price"

"good, if governments keep their noses out of dairy-farming, and let dairy farmers be dairy farmers"

"unsure due to government interference"

"I think there is a good future for the dairy industry in other areas of South Australia apart from the Adelaide Hills, but our area seems to be encumbered with high land prices, EWS restrictions, Mount Lofty review restrictions and levies to subsidise other dairy farmers whose income aren't as high as ours, however their land prices aren't as high either"

> "the government must make a commitment to a state dairy industry based in South Australia, employing South Australians producing high quality products for not only South Australians, but Australia and the huge virtually untapped Asian landmass and its millions right on our northern doorstep".

Some farmers put forward more positive opinions of the future:

> "Good future...only if the city milk portion is retained"

> "good, however at all levels we must continue to strive for efficiencies to remain competitive and to overcome current fragmentation within our industry"

> "plenty of future as there are some good young farmers coming into the industry and history has proved SA has some good areas, good cattle, good managers and there will always be a market..."

9.8 Conclusion

This chapter has discussed the variety of ways farmers have chosen to counteract the economic, social, biophysical and governmental pressures their properties are facing. Despite the availability of these options, many remain pessimistic about their future as dairy farmers and the future seems bleak. What does the future really offer to the farmers in the original Adelaide milkshed?

CHAPTER 10

CONCLUSIONS

10.1 Introduction

This study arose out of concern felt in many sectors of the dairy industry over the decline in the number of dairy farms in the Adelaide region and the threat that this poses for Adelaide's future supplies of liquid milk.

The aims of the study, as set out in chapter 2, were to answer the following questions based on the systems approach:

i) how systems malfunction within the dairy industry has been manifested

ii) what has caused the systems malfunction

iii) how farmers have responded to malfunction

iv) what obstacles exist for farmers wishing to adopt changes, and

v) what possible alternative locations for dairy farms supplying liquid milk are available, and the likelihood of their being used.

It was decided in chapter 3 that the best way to achieve these aims is to conceptualise the dairy industry as a system, with particular objectives, and functioning within an environment.

The "problems" inherent within the dairy industry can then be understood as symptoms of "malfunction" of the

system which reduce its ability to attain its objectives. These malfunctions may be viewed as a form of disequilibrium between the system and its environment.

The system under review comprises the farm system (land, labour and capital resources integrated by the decision maker through a variety of management strategies to produce milk and meet the objectives of the farmer and farm family) operating within the decision making environment, which has a major impact on the type of decisions made by the decision maker. This environment comprises the biophysical environment, the economic environment, the governmental and regulatory environment, and urbanisation pressures.

The objectives of the system include provision of adequate milk supplies to the Adelaide market and providing a satisfactory financial reward to farmers and processors.

The decline in the number of dairy farmers in the Adelaide milkshed appears to indicate that some farmers at least are not achieving satisfactory economic reward for their efforts and in addition poses a potential threat to Adelaide's milk supplies. The system is therefore failing to meet its objectives and represents a form of disequilibrium between the system and its environment.

10.2 Malfunctions discovered

An assessment of the literature indicates that changes in markets, politically motivated economic decisions on the part of the government, the continuing cost-price pressures, increasing concern over sustainability and the appropriateness (or otherwise) of government intervention in markets and production areas have always been, and continue to be, major problems within the dairy industry.

Furthermore, they have been joined by others. As urban populations continue to expand into areas once supporting intensive agricultural enterprises close to larger urban areas (areas traditionally the location of dairying), dairying is increasingly under threat. Farmers are continuing to leave the industry and threatening the availability of liquid milk supplies, in South Australia at least. This shortfall may be overcome by the development of 'free' trade over state borders but such development is viewed as a major threat by many farmers in South Australia. As the economic pressures on the dairy enterprise increase, the value of farm diversification and off farm work to the long term sustainability of the farm business are being reassessed.

Within this environment systems breakdown was identified in many different forms, but all fell into one or two of five types of malfunction a) economic, through the cost-price squeeze and high interest rates, b) social, a declining standard of living, c) biophysical, a reduction

of sustainability of the land resource, d) governmental, especially deregulation, and e) urban encroachment, especially rising land prices. The farmers have responded to these difficult and constantly changing circumstances in a variety of ways. As the stress or severity of the situation increases, the magnitude of change rises, though not all responses are mutually exclusive.

10.3 The causes of malfunction

10.3.1 In the farm system?

A wide variety of on farm resources, land, labour and capital, are available to the farmer and used in the farm system to produce milk. Access to these resources varies widely between farms, and the means by which they are integrated through management are also highly variable throughout the milkshed. The majority of farm managers are specialist milk producers while a small number, largely restricted to the Barossa Valley, have incorporated dairying into a diversified farming system, producing milk in conjunction with horticultural produce, field crops or other extensive livestock.

Land resources are generally perceived as adequate, though many farmers would seize the opportunity to expand their properties. Some farmers are faced with uneconomic land holdings, usually less than 100ha in size, and they are particularly vulnerable to the variety of external pressures, particularly urban expansion, high land prices

and low incomes. Pursuit of a sustainable farming system can be seriously hampered by a smaller property size.

Capital resources are also seen by the majority of farmers to be at satisfactory levels, but again, many would like to increase their herd size and improve milking facilities to overcome economic and management difficulties resulting from small herds and farms.

Farmers in the Rivers/Lakes and Barossa/Plains regions are consistently more positive than their counterparts elsewhere about the future of their farms and the dairy industry as a whole reflecting in the case of the former, larger farms and herds, and in the latter, their diversity of production, and involvement in other agricultural enterprises.

10.3.2 With the decision maker?

The study has clearly shown that regional variations in management are less pronounced than variations from farm to farm. Management problems and strategies (with the exception of soil salinity along the Murray Swamps) vary little over the Milkshed region, and there is minimal variation in management responses at a regional level. The variety exists at a farm or small group of farms level, and relates closely to the resources of that particular farm (land, labour and capital) and individual management decisions.

The labour force engaged in dairying is aging and many farmers believe they will not be replaced by other family members. This must be of great concern to the dairy industry and is certainly a primary reason for malfunction.

Levels of education have shown little correlation with the managerial skills and types of management decisions made by farmers, and vulnerability to systems breakdown has little respect for the qualifications of farmers. In some cases the more conservative, less formally educated farmer is less likely to be vulnerable to external pressures because of that conservatism. On the other hand, more innovative farmers are more likely to have a better long-term future.

10.3.3 With the decision making environment?

In explaining why farmers are restructuring no single factor in the decision making environment can be isolated as more or less important. The processes involved are complex and vary widely between individual farmers. Nevertheless, five main components of the environment have been identified as major influences causing stress and system malfunction. This components are a) economic, b) social, c) urbanisation, d) government regulation, and e) biophysical environments.

Economic factors have been shown to have a profound impact on how the farm system is managed, and how

productive, profitable and sustainable it is. Farmers may not be able to afford to run their farm in the manner they most desire, for example being able to implement particular management strategies, including upgrading capital resources, purchasing more land, or employing more labour. This then will inhibit the farm expansion which may be necessary to provide sufficient income given constantly increasing farm costs. A solution to this problem has been for many farmers to engage in off farm employment.

Other farmers, especially those who have already left the industry, indicated that high costs of inputs can have a considerable impact on the decision of the farmer either to restructure the dairy enterprise in some way, or to leave the industry. This is especially the case if they do not believe they are receiving adequate recompense for the amount of work they are doing and is related closely to their perceptions of farm lifestyle.

High interest rates were shown to be of some influence on restructuring within the dairy industry. It would have been valuable to measure levels of farm indebtedness, and this could merit further research. The impact on farmers' behaviour and perception of the recent decline in interest rates, which has occurred since the survey was undertaken, also needs investigation.

Social aspects of dairy farming are of immense concern and a pleasant lifestyle is of particular importance to most dairy farmers. Even when times are very difficult, the positive aspects of the farm lifestyle and rural living can often be sufficient compensation for those difficulties, at least in the short term, by which time circumstances may have improved. However, there is an increasing number of farmers unhappy with the constraints dairying places on their well-being, and this dissatisfaction can make other problems less tolerable. These perceptions of unhappiness and dissatisfaction can make other enterprises look particularly attractive, especially if they are perceived as being more profitable in return for less work, and greater freedom and flexibility.

It is also necessary to question the relevance of the theory of the family farm as a force ensuring the stability of farm ownership and a desire to pass the farm on to the next generation. Nearly 70% of dairy farms surveyed have been purchased by first generation dairy farmers, and not inherited, as one might have expected in a traditional 'family farm' situation. In the context of the surveyed farmers at least it is, as Gasson et al. (1988) suggested, probably more realistic to view the family as just one set of relationships which may be activated for the successful operation of a farm business, albeit, in many cases, an important consideration.

Whatever the explanation, the aims and aspirations of many farmers are not being met by the dairy farm, and this has lead to great dissatisfaction within the industry.

There can be no doubt that many farmers have been lost from areas close to the metropolitan region, particularly over the last 40 years but as time progresses it is becoming increasingly difficult to determine the degree to which urban expansion (and subsequent displacement of farmers) is responsible for declining numbers of farmers in the region.

On the basis of the survey's results, it is difficult to argue that urban expansion, at present, is a major reason for restructuring. Its impact is restricted to those farmers with properties in the Hills and Fleurieu Peninsula regions (which is not surprising given these regions' proximity to the metropolitan area) but it is farms in these two regions which have also been most vulnerable to non-metropolitan pressures. The smaller farms, with smaller herds, were particularly exposed to the general downturn in the dairy industry experienced throughout the 1970's and 1980's. It may be that being able to get a favourable price for land due to proximity to urban development could then have been adequate incentive to leave an already struggling industry which

had little room for small scale and/or inefficient dairy farmers.

The study's wide coverage of the farm system does not allow a detailed analysis of the relative significance of urban pressures (e.g. rising land values and alternative employment opportunities) versus non urban pressures (technological change, change in living standards and interregional competition), as suggested for example by Bryant et al (1982), and in chapter 5 of this thesis. However, it is easy to see how many of these pressures have been, and are currently manifested in the present situation.

That is not to say that urban expansion is having no impact - this is certainly not the case. Evidence supports those writers who argue that urban expansion is but one (albeit, in some locations, quite significant) of many forces causing structural change within an agricultural industry as it attempts to rationalise and improve efficiency.

Berry observed in 1976 that urban expansion "doesn't mean that farmers will immediately relocate, but that when the owners retire or switch enterprises, nobody takes their place as dairy farmers". This certainly appears to be the situation in the Adelaide Milkshed. Farmers who might like to expand or own a farm in the Hills or Upper Fleurieu Peninsula are generally precluded from making

such a purchase for two main reasons - there is insufficient land to run a viable dairy farm under present economic conditions, and that land which is available is priced out of the reach of the farmer, as its value for urban development far exceeds its agricultural value.

Individual farmers react differently to the pressures of urban expansion and it is difficult to generalise. The situation results in "adaptive change" as proposed by Johnston and Bryant (1987, 12)

> ...those adjustments specific to a single farm or relatively small group of farms, linked closely to local forces, the unique circumstances of an individual decision maker, and how these circumstances are perceived...

Thus how a farmer reacts to urban fringe expansion is probably either going to be different from that of the next farmer, or he or she may reason differently to reach the same conclusion and management response.

Government regulation is also of considerable concern to many farmers. Some believe the dairy industry is overregulated, and that a free market is the only way dairying will continue in the future. Others understandably do not criticise government intervention when it protects them, and would be most concerned if 'protection' of prices were to be removed. Many farmers certainly fear the economic consequences of deregulation

of interstate trade barriers in milk transfer, especially between Victoria and South Australia. It is most unlikely however that this would affect a farmer's decision to leave dairying at present and provides more of a perceived threat than a current problem. Implementation of such a policy may lead to improved economic efficiency overall in the industry, possibly at the expense of some dairy farmers.

Several farmers blame the state and federal governments for their current financial and managerial difficulties which arguably have resulted from inappropriate government policy. High interest rates, the recession, the South Australian banking fiasco, and provisional taxation merely served to worsen economic pressures faced by the farm.

Where environmental controls by the state government have been put in place there is considerable resentment, and the restrictions can encourage farmers to question seriously their future. There is an increasing number of environmental concerns for dairy farms coming under the jurisdiction of the Mount Lofty Review and Development Plan. Effluent disposal within the Mount Lofty Watershed has been a problem of considerable significance and in some cases inadequate disposal systems have prohibited expansion in dairy herd size (which may have been necessary for the farm to remain viable). On an even broader scale, concern over many environmental problems

associated with urban expansion into the watershed has led the State Government to implement planning regulations restricting subdivision of land (particularly agricultural land). This means that many remaining farmers are in a no-win situation - they are unable to afford expansion, and sale of land at a price which would enable them to establish themselves elsewhere, either as farmers or in another occupation, is also not possible. These are farmers who would like to relocate or leave dairying altogether, but who do not view it as a viable option.

Other aspects of the biophysical environment certainly have an impact on productivity and profitability of the farm system and while deteriorating land quality (including soil fertility, erosion, salinity) cannot be said to be at present a major factor affecting farmers' decisions, nevertheless most farmers reveal an awareness of the need to avoid these potential problems. The study's results have shown that many farm practices are geared towards sustainability.

In some situations where there are problems with the environmental sustainability of the farm system additional finance would be sufficient to manage the problem adequately, at least in the short term, by enabling farm renovation work to be carried out (for example, salinity mitigation and effluent disposal management strategies along the Murray Swamps). However,

obtaining the necessary finance is difficult, especially for small enterprises.

10.4 Responses to system malfunction

For farmers currently operating there seem three primary management alternatives for the future - specialisation and maximisation of production through improved management and economies of scale, or diversification, either on farm or through seeking off farm employment, while others will seek to leave dairying or farming all together.

Improved farm management

As Schapper and Mauldon (1957) suggested "it is possible to expand production by readjustment of existing expenditure". Improved management on existing properties would raise farm incomes and most likely prevent any predicted shortfall in milk supplies, in the short term at least, and if achieved in a sustainable fashion, must be cheaper and more effective than establishing farms elsewhere. The latter implies a waste of current resources, and would require large capital expenditure in establishment costs.

Diversification and off farm work

A much considered alternative to concentrating solely on dairying is seeking to diversify the farm enterprise. Related closely to dissatisfaction with income levels and the work load of dairying, many farmers have chosen or

are chosing to diversify into other agricultural pursuits, especially horticulture or beef cattle. This is an attempt to increase income levels, and improve job satisfaction.

Other farmers and members of their families are choosing off farm work as the best means of maintaining income levels. Indeed, 30% of all dairy farmers currently have some form of off-farm income, a very significant proportion, and the number is expected to increase further. It is quite possible that this will hamper efforts to improve farm management on properties affected in this way, with time and labour becoming even more constrained.

Relocation of farmers

A 1953 (163-164) editorial of the Review of the Marketing and Agricultural Economics suggested

> ...the long run stability and maximum efficiency of the dairy industry will be attained only when the industry concentrates its attention on those areas which present the most attractive soil and water supply conditions...

Whilst it is true that resources in alternative locations must at least be appropriate for dairy farming, it is simplistic to suggest that physical resources alone, or even mainly, will determine the location of dairying. What is "best" for dairying may be "best" for many other enterprises, a competitive process which will be resolved

by the ability of the competing enterprises to earn economic rent. However, many farmers currently operating within the Adelaide milkshed do see an improved land resource base as a primary incentive to relocate, especially where it would result in the ability to expand the size of the farm or herd and several dairy farmers are seriously contemplating selling their properties and dairying elsewhere in the state. The milk processors have encouraged relocation for this reason, but also to ensure adequate levels of milk supply are achieved.

The South-East, and to a lesser extent, the Mid-North of the state are the two regions where there is the potential for further expansion of the dairy industry and both have many well established dairies already in operation. The attractions of the South-East are its readily available supplies of groundwater and ample space for expansion. In the Mid-North, the cost effective production of feed grain for supplementary feeding and the running of more intensive dairying operations is a major advantage.

The validity of these suggestions must, in some cases, be questioned. One company has suggested some of its producers relocate to the Upper South-East, in the Bordertown/Keith region. But here in particular, potential is extremely limited. There would need to be a detailed environmental impact statement undertaken before any further dairying could be contemplated for the

region, given the concerns over available water quality and quantity, the water licensing restrictions, and the suitability of soils.

There are cost constraints which would need to be overcome should dairies be relocated to the Lower South-East or Mid-North, both in terms of establishment costs, and in the context of other agricultural enterprises such as beef and horticulture competing for the use of the land. Farmers already in the South-East or Mid-North have argued that profits would never warrant relocation until state equalisation in prices is achieved, and that few could afford to relocate given the lower prices received for milk produced in these regions. If it is determined that relocation of current dairy farmers in the Adelaide Milkshed to outside its boundaries is necessary, it may be that the price equalisation which came into effect in July 1993 will be the incentive required for that transfer to take place.

It remains extremely difficult however to determine the extent to which such a relocation and establishment of new dairies in these regions is necessary. The economic costs and benefits may be comparatively easily quantifiable but social costs resulting from relocation of families would be harder to measure. It also depends upon the extent to which efficiency improvements are possible on present farms and how much further their production could expand, and on the impact of the price

equalisation brought about by the new state legislation. Under the new scheme, there seems no reason why some milk from farmers already established in these regions could not be redirected to the Adelaide liquid milk market to meet any shortfall.

Leaving the dairy farm

The attitudes and perceptions of those farmers who have actually left the dairy industry are very similar to those who remain. However, it is extremely difficult to generalise about farmers who leave dairying, reflecting the way different farms are affected in a diversity of ways by the variety of pressures being faced by the farm system. It is the individual response that provides the greatest insight into why the farmer makes the decision to leave dairying and while individual behaviour cannot be considered in isolation from the physical, economic, social and political environment, Holmes' 1961 conclusion that

> ...economic, social and technological factors, in association with individual characteristics could be contributing factors to farm closure...but were not sufficient causes in themselves, but could only take effect in combination with individual characteristics...

still appears most appropriate in the current situation.

By using the comments of farmers contemplating leaving dairying, as well as those who have left, it is possible to make some generalisations about the reasons for

leaving the dairy industry. In the 1970's the B.A.E. identified farmers leaving dairying as having generally smaller herds, smaller farms and lower incomes. Although in the present study there is some bias towards smaller scale farmers leaving, there is actual or anticipated movement in most size groups. For the smaller farms economic factors seem to be a major impetus for change; in the case of larger farmers deteriorating lifestyle appears a primary explanation. Larger farms are usually able to transfer resources to alternative enterprises, or may have a greater agricultural resale value than their smaller counterparts, making it more possible for successful reestablishment elsewhere after sale. In other words, a dairy farmer may be marginal because he lacks resources and/or managerial expertise, or be marginal because the resources controlled, including the farmer's management expertise, involve a high opportunity cost.

The same B.A.E. study found no significant difference in operator characteristics between those who stayed in or who left the industry, but Rathge et al. (1988) argued that younger married farmers, with larger families, more educated and recently established were more likely to leave. Again, given the sample size, it is difficult to determine any general trend, but those farmers who did leave were under 50 years of age and tended to have been only recently established. On the other hand, education levels were low, families were small, and several farmers were unmarried.

Indeed, the wide range of responses serves to illustrate the significance of the decision making behaviour of each individual in making the ultimate decision to leave, albeit in the context of a variety of pressures being brought to bear on the farm system which are causing it to malfunction or break down completely.

During the 1960's and 1970's the Dairy Farmers Reconstruction Scheme and Dairy Adjustment Programme played important roles in farm restructuring, providing financial support for farmers who wished to leave dairying. Such incentives no longer exist, and contribute nothing to the decision to leave the farm.

10.5 Obstacles to adopting change

The study indicates that many farmers are choosing not to implement a variety of known management practices of which they are aware such as soil and plant tissue testing, management of soil salinity and soil and water erosion and pasture renovation. The study also tends to support Rutherford's (1952) observation, detailed in chapter 4, that "rather than many farmers adopting a few innovative practices most were carried on in conjunction with one another on certain farms, but were mostly absent in others". Certainly some farmers are implementing many innovative practices, while many have only a small number. This study could not identify any particular characteristics of those farmers who have failed to

implement one or more of these practices. Education, often seen as a variable to explain innovativeness fails in this study to provide any significant explanation. However, one personal characteristic which does appear to be significant is age. Farmers approaching or past retirement age, with no desire or need to expand production or the farm further, particularly if the property is not going to be passed on to another family member but sold on the open market, are reluctant to undertake restructuring measures whose payoff period may be many years into the future.

While it would be quite wrong to suggest that personal characteristics of farmers have no impact on management behaviour, this study has tended to show that other problems perhaps dominate in hampering or precluding improved farm management. These include lack of finance, lack of labour, lack of time, the small size of the property, the cost of taking land out of production at a particular time. Many farmers argued that the returns from improvements could not justify the expense or the effort. For others, close to the city, inability to expand the property remains a great hindrance to farm improvement as there is little suitable land for dairying expansion elsewhere in the Adelaide Milkshed region. Dairying makes very specific demands on the land resource and cannot be located 'just anywhere'. There must only be a limited risk of drought, unless irrigation is possible, and aspect and gradient of land surfaces,

soil fertility, and adequate drainage are also primary considerations.

Tenure appears to have no bearing on whether or not improved management techniques are adopted, though this is not surprising given most properties are freehold.

Overall then, economic, social, and environmental constraints are restricting the farmer's ability to implement management improvements, should the desire be there. In many cases however the desire is not, and any change in attitudes of such farmers is very difficult to achieve (certainly in the short term) and will require considerable understanding and patience on the part of the South Australian Dairyfarmers' Association, processors, and agricultural advisers seeking to enhance production. Increasing emphasis in the media on innovative farmers and their management techniques may go some way in achieving this goal, and emphasis on on-farm education must also continue. Extension programmes must focus on farmers who will serve to attract the attention and respect of other producers.

10.6 Further research

There needs to be further research (e.g. a cost/benefit analysis) into the potential impacts on farmers in the Adelaide Milkshed region of deregulation across state borders, in milk transfer, as it is a major concern to many of them and a central component of the 1992

Government of South Australia White Paper on the dairy industry. The Industries Commission also believes deregulation should proceed because it would result in lower prices for the consumer, but it is also necessary to question potential impact on existing farmers.

There also needs to be a more intensive study of farmers who have left the industry, especially over a longer time scale and in greater number than was possible in this study. This may well reveal that social and life-style considerations are just as important as, perhaps in the end more important than, economic ones in affecting a farmer's attitude towards dairying as a way of life for him/herself and his/her children.

Sustainable management practices adopted by farmers need to be assessed in greater detail, particularly a consideration of the characteristics of implementing and non implementing farmers.

Given the growing concern about the sustainability of current farming systems

> ...the deterioration of the environment as a direct consequence of agricultural practices is arguably Australia's most pressing ecological problem... [there is a need] to link the agricultural and the environmental to the social in a manner which provides an holistic account of what might otherwise be considered as 'technical' problems, and in a way which will allow potential solutions to be developed on an integrated basis."
>
> (Lawrence et al., 1992, ix,x)

It is necessary therefore to investigate further the characteristics of farmers and the circumstances of farmers which affect their adoption of innovative management practices.

It should be possible to develop a management policy for the dairy industry, both short and long term, taking into account opportunities for farm relocation. In addition sustainable land management strategies need to be formulated and geography's holistic approach should ensure an important role for the discipline. Finally there is a need to develop theory so as to aid the understanding of the impact of restructuring on the spatial distribution of agricultural enterprises, using the dairy industry as a case study.

10.7 Value of systems approach

The systems approach has proved very valuable in the context of the current study, and has been more useful than a purely behavioural, economic, or agricultural science approach would have been in providing explanations for change.

Given the extreme complexity of the dairy industry and of farm systems within the industry the value of using an integrated approach to monitor change is obvious. Such an analysis ensures all aspects of change are considered and emphasises the multifarious interactions within the farm system. Furthermore, it is necessary to consider how each

individual farm functions as a system before making conclusions on behalf of the whole industry.

It would be ideal to extend further the assessment process along the lines suggested by Martin (1988) that is, to be able to measure further the long term sustainability of the industry and on this basis develop more extensive management proposals but this is outside the scope of the study, and would require considerable further research. However, the framework developed for this study could be used as the basis for this continued investigation.

10.8 Role of social science in the study of an agricultural/farm system

Agricultural science, has, for far too long, tended to focus only on the most theoretical means of improving production, based on applied scientific research; conversely agricultural economics has considered the farm purely from an economically rational viewpoint. While each has an important role in improving farm efficiency, the application of the social science - systems approach allows these aspects to be considered while providing for other factors to be taken into consideration. Such an approach is of particular value to geographical enquiry which, by its very nature, adopts an holistic view of problems, seeking to understand human behaviour and processes of change in a spatial context.

This integrated approach is particularly important as the sustainability of modern farming systems comes into question.

It is pointless for environmentalists to exhort farmers to behave in ways which are economically not sustainable. It is madness for economists to exhort farmers to behave in ways which are environmentally not sustainable. An integrated approach is the only way to identify problems and discover solutions. And it is important always to allow that the problems and solutions may very between farmers, between regions, and over time.

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APPENDIX 1

FARM PRACTICES AND MANAGEMENT

1. Introduction

The following appendix deals with cow management during the cow's lifecycle, feeding, and pasture management, and provides a description of various techniques of management mentioned in the text.

2. Farm management models

Some commonly used symbolic farm management models are as follows:

a) whole farm budgets: these are used to assess the profitability of the whole farm situation, normally as an annual budget for the forthcoming year. This is based on estimated prices, livestock performance, pasture/crop yields, input requirements, fertilizers, pesticides, repairs and so on.

b) partial budgets: are used to help plan a proposed change within an overall plan, only showing the extra costs and extra return resulting from the change.

c) gross margin budgets: these are a form of direct costing which estimates the profitability of individual enterprises on the farm. The gross margin of an activity is the difference between the revenue from that activity and the variable costs incurred in

obtaining that revenue, usually expressed on a per hectare basis.

For a particular enterprise

gross margin = gross income - variable costs

Each husbandry alternative or technology package may be considered as a separate activity with its own gross margins.

Having established the gross margin for each feasible activity the gross margins analysis model is then used to select the group of activities which maximises the total gross margin for the whole farm.

The details of this process can be obtained from any text on farm management and can be most easily achieved using computerised linear programming.

Gross margins are particularly important in that they enable the isolation of the contribution of each single enterprise to farm profitability. Decisions can then be made as to whether to expand or contract the relative size of various enterprises.

Gross margins from animals

Animal income is made up of sales of animals, sales of animal products and byproducts, and inventory changes.

In many livestock enterprises, the change in value of the flock or herd due to change in numbers is an important part of the yearly profits. An increase in value due to increased numbers must be included as income because if these extra stock were sold there would have been a greater cash return. The value of animals in an enterprise can also change due to market influences. It is better to use the change due to market influences and the same per head values of stock at the end of the year as used at the beginning to prevent distortion.

The main components of the variable costs of any animal enterprise are:

<u>feed:</u> maintenance costs of improved pastures, cost of forage crops, hay, straw, silage, purchased feed, home grown grains, agistment, direct labour costs,
<u>husbandry:</u> medicines, cleaning materials for milking shed, contract and casual labour and services,
<u>marketing:</u> transport, processing and selling, and
<u>replacement stock:</u> when not reared on the farm.

d) parametric budgets: enable the assessment of the effects of a range of values for yields, costs, prices and other technical assumptions on the final result of a budget.

e) break-even budgets: used to establish the level of various parameters in the budget which will result in no change in budgeted profit for the change being considered. In this way, the farm can assess the changes that possible changes will be profitable.

f) partial budgets: used to help plan a proposed change within the overall plan, and only shows the extra costs and extra return resulting from the change.

g) cash flow budgets: concerned with what happens to the cash situation as a result of implementing change.

Before a farm operator adopts a new activity or expands an existing one, some or all of the following must be taken into account: market prospects, physical and technical aspects of making the change, change in profit assuming 'normal' season and prices, risk and variability associated with change, the amount of extra capital income needed to bring about the change, extra profit expressed as a % return on extra capital invested, taxation aspects, expected change in assets and debts over time, human and social aspects, and intangibles, including the farmer's own preferences, values and ambitions.

Again, the more mathematical (calculatory) aspects of these models can be obtained from any text on farm management.

Computer modelling

Computer modelling of farm systems has developed rapidly over the last decade, and computers are becoming increasingly important as a management tool. These models have been developed to tackle a variety of complex management issues. One such computer package determines the replacement policy in dairy herds on farm where heifers compete with the cows for grassland (Gartner, 1981, 289; Gartner, 1982, 249). It indicated that a major influence on profitability was the number of cows in the herd. "An increase in replacement rate was not always associated with decreasing profitability, nor was an improvement in yield per cow always associated with an increase in profits relative to performance of a control herd after 15 simulations" (Gartner, 1982, 249).

Van Arendon (1985, 157) developed a model to estimate the performance, revenues and costs of dairy cows under different price and production situations; Doyle and Edwards (1986) constructed a model for evaluating grassland management decisions on dairy farms (including levels of concentrate feeding, grazing

management and fertilizer applications); Culotta and Schmidt (1988, 1960), undertook an economic evaluation of three times daily milking of dairy cows (indicating two times daily milking to be less costly). Schmidt and Pritchard (1987, 2695) used a computer spreadsheet based budgeting procedure to determine the effect of increased milk production on income over feed and variable costs, income over total costs, and marginal return and marginal costs of large and small breeds of cattle. Schmidt (1989, 1605) has also undertaken a study on the effect of calving intervals on income over feed and variable costs, using the same budgeting procedure. Recommmendations based on this model indicated that a 12-13 month calving interval appeared justified (Schmidt, 1989, 1605).

Plant nutrient management strategy implications for optimal herd size and performance of a simulated dairy farm were explored by Westphal et al. (1989, 381) using linear programming. Results again suggested that management decisions cannot be considered in isolation from other components of the entire farm.

There are several computer programmes available in Australia for determining the most profitable feeding strategies for dairyherds, including DAIRY FEED, CAMDAIRY, and, most recently, WADFM (Western Australian Dairy Farm Model). The latter is a linear programming

model which "determines management strategies necessary to maximise farm profit" (Olney and Kirk, 1989, 367).

The use of WADFM provides several management options, suggesting that profit from most non irrigated dairy farms in Western Australia could be improved by adjusting the feeding levels of concentrates to cows in summer, area cut for hay, number of cows being milked and the number of steers being reared. It is emphasised that "there is very little benefit in adjusting any of these strategies on their own" (Olney and Kirk, 1989, 78). Pasture research should concentrate on increasing growth during autumn and early winter rather than the whole growing season. Whatever research is undertaken, the implications of any change must be considered for the whole farm system.

3. The Cow

There are several main events in annual reproductive and lactational cycle of a Freisian dairy cow and the following table details these events, the milk fat yield and the feed required per day to meet cow requirements and to produce the suggested butterfat levels (the cow, in this case, weighing 450kg, producing 180kg butterfat):

Time since req'd calving daily	event	milkfat yield (kg/cow daily)	feed kgDM
day 0	calf born		
1-4	colostrum produced		
4	normal milk produced	0.85	13
25-60	cow begins to show regular oestrous cycle cow may become thinner	0.90	14
70-100	cow mated and conceives	0.85	15
		0.75	14
		0.7	13
	cow pregnant, lactating	0.65	13
		0.57	12
		0.5	11
		0.45	10
200-300 Dry period	cow dried off		6-8
320-350	rapid development of foetus		7-9
350-380	next calf born cycle recommences		8-10

The most appropriate management strategies for each stage of the lifecycle of a cow are now documented. They are taken from the text Dairy Herd Husbandry (DuFaur, 1981, 30,42,51,57,63,74).

3.1 Calf rearing

Early weaning of calves is practical and successful as long as they are subsequently either rotationally or spread grazed on good quality pasture.

Colostrum is the vital component of the calf's diet in the first three days.

At birth the calf's rumen (1st stomach) comprises only 30% of total stomach capacity - the more rapidly the rumen is developed the sooner the calf is able to rely on pasture as its sole source of nutrients. Rumen development is accelerated if calves are grazed on clean, leafy good quality pasture from a week or two from birth, fed meal or concentrates from an early age, and given access to good hay.

Feeding of wholemilk is recommended for three weeks after birth.

The method of rearing is usually governed by the relative cost of one method compared to another.

A low labour demand method is to rear calves by suckling on nurse cows. When paddock grazing, nurse cows and calves should be run in small groups, ensuring

the calves are of similar age. Meal can be introduced on economic grounds at 5-6 weeks.

For early weaning at 8 weeks to be successful, calves must be grazed on leafy grass/clover pasture 8-12cm high during the feeding period, and given access to good quality hay.

3.2 Rearing Heifers - weaning until calving

Poorly reared heifers will produce at a lower level for the first two lactations, are slower to reach maturity weight and may have a higher culling or wastage rate.

If pasture feed is inadequate within 2-3 months following weaning meal (or other feed supplement) should be fed daily.

Young calves are very prone to internal parasitic infestations and should be grazed on pasture previously grazed by the milking herd.

Calves should not be set stocked but either rotationally grazed or spread-grazed for the first 4-5 months after weaning.

Tail-end calves should be grazed: they may require above normal drenching and should be fed supplements if necessary.

3.3 Precalving (Dry) management

Management over the dry period should be directed to ensuring that the herd calves down in good condition and that ample feed is available for cows after calving.

The level of nutrition over the dry (late-pregnancy) period must provide for i) maintenance, ii) calf development, iii) continued growth of heifers and second calvers and iv) development of body reserves or condition (ie with layer of fat covering loins, hips, backbone and around the tail).

Cows should be at score 5 condition one month from calving, and should calve at score 5.5 - 6.

Feed requirements can be calculated by budgeting available feed supplies, in terms of dry matter, allowance for pasture growth, or by assessing the number of 'cow grazing days'.

Feed requirements of the milking herd for the pre-spring growth period must be assessed early in the dry period so that the required amount of pasture is conserved at the appropriate time.

3.4 Calving management

Cows should receive 1-2 hours minimum grazing time daily on pasture for a minimum of 7-10 days prior to calving.

Sudden and marked feed changes should be avoided as calving approaches to minimise dietic upsets and the incidence of metabolic diseases.

Full feeding of cows for a week or two prior to calving may result in a slightly higher level of milk production being attained.

Seperate cows within 4-7 days of calving so they can be kept under close observation.

Cows should be brought into the cowshed as soon as possible after calving and checked for mastitis.

Calves are normally left with the cows for about 4 days so that they obtain colostrum; the cows should also be milked out completely once daily by machine.

3.5 Early lactation management

Cows in the first month of lactation require at least twice as much feed as the last month of pregnancy, and slightly more for the second and third months of lactation.

Under normal circumstances peak production is reached about 8-10 weeks after calving and the higher the output at this time the higher will be the potential production curve for the remainder of lactation. Full pasture feeding for the first 2-3 months of lactation is essential if maximum production is to be achieved.

If feed is being supplemented heavily, it must balanced.

3.6 Late lactation management

Milk production declines steadily towards the end of lactation even when cows are well fed, as pregnancy homrmones become more dominant over secretory hormones after the cow is five months in calf.

Towards the end of lactation cows consume almost twice as much feed as dry cows for a similar liveweight gain.

A dry period of 6-8 weeks is necessary regardless of feed levels to allow for maximum buildup of secretory tissue within the udder prior to calving.

A dry period longer than eight weeks may be necessary under the following circumstances:

1) to avoid critical drop in condition level or provide extra time to regain condition,

2) when winter feed supplies are marginal or inadequate,

3) when calving spread is compact,

4) when stocking rate is high,

5) during drought when supplementation is uneconomic,

6) in cold areas experiencing poor pasture growth over winter and

7) when low production level doesn't economically justify further milking.

Care must be taken to ensure pasture consumption by late calvers doesn't result in a shortage of feed in the post-calving period.

4. The feed

Dairy cattle require adequate supplies of energy, protein, fibre, minerals, vitamins and water for growth, maintenance, reproduction and milk production.

The energy requirements of cattle vary with the animal's weight, sex, rate of growth, state and stage of pregnancy, and the amount and composition of milk produced. The level of energy required is based on metabolizable energy (ME) which is expressed in terms of megajoules (MJ). Energy values of feeds are expressed in terms of megajoules a kilogram of feed (MJ/kg).

In milking cows a lack of energy will result in decreased milk yield, lower solids to fat ratio and a loss of liveweight.

Crude protein is the term used to describe the protein value of feeds. Crude protein requirements of dairy cattle vary in the same way as the requirements for ME. A lack of crude protein in the diet will depress growth rate, milk production and the solids-not-fat content of milk (S.A. Dept. Ag. F/S 28/83).

Dairy cattle require long fibre for the process of rumination and the efficient digestion of food. A lack of fibre in the diet will result in depressed milk fat production; a fibre level in the diet dry matter of at least 19% will prevent this (ibid.).

Calcium and phosphorus are the main minerals likely to be deficient in dairy cattle rations in South Australia, although other minerals and trace elements may be needed in certain areas of the State if there are soil deficiencies (ibid.).

4.1 Calculation of feed requirements

Most dairy cows consume up to three kilograms of dry matter a day for each 100kg of liveweight, although some high-producing cattle during early/mid lactation

may consume up to four kilograms of dry matter a day for each 100kg of liveweight (ibid.).

Concentrates and grains will usually have consistent energy and protein values, although roughages, such as hay and silage, vary considerably depending on the variety of plants and the stage of growth at cutting (ibid.).

When dairy cows are grazing it is difficult to assess accurately the amount of pasture they eat. A large quantity of dry mature pasture may supply no more than half the requirements of a high producing cow. Immature grass pasture less than 10 cm high will also limit the nutrient intake of cows. In both these cases supplementary feeding is necessary.

To maximise milk protein production it is necessary to
i) breed for high protein yield
ii) fully feed the herd,
iii) use high energy supplements - quality pasture
- cereal grain supplement
- minimal use of hay and silage especially if of poor quality

The best means of achieving ii) and iii) is by adequate pasture management and paying close attention to the feedstuffs which have been shown to maximise productivity. It is also essential that the cow be

given access to the right quantity of feed at the appropriate times in the reproductive cycle. This integrated approach to pasture and cow management is undoubtably one of the best and most cost effective ways of optimizing production.

5. Pasture management

There are three main objectives of pasture management:

i) pasture production (kgDM/ha) is maximised,

ii) pasture utilization (kgDM/ha) is maximised,

iii) cow performance (intake-milk production) is enhanced.

5.1 Pasture production

There are three stages in pasture establishment:

i) germination: the resumption of active growth of the embryo resulting in the rupture of the seed coat, and the protrusion of the embryonic root and shoot. Germination is dependent on the permeability of the seed coat, oxygen, favourable moisture, temperature and light.

ii) emergence: appearance of seedling above the surface and

iii) establishment: number of seedlings that grow healthily in a field prior to the decrease in plant numbers due to competition, or the effects of climatic, edaphic or biotic factors (Carter, 1987, 37).

Seedbed preparation varies from an intensive series of tillage operations (either conventional or minimum tillage) through to minimal seedbed preparation involving various surface sowing techniques based on zero tillage (either seed-drop or broadcast).

5.1.1 Intensive seedbed production

The objectives of intensive seedbed preparation are manifold, involving the manipulation of the soil to achieve physical, chemical and biological condiions satisfactory for germination, emergence, establishment and growth of plants, control of weeds, loosening the soil surface and changing several physical aspects of soil (aeration, infiltration, conductivity and evaporation). It is important that deterioration in soil structure which may occur in intensive preparation is avoided, as the change in soil structure is normally accompanied by increased bulk density, decreased porosity, aeration and infiltration.

5.1.2 Maintainance after sowing

On old pasture land, surface sowing involving minimal seedbed preparation has the advantages of lower costs, preserving soil structure and decreasing soil erosion. It is imperative that the seed be covered after sowing to minimise seed loss, to improve moisture conditions and to ensure adequte anchorage for seeding roots.

5.1.3 Zeroseedbed prepation

This is appropriate for the sowing of pasture on non-arable sites. Technique and timing in relation to achieving adequate soil moisture and or reliability of effective rain after sowing are important determinants of successful establishment.

5.1.4 Time of sowing

For annual species that are winter growing it is best if the seed is sown in autumn to ensure adequate time for the completion of the life cycle. There are three main options:

1) dry sowing of pasture seed (with the risk of a false break)

2) to sow at the autumn break, the main concern being to sow rapidly with a disc drill or sod seeder to minimize damage to existing naturally regenerating seedlings, or

3) sow after weeds are killed by tillage or herbicides.

5.1.5 Optimum pasture production

Optimum pasture is medium length sward height. Once pasture is established, its optimum yield of nutrition is before it is too long, and before dead matter makes inroads into net productive area. The more tillers in the pasture, the greater the productivity per unit area.

5.1.6 Irrigated pastures

The main problem arising on the irrigated swamp lands is the prevention of salt accumulation but an efficient deep drainage system is now used on many properties to control levels of salinity in the pastures. Another major problem in the early years of farming along the Murray was utilization of burnt soils which resulted from previous heavy fires in the more highly organic soils (Taylor and Poole, 1931, 6).

Irrigated lands required a certain type of pasture to maximise their productivity. Trumble and Havies (1934) indicated that seed mixtures of permanent strains of perennial ryegrass, cocksfoot, white clover and red clover were particularly suited to irrigated areas. The superiority of mixtures over pure grass was particularly marked during winter.

5.2 Pasture renovation

5.2.1 Why renovate?

There are many causes of pasture deterioration:

i) infestation of weeds, especially capeweed, geranium, barley grass and silver grass,

ii) damage by insects,

iii) incorrect pasture managment - continuous hay cutting
- compaction
- poor weed control

- poor grazing management
- inadequate fertilizer application

iv) deficiencies in P, K or trace elements,

v) acid soils,

vi) use of short term pasture mixtures or unsuitable pasture species or cultivars and,

vii) seasonal factors such as late or patchy breaks, short springs.

Renovation requires reseeding and time for pasture establishment. Cost of renovation must be recouped and a reasonable return made from either increased carrying capacity and animal production, or the making of more and better quality hay. Renovation also has long term benefits of soil protection and weed competition. The aim of renovation is the establishment of a good quality permanent pasture (ie a pasture with a perennial component such as perennial ryegrass, phalaris or white clover). There is also an annual component, such as subclover, barley grass, silvergrass, capeweed and geranium. Once established, a permanent pasture is not cultivated or resown for a number of years.

5.2.2 Cost of renovation

The cost of renovation can be considerable and may act as a deterent to many farmers and if it is to occur there needs to be a 100% success rate in the year the

pasture is sown to justify the expense (S.A. Dept.Ag., 1990, 4).

A $100 per hectare renovation programme will require a gross margin increase in the order of 16% to cover costs of renovation, lost production and give a 12% internal rate of return.

5.3 Pasture management

Weeds can often be controlled using a combination of hard winter grazing and either pasture topping, silage and early hay cutting. Herbicides should be considered a tool not a substitute for good management.

Paddocks used for fodder conservation should be rotated, because continual cutting and fodder removal will weaken perennial ryegrass and decrease seed production of subclovers.

Early cutting (ie. before pasture grasses are flowering) will give the best quality fodder and the pasture a chance to recover before summer.

Pastures should not be grazed until one month after cutting but they should only be closed for fodder conservation when there is a feed surplus developing in grazing paddocks.

Hay and silage remove large quantities of nutrients from the soil (eg. 5t/ha meadow hay cut removes 12kg/ha P, 10kg/ha S and 100kg/ha K). Fertilizer applications to hay paddocks should overcome this deficiency.

Deep tillage is used to correct soil compaction in pasture paddocks without the need to cultivate or disturb the soil surface. It is only likely to produce a response in soils with a compacted layer or hardpan, restricting root growth to the top 8cm of soil.

It is particularly suited to irrigated paddocks where compaction is often a problem and where good water penetration over summer is essential. It is slow and expensive and may, in some cases, be best left to be part of a renovation programme.

5.4 Pasture utilisation

5.4.1 Introduction

McMeekan (1956) states that

> in the conversion of pasture to animal products on high producing grassland three major factors can be used to affect efficiency: grazing method, kind of stock and stocking rate...

McMeeken (1956) identified three basic requirements which need to be met to achieve high animal production:

i) a large amount of high quality feed must be grown, the seasonal distribution of which must fit the seasonal curve of animal requirements.

ii) a large proportion of this fodder must be harvested by the animal, and

iii) efficiency of conversion within the animal must be at a high level.

5.4.2 Grazing

Both undergrazing and overgrazing will cause pasture deterioration although undergrazing perennial pastures is often more detrimental than overgrazing.

The preferred system in South Australia is a combination of rotational and set grazing. The overall objective is to match livestock feed requirements with the level of available pasture feed, ensuring the minimum of pasture is wasted.

5.4.3 Set stocking

Set stocked pastures are grazed for extended periods by the same mob of livestock. Shifting of stock is kept to a minimum. Set stocked paddocks tend to be hard grazed over winter when pasture growth is low, and cows may need supplementary feeding.

5.4.4 Rotational grazing

The implementation of rotational grazing will generally establish a near ideal grazing pressure (Blaser et al., 1974, 24). Ideally paddocks are spelled for 20-30 days between grazings. Rotation periods are not fixed and

stock are moved according to the amount of feed left in the paddock the cows are grazing, the amount of feed in next paddock to be grazed, milk production from cows and the condition of the cows.

Rotational grazing gives the cows access to tall feed, and pasture grasses recover from grazing more quickly if they are not hard grazed. Rotational grazing can result in grass dominant pastures with poor clover content. In such a situation, spray grazing (spray topping) can help but the best solution is using a mob of dry stock to occasionally give rotationally grazed paddocks a hard grazing during winter to decrease weeds. The smaller the paddock the better.

Larson (Herbage Abs., 1989) shows that no effects on yield were seen between different stocking densities in an experiment on rotational grazing with different stocking densities.

5.4.5 Stocking rate

Experiments indicate that the rate of stocking is by far the most powerful weapon of the three means of improving efficiency outlined earlier (McMeekan, 1960). Depending on stocking rate and short term stocking density, treading damage on soils (especially clays) can be severe, and reduction of feed can occur.

The simplified way of determining the stocking rate of a paddock is

$$\frac{\text{amount of feed growth}}{\text{animal requirement}}$$

It has been observed (Carter, 1986) that the stocking rate cannot be increased without associated changes in risks taken by the farmer, including managerial ability, more skilful manipulation of feed in times of shortage and a greater need for supplementary feeding. This introduces the question of the profitability of fodder conservation on a particular farm in a particular seasons, with particular cows under particular management regimes.

5.4.6 Use of fertilizer

A crucial aspect of pasture management is the maintenance of fertilizer application (especially superphosphate) and Wolfe (1972, 203) states that the use of superphosphate is regarded as "the key to pasture development in temperate Australia" by initially stimulating clover growth and nitrogen fixation, and supplying grass with adequate phosphorus and suphur to compete with the legumes.

A variety of aids are available to the farmer to assist in decision making regarding the application of fertilizers, the most commonly used being soil and

plant tissue testing, which may in turn by interpreted by representatives from the Department of Agriculture and/or ferilizer companies.

5.4.7 Intensification of pasture production

Matheson (1972 in Lazenby, 1972, 145) indicates that crops may play three distinct roles in the intensification of pasture production:

i) to supply feed in periods of critical demand or pasture production,

ii) to provide dry supplements to feed year,

iii) for use as 'total pasturage' or lot feeder crops.

The most common fodder crop is lucerne, used because of its perenniality, its ability to use moisture from deep in the soil profile, its resistance to moisture stress, climatic adaptability and persistance under grazing (Matheson in Lazenby, 1972, 148).

Small grains, especially oats are used because of their relatively high growth rates in the early vegetative phase. Grazing can take place within 10 weeks of sowing, with a grazing frequency of 4-6 weeks.

The use of coarse grains (mainly maize and sorghum) is restricted to predominantly summer rainfall areas or to irrigated conditions.

Leguminous fodder crops (soya beans, cowpeas) may also be used (Matheson, in Lazenby, 1972, 178-157).

5.4.8 Supplementary feeding

Once optimum seasonal conditions pass a cow's intake of food decreases rapidly and so does her performance. Often the latter is taken as a reason to reduce the food allowance, accelerating her loss of performance unnecessarily. In such cases, or when there is insufficiently energy intake from the pastures supplementary feeding will decrease milk yield, increase liveweight, decrease pasture intake.

Experiments show that flat rate feeding (ie, the same to all cows) is more profitable than specific feeding to highly productive cows.

Early in lactation, supplementary feeding is not necessary because the cow provides an amount of energy through the use of body fat. Use of grains later in the cycle can extend milk production at higher levels.

Silage and hay are used to provide most of the total roughage intake of dairy cattle prior to autumn opening rains. Feed input-output relationships (Herrmand, 1943, 409) provide a valid basis for using different rates of

silage and hay where and when there are different ratios of feed prices to milk prices.

APPENDIX 2

FEDERAL LEGISLATION AND SUPPORT MECHANISMS

The Dairy Industry is the most highly regulated agricultural industry in Australia, and has been in need of constant marketing support since the turn of the century. A brief summary of these mechanisms makes up the following appendix:

The Paterson Plan (1926-34)

This scheme was introduced to give dairy farmers a return more in keeping with Australian living conditions than could be obtained by accepting London prices. Producers of butter paid a levy on the quantity produced and the funds obtained were used to pay a bonus on exports. The scheme was voluntary.

As the percentage of exports rose, the difference between the rates of the levy and bonus decreased. The serious drop in prices in the United Kingdom and an increasing tendency for certain manufacturers to refrain from exporting and to sell all their butter on local markets without paying the levy showed the weaknesses of the plan. It was abandoned in 1934 in favour of the Commonwealth Price Equalization Plan.

Commonwealth Dairy Produce Price Equalisation Plan, 1934-1941

This was implemented with the aim of "maintaining, developing and preserving the dairy industry in Australia,

a) to secure to manufacturers of dairy produce in the Commonwealth as far as possible, equal rates of return for sale of produce,

b) to fix from time to time by means of an agreement with manufacturers a basic price or prices at which dairy produce manufactured in Australia were taken into account for the purpose of bringing about an equality in rates of returns.

c) to fix or prescribe amounts of costs incidental to transport of dairy produce interstate,

d) to raise money from manufacturers by means of a levy to provide funds for purposes of the company,

e) to make payments to, or reclamation from, manufacturers as are necessary to give them equal rates of returns for their sales.(Dairy farming in Australia, 1954, 38)

United Kingdom Long Term Purchase Agreement 1941-1945

The United Kingdom agreed to purchase a minimum quantity of butter and cheese from Australia (Dairy farming in Australia, 1954, 40).

Stabilisation Fund 1948/49 - 1952/53

A trust fund was established for the purpose of holding return from export in excess of the guaranteed price to

producers under the Commonwealth Government 5 year stabilization plan.

Minimum Price Guarantee 1958/59 - 1962/63

Commonwealth government offered a minimum price to the Commonwealth Produce Equalisation Committee in respect of the realisation from the 1958/59 production of butter and cheese.

Dairying Industry Assistance Act (1942)

This established a subsidy to suppliers of milk and cream for cheese and butter factories. The Act was enforced until 1952.

Commonwealth 5 year Dairy Stabilisation Plan 1952 - 1956

The plan allowed the Commonwealth to determine the ex-factory price of butter and cheese. The States also agreed to make appropriate alterations to prices of processed milk products in line with the Commonwealth ex-factory cheese and butter prices.

Third Commonwealth 5 year Stabilisation Plan 1957 - 1961

Commonwealth price guarantee based on estimated cost of efficient production, in respect of butter and cheese

for five years from 1 July 1957 to cover all butter and cheese consumed in Australia.

Dairy Produce Export Control Act (1924-1927)

The Act provided for the orderly overseas marketing of butter and cheese under the Act, exports being controlled by the Dairy Produce Control Board. The board was in existence until 1986, when it was replaced by the Australian Dairy Corporation.

Dairy Adjustment Act (1974)

This act enabled each state to make an agreement with the Commonwealth providing for the making of payments by the Commonwealth to the state for the purposes of a dairy adjustment programme. This was, in theory, either to assist the viable farmer in developing the property or used to assist farmers leaving dairying as a result of the restructuring occurring in the dairy industry at that time.

Under the Act, an 'uneconomic dairy farm' was defined as a rural property not less than half of the gross income from which was obtained from the production of milk/cream, being not reasonably capable, if used only for dairying, and purposes incidental to dairying, of producing a reasonable level of income.

The state could enter into agreements to acquire and dispose of uneconomic dairy farms.

Other sections of the act provided for loans for personal hardship, loans for the conversion of uneconomic dairy farms to other rural use, for the development of dairy farms, for development of newly combined land, for the conversion of dairy farms to refrigerated bulk milk supply and for carry on loans during a period of adverse market conditions.

Dairy Industry Stabilisation Act (1977)

Dairy Industry Stabilisation Levy Act (1977)

This legislation was introduced to further redress the consequences of dramatic restructuring in the dairy industry, with the levy aimed at providing price stabilisation of manufactured products during times of low prices.

Dairy Legislation (Transitional Provisions and Consequential Amendments) Act (1986)

This act withdrew the Dairy Industry Stabilisation Act (1977), the Dairy Produce Act (1974) and initiated the winding up of the Dairy Produce Sales Promotion Fund and led into the Dairy Produce Act.

Dairy Produce Act (1986)

This Act relates to the Australian Dairy Corporation, to marketing and export of dairy produce and the collection of certain levies imposed in connection with the dairy industry, and for other related purposes. It was the legislative arm of what was colloquially known as the Kerin Plan and was aimed at dramatically improving the efficiency and competitiveness of Australia's dairy industry. It was revised in 1992.
The Australian Dairy Corporation's objective was to enhance the profitable production and marketing of Australian dairy produce. In so doing, the corporation was funded by an all milk levy imposed on all milk production, paid by all processors.

Other sections of the Act established the Dairy Industry Fund, a promotion fund, a market support fund and market support payments.

Dairy Produce Levy (no 1) Act (1986)
There were four levies established by this act, and imposed on the milk fat content of relevant dairy produce; these were known as the market support levy, corporation levy, promotion levy and research levy. The producer of dairy produce was liable to pay the levies.

APPENDIX 3

CURRENT SITUATION OF THE DAIRY INDUSTRY IN OTHER AUSTRALIAN STATES.

Introduction

Very little information on dairying, apart from basic statistics, is available from other states in Australia at the current time. No dairyfarmer organisation, apart from that in Queensland, has replied to requests for information on the state of the industry, and official reports of the state dairying authorities tend to present a very favourable and somewhat biased picture.

Victoria

The most recent annual report suggests that in the last twelve months, to July 1989, "the Victorian Dairy industry continued to make significant economic gains...[the result of] increasing efficiencies in the farm and non farm sectors, sustained marketing efforts and better international prices" (VDA, 1990) Sales of milk showed an increase of 0.7%.

Results of the most recent Dairy Farm Management Study carried out by the Victorian Department of Agriculture and Rural Affairs (1988/89) indicate an improvement in the finanical position of many of the State's dairy

farmers. Data was obtained from 99 dairy farmers selected at random from a list of licensed dairy farms.

Cash farm returns were 27.7% more than the previous season. The main factor causing the increase was a 33.1% rise in income from milk sales.

The net farm gate income for milk rose from $4.16/kg butterfat in 1987/88 to $4.87 in 1988/89.

Cash farm operating costs rose by 19.6%, while the cash farm surplus (ie money from farm operations available for family living and to pay tax) increased 100.4% to $25,661 per farm.

Net farm income rose by 45.8% and real net farm income rose by 36.7%. Equity level was 85.4% (average). 25% of the farms had less than 78% equity and 10% less than 70% equity.

Milk production per farm increased by 14.6% and per cow, 6.6% to 3,815 litres of milk (175kg b.f.)

The average size of a herd (138 cows) is well above the South Australian average of 100 cows.

Average farm cash operating surplus was $64,300.

Queensland

Licenses of farmers to supply milk (other than goat milk) to a processor, fell from 2183 (1987/88) to 2072 (1988/89).

Scattered inefficiently over vast areas all are faced with problems of blending tropical pastures with temperate species to ensure adequate supply of pasture for full lactation.

New South Wales

For the second year in a row many dairy areas in New South Wales during 1990 were too wet to graze and farmers are facing the need for relocation.(Manning, On the Land, The Advertiser, July 4, 1990)

Average farm cash operating surplus

Farm cash operating surplus is calculated as the total cash receipts less total cash costs.

The figures that follow are for all states in the financial years 1987/88 to 1988/89.

At a recent dairying conference in South Australia, a representative of the SADA said that many dairying regions in Victoria were being increasingly threatened by urban expansion, extensive problems of salinity and pasture decline in irrigated areas (Manning, On the Land, The Advertiser, July 4, 1990).

Western Australia

Milk production in Western Australia declined by approximately 2% in the financial year 1988/89, due in part to poor seasonal conditions and a decline in the number of dairyfarmers by 26 (4.6%). Demand for market milk increased over the same period by 4.3%, slightly above the population growth rate of 3%.

> On farm prices for milk supplies can be expected to rise in the coming year. Initial indications from dairy produce factories suggest that manufacturing milk prices could rise by an average of around 7-8%, which together with further increases in dairyfarmer margin in the price of market milk, can be expected to enhance farm incomes...
>
> (W.A.D.A. Ann. Rept, 1989,3)

In the medium term "a number of factors, such as interstate trade in white milk, new processing technologies and concentration of processing capacity...will increase economic pressure on a relatively compact and market milk dependent industry" (W.A.D.A. Ann. Rpt. 1989, 4)

Average farm operating surplus in Australian states
(1987/88 - 1988/89)

$

	1987/88	1988/89
W.A.	58,170	64,300
N.S.W	37,810	44,600
VIC.	40,230	50,400
QLD.	30,080	36,900
S.A.	27,630	32,300
TAS.	39,130	40,400

APPENDIX 4

MARKET MILK PRICING MECHANISMS IN OTHER AUSTRALIAN STATES

Victoria

Payment to farmers is based on three components:

a) the base price, as close as possible to the price paid by Victorian factories for manufacturing milk,

b) a compositional payment scheme (butterfat and protein) and

c) a distribution from the section 54 pool, paid quarterly to each farmer in proportion to the quantity of milk supplied by each of them to the Victorian Diary Industry Authority or to a factory in Victoria.

The winter milk incentive scheme aims to ensure the availability of adequate milk quantities over the winter months when production falls to its lowest level. Farmers supplying milk during April, May, June and July received 6c, 10c, 12c and 6c per litre each month respectively in 1989.

Western Australia

Individual entitlements (quotas) determine the amount of mlk that can be supplied by a dairy farmer to the authority at predetermined prices for market milk and special milk product purposes.

The prices to be set are based on recommendations to the Dairy Industry Authority of Western Australia by an independent pricing committee. The committee provides advice to the authority on the appropriate level of prices and/or margins within the pricing structure. A farmer production cost survey is an input into the price determination process.

Queensland

In fixing and declaring prices, the Queensland Milk Board is required to have regard to the cost of production of milk, cost of processing and vending as well as the effect upon consumption of any variation in price.

A system of entitlements operates in Queensland, controlled by the Milk Entitlements Committee of the QMB. The Committee

- allocates, varies, alters, amends, transfers or cancels the market milk entitlement to which each processor within the prescribed area is entitled
- allocates to producers who supply milk from one or more registered dairies to a processor a market milk entitlement in respect of each such dairy and can vary, alter, amend, transfer, relocate, or cancel any entitlement so allocated.
- allocates supply to a processor.

New South Wales

The retail price of standard milk has been determined in accordance with the automatic price fixing mechanism contained in the Dairy Industry (pricing) Regulation (1984).

The mechanism is a cost based formula system. The retail price of standard milk and individual sector margins are reviewed each quarter (March, June, September and December) whereby movements in costs for each industry sector are determined in relation to the base margins and base price established at a predetermined base date.

The mechanism operates in the following manner:

a) predominant cost factors within each sector are determined and assessed as at a particular date by conducting cost surveys of all dairying industry sectors. In the case of the farming sector, cost factors are broken down into cash costs, paid labour, returns on capital investment and non paid labour (X),

b) percentage changes from base date to the period under reivew of selected indices which relate to the major costs of each sector are determined (Y).

c) percentage changes identified in b are matched with corresponding sector weights,

d) weighted index changes calculated by multiplying (X) with (Y).

e) average price of milk, prior to container costs is then calculated by multiplying base price by aggregate weighted index.

f) container costs as at the time of the review are then added.

Payment to farmers is on a compositional basis (fat and protein).

As from March 1990 the New South Wales Dairy Corporation has been able to take into consideration "prevailing market conditions" in determining the retail price of milk.

SURVEY OF CURRENT DAIRY FARMERS

Please put the postcode from your home address in the boxes provided.

A. HUMAN RESOURCES

1. For each member of your family living on the farm, could you please indicate the following:

Person	Relationship to Person 1	If a joint owner, please tick (✓)	Time spent working on farm Full-time (F) Part-time (P) Casual (C)	If part-time, how many hours per week	If casual, how many weeks per year	Age of each
1. Owner/operator						
Others						
2.						
3.						
4.						
5.						
6.						

Please use the back of this page if there are more than 6 people in your family.

FAMILY MEMBERS WORKING ON FARM

2. For each member of your family employed on the farm, please list the tasks/jobs they perform. Use the same number for each person as before (in Question 1).

Person	Tasks/jobs performed
1. Owner/operator	
2.	
3.	
4.	
5.	
6.	

Education and Training

3. a) For each member of the family employed on the farm, please complete the table below. Please use the same number for each person as in Questions 1 and 2.

Person	Attended secondary school Yes/No	Age at which left secondary school	Please describe briefly any further education or training you have done since leaving school
1. Owner/operator			
2.			
3.			
4.			
5.			
6.			

Other Sources of Information/Assistance

b) How frequently do you or other members of your family working on the farm have contact with or use any of the information sources below? Please tick the appropriate column.

	Weekly	F'nightly	Monthly	6-Monthly	Rarely	Never
Agriculture Dept. Extension Offices						
Soil and plant testing/analysis						
Vet						
Neighbours						
Other farmers elsewhere						
Agricultural Bureau						
S.A. Dairy Farmers Assoc. (S.A.D.A.)						
S.A.D.A. Journal						
Stock Journal						
On the Land (Advertiser)						
Farmer and Stockowner						
Country Hour (A.B.C.)						
Field Days						
Other (please explain)						

FAMILY MEMBERS WITH OFF-FARM EMPLOYMENT

4. For those members of your family who have jobs off the farm, could you please complete the following table. Use the same number as before for each person.

	Jobs done	Full-time (F) Part-time (P) Casual (C)	If part-time, many hours per week (approx.)	If casual, how many weeks per year (approx.)
1. Owner/operator				
2.				
3.				
4.				
5.				
6.				

5. For those owner/operators who gain income by working off the farm, please say:

   i) When did you start working off your farm? _____

   ii) Why is it necessary for you to do this? _____

   _____

   iii) What percentage of your income (on average), after deducting the costs of running your farm, comes from your farm?

   _____

USE OF NON-FAMILY LABOUR ON FARM

6. a) Have you ever employed any non-family labour on the farm? Yes/No

   <u>If yes</u>, please go to Question 6b).

   <u>If no</u>, please go to Question 7.

If yes, and you are employing non-family labour now:

b) Please say for each person employed:

Person	Full-time (F) Part-time (P) Casual (C)	If part-time, many hours per week	If casual, how many days per year	Tasks/jobs performed

If yes, and you no longer employ non-family labour:

c) i) When did you stop? _____

ii) Why? _____

_____

_____

B. LAND RESOURCES

7. What is the average annual rainfall received on your farm?

_____ mm _____ inches

8. What is the total farm size? _____ ha. or _____ acres

9. Is your farm held in one block, or is it split into separate blocks? (please explain)

_____

_____

_____

_____

TENURE

10. For each block that makes up your farm, please tick whether it is freehold, rented, sharefarmed or other.

Block no.	Hundred & section no.	Size ha. or acres	Freehold (/)	Rented (/)	Sharefarmed (/)	Other (please explain)
1						
2						
3						
4						

PRESENT LAND USE

11. a) Unimproved pastures (i.e. pastures not regularly cultivated or resown):

	Ha.	Main pasture species	% which is irrigated	Ha. cut for hay/ silage	Fertiliser	
					Type	Av. quantity (per ha.)
Unimproved pasture						

b) Improved pastures (i.e. regularly sown, perhaps as part of a rotation with fodder crops):

	Ha.	Main pasture species	% which is irrigated	Ha. cut for hay/ silage	Fertiliser	
					Type	Av. quantity (per ha.)
Improved pasture						

c) Fodder crops:

Fodder crops	Ha.	% which is irrigated	Ha. cut for hay/ silage	Fertiliser	
				Type	Av. quantity (per ha.)
Lucerne Oats ---------- ----------					

d) Other land use: (please explain) _____

_____

_____

_____

12. a) Have you added any land to your property in the last ten (10) years? Yes/No

If no, please go to Question 13.

b) If yes, please say for each additional block of land:

Block no.	Year of purchase	Size of purchase	Hundred & section nos.	Reason for purchase	Previous land use
1					
2					
3					
4					

13. a) Have you sold any portion of your property in the last five (5) years? Yes/No

If no, please go to Question 14.

b) If yes, please indicate for each block of land sold:

Block no.	Year when sold	Amount of land sold (ha.)	Hundred & section nos.	Reason for sale
1				
2				
3				
4				

FEED SUPPLEMENTS

14. a) Do you have to buy in any foodstuffs for the dairy herd? Yes/No

b) If yes, what types of foodstuffs are purchased? _____

_____

_____

c) In what months are these foodstuffs most commonly used? _____

_____

d) Why do you use these additional (off-farm) foodstuffs? _____

_____

_____

GRAZING PRACTICES

15. What type of grazing management (of the dairy herd) is used most commonly on your farm? (For example, weekly movement of herd between paddocks, split-up herd, use electric fencing, one day on/one day off, etc.).

_____

_____

_____

_____

LAND MANAGEMENT

16. a) Please indicate the extent to which any of these problems influences the productivity of the land on your farm.

Problem	No impact	Limited impact	Some impact	Significantly reduces productivity
Weeds				
Soil erosion				
Water erosion				
Soil salinity				
Declining soil fertility				
Overstocking of pasture				
Pasture diseases				
Insects, other pests				
Effluent disposal				
Other _____				

b) For those problems which are having any impact at all on productivity, could you please explain how you are managing the problems.

Problem	Management strategies to overcome and/or avoid the problems	Year in which management strategies were introduced
Weeds		
Soil erosion		
Water erosion		
Soil salinity		
Declining soil fertility		
Overgrazing		
Pasture diseases		
Insects and other pests		
Effluent disposal		

c) Are there any management practices which you would like to introduce on your property to improve productivity? (please explain)

_____

_____

_____

d) What prevents you from using these strategies?

_____

_____

_____

17. a) Was the main proportion of your current farm inherited from another family member?

Yes/No

<u>If no</u>, please go to Question 18.

b) <u>If yes</u>, in what year did the ownership change? _____

18. If you purchased the farm:

a) What did you do before you purchased the farm? _____

_____

_____

b) What was the year of purchase? _____

c) Was the farm a dairy farm when you first purchased it? Yes/No

d) If it wasn't a dairy farm previously, what sort of farm was it? _____

_____

_____

e) Why did the previous owners sell? _____

_____

_____

_____

f) What did the previous owner do after he sold the farm to you? _____

_____

_____

_____

19. a) Is your present farm big enough to provide you with an adequate living? Yes/No

<u>If yes</u>, go to Question 20.

<u>If no</u>:

b) i) How much additional land would you require? _____

ii) What would this land be used for? _____

_____

_____

_____

iii) How much would this land cost? _____

iv) What prevents you from acquiring this additional land? _____

_____

_____

_____

C. CAPITAL RESOURCES

20. a) What is the size of your dairy herd (milking cows)? _____

b) What breed(s)? _____

21. a) Please indicate which type of milking shed you are using:

	Yes/No
Traditional	
Herringbone	
Rotational	

b) Why have you chosen this particular shed type? _____

_____

_____

c) In what year was your present milking shed constructed? _____

d) How many cows can be milked at one time? _____

e) How far is the milking shed from Adelaide? _____ kms / _____ miles

f) Is your present milking shed (and facilities) adequate? Yes/No

If yes, please go to Question 22.

g) If no, please explain why it is inadequate? _____

_____

_____

h) Do you intend to make any improvements or changes to your milking shed (and or facilities) in the next (two) 2 years?

Yes/No

If no, please go to Question 22.

i) If yes, what changes do you intend to make and why? _____

_____

_____

_____

_____

22. Please indicate whether you own (and use) the following farming equipment:

	Yes/No
Tractor	
Seeder	
Hay baler	
Other _____	
_____	
_____	
_____	
_____	
Computer (for farm management)	

D. PRODUCTION

23. Please complete the following table to show changes, if any, in your dairy herd over the last (ten) 10 years:

Year	Number of milking cows	Breed(s) (changes in % of herd)	Reason for change
1980			
1981			
1982			
1983			
1984			
1985			
1986			
1987			
1988			
1989			
1990			

24. a) Please complete the following table to show how your milk production fluctuates from month to month:

Month	% of Total year's production	Month	% of Total year's production
January		July	
February		August	
March		September	
April		October	
May		November	
June		December	

b) What factors cause your milk production to vary from one time of the year to another?

_____

_____

_____

c) So far as you are concerned, what would be the ideal pattern of production through the year, and why?

_____

_____

_____

25. a) What is the replacement rate of your herd? _____

b) On what percentage of your cows would you use A.I. each year? _____ %

26. a) Does your present herd size provide you with an adequate income? Yes/No

<u>If yes</u>, please go to Question 27.

b) <u>If no</u>, how many additional cows would you need to provide an adequate income?

_____

c) Could your farm carry this number of additional cows? (please explain)

_____

_____

_____

27. Please complete the following table to show what has happened to the farm's milk production over the last (ten) 10 years.

Year	Production (litres)	Butterfat (%)	Protein (%)	Reason for any change
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990				

28. a) Are you satisfied with your present milk production? Yes/No

If yes, please go to Question 29.

b) If no, why not? _____

_____

_____

c) What total production would you like to reach? _____ litres

d) What prevents you from reaching this production level? _____

_____

_____

e) Are there any management practices you could use to raise your production? (please explain)

_____

_____

_____

f) What difficulties prevent you from using these management practices?

_____

_____

_____

E. THE FUTURE

PROBLEMS IN SOUTH AUSTRALIAN DAIRY INDUSTRY

29. a) Would you please indicate how important you think each of the following factors is to the success and profitability of dairy farming in the areas producing milk for Adelaide.

	Very Important	Important	Some importance	Minor importance	Irrelevant
Government regulation exchange rates protection reconstruction of farms adjustment schemes interest rates other (please explain) ----------					
Economic policy State Government Federal Government any specific aspects ----------					
Deterioration of land quality					
Increased cost of inputs labour feed seed transport breeding programme other (please explain) ----------					
Urban expansion					
High land prices encouraging land sales restricting farm expansion					
Any other (please explain) ----------					

b) If you would like to comment on the way any or all of the above affect your production and profitability please do so.

_____

_____

_____

_____

_____

c) What, if anything, have you done to overcome these problems?

_____

_____

_____

_____

_____

30. a) Is your dairy farm currently for sale? Yes/No

If no, please go to Question 31.

If yes:

b) How long has it been on the market? _____

c) Why have you decided to sell the farm? _____

_____

_____

d) i) When the farm is sold will you move to another dairy farm? Yes/No

If no, please go to (e).

If yes:

ii) Where will your dairy farm be located? _____

e) i) When the farm is sold will you move to another non-dairy farm? Yes/No

If no, please go to (f).

If yes:

ii) Where will your new non-dairy farm be located? _____

iii) Why are you leaving dairying? _____

_____

_____

f) i) When the farm is sold will you quit farming completely? Yes/No

If no, please go to Question 31.

If yes:

ii) Why are you quitting farming? _____

_____

_____

iii) How will you continue to earn a living? _____

_____

_____

31. a) Have you considered taking on a job off the farm and becoming a part-time farmer? Yes/No

If no, please go to Question 32.

If yes:

b) Why are you thinking of becoming a part-time farmer? _____

_____

_____

c) What sort of non-farm job would you take up? _____

_____

_____

d) Where would this job be located? _____

32. a) Have you seriously considered relocating to a dairy farm elsewhere? Yes/No

If no, please go to Question 33.

If yes:

b) Where would you relocate your dairy farm? _____

_____

c) Why would you want to leave the area your present dairy farm is in? _____

_____

_____

d) Why would you want to go to that particular new area? _____

_____

_____

e) Is such a move likely to occur in the next (five) 5 years? (please explain)

_____

_____

33. a) Have you seriously considered relocating to a non-dairy farm elsewhere? Yes/No

If no, please go to Question 34.

If yes:

b) Why do you wish to leave dairying? _____

_____

c) What kind of farm would you take up? _____

d) Why would you wish to take on this new kind of farming? _____

_____

_____

e) Why would you wish to leave this area you are in now? _____

_____

_____

f) Is such a move likely to occur over the next (five) 5 years? (please explain)

_____

_____

34. a) Have you considered remaining in dairying but taking on additional enterprises? Yes/No

If no, please go to Question 35.

If yes:

b) Why take on additional enterprises? _____

_____

c) What additional enterprises would you take on? _____

_____

d) Why would you take on these particular enterprises? _____

_____

_____

e) Is this change likely to occur in the next (five) 5 years? (please explain)

_____

_____

35. a) Have you ever considered changing completely to another kind(s) of enterprise(s) on your present property? Yes/No

If no, please go to Question 36.

If yes:

b) Why would you quit dairying? _____

_____

_____

c) What kind(s) of enterprise(s) would you switch to? _____

_____

_____

d) Why would you switch to that (those) enterprise(s)? _____

_____

_____

_____

e) Is such a change likely to occur in the next (five) 5 years? (please explain)

_____

_____

_____

36. a) How would you describe the future of your dairy farm? _____

_____

_____

_____

_____

b) What future is there for the South Australian Dairy Industry? _____

_____

_____

_____

_____

SURVEY OF

EX-DAIRY FARMERS

Please write the postcode
of your old farm address _____

Please write the postcode
of your current address _____

A. HUMAN RESOURCES

1. For each member of your family, could you please indicate the following:

Person	Relationship to Person 1	If a joint owner, please tick (✓)	Time spent working on farm Full-time (F) Part-time (P) Casual (C)	Present occupation	Age
1. Owner/occupier					
2.					
3.					
4.					
5.					
6.					
7.					

Please use the back of this page if there are more than 7 members of your family.

2. For each member of the family who was employed on the farm, could you please provide some information concerning education and training. Please use the same number for each person as in Question 1.

Person	Attended secondary school Yes/No	Age left school	Please describe briefly any further education or training you have done since leaving school
1.			
2.			
3.			
4.			
5.			
6.			
7.			

3. a) Prior to the leaving of your dairy farm, did you, as owner/operator, obtain any income by working off the farm?

YES / NO

If no, please go to Question 4.

If yes, please go to part (b).

b) When did you commence this work? _____

c) Why was it necessary for you to do this? _____

_____

_____

d) What proportion of your income (on average), after deducting the costs of running your farm, came from the farm?

_____

e) Did you continue in this job after leaving the farm? YES / NO

B. LAND RESOURCES

4. a) What is the total size of your farm? _____ ha. or _____ acres

b) Was the majority of the farm held freehold, sharefarmed, rented, or held on perpetual lease? (please explain your answer)

_____

_____

_____

_____

5. a) Did you inherit ownership of the property? YES / NO

If no, please go to part (c).

If yes:

b) i) When did the change of ownership take place? _____

_____

ii) How long had the farm been in the family? _____

_____ (please go to part (d))

c) i) How did you come into ownership of the property? _____

_____

_____

_____

ii) When did this take place? _____

_____

iii) What did you do prior to taking up farming on this property? _____

_____

_____

d) In what year did you cease dairy farming? _____

e) i) Was the farm sold? YES / NO

If no, please go to Question 6.

If yes:

ii) When was the farm sold? _____

iii) Please indicate to whom you sold the property, and, if the property was sold in parts, indicate the size of each part.

	Yes/No	Size of each part of land sold (ha. or acres)
Another dairy farmer (non-family)		
Another non-dairy farmer (non-family)		
Family member (for dairying)		
Family member (for other purposes)		
A 'hobby' farmer		
Land agent		
Other (please specify) ----------		

iv) If you sold your property to a non-dairy farmer, could you explain what type of farming enterprise is being carried out on the farm at present?

_____

_____

v) Were the purchasers personally known by you? (please explain)

_____

_____

vi) What was the price per hectare of land you received from the sale of the property?

_____

vii) How do you think this compared to the actual value of the land for agricultural purposes?

_____

_____

C. CAPITAL RESOURCES

6. a) What was the size of your dairy herd (milking cows) over the last five years prior to your leaving dairying?
(please use an average) _____

b) What was the average annual level of milk production over the five years prior to your leaving dairying?

Year	Litres	Butterfat (K.G.)
19 ____		
19 ____		
19 ____		
19 ____		
19 ____		

7. a) What type of milk shed were you using? _____

b) When had the shed been constructed? _____

c) How many cows could be milked at a time? _____

8. Had you made any significant capital improvements (for example, expansion of milking shed, purchase of new machinery) in the five years prior to your leaving dairying? (please explain)

_____

_____

_____

_____

D. DECISION TO LEAVE DAIRYING

9. a) Prior to leaving dairying did you seek any advice or assistance from:

	Yes/No
A rural counsellor	
Dept. of Agriculture	
Other farmers	
Your bank	
Your accountant	
Other (please indicate) ----------	

b) How did this advice influence your decision to leave dairying? _____

10. a) Did you receive any financial assistance from the Federal or State Government prior to your leaving the farm?

If no, please go to Question 11. YES / NO

If yes:

b) Was it adequate for the purpose? (please explain) _____

11. a) The following table lists a variety of problems which may have contributed to your decision to cease dairy farming. Please indicate, by ticking the appropriate column, how important each was in your decision.

	Very Important	Important	Some importance	Minor importance	Irrelevant
Government regulation exchange rates protection reconstruction of farms adjustment schemes interest rates zoning, other planning regulations other (please explain) ----------					
Economic policy State Government Federal Government other (please explain) ----------					
Deterioration in land quality weeds soil erosion water erosion soil salinity declining fertility pests and diseases overgrazing other (please explain) ----------					
Increased cost of inputs (relative to production) labour feed seed transport breeding other input(s) ----------					
Urban expansion					
High land prices prohibiting expansion encouraging land sales					
Other (please explain) ---------- ---------- ----------					

b) Please state in your own words why you decided to leave dairying: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

E. LIFE AFTER THE FARM

12. a) Was the money obtained from the sale of the farm sufficient for you to re-establish yourself (and your family) elsewhere? YES / NO

If yes, please go to Question 13.

If no:

b) Why was it inadequate? _____

_____

_____

13. a) Did you move immediately to your current address? YES / NO

If no, please go to Question 14.

If yes:

b) Why did you choose this location? _____

_____

_____

14. Did you already have a job organised before you ceased dairy farming? _____

_____

15. Do you intend to stay in your current job? YES / NO

Please explain your answer _____

_____

16. a) Do you intend or hope to return to farming? YES / NO

If no, please go to Question 17.

If yes:

b) What will need to occur to allow this to happen? _____

_____

_____

c) Will you return to dairying? (please explain) _____

_____

_____

_____

_____

17. How would you describe the future of dairying in South Australia? _____

_____

_____

_____